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distribution of the existing tubewells is given in Table 1

1.-05 Gravity irrigation in Indonesia is frequently classified by the government into three categories: technical categories: technical irrigation, semi-technical irrigation and simple irrigation. These are described as follows:

- 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.

- Semi-technical systems have fewer permanent structures, only one measuring device (usually at the main headworks), and supply and drainage systems are not always fully separate.

- Simple (sederhana) irrigation systems (which may also be termed desa or village systems) are theoretically not under Government control and are operated and managed by village leaders. These systems have temporary or semi-permanent structures and have no water measurement or control devices.

1.-06 The distribution of these types of irrigation systems in the different regions of Indonesia is shown in Table 2. Java has 62% of the total and also most of the technical irrigation systems. With only 7% of Indonesia's land area, rice production in Java is estimated to support 66% of the total requirement of the population.

1.-07 The institutional framework in which irrigation development and operation takes 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 (PU). Legal responsibility for irrigation development and operation to the tertiary outlet is officially decentralized to the Provincial governments.

1.-08 The Provincial Public Works Departments are the implementing agencies for the provincial governments, but receive technical guidance from DGWRD. But much of the funding for irrigation activities comes from the Central Government, either through the Provincial Governor's office, or directly from DGWRD to the Provincial Public Works Department. The Provincial Public Works Departments

are thus responsible for operating separate budgets from the central and provincial governments.

1.-09 Furthermore, many of the larger projects, particularly those receiving external funding, are directed from the Central government. Frequently these projects have separate executive bodies formed for them, and maintain separate project offices in the field.

1.-10 Below the level of the tertiary, operation and maintenance of irrigation projects is the responsibility of the village (desa). 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.

1.-11 It must be recognized that there are considerable differences among different areas within Indonesia with respect to the details of irrigation organization. As Bottrall has noted, "Irrigation in Indonesia is thus characterized by a high degree of diversity topographically, culturally and administratively, not only as between Java, Bali and the Outer Islands but even within particular regions and provinces" (Bottrall 1981, p 10).

1.-12 Repelita IV on Agriculture and Irrigation Repelita IV, Indonesia's Fourth Five-Year Development Plan (1984/85-1988/89), continues to give priority to economic development with emphasis on agriculture and self-sufficiency in food. Agriculture is expected to grow at 3% per annum. Moreover, the share of agriculture in the GDP is predicted to decline from 29.2% at the end of Repelita III to 26.4% by the end of Repelita IV (1988/89). The average rate of growth for the exports of agricultural products during 1984/85 to 1988/89 is 9.9%. Shrimps, palm oil and rubber are the commodities considered to have the best export potentials. However, in relative terms, the share of agriculture in the total value of non-oil and non-liquified natural gas exports is estimated to decline from 50.2% to 38.7% during the plan period.

1.-13 Of the total Government Development Budget of Rp. 78,609.5 billion for the entire Repelita IV period, 12.74% or Rp. 10,014.3 billion is earmarked as the sectoral allocation of agriculture and irrigation. Rice production is expected to increase from 23.5 million tons in 1983 to 28.6 million tons in 1988/89, an increase of approximately 4% annually. By 1988/89, the total harvested area for rice will reach 9,706 thousand hectares with an average yield of 2.94 tons per hectare. An additional 350,000 hectares of land will be developed as new wet-rice fields during Repelita IV.

1.-14 The irrigation development program includes the construction of new irrigation systems, as well as the rehabilitation, maintenance and improved utilization of existing schemes. As irrigation water is made available, farmers will be encouraged to open up new paddy fields and to intensify the utilization of existing irrigation schemes. During Repelita IV, improvements will be made on existing irrigation systems covering 360,000 hectares; new irrigation systems will be constructed on 600,000 hectares; and the development of tertiary canals will cover 720,000 hectares. Likewise, the reclamation of marsh and swamplands will involve 460,000 hectares, while river control projects will cover 500,000 hectares.

1.-15 Estimates for investment and irrigation area developed for Repelita III and IV are given in Table 3. Expenditure on rehabilitation accounts for 29% of the total budget, followed by expenditure on large scale systems without dams of about 27%. However, in terms of areas developed, the budget for rehabilitation accounts for 27% of the total area. While the expenditure on tertiary development is only 5%, the area developed by the end of Repelita IV is 26% of the total area for development. The largest incremental production is expected to come from tidal/swamp development and from the large scale systems.

2. General Policies Regarding Irrigation Financing

2.-01 Theoretically and legally, the responsibility for irrigation development is decentralized. Government Regulation No.18/1953 assigned to the provincial government the operation of irrigation systems, despite the limited funds available to the provincial governments for executing the work. This responsibility on the management of the O&M of the main system is reiterated in Government Regulation No.23/1982 (Annex 1).

2.-02 During the 1950's and the first part of the 1960's, little investment was made in irrigation systems. Maintenance of the existing systems was frequently very poor, and many of them deteriorated badly. In the late 1960's, major rehabilitation efforts were undertaken by the 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.

2.-03 The general policy of the government toward the financing of the capital cost of rehabilitation and new investments has been to rely on general government revenues to provide the necessary funds for the local

component of the initial financing, and for the repayment of the foreign loans incurred. As with the case for the large central government subsidies for fertilizer, investment in irrigation has been seen as a general development expenditure necessary to support the self-sufficiency objectives of Indonesia's development plans. There has been little concern with recovering the capital cost of irrigation development from the users of irrigation.

2.-04 With respect to O&M, a distinction must be made between the main distribution system (primary and secondary canals) and the tertiary system (i.e., 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 resides formally with the Provincial governments. Inadequate sources of financial resources to the Provincial governments have led, however, to increased Central government funding of these O&M activities through complex financial arrangements which are discussed in section 4.1.

2.-05 Historically, farmers have not been charged directly for the cost of the O&M services provided by the Provincial and Central governments. Prior to independence, a land tax called "landrente" was levied on all agricultural lands. As higher rates applied to irrigated as opposed to dry or rainfed lands, this tax provided a mechanism for some indirect recovery of the O&M costs incurred; however, there was no attempt to specifically earmark or identify the incremental funds generated from this tax as a result of irrigation.

2.-06 After independence, the land tax was abolished, but ultimately a land-based tax, first known as the Pajak Hasil Bumi (Tax on Land Production) and subsequently renamed Iuran Pembangunan Daerah, or IPEDA (Contribution for Regional Development) was re-established (ADB 1981 Kim; Gadjah Mada University 1982, pp IV-26 - IV-27). This tax, which is still in existence today, provides the primary means of cost recovery of the government's O&M expenditures. As with the "landrente", however, there is no specific identification of the increase in tax revenues resulting from irrigation, and no financial linkage between the revenues generated from the tax and the funds provided for O&M.

3. Capital Cost of Irrigation

3.-01 Limited information on the capital cost of irrigation in Indonesia is available in the literature. Cost estimates for the Arakundo-Jambu Aye project are presented in the Appraisal Report for the project (ADB June 1984, p 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 $93.9 million. This implies an average cost of about $4,850 per ha for the 19,360 ha area of the project. At the 1984 exchange rate of Rp 1074 to the U. S. dollar, this is equivalent to Rp 5.2 million per ha.

3.-02 Bottrall (1981, p 37) reports on the construction cost of one 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 per ha. At 1983 prices, this would amount to approximately Rp 1.4 million per ha.

3.-03 The expected construction costs of two ADB-financed irrigation projects, namely the Cibaliung and the Lower Citanduy Projects were $2,042 and $2644 per ha, respectively (ADB 1981, p 15). At 1983 exchange rates, these would amount to approximately Rp 2.0 and Rp 2.6 million per ha.

3.-04 As rules of thumb, DGWRD indicates that the capital cost for new irrigation projects is roughly Rp 3.0 million per ha for large projects (greater than 10,000 ha); Rp 1.5 million per ha for medium projects (2,000 to 10,000 ha); and around Rp 800,000 per ha for small projects.

3.-05 Some data on the investment cost of groundwater pump projects is available. The estimated costs for five different sizes of wells vary from Rp 0.8 million per ha to Rp 2.7 million per ha (Table 4).

4. Operation and Maintenance Costs

4.1 Budgetary Procedures for the Provision of O&M Funds

4.1-01 Flow of Funds for Irrigation Development. A complex financial relationship exists between the central government and the provincial government, which gets about 75% of its provincial revenue from central government sources. The flow of funds from the central government is illustrated in Figure 1. The main budgets are the following:

(a) Subsidi Daerah Otonom. This 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. This routine budget represents about 46% of the total revenue of the regional governments and 22% of the national routine budget.

(b) Bantuan Pembanguman Dati I (Inpres Dati I). This multi-purpose Provincial Development Grant is for the development projects in the provinces. It has both fixed (earmarked) and discretionary components. The funds may be made available for the upgrading and rehabilitation of irrigation systems, roads and bridges, and irrigation O&M. Salaries can not be paid out of Inpres Dati I funds. The share of each province is weighted by population, size of area cultivated and the length of existing roads in the province.

(c) Bantuan Kabupaten Dati II (Inpres Kabupaten). This is allocated on a per capita basis. The actual allocation depends on the assessment of BAPPENAS (Indonesia's national planning agency) of the Kabupaten's ability to implement programs. While its use is not earmarked, most of it must be spent on infrastructure development and about 10-15% on the maintenance of infrastructure.

4.1-02 In addition to the above-mentioned budgets, the sectoral budget (APBN) of the DGWRD is provided directly to the provincial public works departments. The provincial DPUs submit project proposals to the provincial authorities, who appraise and recommend the proposed projects to the central government for its final decision after a negotiation process.

4.1-03 Aside from the allocation of funds from the central government, the provincial and district (Kabupaten) governments directly raise revenues. Taxes and charges are collected and retained by these regional governments. Some revenues levied by the central government may also be given wholly or in part to the regional governments.

4.1-04 Using data for 1980-81,Bottrall (1981) developed budget estimates categorized by source of responsibility for expenditures (Table 5). The sectoral budget of DGWRD (APBN) provided Rp.200.3 billion of the Rp 269.1 total government budget. Rp 110.5 billion of the APBN budget was for new construction, Rp 69 billion for rehabilitation and another Rp 20.8 billion for the development of swamp and tidal areas. An additional Rp

66.9 billion from foreign aid sources was budgeted for the same categories funded by the APBN. About Rp 13.9 billion for tertiary development and tertiary construction/ rehabilitation was also earmarked to come from central government.

4.1-05 At the provincial government level, most of the Rp 38.8 billion budgeted for the Provincial Public Works Departments also come from central government sources. Rp 7.4 billion for rehabilitation and improvement work and Rp 19.8 billion for O&M are funded from specifically earmarked Inpres Dati I funds. In addition, Bottrall estimated that about Rp 2.2 billion of the discretionary 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, are estimated at Rp 8.2 billion.
Direct contributions from provincial revenues are thus very small.

4.1-06 The central and provincial budgets of the Ministry of Agriculture have an APBN (sectoral) allocation of only Rp 266 million to fund the establishment of water users' associations at the tertiary level. The central Java provincial government has an allocation of Rp 36 million for the Dharma Tirta (water-users' association) program and the North Sumatra provincial budget has Rp 418 million to assist communal irrigation systems.

4.1-07 At the Kabupaten and Desa levels, the Inpres Dati II (Rp 7.8 billion) and the Inpres Desa (Rp 4.9 billion), the biggest sources of funding, are used for small construction and repair work. The contribution from direct revenues, estimated at Rp 0.8 billion, is largely from the IPEDA. Although IPEDA revenues are enhanced by irrigation, it is a very small source of direct funding for irrigation.

4.1-08 Excluding foreign aid, the percentage breakdown for the sources of responsibility for irrigation expenditures in fiscal year 1980-81 was:

Central government	- 80.4%
Provincial government	- 14.6%
Kabupaten	- 3.2%
Desa	- 1.8%

This percentage breakdown represents only the relative financing that was coursed through the different levels of government and identifies the responsibility for the expenditures. Some of the funds for which the regional governments have expenditure control are provided from the

financing that was coursed through the different levels of government and identifies the responsibility for the expenditures. Some of the funds for which the regional governments have expenditure control 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 actually come from the central government as part of the subsidy for Local Government Development Program (LGDP), with the allocations specified (fixed programs component of the subsidy). Likewise, the routine budget for salaries is also from the central government, appropriated to the provincial government through the Subsidi Daerah Otonom. Thus, a breakdown by actual source of budget decisions for 1980-81 would be as follows:

	Rp. billion	
Central Government		
Purposes as indicated in Table 5	216.3	
Rehabilitation/improvement	7.4	
O&M	19.8	
Routine budget (salaries)	8.2	
	251.7	93.5%
Provincial Government		
Inpres Dati I (discretionary portion)	2.2	
Local taxes	1.2	
Miscellaneous	0.5	
	3.9	1.5%
Kabupaten		
Inpres	7.8	
Local taxes	0.8	
	8.6	3.2%
Desa		
Inpres desa	4.9	1.8%
Total	261.9	100%

4.1-09 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, as development grants to the provincial and local governments from the Central government. Although the budgetary decisions to allocate these funds to irrigation are made at the local level, the original source is the Central government.

4.1-10 Allocations for Main System O&M. Since the beginning of the second Five-year Plan, and by virtue of Presidential Instruction No.7, 1974, 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 central government sectoral budget (APBN), and flow directly to the Provincial Public Works Departments. These APBN funds are designed to supplement the Inpres Dati I or APBD funds from the central government, and, by by-passing the Provincial Governor's office, to provide for a faster disbursement of funds to the Provincial Public Works Departments. Schematic representations of the allocation of the APBD and APBN subsidies are presented in Figure 2.

4.1-11 O&M allocations from the central government for the irrigation systems under the Public Works Department from 1974/75 to 1985/86 are shown in Table 6. All the allocations, except those as indicated for 1984/85 and 1985/86, are from the central government through the Inpres Dati I (APBD funds). 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 5.8 billion (equivalent to approximately Rp 18.6 in terms of 1983 prices). By 1983/84 the allocation had risen to Rp 32.9 billion. An additional Rp 11 billion was made available beginning in 1984/85 through the APBN budget.

4.1-12 Considering the first three years of the subsidy (1974/75 - 1976/77) and the last three years prior to the provision of the additional funds through the APBN budget, the average annual allocation per ha of eligible area increased in terms of constant 1983 prices from about Rp 4,750 to about Rp 7,260. This represents a 53 percent increase. The more recent supplementary allocations to special areas with APBN funds coming directly from the DGWRD have earmarked about Rp 11,000 per hectare 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 kabupaten sources have further increased the dependence of the provincial governments on the central government for irrigation operation and maintenance.

4.1-13 The original intent of the Presidential Instruction in 1974 was to decrease gradually the total funding provided by the Central government (which was regarded as a subsidy to the provincial governments) as the provincial governments developed their capabilities for

self-financing. This expectation has not been realized. Table 7 presents the total Central government funding (i.e., funding for both fixed and discretionary programs) for the Local Government Development Programme (LGDP) from 1974/75 to 1983/84. The total central government funds have increased from Rp 43,950,000 in 1974/75 (equivalent to about Rp 140,900,000 in 1983 prices) to Rp 253,000,000 in 1983/84. The funds for O&M have ranged between 10 to 13 percent of the total central government funding for the provincial governments.

4.1-14 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. The province of West Java had an average of 37.2%, while Central Java and East Java both registered an average of 25.8% of their total government subsidies going to the O&M budget. The higher figures for Java are attributed to the large irrigation systems in the region, which are more sophisticated and which support higher cropping intensities (Gadjah Mada University 1982).

4.1-15 While the proportion of the Central government funds for the LGDP devoted to irrigation O&M has remained within the narrow range of 10 to 13 percent, the proportion of the funds used for rehabilitation of irrigation systems has been decreasing every year. From a high 10.1% in 1975/76, the LGDP funds for the rehabilitation of irrigation systems dropped to only 3.6% of the total LGDP funds in 1983/84.

4.1-16 Budget requests for main system O&M are prepared by the Provincial Public Works Departments, using guidelines prepared by the Sub-directorate for O&M, in the Irrigation I Directorate of DGWRD. These calculations include O&M costs for the different types of irrigation systems (i.e., technical, semi-technical and simple) and overhead expenditures for the provincial and section-level offices. A budget proposal is submitted by each Provincial Public Works Department to the Directorate of Irrigation I for evaluation. An integrated budget proposal for O&M of water resources (irrigation, swamplands and rivers) is then submitted to BAPPENAS through the DGWRD.

4.1-17 At the national level, BAPPENAS, the Ministry of Internal Affairs and the Ministry of Public Works meet and decide on the allocation of the Inpres Dati I funds. Budgetary ceilings are determined for each province. The Provincial Public Works Departments in turn decide on the allocations for the various Section offices.

4.1-18 As shown in Table 6, the approved budgets for O&M have averaged less than 60 per cent of the amounts requested. For example, the proposed budget for irrigation O&M for 1983/84 was Rp 59,524 million, but the amount approved was only Rp 32,895 million, or 55% of the total request.

4.2 Expenditures for O&M

4.2-01 Gravity Irrigation O&M: Main Systems. Information on actual expenditures for O&M is quite fragmentary. Discussion in the previous sections suggests that O&M expenditures for the main systems are largely limited to the earmarked funds coming from the Central government. This suggests that at an aggregate level, current expenditures average between Rp 8,000 and 11,000 per ha (Table 6). But this is a national average, covering all types of systems. Data on the amount of Central government funds for irrigation O&M budgeted for 1983/84 for each province indicate a considerable variability among the provinces in the average amounts expended per ha. The amounts generally ranged from about Rp 5,900 to Rp 16,500 per ha of "potential" irrigated area (Table 8). There is a distinct tendency for provinces with little irrigated area to have relatively high per ha values. This probably reflects the portion of funds that are needed for the relatively fixed costs of administrative overhead at the regional government levels.

4.2-02 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 9. Although the overall average allocation for O&M is approximately Rp 7,000 per ha, the average allocation for the 14 technical systems was about Rp 5,350, while for the 40 semi-technical systems the average figure was Rp 18,270 per ha. One possible explanation for this unexpected result is that the O&M cost per ha for small systems tends to be greater than for large systems. In the case of Lampung, all 40 of the semi-technical 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.

4.2-03 Taylor (1979) reports that main system O&M expenditures in the Pekalen Sampean Irrigation Project for 1973/74 amounted to approximately Rp 830 per ha, which is approximately equivalent to Rp 3,600 in 1983 prices. He notes that approximately 90 percent of this amount was for salaries of personnel; 5 percent for equipment and 5 percent for materials.

4.2-04 Bottrall (1978) studied one section (Jember) of the same project earlier studied by Taylor. He noted that expenditure levels had recently risen sharply, reflecting the Central government's concern with improving levels of O&M. The Section Engineer reported to him that O&M expenditures for 1976/77 were $8 (Rp 3,320) per ha, which is equivalent to about Rp 8,300 in 1983 prices.

4.2-05 An IBRD loan-financed study 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 per 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 be spent for O&M costs at the region and provincial levels.

Although not clearly specified in the report, this presumably refers to administrative overhead expenditures.

4.2-06 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 (WUA), such as OPPA, P3A, Dharma Tirta, and Subak. These WUA 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.

4.2-07 The large number of WUA 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. Data from WUA in ten High Performance Sederhana Irrigation Projects are presented in Table 10. Both the rates of farmer contributions and the allocation of funds vary among the WUA under consideration. Farmers pay 12 kgs of paddy per hectare per season in South Sumatra and as much as 75 kgs of paddy per ha per season in North Sumatra, with an average of 36 kgs per hectare per season for the 10 WUAs. The proportion of the fund collected and allocated for O&M varies from zero to 50 percent. Where no allocation is given to O&M, the component alloted to "cash" may be used when needed and as decided by the members of the WUA.

4.2-08 The allocation for O&M is mostly spent on the purchase of materials like cement, gravel and sand in lining canals, food for the farmer-members of the association

providing unpaid labor for rehabilitation and repair work, and other expenditures directly incurred for operation and maintenance work.

4.2-09 The categories for the allocation of funds shown in Table 10 may not be strictly comparable among the WUA. For example, in the first association, 15 percent is allocated to the O&M category, while 50 percent of the collection is alloted to field workers. But the field workers are hired to repair and maintain the canals; therefore, for those WUA with no "field worker" category, the cost of field workers may be included in the O&M category.

4.2-10 In August 1985, the team visited the Blotan OPPA in Yogjakarta (in Ngemplak Subdistrict of Selman District) and the Blimbing Dharma Tirta in Central Java (in Gatak Subdistrict of Sukoharjo District). These WUA gave the rates per season and allocation of the funds as follows:

Organization	Rates Charged	Allocation of Funds	
OPPA of Blotan	20 kg/ha/wet season Rp 4,000/ha/dry season	1. OPPA Officers 2. OPPA Administration 3. O&M	40% 20% 40%
Dharma Tirta of Blimbing	Rp 4,000/ha/crop	1. O&M 2. DT Committee 3. DT Field workers	50% 18% 40%

4.2-11 At the government support price of Rp 175/kg paddy, the rate charged during the dry season by the OPPA of Blotan is higher by about 15% than the wet season rate. Discussions with the officers of the OPPA indicated a preference on the part of the organization to collect membership fees (water charges) in cash rather than in kind, due to problems in handling the collection in kind and the depressed prices of paddy.[2]

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[2]The rice surplus in 1985 caused farm gate prices of paddy to be as low as Rp 100/kg. At this price, the cash equivalent of the rate charged for the wet season only amounts to Rp 2,000/ha, compared to Rp 3,500/ha at the government support price. This demonstrates that denominating irrigation service fees in kind to avoid erosion of the real value of the charges due to inflation can create serious financial problems in times of depressed output prices.

4.2-12 The allocation of the funds collected from the farmer-members of the OPPA and Dharma Tirta is very similar to those for the WUAs included in Table 10.

4.2-13 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 11.

4.2-14 In his study, Taylor (1979) found that payments by farmers to local village officials for irrigation services (including the imputed value of unpaid labor) averaged about Rp 3,780 per ha, equivalent to about Rp 16,200 at 1983 prices. In his subsequent study of one portion of the same project, Bottrall (1978, p 14) reported generally similar rates of payment.

4.2-15 In their study of two project areas, the Gadja 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 2,500 per ha in the South Sulawesi area (Gadja Mada University 1982, p IV-25). In addition, farmers contributed an unspecified amount in the form of unpaid labor.

4.2-16 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 12. The amounts range from about Rp 5,000 to about Rp 11,000 per ha per season, with the total annual contributions ranging from Rp 11,400 to Rp 21,100 per ha. The largest figure is for the communal system, which is entirely managed by the local WUA. The relatively high farmer contribution to the technical system (Rp 17,100 per ha per year) reflects the fact that this system supports three crops per 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.

4.2-17 Data on O&M expenditures by farmers in irrigation systems in Cirebon district of West Java in 1980/81 are presented in Table 13. The data distinguish contributions made in kind to the village officials, labor contributions for O&M, and cash contributions for maintenance and repair. Information was collected for each of the three cropping seasons during the year. For areas where paddy

dominated the cropping pattern throughout the year, the contributions amounted to Rp 33,150 per ha. In areas predominately planted to crops other than paddy during the dry season, the payments averaged Rp 21,450 per ha.

4.2-18 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 substantially exceeding the per ha expenditures of the government for main system O&M -- and that the amount of the contributions can be highly variable.

4.2-19 Pump Irrigation O&M. Groundwater irrigation is relatively new, with the existing systems being in operation for not more than 10 years. The Groundwater Development Project of Irrigation II, within the DGWRD, is the agency responsible for groundwater development. The main problem encountered in the existing systems has been the lack of capability within the farmers' association to fully take over the operation and maintenance of the system, once the system is handed over to them by the government. The need for cash in paying for fuel, the distance between the pump and the source of fuel (station), and the lack of other complementary support programs on marketing and provision of production inputs, have been pointed out by the Project office as other constraints.[3]

4.2-20 The cost of operation, including regular maintenance but excluding major repairs, has been estimated by the Groundwater Development Project office to average Rp 1,317.50 per hour of pumping. This figure is based on the following:

Item	Volume	Cost[a/]	Cost per hour
1. Fuel	0.5 lit/hr	Rp 220/lit	Rp 1,100.00
2. Oil	0.035 lit/hr	Rp 700/lit	Rp 24.50
3. Grease	-	Rp 10/hr	Rp 10.00
4. Operator	-	Rp 33/hr	Rp 33.00
5. Administration, WUA	-	Rp 100/hr	Rp 100.00
6. Maintenance	-	Rp 50/hr	Rp 50.00
		Total	Rp 1,317.50

[a/] As of September 1984.

[3/] Discussion with Mr. Marzuki Saleh, Groundwater Development Project, Irrigation II, DGWRD.

4.2-21 Using the above cost per hour, the pumping cost per hectare for different crops were estimated. For wet season paddy, where pump irrigation is used only to supplement rainfall during periods critical need, the cost of pumping is calculated to be Rp 9,762 per hectare. However, for paddy grown during the dry season, the cost is estimated to be Rp 81,860 per hectare. Corn or peanuts planted after the first wet season crop have estimated pumping costs of Rp 30,214 per ha, while a third crop of corn would entail pumping costs of Rp 42,225 per ha. These various pumping costs are indicative figures since the actual hours of operation depends on the type of soil, amount of water received from rainfall, etc., in addition to the kind of crop grown. DGWRD has also estimated the O&M costs to vary from Rp 50,000 to 84,000 per ha per year, according to the size of pumps, with the highest cost being associated with the smallest pumps (Table 4).

4.2-22 An OPPA (Water Users' Association) in Bantul, Pajangan in the Province of Yogjakarta charges a fee for groundwater irrigation of Rp 150,000 per hectare per crop, payable in 3 installments - during land preparation, after planting and before harvest. Prior to 1984, when the OPPA received a subsidy for O&M from the government, the fee was only Rp 50,000 per hectare per crop. Of the 60 hectares covered by the association, only 10 hectares of paddy field were being irrigated during the dry season crop of 1985 because of the high cost of pumping and the depressed prices of paddy. The association has earmarked the Rp 1,500,000 collected from the 10 hectares for expenditure as follows:

1.	Fuel	Rp 600,000	(40.0%)
2.	Spare parts	Rp 200,000	(13.3%)
3.	Canal maintenance	Rp 200,000	(13.3%)
4.	Honorarium for officers and wage operator	Rp 200,000	(13.3%)
5.	OPPA administration, meetings, training programs	Rp 300,000	(20.0%)
	Total	Rp 1,500,000	

It would appear that the actual cost of pumping (mainly fuel and spare parts) is comparable to the Rp 81,860 per hectare for a dry season paddy crop estimated by the Groundwater Development Project of DGWRD.

4.3 Desired Expenditures for O&M

4.3-01 The Sub-directorate of Operation and Maintenance under the Irrigation I Directorate of DGWRD has calculated detailed estimates of the expenditures needed for proper O&M for the different types of gravity irrigation

systems. The estimated total costs, calculated at 1983 prices, are as follows:

Technical irrigation systems	Rp 13,600/ha.
Semi-technical irrigation systems	Rp 9,718/ha.
Simple irrigation systems	Rp 5,388/ha.

4.3-02 The cost components in arriving at these O&M costs per hectare are shown in Table 14. In each case, the computations are based on the requirements of a 30,000 hectare system. The DGWRD has provided these guideline cost figures to the provincial governments for their use in the preparation of their budget requests for main system O&M.

4.3-03 From Table 14, the percentage distribution of the proposed O&M costs can be calculated as follows:

	Technical	Semi-technical	Simple
Salaries/wages	28.2%	24.9	24.7
Maintenance of facilities	3.2	2.9	3.9
Maintenance of irrigation canals/structures	61.4	63.4	59.2
Upgrading of services (tertiary)	1.8	2.6	4.6
Other costs	5.4	6.2	7.6

4.3-04 Compared with the distribution of O&M expenditures reported in above from the studies by Taylor (1979) and Gadja Mada University (1982), these guidelines show a substantial reduction in the proportion of funds used for salaries and wages, and a larger proportion earmarked for the actual maintenance of irrigation canals and structures.

4.3-05 In addition to these O&M costs per ha, O&M costs for special structures, exclusive of emergency repairs due to natural disasters, are estimated by the Sub-directorate of O&M as follows:

- Reservoir (Waduk) — Rp 200,000 per million m^3 per year
- Pump — Rp 105,000 per pump per year
- Flood control dike (Tanggul Banjir) — Rp 600,000 per km. per year
- Small weir (Bendung Gerak) — Rp 100,000 per m^2 per year

4.3-06 The Gadja Mada University (1982) study of O&M in the Gung Section of the Pemali-Comal project concluded that the existing allocation for O&M was not sufficient for the efficient operation of the systems. 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 per hectare per year. As this estimate was made for the 1980/81 year, this value would be equivalent to about Rp 29,000 in 1983 prices. About Rp 13,000 of this amount (Rp 18,000 in 1983 prices) would be to provide for the main system O&M costs and the remaining Rp 8,000 (Rp 11,000 in 1983 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 15.

4.3-07 As shown in Table 15, the increase in O&M expenditures proposed in the Gadja Mada University report 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 Gadja Mada University indicate that nearly 50 percent of the total expenditures was for salaries and wages. Expenditure on O&M of channels, hydraulic structures and inspection accounted for about 35 percent. The proposed O&M cost for the main system has a relatively lower proportion (40%) allocated for wages and salaries, while a larger percentage (48.6%) would be allocated for O&M of channels, hydraulic structures and inspection, including routine and periodic O&M costs.

4.3-08 At the tertiary level, the Gadja Mada study estimated the farmers' contribution in cash and in kind to be Rp 2,490 per hectare per year, or 18.6% 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 O&M level of expenditures, farmers are expected to contribute a total of Rp 5,950 per hectare 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 nearly 30 percent of the combined O&M costs for the main system and tertiary canals.

4.3-09 The proposed level of O&M expenditures would thus increase not only the total amount spent per ha, 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. In effect, the relative amount for overhead costs would be lower.

4.3-10 A word of caution is perhaps in order when considering these figures proposed for "adequate" O&M funding. These should be taken as indicative figures, since the amounts needed will vary with the type and status of the irrigation systems. O&M costs will differ for technical, semi-technical and simple systems. O&M needs will also depend on the existing state of rehabilitation or level of upgrading of the system. Furthermore, expenses for "operation", "maintenance" and "overhead" are not well defined. These categories of expenditure are most likely to vary from one budget to another.

4.4 Control Over Expenditure Decisions

4.4-01 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 clearly has a major role in determining the aggregate level of O&M funds available to the Provincial governments. Within the budget limits established, the Provincial governments, through the Provincial Public Works Departments, exercise considerable control over expenditure decisions. Farmers are not involved in these decisions.

4.3-02 For O&M at the tertiary level, farmers' organizations and the local village government officials are responsible for the control of expenditures. As noted in section 4.2, one consequence of this is the existence of considerable variability among projects in the levels and types of expenditures for tertiary O&M.

5. Farmers' Ability to Pay for Irrigation Services

5.1 Output Price Policies

5.1-01 The Government of Indonesia has followed a pricing policy for rice which has generally 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 (World Bank 1982 draft Thompson paper, p 31).

5.1-02 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 1983 prices for 1976 to 1984 are shown in Table 16. In real terms, the floor price has remained relatively constant over most of this period. Farmers frequently receive less than this price. It is reported that because of the difficulties associated with the rice surplus that Indonesia is currently experiencing, farmers are often receiving a price of only about Rp 100 per kg for paddy.

5.1-03 For 1981, a nominal protection coefficient of 0.63 for rice was estimated (World Bank August 1982, p 32). 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 paddy 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.

5.2 Price Policies on Inputs Other than Water

5.2-01 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 the farmers. This has resulted in a significant subsidy to the farmers, which enhances their ability to pay for irrigation services, and may offset the negative effects of the rice policy on their ability to pay.

5.2-02 The total amount of the fertilizer subsidy in 1980/81 was Rp 138 billion. The amount budgeted for 1981/82 was Rp 314 (World Bank 1982 draft Thompson, p 31). Timmer (n.d.) notes that the 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.

5.3 Tax Policies

5.3-01 The most important government tax policy affecting the farmers' ability to pay is the land-based IPEDA tax. Since the amounts collected from this tax are related to irrigation, it is discussed in section 6.2 dealing with indirect methods of financing irrigation services.

5.4 Irrigation Benefits and the Farmers' Ability to Pay for Irrigation Services

5.4-01 Under conditions typical for Indonesia, irrigation can be expected both to increase yields of rainfed crops (mostly rice) and to increase cropping intensities. Measuring the incremental benefits due to irrigation is difficult, however, and only limited information is available.

5.4-02 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 an non-irrigated crop, due to increased use of inputs. But 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 rainfed ares.

5.4-03 The Gadja Mada University (1982) 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 the net annual income in the irrigated area with that of a corresponding rainfed area. Pemali-Comal in Central Java represented in the study the type of irrigation projects characterized by diversified cropping and high cropping intensity. Bantimurung and Lanrae in South Sulawesi are typical of projects in the Outer Islands with rice-oriented cropping patterns and lower cropping intensities.

5.4-04 The net incremental benefits by farm size and type of irrigation system are shown in Table 17. The results show that the incremental income from irrigation is higher for the technical irrigation systems than for the semi-technical or simple systems. In the technical systems, owner-operators receive greater benefits than did share croppers. In the semi-technical systems, the differences in income between the two groups were not consistent among the different farm sizes.

5.4-05 A World Bank (1984) report contends that while the Gadja Mada University data was gathered in 1981/82 and its accuracy may be subject to question, its implications and order of magnitudes are still valid. The incremental benefit figures, however, only show whether there is sufficient increment in net income resulting from irrigation to pay for the cost of supplying the water used.

5.4-06 On the basis of the UGM study's recommendation that Rp 21,100 per hectare per year is the "adequate" level for O&M expenditures and taking Rp 7,000 per hectare as the average IPEDA paid by farmers in irrigated farms, the farmers would have to pay an average of about Rp 28,000 per hectare per year just for water charges (O&M) and IPEDA. This amount is equivalent to approximately 16% of the average incremental benefit due to irrigation. The payment to IPEDA (Rp 7,000/ha) plus the in cash and in kind payment of farmers at the tertiary level (Rp 2,490/ha) only come up to 5.4% of the average incremental benefit. It appears that even without a government subsidy for O&M expenditures, the incremental gain from irrigation is much more than the payments for irrigation service fee and the IPEDA.

5.4-07 The UGM 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). The average size of farm below which there is no economic surplus is shown in Table 18 for the technical, semi-technical and simple irrigation systems in the two project areas.

5.4-08 Given the farm size distribution in the areas studied, a total of 62% of the owners had a zero economic surplus. This implies that if the criterion of zero economic surplus is used as a cut-off 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 Gadja 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. As the data shows, larger farmlands with technical irrigation systems are in a better position to pay for water charges.

5.4-09 Farm production survey data from the Ministry of Agriculture, which compare production, cost of production and net income per hectare for lowland and upland paddy, are presented in Table 19. Net income per hectare derived from lowland paddy is 2.2 times that from upland paddy.

While the total cost of production per hectare of lowland paddy is almost twice (1.9 times) that of upland paddy, the yield of lowland paddy is 2.1 times as much. The total value of the production from lowland paddy is twice that obtained from the upland paddy. However, had the same price of Rp 130.85 per kg. of paddy been applied to both lowland and upland paddy, the total value of the production of the upland paddy would have been Rp 348,846 only instead of Rp 369,107 as indicated in the Table. Consequently, this would have resulted in a net income of Rp 102,705 per hectare for upland paddy production. In such a case, the net income from the production of lowland paddy would be 2.65 times that from upland paddy.

5.4-10 The components of the cost of production for both types of paddy are also shown in Table 18. The value of the production inputs per hectare applied to lowland paddy is 1.3 times that for upland paddy, with substantially much greater applications of commercial fertilizers, pesticides and herbicides on lowland paddy fields. On the other hand, farmers in the upland use more compost and organic fertilizers than their counterparts in the lowland. The higher amount of interest paid for credit by lowland paddy farmers may be attributed to the higher production inputs they utilize. The fact that the rent to land is three times as high for the lowland paddy is an indication of substantial increases in the net returns resulting from irrigation. The category that includes taxes, depreciation and contribution to the WUA (P3A) is very much higher in lowland paddy fields. This reflects the 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 the IPEDA) is increased as a result of irrigation.

5.4-11 The changes in labor utilization associated with lowland production are significant when one considers the population and unemployment situation in Indonesia. Although there is some decrease in the amount of family labor used, total labor use is increased, and, more significantly, hired labor use more than doubles.

5.4-12 In general, if one associates irrigation with lowland paddy production, it can be said that the higher productivity in lowland paddy fields encourages the use of fertilizers and other inputs, requires more labor, and produces more income. The increased income can be expected to be capitalized in higher land values, which are reflected in the higher rent to land.

5.4-13 Provincial data on yield, cost of production and income from the cultivation of lowland and upland paddy are presented in Tables 20 and 21. As indicated by the national averages, on a per ha basis, upland paddy fields registered lower cost of production, yield and income than in the case of lowland paddy. But the fact that production costs per kg of paddy 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 non-land 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.

5.4-14 While both kinds of paddy show large variations from province to province in both production and yields, the variability is more pronounced in the case of upland paddy. Furthermore, there is less correspondence between the cost of production and yield in the case of upland paddy. The erratic relationship between production inputs and output is most probably due to water being a more limiting factor in upland paddy fields. As a result, fields with high costs of production are not necessarily those with high yields. For example, in Kalimantan Selatan, the cost of production of upland paddy is Rp 269,800/ha and the average yield is 1.6 metric tons/ha, while in the same region, Kalimantan Barat has an average cost of only Rp 174,240/ha, but a yield of 1.65 metric tons/ha.

5.4-15 In effect, the two tables show the complementarity between water and the other production inputs in the production of paddy. In the case of upland paddy, the unreliable supply of water which is needed to complement the other inputs, may have prevented the realization of the yield-targets much more than any other factor of production.

6. Methods of Financing Irrigation Services

6.1 Direct Methods of Financing

6.1-01 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 (the landrente) as a cost recovery measure for irrigation (by means of the higher taxes levied on irrigated lands). Given this history, the existence today of a similar land-based tax (IPEDA), may present a constraint to any change in policy in the direction of the introduction of direct government charges for irrigation services.

6.1-02 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 operation and maintenance (O&M) of the system. Furthermore, while Act No.11 of 1974 states that water is a gift from God, one of the Articles stipulates that those who derive direct benefits from an irrigation project should be called upon to contribute towards the management service cost.

6.1-03 At the tertiary level, farmers make a variety of types of contributions to provide resources for the O&M of the tertiary system. It appears that in general, the collection of the required fees, either in the form of cash payments, payment in paddy, or labor contributions, through WUA and village government is not a problem. The social pressure on farmer-members to pay is strong, especially in the traditional WUAs in Java and the Subaks of Bali.

6.1-04 An OPPA of Blotan in Sleman, Yogjakarta reported a 100 percent collection from its 274 farmer-members covering 66.5 hectares. When the team asked the officials of the association how they managed to collect all the dues, their answer was simple: No water is given to any farmer who does not pay his dues. Another OPPA in Bantul, Jogjakarta also claims to strictly follow a policy of "no water for non-payment of dues". However, since the fee is paid in three installments, we inquired about the possibility of the farmer defaulting in his payment after the first or second installment. In such cases, the members of the association will harvest from the non-paying farmer's field the equivalent amount that is due the association.

6.1-05 It is apparent that the associations are successful in collecting the membership fees from the farmers because these are able to implement the regulations and impose the sanctions agreed upon by the farmer-members. In the

constitution of the Dharma Tirta of Blimbing, District of Sakoharjo in Central Java, it is written that "1) a member is prohibited to damage, steal and disturb the course of water and 2) a member is prohibited to damage the legumes planted along the banks of ditches/canals, ridges and dikes, as well as to damage irrigation structures." In the first offence, one gets a warning. In the case of a second offense, the farmer is fined 10 times the value of the damage or loss or, in the case of stealing water, the farmer will receive his water 10 days after his scheduled turn. A third offense will bring the matter to the committee and the members in plenary session for final decision.

6.1-06 Since the establishment of Blimbing's Dharma Tirta in 1972, only one member of the association was disciplined for stealing water. The above-mentioned sanctions were not yet enforced at that time and the members decided to require the offender to clean the entire stretch of the canal which, otherwise, was assigned to the farmers served in the area. The cleaning was under the direct supervision of the officers of the association.

6.1-07 Other measures to impose discipline include lining (using bricks and concrete) the side of the canal adjacent the farmer's field, primarily to reduce and control the access points where water can be drawn and only secondarily to reduce water loss. Furthermore, during the dry season when water is scarce, only the assigned gate keeper has the right to open or close intakes to the rice fields. All intakes are also considered the property of the Dharma Tirta.

6.2 Indirect Methods of Financing Irrigation Services

6.2-01 The most significant indirect method of financing irrigation services in Indonesia is the land-based tax, IPEDA (Iuran Pembangunam Daerah or Regional Development Fee).

6.2-02 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 and 20 percent of the value of average net yields of land, depending on transport and marketing facilities in a village (ADB 1981).

6.2-03 The first individual property tax (verponding) was introduced in 1928. Prior to this time, the customary law in Indonesia (the Adat), considered the right to land as a combination of several rights controlled by the community.

6.2-04 Ordinance No.11, 1959 established the tax on land production (Pajak Hasil Bumi). The tax was levied at a rate of 5 percent of the value of the net yield of the land. The revenue from the tax was for the financing of rural development projects. Law No.11 authorized the Minister of Finance to approve a higher rate (not exceeding 10 percent) at the request of a local government. However, this authority has never been exercised.

6.2-05 In 1965, administrative changes were made, and the Pajak Hasil Bumi was renamed as the Iuran Pembangunan Daerah or IPEDA. The name stresses the nature of the tax as a contribution (Iuran) to regional development (Pembangunam Daerah). Since 1965, the IPEDA has been levied on all lands: rural, urban, estates, mining and forestry. Subsequent discussions on IPEDA will focus on the land tax in the rural sector.

6.2-06 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 Kaputusan Direktur Jendual Pajak No. KEP-850/PJ.66/ 1979, which refers to the classification of irrigated and rainfed 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 by the size of the land holding.

6.2-07 Tables 22 and 23 present the rates of IPEDA assessment for rural paddy and non-paddy lands by productivity class and size of land holding. Irrigated paddy land has 15 productivity classes, while non-paddy land has 17 classes. The classes are also categorized by farm size, from less than 1/2 ha to greater than 5 ha. For the productivity classes, the greater the number of the class, the less productive is the land and therefore, the lower is the IPEDA rate. Within any productivity class, a higher IPEDA rate is applied as the size of the land holding increases.

6.2-08 Although assessment and collection of IPEDA is formally the responsibility of the IPEDA Directorate, for the rural sector the IPEDA tax is frequently collected by the

village (desa) officials, who then remit the funds to the district (Kabupaten) through the sub-district 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 Kabupaten), and the remainder (72 percent of the total collected) goes to the Kabupaten.

6.2-09 The revenues collected from IPEDA on all types of land from 1979/80 to 1984/85 are presented in Table 24. The growth rate for the total IPEDA collections averaged 17.8% during the period, while the revenues derived from rural land grew at an average of 9.8 percent per year. The relative share of the contribution of the rural sector in the total IPEDA revenue has thus declined from 42% in 1979/80 to 30% in 1984/85.

6.2-10 Collections from the rural sector still comprise the single largest source of "contributions to rural development," although the collections from urban land, which have been growing much more rapidly, are now nearly as large.

6.2-11 Relationship between IPEDA Revenues and Irrigation. Details on the revenues derived from irrigated paddy 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 IPEDA revenues may be weak.

6.2-12 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 to 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.

6.2-13 In his study in the Jekalen Sampean project, Taylor (1979) collected information on the amounts of IPEDA

payments of farmers of both irrigated and non-irrigated land in 1973-74. The average payment for irrigated land was about Rp 5300 per ha per year (equivalent to about Rp 22,700 in 1983 prices), while the average payment for dry land was only about Rp 800 per ha (about Rp 3,400 in 1983 prices). This suggests that the IPEDA may result in a substantial amount of indirect recovery of irrigation costs.

6.2-14 Utilization of IPEDA Revenues. The IPEDA fund, as stipulated in Law No.11 of 1959, is required to be used by the Kabupaten 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 (1) irrigation infrastructure, (2) transport infrastructure, like roads and bridges, (3) flood control structures and (4) agricultural support services, such as seed stations and other agricultural inputs.

6.2-15 An additional requirement imposed by the Ministry of Home Affairs (Instruction No. Ekbang 7/27/72 of 1972) is that 20% of IPEDA fund should be allocated for the maintenance of infrastructure created through the Inpres programs. However, a World Bank (1984) report claims that inquiries in the field revealed that this allocation was not always made.

6.2-16 Except for the broad categories on the composition of the development projects, the Bupati (head of the Kabupaten) has considerable discretion over the allocation of the 72% of the IPEDA revenues he receives. The Gadja Mada University (1982) study found that only a very small percentage of the IPEDA revenues is spent on agricultural development, with only perhaps one percent spent for irrigation development (Tables 25, 26 and 27).

6.2-17 The World Bank (1984) points out that the IPEDA revenue is regarded solely as a development fund and not as a routine O&M fund, particularly in Java. The same report implies that in the allocation of funds, 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 a central and/or provincial government subsidy. Since most of the other revenue sources directed to the Kabupaten level are fixed or earmarked for specific purposes, the IPEDA revenues may be the only significant fund over which the Bupati may exercise his discretion.

6.2-18 Non-compliance with the objectives for the use of funds has been reported by Booth (1974), who wrote "Expenditure

on development projects defined as economic infrastructure seems a residual category to be considered after expenditures on wages, salaries, vehicles and office equipment have been allocated". She also mentioned the use of the development budget on "bureaucratic infrastructure" and "a considerable portion of the funds not being used for economically justifiable development projects". Likewise, the Kabupaten budget for 1978/79, estimated on the basis of samples covering 69% of the population, indicates that total development expenditure on rural economic development projects was equivalent to 76% of IPEDA revenue, suggesting that the remaining 24% was spent for purposes other than rural development (World Bank, 1984)

6.2-19 Proposals for Modifications in IPEDA. The structure of IPEDA as a tax designed to reflect the productivity of land has led to suggestions for modifications to make the tax more satisfactorily recover irrigation costs. 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 revenue from beneficiaries of irrigated lands; and allotment of a portion of the IPEDA for O&M costs of irrigation projects.

6.2-20 The simplest approach to modifying IPEDA is to update the land classification and assessment system so that assessments more accurately reflect actual productivity conditions. The loan agreement between the Government of Indonesia and the World Bank for the Kedung Ombo Project provides for technical assistance for "updating classification of land for tax purposes to improve cost recovery". Similarly, the loan agreement for the West Tarum Canal Improvement Project provides for "land mapping for reclassification and reassessment of taxation". The reclassification of all lands benefitting from project works and the subsequent reassessment and collection of IPEDA taxes from all project beneficiaries should increase the total revenues collected from IPEDA.

6.2-21 Earmarking a portion of the additional IPEDA revenues generated for irrigation development for the purpose of irrigation O&M represents a more fundamental modification of IPEDA. The idea is attractive because it provides a direct link between revenues and expenditures, and because it utilizes an existing collection mechanism which appears to be fairly efficient. While it may be possible to implement such changes in selected pilot project areas, there are problems associated with a more general effort to "graft" an irrigation tax onto the IPEDA.

6.2-22 One difficulty is that at the Kabupaten level, where decisions about expenditure of IPEDA revenues are made, IPEDA has been seen as a major source of revenue for development activities. Ministerial decrees have also emphasized IPEDA as a development fund, rather than as an O&M fund. Earmarking a significant portion of IPEDA for O&M would require significant policy changes which are likely to be resisted by the Bupati, unless some alternative source of discretionary funding for the Kabupaten were provided by the Central government. But such an arrangement would defeat the objective of reducing the fiscal burden which irrigation is placing on the Central government.

6.2-23 A second difficulty is that if IPEDA is to be used to fund O&M in national irrigation systems, a distinction needs to be made between rates of tax that would apply to land covered by national irrigation systems and rates for land that is irrigated by communal systems. Higher tax rates would need to be applied to land served by government irrigation systems than to land of comparable productivity which is served by communal systems. Unless this is done, land which is communally irrigated would be penalized by having to pay taxes for services that are not received from the government. Such taxes might have the effect of reducing the level of funds which the local communities could collect from the farmers for irrigation O&M and improvement, thus reducing the quality of irrigation services in these areas. It could also discourage communal efforts to upgrade irrigation facilities, since these activities, undertaken at the expense of the farmers, would lead to increased taxes for irrigation.

6.2-24 A third problem, discussed by Bottrall (1981) is that because the level of IPEDA a farmer is required to pay depends on the rating of a given parcel of land as to its irrigability rather than on the quality of irrigation service actually received, "the IPEDA payments, instead of being seen as a service charge (to be increased or withheld according to farmers' satisfaction with the service received), will simply continue to be regarded as a tax, and hence a burden" (p 34).

7. Relative Contribution of Farmers to Irrigation Financing

7.-01 If one ignores the indirect contribution to government finances that farmers make through IPEDA, farmers in government irrigation systems generally contribute a portion of the O&M costs (for the tertiary O&M) and none of the capital costs. 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 28 and 29. Using the moderate level of tertiary O&M costs of Rp 15,000 per ha, the estimated percentage of the total cost of irrigation services paid by farmers ranges from less than 4 in the case of investment costs typical of technical irrigation systems to 13 percent in the case of investment costs typical of small irrigation systems (Table 29).

7.-02 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 29. If one assumes that this averages Rp 8,000 per ha (a figure equal to the assumed O&M cost for the main system), then the percentage contributions of the farmers increase, in the case of a moderate level of cost for tertiary O&M, to 5.5 percent for large ("technical") systems to about 20 percent for small systems. These latter figures represent the contribution of the farmer to the total cost of irrigation services when the farmers' contributions are equal to the entire cost of system operation and maintenance, but with no contribution to the recovery of the capital costs.

8. Evaluation of Financing Policies

8.-01 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 to the local WUA. 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.

8.-02 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) 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" (p 120). 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.

8.-03 The critical factor leading to efficient water use would seem to be the high opportunity cost of scarce irrigation water, combined with a 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 local WUA, seems to provide the necessary incentives and structure for efficient water use.

8.-04 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.

8.-05 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 WUA.

8.-06 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 DGWRD. These dual lines of accountability complicate the context within which control of O&M activities and expenditures takes place.

8.-07 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 the DGWRD estimates of need appears to vary considerably among the provinces.

8.-08 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 creates 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. Payments traditionally have not been fixed charges or "taxes"; rather, they are "feeling" payments, with the amounts 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 among 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.

8.-09 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 routine staff involved in main system O&M. The only significant inflow of public funds resulting from irrigation is the IPEDA. Although data are available on the total amount of IPEDA funds generated by rural land (Table 24), the extent to which irrigation has contributed to the IPEDA collections is not known.

8.-10 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 7) with the total IPEDA collections from the rural sector (from Table 24). This comparison is presented in the first column of Table 30. 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 IPEDA revenues 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 (column 2 of Table 30). Although there has been some year-to-year fluctuations, since 1981 these grants have been approximately equal to the revenues from IPEDA.

8.-11 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 funded through the IPEDA funds), and it is definitely not a tax to fund irrigation O&M.

8.-12 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 Indonesian) were originally intended to be temporary, until the local government units could generate adequate funds from their own tax sources to fully support such activities.

8.-13 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 30. In recent years, the total government grants earmarked for these rural development activities have been from 1.7 to nearly 2.0 times as much as total rural IPEDA revenues.

8.-14 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 30. 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 the IPEDA revenues from other sources are included (since not all of the discretionary funds are used to support rural development activities), the grants have been from 1.8 to 2.4 times as much as the IPEDA revenues (Table 31, last column).

8.-15 It is 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.

8.-16 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 of Indonesia 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.

8.-17 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 irrigated farmers. Considering the small size of many farmers -- particularly on 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.

8.-18 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.

Annex 1

Authority on the Management of Irrigation Water and Irrigation Network - Article 2, Part II of Government Regulation No.23 of 1982 on Irrigation, Republic of Indonesia.

Article 2

1. The management and regulation of irrigation water and irrigation networks together with their accessory structures within a Provincial area of jurisdiction shall be delegated to the relevant Local Government subject to the provisions of this Government Regulation, unless otherwise governed by Government Regulation or Law.

2. The management of irrigation water and irrigation networks together with their accessory structures within tertiary blocks, Desa irrigation and Subak shall be delegated to the water user farmers or Desa or Subak under the administration of the Local Government taking into account the provisions of this Government Regulation.

3. The management of irrigation water and irrigation networks together with their accessory structures, constructed by corporations, associations, and individuals, shall be delegated to the relevant corporations, associations and individuals taking into account the provisions of this Government Regulation.

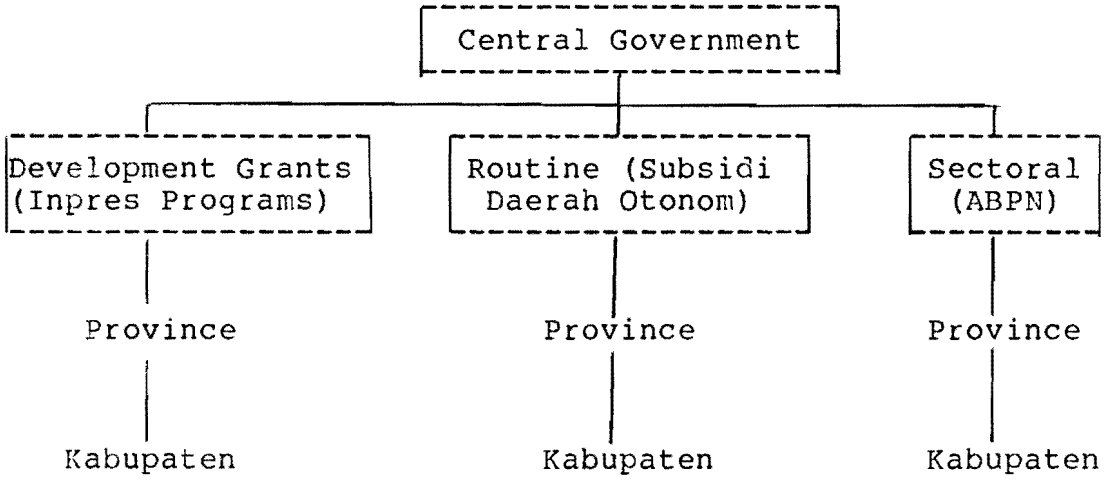
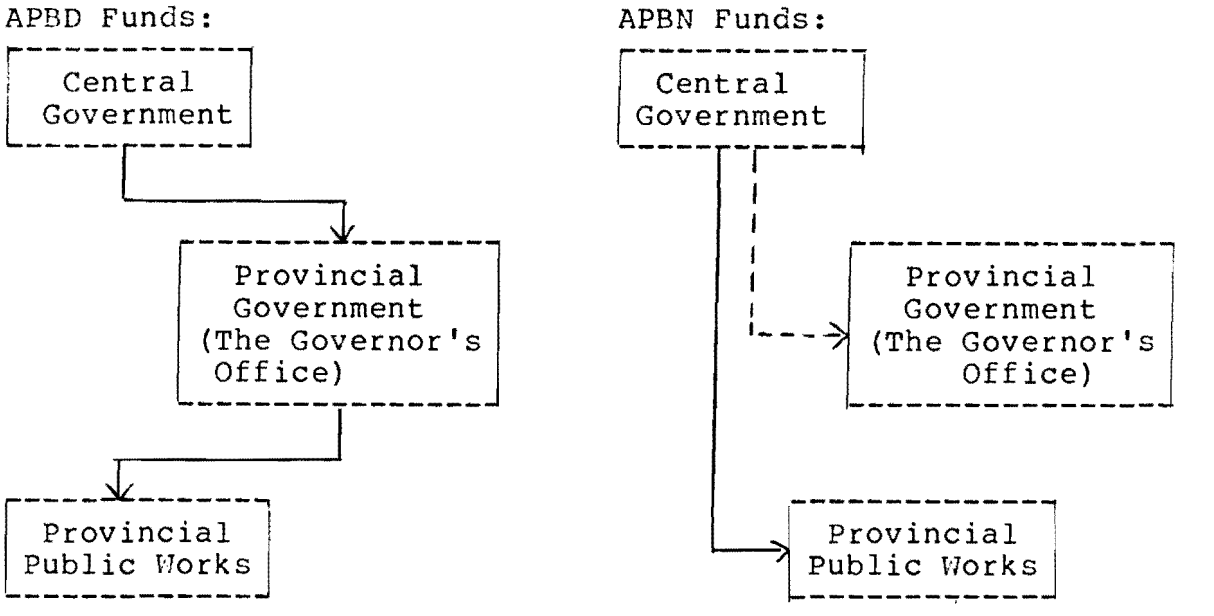


Figure 1. Funding Flows from the Central Government to Province and Kabupaten Levels

Source: The World Bank. Indonesia Cost Recovery: Issues and Options in the Irrigation Sector. Washington, D.C., The World Bank, 1984.



———> = Subsidy line
-----> = Information line

APBN = Central Government Budget
APBD = Provincial Government Budget

Figure 2. Central Government Subsidies for O&M of Irrigation Systems

Source: General Information on : Irrigation Operation and Maintenance Activities in Indonesia Directorate of Irrigation I, Directorate General of Water Resources Development, July 1984.

Table 1

Distribution of Existing Tubewells, 1983-84.

Place	Potential Area, Ha.	Completed Units	Completed Ha	Handed to Farmers Units	Handed to Farmers Ha	Still W/DGWRD Units	Still W/DGWRD Ha
1. Madium - solo	58,500	54	4,500	42	2,632	12	1,868
2. Kediri - Nganjuk	23,000	129	5,500	119	4,787	10	763
3. Jawa Timur Lainnya	20,000	22	827	19	606	3	221
4. Madura	6,500	36	1,089	27	804	9	285
5. D.I. Yogyakarta	3,500	36	1,150	28	894	8	256
6. Jawa Tengah	10,000	6	108	-	-	6	108
7. Bali	5,000	3	91	2	80	1	11
8. Nusa Tenggara Barat	5,000	7	120	-	-	7	120
9. Other Areas	19,000	2	40	-	-	2	40
Total	164,500	295	13,675	237	9,899	58	3,776

Source: Groundwater Development Project
Directorate of Irrigation II, DGWRD, 1985.

Table 2

Types and Areas of Existing Irrigation Systems
(million ha)

Region	Gravity Irrigation				Tidal and Swamp Lands	Total	Percent (%)
	Technical	Semi Technical	Simple	Village			
Java	1.63	0.38	0.55	0.53	-	3.10	62
Bali	-	0.04	0.01	0.05		0.10	2
Sumatera	0.22	0.32	0.28	0.29	0.03	1.15	23
Kalimantan	-	0.02	0.04	0.02	0.04	0.11	2
Sulawesi	0.14	0.09	0.05	0.09	-	0.35	7
Nusa Tenggara	0.07	0.06	0.05	0.04	-	0.21	4
	2.06	0.91	0.98	1.02	0.07	5.03	100

Note: A more recent survey covering the same categories in the table was not available at DGWRD in August 1985. However, government-managed irrigation systems under the DGWRD indicated the following data:

Technical	-	2,088,896 ha.
Semi-technical	-	1,116,682 ha.
Simple	-	1,029,325 ha.
Tidal and Swamp lands	-	433,943 ha.
Total:		4,668,846 ha.

As in the 1978 survey, Java has maintained its share of 62.8% (2,660,016 ha.) of the total irrigated area in 1984.

Source: The World Bank, Indonesia: Irrigation Program Review (Washington D.C., The World Bank, 1978).

Table 3

Investment and Irrigation Area Developed for Repelita III and IV

	Investment in Constant (1982/83 Billion Rp.)			Areas Developed (000s ha)			Production	Incremental Cost/ha	
	Repelita III	Repelita IV	Total	Repelita III	Repelita IV	Total	(tons/ha)	(000s Rp.)	(US$)
1. Simple irrigation	92.8	109.3	202.1	147.0	198.0	345.0	1.6	590.0	920.0
2 Medium scale	145.9	197.9	343.8	55.0	133.0	188.0	2.2	1,830.0	2,860.0
3. Large scale (without dam)	(1,102.0) 442.0 -	1,109.7	1,102.7	131.0	411.0 (223.0)	542.0	3.2	2,460.0	3,840.0
(with dam)	(449.0)		449.0						
4. Rehabilitation	757.7	417.2	1,173.9	729.0	594.0	1,323.0	0.8	890.0	1,390.0
5. Tertiary	81.6	123.7	205.3	522.0	778.0	1,300.0	0.6	160.0	250.0
6. Tidal swamp	110.4	245.4	355.8	347.0	452.0	799.0	2.5	450.0 (2,590.0)[a]	700.0 (4,050.0)[a]
7. Inland Swamp	43.9	69.3	113.2	116.0	240.0	356.0	1.0	320.0	500.0
8. Groundwater	53.4	57.8	111.2	12.0	21.5	33.5	4.0	1,540.0	2,400.0
TOTAL	1,726.7	2,330.3	4,057.0	1,928.0	2,827.5	4,886.5			

[a] Including land clearing and settlement and infrastructure cost.

Source: Directorate General of Water Resources Development, Ministry of Public Works, May 1982.

Table 4

Average Costs of Investments in Pumps
and O&M Costs, in thousand Rp.

Item	Diameter (in)	16	12	10	6	4
	Depth (m)	200	100	85	70	36
	Area (ha)	95	41	30	27	27
1. Well insulation (pipe, screen)		39,538	21,929	16,301	12,290	6,894
2. Pump set [a/]		22,818	13,199	11,034	2,831	2,831
3. Pump house/installation		8,250	8,250	8,250	4,000	4,000
4. Rehabilitation of irrigation canal system		38,893	52,202	36,000	7,500	7,500
- Total cost (complete scheme)		109,499	95,579	81,585	26,621	21,225
- Total cost/ha		1,153	2,331	2,720	986	786
- O&M cost/year/ha		50	62	73	82	84

[a/] For costs > Rp 10,000,000 turbine pump
< Rp 10,000,000 centrifugal pump

Source: Groundwater Development Project, Directorate ofIrrigation II, DGWRD, 30 July 1985.

Table 5

Financing of Irrigation Development, by Source of Responsibility for Expenditures 1980-81

Source of Responsibility	Purpose	Government Expenditure (Rp. billion)	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 programme	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 and M	19.8		19.8
Public Works	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
Kabupaten				
	Inpres	7.8		7.8
	Local taxes	0.8[a]		0.8[a]
Desa				
	Inpres desa	4.9[a]		4.9[a]
TOTAL		269.1	66.9	336.0

[a] Estimated.

Source: Anthony Bottrall, Financing Irrigation: Central-Local Financial Relation Review for the Government of Indonesia. Sectoral Study No.3 (Birmingham: Development Administration Group, September 1981).

Operation and Maintenance Allocation by Central Government
For Public Works Irrigation Systems

Year	Eligible area (ha)	Proposed Total (Rp'000)	Proposed Per ha (Rp)	Approved Total (Rp'000)	Approved Per ha Current Rp	Approved Per ha 1983 Rp/a
1974/75	3,657,175	5,851,480	1,600	5,851,479.2	1,600	5,128
1975/76	3,724,286	10,977,150	2,844	5,736,000	1,540	4,302
1976/77	3,249,482	9,033,900	2,671	6,273,850	1,931	4,815
1977/78	3,771,859	14,750.474	3,719	7,920,984	2,100	4,615
1978/79	4,346,768	15,076,414	3,493	9,967,036	2,293	4,444
1979/80	4,474,706	21,874,625	4,888	13,267,000	2,965	5,103
1980/81	4,541,186	23,000,000	5,065	19,771,000	4,354	6,014
1981/82	4,577,526	36,211,000/b	7,911	26,009,000	5,682	7,076
1982/83	4,506,809	47,767,000/c	10,598	31,235,000	6,920	7,604
1983/84	4,668,836	59,524,131/d	12,749	32,895,000	7,093	7,093
1984/85	3,906,706			30,732,000	7,866	
	985,751			11,348,000/e	11,512	
1985/86	3,949,324			32,425,308	8,210	
	1,008,558			11,901,500/e	11,801	

/a Current Rp adjusted by the Consumer price Index.

/b Three earlier alternatives - "high", "medium", and "low" - had been presented to Bappenas and rejected. These were:

High	Rp	43,735,000,000; 9,603 Rp/ha.
Medium	Rp	40,340,000,000; 8,858 Rp/ha.
Low	Rp	38,211,000,000; 7,951 Rp/ha.

The large increase in proposed O&M expenditure in 1981/82 reflects an attempt by Directorate of Irrigation to persuade GOI to increase the O&M subsidy.

/c This is the "low" alternative presented to Bappenas. The high alternative was Rp 50,488,000,000.

/d This is the "low" alternative presented to Bappenas. The high alternative was Rp 63,626,891,000.

/e Starting 1984/85, additional funds for O&M were made available from the APBN of the DGWRD.

Source: Directorate of Irrigation I, DGWRD, August 1985.

Table 7

Central Government Funding for Local Government Development Program, 1974/75 to 1983/84

(Rp.10^3)

Fiscal Year	Funding for fixed program				Funding for discretionary program	Total	Percentages		
	Rehabilitation for Roads and bridges	Rehabilitation for Irrigation system	Operation and Maintenance for Irrigation, Swamp and River	Total					
(1)	(2)	(3)	(4)	(5) = (2+3+4)	(6)	(7) = (5+6)	(3):(7)	(4):(7)	(5):(7)
1974/1975	2,750,032	3,615,000	5,851,480	12,216,512	31,733,188	43,950,000	8.2	13.3	27.8
1975/1976	3,404,000	5,280,000	5,736,000	14,420,000	37,867,000	52,287,000	10.1	11.0	27.6
1976/1977	4,020,531	5,596,619	6,273,850	15,891,000	44,559,000	60,450,000	9.3	10.4	26.3
1977/1978	5,695,000	5,918,556	7,920,444	19,534,000	55,466,000	75,000,000	7.9	10.6	26.0
1978/1979	6,989,000	6,771,517	9,967,036	23,727,553	61,946,897	85,674,450	7.9	11.6	27.7
1979/1980	8,316,000	6,212,000	13,267,000	27,795,000	74,427,000	102,222,000	6.1	13.0	27.2
1980/1981	22,750,000	7,406,000	19,771,000	49,927,400	116,662,600	166,590,000	4.4	11.9	30.0
1981/1982	29,936,000	10,091,000	26,009,000	66,036,000	148,964,000	215,000,000	4.7	12.1	30.7
1982/1983	34,720,000	11,719,000	31,235,000	77,674,000	175,326,000	253,000,000	4.6	12.3	30.7
1983/1984	35,080,000	9,213,000	32,895,000	77,188,000	175,812,000	253,000,000	3.6	13.0	30.5

Note: Aside from the subsidies indicated above, there is a routine budget for O&M in the form of salary for the permanent staffs in the Water Resources Division of the Provincial Public Works.

Source: Directorate General of Water Resources Development, Department of Public Works. General Information on Irrigation Operation and Maintenance Activities in Indonesia. Jakarta, July 1984.

Table 8

Central Government Grants to Provincial Governments (APBD)
for Irrigation O&M, 1983/84

Province	Potential Irrigation Area (ha)	O&M Grant ('000 Rp)	O&M Grant/ha (Rp)
1. D.I. Aceh	154,234	950,000	6,160
2. Sumatera Utara	259,855	1,800,000	6,927
3. Sumatera Barat	213,729	1,500,000	7,018
4. Rian	84,379	800,000	9,481
5. Jambi	27,268	450,000	16,503
6. Sumatera Selatan	88,120	1,000,000	11,348
7. Bengkulu	50,085	750,000	14,975
8. Lampung	133,161	1,300,000	9,763
9. DKI Jaya	21,676	220,000	10,150
10. Jawa Barat	888,391	5,750,000	6,472
11. Jawa Tengah	756,081	4,500,000	5,952
12. D.I. Yogyakarta	65,377	860,000	13,155
13. Jawa Timur	950,247	5,300,000	5,578
14. Kalimantan Barat	58,053	500,000	8,613
15. Kalimantan Tengah	80,086	500,000	6,243
16. Kalimantan Selatan	155,098	500,000	3,224
17. Kalimantan Timur	57,015	430,000	7,542
18. Sulawesi Utara	51,894	600,000	11,562
19. Sulawesi Tengah	44,892	500,000	11,138
20. Sulawesi Tenggara	25,245	250,000	9,903
21. Sulawesi Selatan	271,670	1,650,000	6,074
22. Bali	59,106	800,000	13,535
23. Nusa Tenggara Barat	135,672	1,275,000	9,398
24. Nusa Tenggara Timur	31,430	500,000	15,908
25. Maluku	3,342	110,000	32,914
26. Irian Jaya	450	0	0
27. Timor Timur	2,290	100,000	43,668
Total, Indonesia	4,668,846	32,895,000	7,046

Source: DGWRD

Table 9

O&M Fund Allocation by Scale and Type of Irrigation System,
Province of Lampung, 1980/1981 to 1984/1985 (Rp)

Scale (Ha)	Technical			Semi Technical			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	21,325	29	6,659	23,876	31	7,409	23,348
501 - 1000	2	1,331	5,950	11	6,532	12,863	3	7,863	11,544
1001 - 5000	4	8,263	4,902	0	0	0	4	8,263	4,902
> 5000	6	76,468	5,227	0	0	0	6	76,468	5,227
Total	14	86,812	5,346	40	13,191	18,271	54	100,003	7,039

[a] Average O&M funds allocated during 5 year period, 1980/1981 - 1984/1985 (Rp/ha/year)

Source: Effendi Pasandaran, "Operation and Maintenance of Irrigation Systems in Indonesia", 1985

Table 10

Collection and Uses of P3A Funds HPSIS[1/] Project

Name of Province and Sub. Project	Rate of membership fee and dues per season	Allocation of Funds		
		For	Percent	
North Sumatra				
1. Semangat Baris	75 kg/ha [2/]	a. P3A Cash	20%	
		b. P3A Officers	15%	
		c. O&M	15%	
		d. Field Workers	50% +	
		Total		100%
South Sumatra				
1. Air Salak	12 kg/ha	a. P3A Cash	25%	
		b. P3A Officers	10%	
		c. O&M	50%	
		d. Administration	5%	
		e. Technical Assistant	10% +	
		Total		100%
Lampung				
1. Way Lunik Panengahan	40 kg/ha	a. P3A Cash	40%	
		b. P3A Officers	10%	
		c. Technical Assistant	40%	
		d. P3A Administration	10% +	
		Total		100%
2. Way Awi II	25 kg/ha	a. P3A Cash	10%	
		b. P3A Officers	40%	
		c. O&M	40%	
		d. Others	10% +	
		Total		100%
West Java				
1. Cumanggala	50 kg/ha	a. P3A Cash	20%	
		b. P3A Officers	30%	
		c. O&M	40%	
		d. Administration	10% +	
		Total		100%
West Nusa Tenggara				
1. Mencongah	60 kg/ha	a. P3A Cash	25%	
		b. P3A Officers	30%	
		c. LKMD	25%	
		d. Collector	20% +	
		Total		100%
2. Penimbung Kiri	25 kg/ha	a. P3A Cash	10%	
		b. P3A Officers	15%	
		c. O&M	50%	
		d. Kelompok Leader	15%	
		e. For the desa	10% +	
		Total		100%
South Sulawesi				
1. Leang-leang	30 kg/ha	a. P3A Officers	40%	
		b. O&M	40%	
		c. Administration	15%	
		d. Social Contribution	5% +	
		Total		100%
2. Kocikang	25 kg/ha	a. P3A Cash	15%	
		b. P3A Officers	30%	
		c. O&M	50%	
		d. Social Contribution	5% +	
		Total		100%
North Sulawesi				
1. Tadoy	20 kg/ha	a. P3A Officers	35%	
		b. Administration	10%	
		c. O&M	25%	
		d. Social Contribution	10%	
		e. Kelompok Contest	20% +	
		Total		100%

1/ High Performance Sederhana Irrigation System
2/ Kg. of paddy

Source: Ministry of Agriculture, August 1985.

Table 11

Farmers' Payments to Village Irrigation Officials--Some Examples

Run-of-the-River	Average Seasonal Rate (per ha)	Crop Seasons	Total Annual Payments (Rp/ha) (@ Rp 100/kg rice)
1. Bali:			
a. DPU system	20 kg rice	2 x rice	4,000
b. Communal system	10 kg rice	2 x rice	2,000[a]
2. Pekaten Sampean, E. Java - DPU system	30-50 kg rice	2 x rice or 1 x rice plus 1 x palawija	6,000-10,000
3. Sragen/Solo region, C. Java - Dharma Tirta communal system	115 kg rice	3 x rice	34,500
4. Lake Toba region, N. Sumatra- communal system	20 kg rice	2 x rice	4,000
5. Sidrap, S. Sulawesi, DPU system	50 kg rice	2 x rice	10,000
Pumps			
6. Kediri-Nganjuk, E. Java, DPU Tubewells	hourly charges for fuel consumption and operator (Rp. 250-600/ha)	2 x rice or 1 x rice plus 1 x palawija	25,000-40,000
7. Sedrap, S. Sulawesi, communal low-lift pumps	100 kg rice	2 x rice	20,000

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

Source: Anthony Bottrall, Financing Irrigation: Central-Local Financial Relation Review for the Government of Indonesia. Sectoral Study No.3 (Birmingham: Development Administration Group, September 1981).

Table 12

Farmer Contribution to O&M in Selected Irrigation Systems, Sukabumi, 1983/1984

Irrigation system	Status	Area (Ha)	Value of contribution (Rp/Ha)			
			Season I (1983/84)	Season II (1984)	Season III (1984)	Total/ year
Ciraden	Public works-Technical	456	6,900	5,300	4,900	17,100
Cisungapan	Public works-Sederhana	126	5,800	5,600	0	11,400
Cigayung	Communal	107	10,500	10,600	0	21,100

Source: Effendi Pasandaran, "Operation and Maintenance of Irrigation Systems in Indonesia", 1985.

Table 13

Irrigation O&M Expenditures of the Farmers In Selected Areas of Cirebon Irrigation Systems, 1980/1981 (Rp/Ha)

Type of Irrigated area and Season	A	B	C	Total
Predominantly planted to paddy throughout the year				
First Dry Season 1980	9200	750	2000	11950
Second Dry Season 1980	2400	2250	7500	12150
Rainy Season 1980/1981	3800	750	4500	9050
Total	15400	37500	14000	33150
Diversified crops during dry season				
First Dry Season 1980	3200	750	1500	5450
Second Dry Season 1980	1600	2250	4200	8050
Rainy Season 1980/1981	3200	750	4000	7950
Total	8000	3750	9700	21450

A = Contribution to village irrigation officials

B = Labor contribution for O&M

C = Cash contribution for maintenance and repair

Source: Effendi Pasandaran, "Operation and Maintenance of Irrigation Systems in Indonesia", 1985.

Table 14

Main System O & M Costs by Type of Irrigation System

Cost in thousand Rp for a 30,000-ha. system

Items \ Type of System	Technical	Semi-Tech.	Simple
1. Salaries/Wages of Personnel	Rp 115,200	Rp 72,720	Rp 39,840
2. Maintenance of Facilities[1]	12,880	8,520	6,360
3. Maintenance of Irrigation Canals and Structures	250,800	184,800	95,700
4. Upgrading of services (Tertiary)	7,500	7,500	7,500
5. Other Costs	22,260	18,000	12,240
Total costs for Systems (30,000 hectares)	Rp 408,640	Rp 291,540	Rp 161,640
Notes: O&M Costs per ha per year	Rp 13,600/ha Technical	Rp 9,718/ha Semi-Tech. (approx.71% of tech.)	Rp 5,388/ha Simple (approx.40% of tech.)

Source: Sub-Directorate of Operation and Maintenance
Directorate of Irrigation I, DGWRD
October 17, 1983.

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

Table 15

Comparison of Actual & Proposed O&M Costs,
Gung Irrigation Section (Pemali-Comal, Central Java)

Cost Allocation	O&M Cost, Rp/ha			
	Actual	%	Proposed	%
Main irrigation system				
Wages and Salaries	4,442	49	5,027	39.8
Transport Cost and Vehicle maintenance	149	1.6	395	3.1
Office Supplies	276	3	221	1.8
O&M Costs (routine + periodic)			393	3.1
O&M (Channels, Hydraulic Structures, Inspection)	3,170	34.9	5,748	45.5
Miscellaneous	1,037	11.4	850	6.7
	Rp 9,074		Rp 12,634	
O&M cost at Regional and Provincial levels (estimated as 20% of main system O&M cost)	Rp 1,815		Rp 2,520	
Tertiary Irrigation level				
Channel Maintenance Cost	-		3,750	
Hydraulic Structure Maintenance cost	-		500	
Complementary Structure Maintenance cost	-		500	
Ulu-ulu and P3A salaries	-		1,200	
	Rp 2,490		Rp 5,950*)	
Total	Rp 13,379		Rp 21,104	

*) 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 contribution in terms of own-labor (Rp 3,460,-).

Source: The Gadjah Mada University Team, Executive Summary: Study of Regional Capability to Finance the O&M Costs for Irrigation Systems in the Prosida Projects in the Pemali-Comal Area, Central Java and in the Bantimurung and Lanrae Project Areas, South Sulawesi, May 1982.

Table 16

Government Floor Prices for Paddy, Indonesia, 1976 - 1984

Year	Floor Price in Current Rp (Rp/kg)	Floor Price in Constant 1983 Rp[a] (Rp/ha)
1976	68.5	171
1977	71	156
1978	75	145
1979	95	164
1980	105	145
1981	120	149
1982	135	148
1983	145	145
1984	165	147

[a] Current prices deflated by the Consumer Price Index

Source: PATANAS, PAE

Table 17

Net Incremental Benefit by Farm Size and Type of Irrigation System
(Rps per Farm)

Study area	Ownership pattern	Farm size (ha)	Technical	Semi-Technical	Simple
Pemali-Comal	Owner-operator	less than .5	119,009	58,543	25,397
		.5 - 1	204,301	133,542	176,602
		1 - 1.5	439,875	625,426	160,074
		1.5 - 2	- /a	-	122,781
		over 2.0	-	-	190,737
	Share cropper	less than .5	45,554	57,307	42,895
		.5 - 1	66,369	-	2,849
		1 - 1.5	-	-	-
		1.5 - 2	-	-	-
		Over 2.0	-	-	-
Bantimurung Lanrae	Owner-operator	less than .5	53,098	64,650	-
		.5 - 1	162,498	54,270	-
		1 - 1.5	304,543	130,497	-
		1.5 - 2	-	188,068	-
		Over 2.0	-	-	-
	Share cropper	less than .5	-	29,867	-
		.5 - 1	-	70,852	-
		1 - 1.5	-	76,824	-
		1.5 - 2	-	225,632	-
		Over 2.0	-	-	-

/a Indicates data unavailable.

Source: The Gadjah Mada University Team, Executive Summary: Study of Regional Capability to Finance the O&M Costs for Irrigation Systems in the Prosida Projects in the Pemali-Comal Area, Central Java and in the Bantimurung and Lanrae Project Areas, South Sulawesi, May 1982.

Table 18

Size of Farm Holding with Zero Economic Surplus,
by Type of Irrigation System.

Location / Type of Irrigation System	Premali-Comal (Hectare)	Bantimurung-Lanrae (Hectare)
Technical	0.33	0.52
Semi-Technical	0.35	0.61
Simple	0.73	-

Source: The Gadjah Mada University Team, Executive Summary: Study of Regional Capability to Finance the O&M Costs for Irrigation Systems in the Prosida Projects in the Pemali-Comal Area, Central Java and in the Bantimurung and Lanrae Project Areas South Sulawesi, May 1982.

Table 19

Farm Production Data for Lowland and Upland Paddy, 1983/84.

	Rp/ha/crop				Difference,	Ratio,
	a/ Lowland	%	b/ Upland	%	Lowland Upland	Lowland Upland
Rent to Land, Rp/ha/crop	134,811	28.7	44,898	18.2	89,193	3.0
Ipeda, Zakat[c/], Contribution to P3A, depreciation cost	27,604	5.9	4,487	1.8	23,117	6.2
Interest on credit	2,236	0.5	872	0.4	1,364	2.6
Applied production inputs	48,561	10.3	37,584	15.3	10,977	1.3
Seeds	8,116		9,330			0.9
Commercial fertilizer	29,423		17,578			1.7
Compost	1,641		5,353			0.3
Pesticides	6,259		3,888			1.6
Herbicides	1,267		281			4.5
Others	1,855		1,154			1.6
Labor	256,421	54.6	158,300	64.3	98,121	1.6
Family- 50.9/62.7 days[d/]	63,551		71,370			0.9
Hired - 154.7/91.6 days	192,870		86,930			2.2
Total Cost of Production	469,633	100.0	246,141	100.0	223,492	1.9
Yield - 5,668/2,666 kg						
Price[e/] - 130.85/138.45 Rp/kg						
Total Value of Production	741,658		369,107		372,551	2.0
Net Income	272,025		122,966		149,059	2.2

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, Ministry of Agriculture, 1984.

Table 20

Yield, Cost of Production and Income,
Lowland Paddy, 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
Di Aceh	5.530	863.465	693.085	125,33	170.380	30,81
Sumatera Utara	5.100	848.693	516.380	101,25	332.313	65,16
Sumatera Barat	5.905	830.189	558.013	94,50	272.176	46,09
Riau	4.413	700.733	462.394	104,78	238.339	54,01
Jambi	7.739	979.760	541.181	69,93	438.579	56,67
Sumatera Selatan	4.559	743.178	345.167	75,71	398.011	87,30
Bengkulu	5.533	825.533	402.457	72,74	423.073	76,46
Lampung	10.870	670.373	372.740	34,27	297.633	27,38
Dki Jaya	-	-	-	-	-	-
Jawa Barat	5.760	721.257	516.463	89,66	204.794	35,55
Jawa Tengah	6.326	775.360	497.406	78,63	277.954	43,93
D.I. Yogyakarta	4.170	596.280	365.070	87,55	231.210	55,45
Jawa Timur	5.142	646.160	425.105	82,67	221.055	42,99
Kalimantan Barat	4.310	616.270	393.628	91,33	222.642	51,66
Kalimantan Tengah	2.140	360.700	177.970	83,16	182.730	85,39
Kalimantan Selatan	7.667	1.016.066	473.272	61,73	542.794	70,80
Kalimantan Timur	-	-	-	-	-	-
Sulawesi Utara	4.887	926.500	496.480	101,59	430.020	87,99
Sulawesi Tengah	4.604	597.000	356.123	77,35	240.877	52,32
Sulawesi Selatan	5.280	688.872	394.167	74,65	294.705	55,82
Sulawesi Tenggara	3.500	472.500	157.000	44,86	320.500	91,57
Bali	6.358	762.960	323.750	50,92	439.210	69,08
Nusa Tenggara Barat	5.681	607.343	419.461	73,84	187.882	33,07
Nusa Tenggara Timur	5.012	666.500	316.286	63,11	350.214	69,87
Maluku	-	-	-	-	-	-
Irian Jaya	-	-	-	-	-	-
Timor Timur	2.000	280.000	152.500	76,25	127.500	63,75
Average	5.668	741.655	469.633	82,86	272.022	47,99

Note: Survey covered only 23 provinces.

Source: Directorate General of Food Crops, Ministry of Agriculture, 1984

Table 21

Yield, Cost of Production and Income,
Upland Paddy, 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
Di Aceh	-	-	-	-	-	-
Sumatera Utara	2.190	430.421	307.450	140,39	122.969	56,15
Sumatera Barat	1.950	302.500	265.000	135,90	37.500	19,23
Riau	1.867	242.667	117.094	62,72	125.573	67,26
Jambi	-	-	-	-	-	-
Sumatera Selatan	1.700	319.250	230.555	135,62	28.695	52,17
Bengkulu	1.300	195.000	152.250	117,11	42.750	32,88
Lampung	2.670	332.528	266.024	99,63	66.504	24,91
DKI Jaya	-	-	-	-	-	-
Jawa Barat	3.030	246,817	290.739	95,95	56.078	18,51
Jawa Tengah	3.875	310.000	291.260	75,16	18.740	4,84
D.I Yogyakarta	4.627	592.793	289.631	62,59	303.162	65,52
Jawa Timur	3.088	378.732	297.668	96,39	81.064	26,25
Kalimantan Barat	1.650	381.610	174.240	105,60	207.370	125,68
Kalimantan Tengah	-	-	-	-	-	-
Kalimantan Selatan	1.600	280.000	269.800	168,63	10.200	6,38
Kalimantan Timur	-	-	-	-	-	-
Sulawesi Utara	-	-	-	-	-	-
Sulawesi Tengah	2.880	417.500	301.875	104,82	115,625	40,15
Sulawesi Selatan	1.003	119.438	76.628	76,46	42.750	42,62
Sulawesi Tenggara	1.200	240.000	163.400	136,17	76.600	63,83
Bali	-	-	-	-	-	-
Nusa Tenggara Barat	3.520	315.400	205.625	57,44	109.775	30,66
Nusa Tenggara Timur	1.000	334.078	201.632	201,63	132.446	132,45
Maluku	-	-	-	-	-	-
Irian Jaya	-	-	-	-	-	-
Timor Timur	-	-	-	-	-	-
Average	2.666	369.106	246.141	92,33	122.965	46,12

Note: Survey covered only 17 provinces.

Source: Directorate General of Food Crops, Ministry of Agriculture, 1984.

Table 22

Rates of IPEDA Assessment for Rural Paddyland by Productivity Class and Landholding Size (Rp/m²).

Productivity Class of Paddy land	IPEDA Assessment By Size of Landholding (1) < 0.5 ha	(2) 0.5-1.0 ha	(3) 1.0-3.0 ha	(4) 3.0-5.0 ha	(5) > 5.0 ha	Average Paddy Yield Potential (Kw/ha)
1	2.54	2.96	3.38	3.80	4.22	80
2	2.28	2.66	3.04	3.42	3.80	73
3	2.03	2.37	2.71	3.05	3.38	66
4	1.81	2.12	2.42	2.73	3.03	60
5	1.60	1.87	2.14	2.41	2.68	54
6	1.39	1.63	1.86	2.09	2.33	48
7	1.21	1.42	1.62	1.82	2.02	43
8	1.03	1.21	1.38	1.55	1.71	38
9	0.85	1.00	1.14	1.28	1.43	33
10	0.68	0.79	0.90	1.02	1.15	28
11	0.53	0.62	0.71	0.80	0.89	24
12	0.39	0.40	0.52	0.59	0.65	20
13	0.28	0.33	0.38	0.43	0.18	17
14	0.18	0.20	0.23	0.27	0.31	14
15	0.08	0.09	0.10	0.12	0.14	11

Kw = Quintal = 100 kg.

Source: Surat Keputusan Direktur Jenderal Pajak No. KEP-850/PJ.66/1979

Notes: 1) PJ.66/1979 does not include the last column on average paddy yield potential. This has been supplied by the IPEDA Directorate to give a better indication of the productivity class of paddy land.

2) The weighing system in calculating the IPEDA rates consider the following prioritized factors -
   a. soil productive potential
   b. type and quality of irrigation facilities
   c. topography, elevation, soil depth.

Table 23

Rates of IPEDA Assessment for Rural Non-Paddy Land By Productivity Class and Landholding Size (Rp/m^2).

Productivity Class of Non Paddy Land	IPEDA Assessment By Size of Landholding				
	I	II	III	IV	V
	< 0.50 ha	< 0.5-1.0 ha	> 1.0-3.0 ha	> 3.0-5.0 ha	> 5 ha
1	2.40	3.00	3.60	4.20	4.80
2	1.60	2.00	2.40	2.80	3.20
3	1.20	1.50	1.80	2.10	2.40
4	0.96	1.20	1.44	1.68	1.92
5	0.72	0.90	1.08	1.26	1.44
6	0.48	0.60	0.72	0.84	0.96
7	0.40	0.50	0.60	0.70	0.80
8	0.32	0.40	0.48	0.56	0.64
9	0.24	0.30	0.36	0.42	0.48
10	0.20	0.25	0.30	0.35	0.40
11	0.16	0.20	0.24	0.28	0.32
12	0.14	0.17	0.20	0.24	0.27
13	0.12	0.14	0.17	0.20	0.22
14	0.10	0.12	0.14	0.17	0.19
15	0.08	0.10	0.12	0.14	0.16
16	0.06	0.08	0.10	0.12	0.14
17	0.04	0.06	0.08	0.10	0.12

Source: Surat Kaputusan Direktur Jenderal Pajak No.KEP-850/PJ.66/1979.

Notes: 1) Included in the rural non-paddy lands are - gardens, orchards, rainfed (non-paddy) croplands, grazing (pasture) lands, fish ponds and coastal nipa forest lands (mangroves).

2) The assessment is based on the price and rental of each class of land taking into consideration location, soil productivity, water supply and other infrastructure facilities.

Table 24

IPEDA REVENUES, by Source, 1979/80 - 1984/85

(Rp '000)

Budget Year	Rural	Urban	Plantation	Forestry	Mining	Total	Rural as a Percent of Total
1979/1980	31,093,827	12,696,339	7,965,577	13,384,101	9,148,550	74,288,394	41.9%
1980/1981	32,597,401	16,810,620	9,858,833	20,005,212	11,296,954	90,569,020	36.0%
1981/1982	36,190,702	20,570,480	11,212,178	12,492,198	15,144,784	95,610,342	37.9%
1982/1983	39,678,520	26,405,075	10,081,004	12,533,944	16,509,271	105,207,814	37.7%
1983/1984	45,763,227	37,889,165	12,876,977	16,954,155	24,088,232	137,571,756	33.3%
1984/1985	49,562,080	45,219,261	15,527,472	19,085,360	36,846,759	166,240,932	29.8%

Notes:

Period	Growth of Revenues from the Rural Sector	Growth of Total IPEDA Collections
1979/80-1980/81	4.8%	21.9%
1980/81-1981/82	11.0%	5.6%
1981/82-1982/83	9.6%	10.0%
1982/83-1983/84	15.3%	30.8%
1983/84-1984/85	8.3%	20.8%
Average	9.8%	17.8%

Source: IPEDA Directorate, 1985

Table 25

Utilization of IPEDA Revenues in Tegal Regency, Central Java (Rp 1,000)

Category of Expenditure	1977/78	%	1978/79	%	1979/80	%
I. Enhancement of Agricultural infrastructure[1]	6,740	1.78	12,000	2.90	23,680	5.57
II. Transportation Infrastructure	48,626	12.87	63,122	15.23	58,851	13.85
III. Public Utilities [2]	152,280	40.30	210,865	50.90	172,494	40.60
IV. Routine Expenditure						
V. Others [3]	170,257	45.05	128,287	30.97	169,801	39.98
Total	377,893	100	414,274	100	424,826	100

1) Irrigation O&M, slaughter houses, market buildings, fish ponds, etc.
2) Tourist facilities, education, health, etc.
3) IPEDA Collectors' bonus, administrative costs, village development grants, Provincial Government share of IPEDA takings, Bank Pembangunan Daerah shares, etc.

Source: Gadja Mada University study, May 1982.

Table 26

The Utilization of IPEDA Revenues in Maros Regency, South Sulawesi (Rp 1,000)

Category of Expenditure	1975/76	%	1976/77	%	1978/79	%
I. Enhancement of Agricultural Infrastructure	1,025	1.52	750	1.19	4,388	5.06
II. Transportation Infrastructure	10,636	15.75	12,279	19.41	24,532	28.29
III. Public Utilities	36,968	54.72	31,696	50.12	26,305	30.34
IV. Routine Expenditure	-	-	-	-	-	-
V. Others	18,911	28.01	18,513	29.28	31,490	36.31
Total	67,540	100	63,238	100	86,715	100

Source: Gadja Mada University Study, May 1982.

Table 27

The Utilization of IPEDA Revenues in Barru Regency, South Sulawesi (Rp 1,000)

Category of Expenditure	1976/77	%	1977/78	%	1978/79	%
I. Enhancement of Agricultural Infrastructure	9,191	16.65	20,689	34.00	3,069	5.50
II. Transportation Infrastructure	15,704	28.46	18,934	31.10	10,193	18.20
III. Public Utilities	15,098	27.36	2,210	3.70	3,430	6.10
IV. Routine Expenditure[1)]	888	1.61	10,511	17.30	9,102	16.30
V. Others	14,306	25.92	8,495	13.90	30,200	53.90
Total	55,187	100	60,839	100	55,994	100

Source: Gadja Mada University study, May 1982.

Table 28

Hypothetical Annualized Cost of Irrigation Services,
by size of investment and amount of expenditures on tertiary O&M (Rp/Ha)

	Size of Investment		
	High	Medium	Low
Construction Cost	3,000,000[a]	1,500,000[b]	800,000[c]
Interest during construction[d]	916,000	248,000	84,000
Total Capital Cost	3,916,000	1,748,000	884,000
Annualized value of capital Cost	395,000	176,000	89,000
O&M cost main system	8,000	8,000	8,000
Subtotal (Capital cost plus main system O&M)	403,000	184,000	97,000
Total annualized cost if tertiary O&M costs are:			
Rp 3,000/ha	406,000	187,000	100,000
Rp 15,000/ha	418,000	199,000	112,000
Rp 30,000/ha	433,000	214,000	127,000

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

[b] Represents typical level of investment for semi-technical 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% of construction cost; and 10% interest.

Table 29

Percentage of Hypothetical Annualized Cost of Irrigation Services Borne by Farmers

Basis for Calculation	Size of Investment		
	High	Medium	Low
A. Direct farmer payments only			
1. low tertiary O&M cost (Rp 3,000/ha)	0.7	1.6	3.0
2. moderate tertiary O&M cost (Rp 15,000/ha)	3.6	7.5	13.4
3. high tertiary O&M cost (Rp 30,000/ha)	6.9	14.0	23.6
B. Direct farmer payments plus IPEDA, assuming IPEDA equal to main system O&M cost of Rp 8,000/ha			
1. low tertiary O&M cost (Rp 3,000/ha)	2.7	5.9	11.0
2. moderate tertiary O&M (Rp 15,000/ha)	5.5	11.6	20.5
3. high tertiary O&M cost (Rp 30,000/ha)	8.8	17.8	29.9

Source: Calculated from Table 28

Table 30

Ratios of Central Government Grants under the Local Government Development Program (LGDP) 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 LGDP 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/]	not available	not available	

Computed from Tables 7 and 24.

Notes:

a/ Ratio of grants for irrigation operation and maintenance (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 includes grants for: Irrigation O&M, Rehabilitation of Irrigation Systems, and Rehabilitation of Roads and Bridges.

d/ Includes all fixed programs plus the discretionary, or non-fixed grants.

e/ Includes the direct grant from the Central Government to the Provincial Public Works Departments (APBN funds).

Table 31

Ratios of Central Government Grants under the Local Government Development Program (LGDP) to Total IPEDA Collections, 1979/80 to 1983/84.

Year	O&M Grants only[a/]	O&M Grants Plus Irrigation Rehabilitation Grant[b/]	Local Grants for Fixed Programs [c/]	Total all LGDP 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

Computed from Tables 7 and 24.

Notes:

a/ Ratio of grants for irrigation operation and maintenance (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 LGDP 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 LGDP grants to total IPDEA revenues. LGDP grants include fixed program grants plus discretionary grants.

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Appendix 2. Korea

Korea

1. Introduction

1.1 Agriculture and the Korean Economy

1.1-01 The gross national product (GNP) of the Republic of Korea (ROK) increased from US$ 61.2 billion in 1980 to US$ 81.1 billion in 1984, an increase of 31%. Per capita GNP grew at an average of 5.35% per annum from US$ 1,605 to US$ 1,998 during the same period.

1.1-02 The shares of agriculture, forestry and fishery, manufacturing and mining, and other industries in the total GNP from 1980 to 1983 are shown in Table 1. The contribution of agriculture, forestry and fisheries to the GNP, at current prices, averaged 14.8% from 1980 to 1983, while manufacturing and mining averaged 29.8%. The total contribution of all other industries averaged 55.2% of GNP during the same period.

1.1-03 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% in 1961 to 14% in 1983. The contribution of the agricultural sector to foreign exchange earnings fell from 35% during the first half of the 1960's to only 5% in 1983. The proportion will decline further despite increases in agricultural and fishery exports, due to the continuing rapid growth of manufacturing exports (World Bank 1984).

1.1-04 The Republic of Korea has a land area of 9,909,000 hectares. About 2,167,000 hectares (21.9% of the total area) are cultivated, of which 1,316,000 hectares are paddy fields and 851,000 hectares are upland. The remaining 7,742,000 hectares are classified as forest land (6,547,000 ha) and others (1,195,000 ha) (Table 2).

1.1-05 The utilization of cultivated area by various food crops is given in Table 3. Rice is planted in 1.23 million hectares, which is about 57% of the total cultivated area and 63.8% of the total area devoted to food crops. The area, yield and production of paddy and upland rice are presented in Table 4. On the average, the yield and production of paddy rice have decreased compared to 1978 and 1979; however, paddy rice yields in

Korea are high by international standards. The yield and production of upland rice have been rather erratic. This may be attributed mainly to the absence of irrigation in the upland areas.

1.1-06 A World Bank report predicts that given the relatively high average income and consumption levels nationally, total demand for agricultural products is unlikely to expand much faster than the population growth rate (World Bank 1984). The principal food in the Korean diet is rice, which represented 33% of the total food consumption by weight in 1982. Other grains comprise a further 16% of total food consumption, so that about half of the diet is met by grains.

1.1-07 Korea's population of nearly 40 million is growing at a rate of 1.6% per year. Its population density of 400 per sq.km. and 18.2 per ha of farmland is one of the world's highest (World Bank, 1984). As a result of this high population pressure, the land made available for agriculture is intensively developed. Furthermore, the government has invested in the reclamation of agricultural land from forests and tidal flats, in addition to irrigation and land consolidation.

1.1-08 The average size of cultivated land per farm household was about 1.1 ha in 1983 (Korea MAF 1985, p 70). However, farm households with less than 1 ha accounted for 67 percent of total farm households (Table 5). With farm households comprising about 24% of the total households and a farm population per household of 4.8 persons, the role of agriculture in the economy - as a major source of employment and income for the rural population - is very significant.

1.2 Agriculture and the Fifth Economic and Social Development Plan (1982-1986).

1.2-01 In the Fifth Five-year Economic Development Plan (1982-86) and the Revised Economic and Social Development Plan (1984-86), the Government's primary objectives for the agricultural sector are 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

condition for maintaining high agricultural output,

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, 1984).

1.2-02 During the plan periods, agricultural productivity was projected to increase at an average annual rate of 3.5%. The rate of utilization of farmlands was targeted to increase 134%. Annual rice production is estimated to increase from 3.55 million metric tons to 5.9 million metric tons. With this increase in production, rice imports will likely be reduced to an average of 430,000 metric tons per year.

1.2-03 Average annual farm household income is projected to rise at an average rate of 9.8%, from the 1981 level of 3,687,000 won to 5,481,000 won in 1986. Non-farm income of farm households is estimated to increase even more rapidly, at an average annual rate of 14%.

1.2-04 Other Government projections of change in the agricultural sector during the Fifth Plan (1982-86) are summarized in Table 6. The projections include: a decline in the agricultural labor force; an improvement in the quality of arable land through increased irrigation and more land consolidation; increased agricultural mechanization and use of fertilizer and other farm chemicals; and increased production of various crops.

1.2-05 A total of W 4,600 billion (at 1980 prices) is to be invested in the agriculture sector, with 1,490 billion won (33%) for the development of agriculture 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 paddy fields for a stable supply of foodgrains. About 76% of the paddy fields are projected to be irrigated by the end of the plan period, 1986.

1.3 Irrigation Systems Development

1.3-01 Irrigation of paddy rice in Korea is largely a matter of supplementing the relatively abundant but somewhat erratic rainfall. Generally one irrigated crop of paddy 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.

1.3-02 There are several types of agencies which are responsible for the provision of irrigation services in Korea. The Agricultural Development Corporation (ADC) is a semi-autonomous government corporation responsible for the planning, design and construction of all large (over 5,000 ha) projects 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 to 5000 ha). Farmland Improvement Associations (FLIAs), of which there are currently 103, are semi-autonomous organizations supervised by the Ministry of Agriculture and Forestry and by the Provincial Governments. FLIAs are responsible for the operation and maintenance of both medium and large irrigation projects, and for the implementation (with assistance from the ADC) of construction of new medium scale irrigation projects. While the members of the FLIA are the farmers in the service areas, the managing staff are appointed by chairman of the FLIA, who in turn is appointed either by the MAF or by the provincial government.

1.3-03 All of the FLIAs are members of the Federation of Farmland Improvement Associations (FFLIA). The FFLIA provides specialized services to the FLIAs. One of these services is related to land consolidation. The FFLIA provides technical assistance in the planning for land consolidation, and supervision during construction. It also provides legal assistance regarding the realignment of land holdings. A second service is the provision of a management fund for the FLIAs. Those FLIAs which have excess funds available can deposit them with the FFLIA, where they earn interest at rates of 11 to 13 percent. The FFLIA is able to loan these funds to those FLIAs having financial difficulties. A third service provided by the FFLIA involves a fund for the repair of irrigation facilities. Finally, the FFLIA acts as an intermediary for the FLIAs in obtaining supplies such as cement and iron from the government office of supply.

1.3-04 Provincial governments are responsible for funding the construction of the small scale irrigation projects (less than 50 ha). These projects are operated and maintained by Irrigation Groups consisting of the farmers served by these projects. These groups generally do not have any professional management staff. County (gun) and city governments provide some supervision over the financial activities of these irrigation groups, which currently number over 15,200.

1.3-05 For large 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, 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 ADC for two to five years prior to being turned over to the local FLIA. During this period, ADC repairs or rehabilitates the facilities if defects are found, and also trains the staff of the FLIA responsible for the operation and maintenance of facilities.

1.3-06 Information related to the importance of irrigation in Korea is presented in Table 7. Approximately 929,000 ha, or 71 percent of the total area of paddy is irrigated. The remaining 29 percent is classified as "partially irrigated" paddy. Historically, the total area irrigated by small scale systems has accounted for considerably over half of the total irrigated area. However, between 1974 and 1983 the area irrigated by the medium and large systems grew by a total of 35 percent, while the area irrigated by small systems increased only by about 9 percent. Thus by 1983, of the 929,000 ha of irrigated paddy, 51 percent was irrigated by small scale projects operated by over 15,200 Irrigators Groups; 17 percent was irrigated by medium scale projects operated by 72 FLIAs; and 32 percent was irrigated by large scale projects operated by 31 FLIAs.

1.3-07 Irrigation projects in Korea are not easily classified as "gravity" or "pump" projects. Many projects involve both pumps and reservoirs, and frequently water is pumped into a canal or a reservoir. However, some idea of the areas served by different types of facilities is given in Table 8. For medium and large scale projects, most of the area is served either by reservoirs (71% of the area) or by pumping facilities (26%). For small irrigation projects, pumps (including tubewells) 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 projects.

1.3-08 In general, very little systematic information is available on the small irrigation projects. The most

useful information comes from a study by Oh (1976), who surveyed 64 small 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 report will focus mainly on procedures for the medium and large scale projects which are managed by the FLIAs.

2. General Policies Regarding Irrigation Financing

2.-01 There are four key elements in Korea's policies related to the financing of 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 projects, is the provision of construction and development services through a centralized agency (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 MAF, 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 final 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 paddy and for electricity.

2.-02 The general financing principle applicable to medium and large scale irrigation projects is that the water users are responsible for the entire O&M costs, plus some portion of the capital development costs. The same is true of the small scale projects, except that the full development costs may be borne by the provincial government.

2.-03 The nominal magnitude of the subsidy provided by the central government for capital costs varies from 70 to 85 percent, depending on a number of factors, such as the total cost of the project and the type of facility constructed. The amount to be paid by the water users is financed by long-term loans from the National Agricultural Cooperative Federation (NACF) to the FLIAs at a subsidized

rate of interest of 3.5 percent.[1] (Like ADC, the NACF is a semi-autonomous government organization supervised by MAF.) Certain costs, such as for survey and design, and for supervision of construction are completely subsidized by the government.

2.-04 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 burden placed on the water users of recently developed irrigation facilities, has led the MAF to set a ceiling on the component of user charges levied for project repayment. The ceiling is set at 200 kg of rice (*paddy?) per hectare, the monetary value of which depends on the official government purchase price. 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 to directly increase the subsidy on the capital costs, thus decreasing the portion of the amount which is to be repaid by the farmers.

2.-05 With respect to price policies, the government has for some time maintained domestic rice prices significantly above world prices (Table 9). The Grain Marketing Fund responsible for government rice purchases and sales has experienced significant deficits in its operations, as the government has been reluctant to maintain consumer prices at the level that would be necessary to eliminate this deficit. Still, the consumer price of rice has been well above world prices. These pricing policies have thus had the effect of transferring income from rice consumers and from taxpayers to farmers. This additional income (or subsidy) has facilitated the payment of the charges imposed for irrigation services.

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[1] Several years ago the 3.5 percent rate of interest was nominally raised to 5.5 percent. According to 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 thus remains at 3.5 percent.

2.-06 Electricity pricing policies also favor agriculture. Separate rates are charged for agriculture, industry and household consumption. The lowest rate is charged to 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.

3. Capital Costs of Irrigation

3.-01 A great deal of irrigation development in Korea is a gradual process, with improvements and additions being made on a more-or-less continuous basis to existing facilities. Of the 103 FLIAs, a total of 65 reported expenditures in 1983 under the category of "new irrigation facilities."

3.-02 The pattern of gradual development of irrigation facilities can be illustrated by information from the Ki Ho FLIA in Kyonggi Province. This FLIA, which covers some 14,300 ha, has 4 main reservoirs, 14 smaller reservoirs, 28 pumping stations, and 9 concrete wiers. Of the main reservoirs and their distribution canals, three were built between 1961 and 1965, while the fourth was built in 1972. The smaller reservoirs were built between 1942 and 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.

3.-03 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 Agricultural Development Corporation on construction costs for 8 completed agricultural development projects are given in Table 10. These costs, which have been adjusted to 1983 prices using the wholesale producer price index, often include aspects of tidal reclamation and drainage as well as irrigation. The range of costs is from 6.7 to 14.4 million won per ha. At the 1983 exchange rate of 796 won to the U.S. dollar, these costs are from $8,400 to $18,100 per hectare.

3.-04 Data on farmland improvement and expansion projects completed in 1983 are presented in Table 11. Land consolidation averaged 5,940 thousand won per ha, or approximately $7,500 per ha. Drainage and slope

reclamation projects were less costly, amounting to about $4,200 per ha.

3.-05 Data on irrigation development projects completed or under construction in 1983 are shown in Table 12. The cost of reservoir projects completed in 1983 averaged 8,540 thousand won per ha, or about $10,700 per ha. The cost of pumping stations, weirs, infiltration galleries and tubewells ranged from about $1,680 per ha (for weir projects) to $3,440 per ha (for pumping stations).

3.-06 Tables 11 and 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 tubewells 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 tubewells).

3.-07 Data on the capital cost of the Im Jin project, financed by the Asian Development Bank, are given in Table 13. The total cost of the project averaged 7,900 won per ha, of which about 4,600 won was for the cost of the pumping stations. Land consolidation, undertaken on only a portion of the total area, cost about 4,800 won per ha consolidated. The nominal government subsidy averaged 77 percent, but varies from 72 percent for the pumping stations to 100 percent for the drainage costs.

3.-08 Data on the construction costs of five medium scale irrigation projects financed by the World Bank are given in Table 14. These costs, given in 1981 prices, ranged from about 4.6 to 6.1 million won per ha.

4. Operation and Maintenance Costs

4.1 Budgetary procedures for the provision of O&M funds

4.1-01 Each individual FLIA is responsible for the preparation of an annual budget for the operation and maintenance of its irrigation facilities. Funding of the O&M budget comes from the revenues of the FLIA, the

principal component of which is 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.

4.1-02 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 develops a proposed budget and forwards it to its respective Provincial Government by the end of November for approval. The Provincial Government in turn must send back to the FLIA its approved budget by the end of December.

4.1-03 The Ministry of Agriculture and Fisheries (MAF) provides the Ministry of Interior (MOI) with general guidelines on O&M costs of agricultural projects. However, the MOI makes the final decisions on what adjustments to make and what guidelines to adopt. As a general rule, the MOI does not refer back to the MAF the final guidelines prior to sending these to the FLIAs through the Provincial Government offices. Furthermore, the MOI has its own set of criteria for budget preparation. Most of the items in the guidelines pertain to personnel and administrative expenses, with only a few being related specifically to agriculture.

4.1-04 In the budget guidelines is stated a three-fold rationale for their existence: (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 a good financial management condition.

4.1-05 In estimating the revenues, the guidelines suggest that estimates should be "sound" and must be based on "reasonable assessments". The value of the products are to be based on the Government purchase price of second grade products. The FLIAs are urged to aim for increased revenues from non-irrigation water charges and to carefully manage the existing assets of the associations. 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 utilized. The FLIAs are also asked to establish priorities for project expenditures.

4.1-06 FLIAs are to have reserve funds both for depreciation and for retirement pension. 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 retirement pension fund must equal one-tenth of the expenditure for salaries.

4.1-07 The guidelines for budget preparation have specific figures which set limits on many of the FLIAs expenditures (see Annex 1). 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 kg of paddy per ha, 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 on the number of staff members;

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

Operation and maintenance 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.

4.1-08 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.

4.1-09 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.

4.2 Expenditures for O&M

4.2-01 Information on O&M expenditures for medium, large and very large (over 20,000 ha) irrigation projects, as well as for four FLIAs visited by the team in September of 1985 are presented in Table 15. The figures are expressed in terms of average amounts spent per hectare of benefitted area. There is little variation in the total amount among the three size categories of projects (ranging from 155,600 to 167,600 won per ha), although the three very large projects show a somewhat lower cost. Two of the four FLIAs visited by the team had O&M costs per ha very comparable to these averages, while one was considerably lower, and one somewhat higher.

4.2-02 In Table 15, O&M costs are divided into three categories. 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 gate keepers. (Using the FLIA accounting system as shown in Annex 2, this category is the same as item 1 (Irrigation Costs) under Project Direct Costs). Administrative costs include personnel costs other than for employees directly involved in pumping station and reservoir and canal operation, plus office expenditures (items 1 and 2 under Administrative Costs in Annex 2). "Other" O&M costs include items such as rental of assets, dredging costs for reservoir maintenance, and forestry costs for upstream reservoir management (items 2 and 3 under Project Direct Costs in Annex 2).

4.2-03 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 four FLIA visited by the team, the direct O&M costs ranged from about one-fourth of total O&M costs in two cases, to nearly 40 percent in one case.

4.2-04 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 per ha to decrease as the size of the project increases. For small projects, these costs are 51 percent of the total. For large projects between 5,000 and 20,000 ha of planned area, the average administrative cost is about 46 percent of the total, while for the three largest FLIAs in Korea (over 20,000 ha each), the comparable figure is 45 percent. Administrative costs in the four FLIAs visited ranged from 41 to 55 percent of total costs.

4.3 Desired Expenditures for O&M

4.3-01 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 MAF. It appears that in general projects are not suffering 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.

4.4 Control over Expenditure Decisions

4.4-01 Control over expenditure decisions of FLIAs is largely accomplished by the MAF and the Provincial governments through budget controls (oversight over the budget preparation through the detailed budget guidelines provided to the FLIAs, and ultimately through the power of approval of the budget) and through audits of expenditures. Financially, the FLIAs are thus accountable primarily upward to the Provincial government and to the MAF. For small irrigation projects run by Irrigators'

Groups (non-FLIAs), financial accountability is upward to the county (gun) executive, who has approval authority for the expenditure of the funds.

4.4-02 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 eliminates 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 diffuse sense of what 'the farmers' as a body will tolerate and what they will not" (p 132).

4.4-03 Sensitivity to farmers' dissatisfaction with high levels of water charges also appears to exist within the government. The establishment of a ceiling on water charges for project repayment and the fact that budgets and water charges are not finalized until the price of rice is announced each year are indications of this. In discussions at MAF, efforts of the Ministry to reduce the O&M costs borne by farmers were noted. MAF is undertaking training to increase the productivity of FLIA staff, with a view to gradually reducing the number of staff employed. A desire to avoid political unrest among farmers and an awareness that farmer discontent with the level of water charges is high appear to motivate government efforts to control the expenditures of the FLIAs. In this indirect way, farmers appear to have some influence over the O&M expenditures of the FLIAs.

5. Farmers' Ability to Pay for Irrigation Services

5.1 Output Price Policies

5.1-01 As noted in Section 2, 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 water charges which are levied. In 1983 the average water charge was 156,300 won per ha. At the 1983

government rice price of 504 won per kg of paddy, this amounts to 310 kg of paddy per ha. Taking the average 1983 yield for the high yielding rice variety (Table 16) of 6,700 kg of paddy per ha (4,800 kg of polished rice per ha, converted at the milling rate of .72), the water charge amounts to 4.6 percent of gross production. At world prices, it is estimated that the farmgate price of paddy in 1983 would have been only 332 thousand won per ton of polished rice (Table 9), which is equivalent to 239 won per kg of paddy. At this price, it would require 654 kg of paddy to meet the average water charge, or 9.8 percent of the average gross production of the high yielding variety of rice.

5.1-02 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.

5.2 Price Policies for Inputs other than Water

5.2-01 As noted in Section 2, 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.

5.2-02 Of greater importance than fertilizer price policies are the policies for the pricing of electricity. Agriculture has the most favored rate for electric power, paying only 20.35 won per kilowatt hour, compared with the lowest rate for industrial users of 46.85 won per kwh. Given the large amount of pumping for irrigation in many projects, this subsidy can have a significant impact on the costs which the farmer must pay.

5.2-03 Data from the Pyong Taek 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 thousand kwh of electricity were consumed. At the agricultural price of electricity of 20.35 won per kwh, this amounts to 379,261 thousand won, or about 24,000 won per hectare of assessed area. If the industrial rate of 46.85 won per kwh applied, the electricity charge would have been approximately 2.3 times as much, or 55,200 won per ha. The subsidized electricity rate thus reduces the water charge that must be paid by

the farmers served by the Pyong Taek project by an average of about 31,200 won per ha, which is about 16 percent of the total water charge that farmers actually pay.

5.3 Tax Policies

5.3-01 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; however, the farmers pay two land-related taxes to the provincial government.

5.3.1 Property Tax

5.3.1-01 Owners of agricultural land are required to pay a tax at the rate of 0.1 percent applied to the taxable value of the land, which in turn is 50 percent of the established market value of the property. In the absence of data on the actual amounts of these taxes, it is difficult to assess their impact on the ability of farmers to pay for irrigation services. A crude indication of the importance of this tax can be constructed from data on land values of irrigated land in sample sites studied by Kim (1982). The average value of irrigated paddy land in five districts studied was 1.14 million won per ha. A tax of 0.1 percent on 50 percent of this value is only 570 won per ha. It thus seems unlikely that this tax is an important factor affecting the farmers' ability to pay for irrigation services.

5.3.2 Farmland Tax

5.3.2-01 In addition to the property tax, a farmland tax must be paid by owners registered in the farmland tax book. The taxable land is classified as either Class A (farmland for the production of rice) or Class B (farmland for the production of other crops). Taxes are based on the income derived from the farmland, minus a fixed exemption of 1.44 million won. Taxable income is classified into 16 levels, to which a set of progressive tax rates is applied (Table 17). These rates range from 6 to 55 percent of the taxable amount.

5.3.2-02 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. Production expenses

include all direct expenses, plus the value of family labor. It has been suggested that the use of standard production and expense figures results in taxable income figures which are low relative to actual income (Hansen and Rao 1979, p 348).

5.3.2.-03 As in the case of the property tax, the absence of data on actual collections makes it difficult to assess the importance of the farmland tax on farmers' ability to pay for irrigation services. 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 18). These figures are based on an annual survey of production costs conducted by MAF. It appears that for farms under 1.0 ha in size, little or no tax would be due. About two-thirds of all farm households in Korea have less than 1.0 ha of cultivated land (Table 5); therefore, it appears that for the majority of Korean farmers, this tax is of little consequence. For the farmers farming between 1.0 and 1.5 ha (about 20 percent of the farm households), the tax is estimated to average about 20,000 won per ha, which at current government rice prices (520 won per kg paddy) is equivalent to about 38 kg of paddy per ha, or about 12 percent of the average charge for irrigation services.

5.4 Nature and Magnitude of Direct Irrigation Benefits

5.4-01 The benefits of irrigation to Korean farmers consist mainly of increased yields due both 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 to paddy 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 paddy land. On the other hand, cropping intensities have been observed to increase in some cases where existing paddy land is brought under irrigation. In these cases, farmers with irrigated paddy planted a winter barley crop following the summer paddy crop, while farmers with unirrigated paddy did not grow barley because it interfered with timely transplanting of the paddy crop (Kim 1982).

5.4-02 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.

5.4-03 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 Pyong Taek-Kumgang Irrigation Project estimated that yields would double as a result of irrigation. This was based on the reported average yield of rainfed paddy of 2.0 tons of polished rice per ha in normal years, and a reported average yield of over 4.0 tons per 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 Pa Jo FLIA) financed by the ADB, rice yields were projected to rise from 3.2 to 5.3 tons per ha by 1988 as a result of the project (ADB 1983, p 83).

5.4-04 Some post-project evaluations have also reported large increases in yields as a result of irrigation. In an evaluation of a the results of a loan by the United States Agency for International Development (USAID) for some 66 small-scale irrigation projects, it was reported that the average increase in yields in 14 projects visited was 2.4 metric tons of polished rice per ha, with increases in the individual projects ranging from 1.5 to 3.6 tons (USAID 1980, p 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 to 1.3 tons of polished rice per ha, with the average increase being 1.1 tons (Kim 1982, p 48). Again, however, the increase (which the report attributes entirely to irrigation) is simply the difference in yields before and after the project.

5.4-05 A rather different picture emerges from the aggregate data published by MAF. Yield data for rice in irrigated areas managed by the FLIAs are compared with average yield data for all rice in Table 19. No yield data on the small irrigation projects of less than 50 ha (managed by the Irrigators' Groups), are available. It was thus assumed in making the calculations for Table 19 that the average

yield in the areas served by the Irrigators' Groups is the same as in the areas served by the FLIAs. This assumption probably overstates the yields of the small projects. Oh (1976), 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.

5.4-06 The implied differences between the average yields of irrigated and non-irrigated rice are presented in the final column of Table 19. To the extent that the yield of irrigated rice in areas served by the small systems is overestimated, the figures in this column are also overestimated. For the entire country, the difference is only 720 kg of polished rice per ha. Among the provinces, the differences range from 210 kg per ha to 1,300 kg per ha. Four of the eight provinces showed differences of less than 500 kg per ha.

5.4-07 Part of the reason for the small difference between the yields of irrigated and non-irrigated rice may be that the non-irrigated 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.

5.4-08 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 projects funded by the World Bank, Kim (1982) obtained data on land values in the area irrigated by the projects, and in nearby non-irrigated 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.

5.4-09 Calculations based on Kim's data are presented in Tables 20A and 20B. The last line of Table 20A presents Kim's estimates of the increase in net income due to irrigation. These range from 663,000 to 819,000 won per ha. Also shown in the table are the major components underlying the estimated increase in net income.

5.4-10 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 savings 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 per hectare for irrigation and drainage activities, and an increase of about 6 man-days per hectare 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, per ha.

5.4-11 Additional fertilizer use following the introduction of irrigation increased the cost of production modestly. The residual category "other increases in production costs" in Table 20A includes changes in a variety of items such as pesticides, seeds, machinery, etc.

5.4-12 Kim's data on land prices permit an alternative estimate of the increase in net income from these irrigation projects (Table 20B). Data for the best class of land indicate increases in land values of from 907,000 to 3,530,000 won per 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 Table 20B. At this rate, the estimated increase in net income due to irrigation ranges from 181,000 to 706,000 won per ha. Using the same figures as presented in Table 20A 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.

5.4-13 In the final line of Table 20B, 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 Chungseo, 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.

5.4-14 It is likely that part of the reason for the difference between these two latter districts and the first three districts is that in Hoam and Samduk districts, barley is 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 Table 20B.

5.5 Estimates of Farmers' Ability to Pay for Irrigation Services

5.5-01 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 latter approach is more satisfactory from a conceptual point of view, the data requirements for the former are much less demanding.

5.5-02 Estimates of the cost of irrigation services relative to income for various projects are presented in Tables 21 and 22. Estimates for the Im Jin and Pyong Taek-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 ADB Project Completion Report, the target for irrigated paddy for the project had increased by 24 percent over the amount anticipated at the time of appraisal (ADB 1983, p 24).

5.5-03 Similar estimates were derived from projections in the World Bank's appraisal report for the Pyong Taek-Kumgang project. These estimates suggest that on the average, approximately one-third of the net benefits would be needed to meet the water charges imposed.

5.5-04 The post-project 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 Pyong Taek-Kumgang projects, as shown in Table 21, then the average benefit recovery ratio for these projects would be between 14 and 17 percent.

5.5-05 Two alternative estimates of the benefit recovery ratios for each of the five medium scale projects studied by Kim (1982) are presented in Table 22. 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 to 27 percent. The second method gives a wider range of values for the five projects. For two of the projects, the estimated benefit recovery ratios are approximately 50 percent, while in one case, the ratio is about 100 percent. For the two 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.

5.5-06 The aggregate data on irrigated and non-irrigated yields by province provide the possibility of estimating the average water charges as a percent of the difference in gross income between the irrigated and non-irrigated rice (Table 23). Conceptually, these estimates are roughly comparable to those in the second column of Table 21. But because they ignore the effect of irrigation on crops other than rice, while including total charges for irrigation water, they over-estimate the proportion of actual benefits which is used to pay for water charges.

5.5-07 With the exception of Chung Nam and Gyeong Nam provinces, these estimates imply that between about one-fifth to slightly over one-half of the gross incremental rice production goes to pay water charges. Again assuming that the relationship between this ratio and the benefit recovery ratio is approximately the same as observed for the Im Jin and Pyong Taek-Kumgang projects in Table 21, the implied benefit recovery ratios for these provinces would range from about one-fourth to two-thirds. For Chung Nam and Gyeong Nam provinces, the data imply that average water charges are equivalent to

approximately 80 and 100 percent, respectively, of the gross incremental rice production.

6. Methods of Financing Irrigation Services

6.1 Direct Methods

6.1.1 Policy Principles

6.1.1-01 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.

6.1.1-02 A second implied policy principle is that water charges should be related to the benefits received. This principle leads to differences, even within a single FLIA, in water charges among farmers.

6.1.2 Financing mechanisms

6.1.2-01 The primary mechanism of direct financing of irrigation services is per hectare charges levied on farmers in irrigated areas. This mechanism is used in areas irrigated by both FLIAs and Irrigators' Groups. A second important financing mechanism is the generation of income or other revenues from assets controlled by the FLIAs. This includes interest income, income from the sale of water for non-agricultural purposes, and revenues from the sale of assets.

6.1.3 Assessment, billing and collection procedures

6.1.3-01 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 is divided into several districts, or project units, each of which may be served

by relatively independent irrigation facilities.[2] There are a total of 932 such districts in the existing 103 FLIAs. Within a single FLIA, certain components of the water charges vary by district.

6.1.3-02 Information obtained from the Pajo FLIA illustrates the assessment procedures. Pajo consists of 5 districts, or sub-projects. The O&M component of the water charge varies among the 5 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 ha cost of administration is calculated and applied to all land in all districts. The direct costs of irrigation are calculated separately for each district.

6.1.3-03 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.

6.1.3-04 The Pyong Taek FLIA has a slightly different way of applying the same basic benefit principle. Unlike most FLIAs, Pyong Taek consists of a single zone. Thus the component of the water charge covering O&M is uniform throughout area served. The component of the charge for the repayment of project costs varies according to three

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[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.

[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.

factors. A basic charge for capital repayment (currently 50 kg per ha) is levied against all irrigated land. Additional charges are levied against sloped land (70 kg per ha) and against land which has been consolidated (60 kg per ha).

6.1.3-05 Billing. Bills for each farmer are prepared by the FLIA. In some cases, as with the Pyong Taek 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; however, in order to speed delivery of the bills to the farmers (and thus to enhance the prospects for early receipt of the charges), 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.

6.1.3-06 As a rule, the bill is delivered to the farmer on or before the 25th of November. The bill contains the farmer's name, his address, the amount due if it is paid on or before the 25th 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 has only the amount of water charge to be paid and has no indications on the kind of crop served by the irrigation system, nor does it state the hectares covered.

6.1.3-07 Collection. Beginning in 1984, all water charges must be paid by the farmers in cash to the FLIA through the county and sub-county cooperatives of the National Agricultural Cooperative Federation (NACF). It is the policy of MAF that all matters pertaining to collections of money from farmers must be handled solely through the NACF. Four reasons are given for this policy:

1. Adding the collection of water charges to NACF's activities will increase the utilization of the local NACF branch offices, which are fairly accessible to the farmers;

2. It is considered to be less costly for NACF to collect the water charges than for the MAF and the FLIAs to provide the needed staff members at the office and field stations for the same purpose;

3. Direct payments made by farmers to the NACF will avoid 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

4. The collection methods are the same as exist for the collection of government taxes.

6.1.3-08 Every year, the local FLIA signs an agreement with the county coop (i.e., local NACF cooperative bank branch), authorizing the cooperative to receive, for the special account of the FLIA, the payments of farmers for water charges. The county coop notifies its sub-county 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 coop designated by the FLIA as its collector or at any of the sub-county offices of the county coop.

6.1.3-09 The county or sub-county office issues the farmer a receipt upon payment. A copy of the receipt is forwarded within 1 day to the FLIA for its record. The sub-county coop may keep the payments received from farmers for a maximum of only 2 days prior to forwarding the amount to the county coop. The county coop keeps the pooled collections as a deposit of the FLIA until the amount is used or withdrawn by the FLIA. Any payments 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.

6.1.3-10 The county and sub-county coops receive no commission, nor do they charge any service fee for the collection of water charges for the FLIA. However, they benefit in the following ways:

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

2. In the process of going to the bank to make his payment, the farmer may also buy from the cooperative store, which in most cases is housed in the same building; and

3. The farmer may be more likely to pay his other taxes (eg., income or land tax) through the county coop. The coop profits from these transactions since it is able to keep the

money for a period of time before the money is remitted to the national treasury.

6.1.3-11 Furthermore, there is a keen business competition between the commercial banks and the NACF coops. The county coops consider serving the FLIA farmers as a source of goodwill. In most cases, the farmers paying their water charges are also members of the NACF county coop.

6.1.3-12 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 paddy 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 office of the NACF. Delays in turning over the cash to the local office of the NACF and problems in the handling of cash by the FLIA staff were encountered with this system of collection.

6.1.3-13 Under the previous system, if the farmer chose to pay in kind, he took his paddy to the county NACF warehouse. The quantity and quality of the paddy were determined by an officer of the Farm Products Inspection Office of the MAF, who certified the grade and value of the paddy, which was indicated on a bond issued to the farmer. If the paddy failed to meet the minimum quality requirement, the farmer was not allowed to use his paddy as payment in kind. The bond issued to the farmer for "acceptable" paddy was brought by the farmer to the FLIA office. If the value of the paddy 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 paddy 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 water charge was in turn used by the FLIA in withdrawing money from the county office of the NACF.

6.1.3-14 Two problems were encountered with the payment in kind method. First, the NACF found itself with varying amounts of several different grades and varieties of paddy. Second, variations in the moisture content of the paddy received from farmers introduced problems in the handling and post-harvest processing. As a result of these problems, losses were incurred by the county office of the NACF.

6.1.3-15 The present method of requiring farmers to pay for water charges in cash makes the accounting of NACF simpler. The farmer sells his paddy to the county office of the NACF and pays his water charges with part of the cash he receives from the sale of his paddy. Since the local NACF warehouse and purchasing office is near the county office (or cooperative bank) of the NACF, the sale of paddy and the payment of the water charge by the farmer can be done in the same place. In turn, NACF is able to keep its paddy purchases and collection of water charges in separate accounts.

6.1.4 Enforcement

6.1.4-01 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 governments. Thus, although the FLIAs use the term bi, which implies a "charge" or "cost" or "fare" for irrigation (Wade 1982, p 85), the term "water tax" (soo sae), commonly used by farmers, is a more accurate reflection of the legal reality.

6.1.4-02 Financial penalties exist for late payment of the water charges. The penalty is equivalent to 5 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 of the farmer to recover the charge. Wade (1982, p 87) notes that in such situations, the police sequester assets of the farmer valued at the amount owned, and can sell them after 15 days if the farmer has still not paid.

6.1.4-03 According to the Chairman of the Pajo FLIA, legal action has never been taken by the association against any farmer; however, a number of farmers are penalized for late payment. In 1984, the Pajo 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.

6.1.4-04 Termination of water deliveries to farmers who do not pay their water charges is not considered a realistic alternative, at least in the Pajo FLIA. We were told not only that it would 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.

6.1.4-05 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 an FLIA, monetary prizes may be given to the first three villages to achieve 100 percent payment from all the farmers in the village. The amount of the prizes varies among FLIAs. In 1984, the first prizes were 60,000 won in the Ki Ho FLIA (but reduced to 40,000 in 1985 due to tighter budget conditions), and 70,000 won in the Pyong Taek FLIA. The FLIA may also offer monetary prizes to its own field station staff for those who are the first to achieve 100 percent collection rates from the areas for which they have responsibility.

6.1.5 Collection efficiencies

6.1.5-01 As implied by the discussion in the previous paragraph, rates of collection of water charges in Korea are very high. Data for 1983 show that for the 103 FLIAs, collections were 98.3 percent of the amounts assessed. The accumulated amounts in arrears was only 4.3 percent of total current assessments. Rates of collection the four FLIAs visited during the study ranged from 96.4 to 99.5 percent.

6.1.5-02 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 three times the amount of current assessments.

6.1.6 Collection Costs

6.1.6-01 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, probably has lowered collection costs. But it would be extremely difficult to determine what proportion of the expenses of the NACF 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 coops (noted in section 6.1.3 above), there is a net benefit, rather than a net cost, to their collection activities.

6.1.6-02 Responsibility for the assessment and billing of water charges falls to 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 to the FLIA of these activities would require an estimation of the alternative activities that these personnel might engage in, and in the change in staffing patterns which might be possible if these responsibilities were removed.

6.2 Indirect Methods of Financing Irrigation Services

6.2-01 The Constitution of Korea provides for the principle of local autonomy, which, among other things, gives local government the right to assess and collect local taxes. In 1984, farmers paid two kinds of local taxes to the provincial tax offices -- a property tax on agricultural land (i.e. rice field, dry field, orchard, woodland and pasture land) and a farmland tax for the production of rice and other crops. The provincial tax office at Suweon estimates that about 10% of the total budget of a county comes from these land taxes. Although these taxes are not designed to finance irrigation services, the amounts collected are affected by irrigation investments. It is thus appropriate to consider them as contributing indirectly to the financing of irrigation services.

6.2.1 Property Tax

6.2.1-01 The property tax is paid by land owners registered in the land taxation book as of the beginning date of the payment period. For agricultural land, the tax rate of 0.1% is applied on the taxable amount determined to be 50% of the established market value of the property. Rural lands are valued using the sales approach. A semi-annual survey of land values is conducted by the local governments. The valuation process establishes a value for a standard land upon which the value of a price of land in the same classification (e.g. agricultural) is based.

6.2.1-02 The valuation procedure for both urban and rural lands is as follows (SGATAR, 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 transaction.

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.

6.2.1-03 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. However, considering that the tax rate is only 0.1% applied to only 50% of the market value of the agricultural land, the amount of indirect cost recovery represented by this property tax may not be substantial.

6.2.1-04 The property tax is payable from September 16th to September 30 each year. A demand note is issued within 7 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.

6.2.2 Farmland Taxes

6.2.2-01 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.

6.2.2-02 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 food and foodgrains are prepared by the MAF, 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 provincial government of the "basic production" for different classifications of land and the "necessary expenses" to be used in determining production costs.

6.2.2-03 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 socio-economic 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.

6.2.2-04 Tax for the income earned during the period January 1 to June 30 (summer crop) must be paid between July 15 to 31, while income earned from July 1 to October 31 (usually the rice crop) must be paid between November 15 to 30 of the same year. The same penalty of 5% that is levied on property taxes is added to unpaid farmland taxes after the due date for payment.

6.2.2-05 Exemptions from the payment of taxes or reductions in the amount of taxes due are possible in the case of crop

failure due to drought or flood. The extent of the damage is determined by the MAF, 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.

7. Relative Contribution of Farmers to Irrigation Financing

7.1-01 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 24, average O&M costs and the average water charges, both calculated per ha of assessed area, are presented for the various sizes of FLIAs, and for the 4 FLIAs visited during the study. As shown in the final column, for all sizes of projects, the average water charge is equivalent to between 84 and 92 percent of the average O&M cost. The corresponding figures for the 4 FLIAs visited were somewhat higher. In the case of the two projects with recent ADB and World Bank financing (Pajo and Pyong Taek), 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.

7.1-02 That 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 reflects the fact that the FLIAs have additional sources of income besides water charges on farmers. These additional sources of income, as noted in section 6.1.2, result from the assets of the FLIAs. As shown in Table 25, these other sources of income accounted for an average of approximately one-fourth of the total revenues of the FLIAs.[4] This income comes from a variety of sources, including the sale

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[4] 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 (Korea. Agricultural Development Corporation 1984), Table 12.

of surplus water outside the project or for non-agricultural uses, rental of land owned by the FLIA, and interest on funds held by the FLIA. In addition, one component (averaging 3 percent of the total revenues of the FLIAs) consists of special government subsidies.

7.1-03 Indirect subsidies underlie some of these components of FLIA income. For example, FLIAs generally hold reserve funds which, according to government guidelines, should be equivalent to 70 percent of the annual expenditures of the FLIA. These funds can be deposited either with NACF or with the Federation of Farmland Improvement Associations, where they earn interest at rates which currently range from 10.5 to 13 percent. At the same time, the FLIAs are allowed to borrow funds from NACF for certain types of repairs at 3.5 percent interest, with a 30 year repayment period.

7.1-04 It not possible to determine with precision 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 26 and 27.

7.1-05 The details for the calculations based on a net construction cost of 5 million won per ha are presented in Table 26. It is assumed that the nominal government subsidy on the net construction cost is 30 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 Agricultural Development Corporation, 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.[5] The

[5] Several years ago the 3.5 percent rate of interest was nominally raised to 5.5 percent. According to MAF, however, there is a special subsidy arrangement whereby the additional

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.

7.1-06 The O&M cost shown in Table 26 as borne by the FLIA is approximately the same as the average annual O&M costs of the FLIAs, of 168,200 won per ha (Table 24). The additional 15,000 won per 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 5.2 for the Pyong Taek FLIA, which relies heavily on pumping.

7.1-07 The results from Table 26 are again presented in Table 27, 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 reported in Tables 10 to 14.

7.1-08 The last four columns of Table 27 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 from 4 to 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, it can be seen that 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 per ha -- were the charges enough to fully cover O&M costs. In this case, there was a contribution to the capital cost of approximately one percent.

7.1-09 Although these figures represent a hypothetical situation, they are indicative of the order of magnitude of farmer payments and government subsidies in Korea.

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interest represented by the 2 percentage point increase is returned to the FLIAs. The effective cost of these loans thus remain at 3.5 percent.

8. Evaluation of Financing Policies

8.1-01 Korean policies for financing irrigation can be evaluated from the perspectives of both economic efficiency and income distribution.

8.1-02 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.

8.1-03 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 per FLIA, 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.

8.1-04 Efficiency of water use in Korea is thus related to the effectiveness the FLIAs' control over the distribution of the supply of water to individual farmers, rather than to 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 1982b; Wade 1982).

8.1-05 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

less 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 MAF for irrigation activities may be a more critical factor in investment decisions than the amount of water charges that farmers will have to pay.

8.1-06 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.

8.1-07 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.

8.1-08 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, 1982b; USAID 1980; Wade 1982), but rather "a bureaucratic entity designed to deliver water and collect water fees" (USAID 1980 p.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 b).[6]

8.1-09 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).

8.1-10 Although if 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 MAF. 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.

8.1-11 Income Distribution between the Public and Private Sectors. Irrigation results in a net expenditure of public funds in Korea. It is likely that less than 10 percent of the economic cost of irrigation investments is recovered from the FLIAs, in spite of levels of water charges 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.

8.1-12 On the other hand, the recurrent costs associated with the operation and maintenance of irrigation facilities in Korea does 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 operation and maintenance are paid for entirely by the FLIAs, largely through the water charges paid by the farmers.

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[6] 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, p 185).

8.1-13 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.

8.1-14 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.

Annex 1

Some Specific Cost Provisions in the Budget Preparation Guidelines for FLIAs - Gyong Gi Province, 1985.

Costs Allowed

1. Water charges for O&M, excluding project cost repayment.

Source of Water	Standard Water Charge
Pumping/Drainage	≤ 35 kg paddy per o.1 ha.
Pumping	≤ 30 kg paddy per 0.1 ha.
Reservoir	≤ 25 kg paddy per 0.1 ha.

2. Temporary hired labor for office work must be hired based on a maximum of 300 work days per year.

Kind of Work	Rate per Day
Assistants in miscellaneous Office work	W 3,620/day
Errand office boy	W 3,190/day

3. Personnel allowances/benefits.

Kind of Allowance	Rate
Meal for staff outside office	W 1,500/person/day
Medical insurance	19/1000 of salary (basic + allowance) per month
Clothing allowance	Provide for half of regular staff
examples:	
Gate keeper clothes	W 70,000
Voluntary police clothes	W 70,000
Work clothes	W 11,700
Raincoats	W 3,000
Tuition fee allowances	For maximum of 2 children of regular staff
Junior high school	W 54,500 for city, W 34,300 for county
Senior high school	W 85,800 for city, W 57,200 for county
Overtime pay during irrigation period	W 3,620/night for temporary staff
Temporary labor during irrigation period	W 5,560/day

Increase in salary

1. Cashier of senior level	W 20,000/mo.
2. Senior-level staffs	W 20,000/mo.
3. Junior-level staffs	W 15,000/mo.

4. Fuel costs for heating offices - actual costs for heating but must maintain office temperatures only at 18°C, 105 days during the year at 8 hours per day.

5. Office expenses

Newspapers	Subscriptions
for chairman	2 nationwide, 1 provincial
for section unit	2 nationwide
for FLIA without section	1 nationwide
for field office	1 nationwide
Government publication (gazette)	1 subscription
Book on Law	1 copy
Magazines	No funding available

Allowance for telephones/ telegrams	25,000 per mo. for cities 100,000 per year for counties

6. Allowances for FLIA officials

Official	Rate per year according to FLIA area
Chairman	W 120,000 < 5,000 ha
	W 160,000 5,000 to < 10,000 ha.
	W 220,000 10,000 to < 20,000 ha.
Chief, Branch Office	W 50,000 < 1,000 ha.
	W 60,000 1,000 to < 3,000 ha.
	W 80,000 3,000 to < 5,000 ha.
Director	W 70,000
Section Chief	W 50,000
Sub-section Chief	W 30,000

7. O&M budget for vehicles

Kind of Vehicle	Rate per Unit Year
Car, 1300 cc	W 2,604,000
Jeep	W 2,738,000
Wagon	W 1,255,000
Motorcycle, < 125 cc	W 400,000
Truck, > 6 tons	W 2,471,000
> 2 tons to 6 tons	W 1,390,000
≤ 2 tons	W 1,255,000

8. Incidental expenses related to project implementation

Benefitted Area	Rate in % of Collected Water Charges
< 5,000 ha	≤ 0.6% of collected water charges
5,000 to < 10,000 ha	≤ 0.4% of collected water charges
10,000 to < 20,000 ha	≤ 0.3% of collected water charges

Annex 2

Revenue and Expenditure Items in the Budget/Accounting System of FLIAs

(Revenues)

Project Income

1. Water charges
   1.1 O&M cost
   1.2 Project repayment cost

2. "Surplus" Water charges - sale of water outside FLIA's irrigation system
   2.1 Farm use
   2.2 Industrial use
   2.3 Domestic drinking water
   2.4 Other uses

3. Rent Income
   3.1 Land/bldg. rental of FLIA assets
   3.2 Farm agricultural machines
   3.3 Dredger or bulldozer
   3.4 Facilities/reservoir
   3.5 Others

4. Other Assets Income
   4.1 Wood from upstream of reservoir
   4.2 Sand/sediments removed from reservoir by dredger

5. Commitment charges
   5.1 Handling of farm machines
   5.2 Others

6. Others - all other income/revenues

Special Project Income

1. Subsidy for O&M
   1.1 From Central Government
   1.2 From Provincial Government

2. Subsidy for Project
   2.1 From Central Government
   2.2 From Provincial Government

3. Other Subsidies

4. Income from the Funds of the Federation of FLIA's.

5. Transfers from Other Accounting Items

6. Other Incomes
   - 6.1 Interests from bank deposits of FLIA
   - 6.2 Interests from bonds
   - 6.3 Income from resale of bonds
   - 6.4 Others

7. Surplus Turned-over from Last Year

(Expenditures)

Project Direct Costs

1. Irrigation Costs
   - 1.1 O&M cost for reservoir, pumping station, canals, weir, direct costs for irrigation facilities
   - 1.2 Personnel cost for operation of pumping stations & reservoir (includes gate keepers and 6-month employees)
   - 1.3 Repair costs for irrigation facilities
   - 1.4 Others

2. Rent cost
   - 2.1 Rented assets for O&M
   - 2.2 Others

3. Other costs
   - 3.1 Forest-related costs for upstream of reservoir, insect/pest control, including labor cost
   - 3.2 Dredger-related costs for maintenance of reservoir
   - 3.3 Commitment expenditures
   - 3.4 Others

Administrative Costs

1. Personnel costs
   - 1.1 Basic salaries
   - 1.2 Allowances
   - 1.3 Others (lecturers)
   - 1.4 Temporary staff
   - 1.5 Retirement pensions

2. Office expenditures
   - 2.1 Welfare expenses (food, sports, etc)
   - 2.2 Travel costs

2.3 Telecommunications
2.4 Electricity
2.5 Fuel
2.6 Tax and others (donations)
2.7 Consumable material
2.8 Clothing
2.9 Printing cost
2.10 Rent for land, bldg.
2.11 Depreciation
2.12 Repair of bldg., tools
2.13 Operation costs of automobiles
2.14 Insurance
2.15 Commitment charges paid to bank for land price assessments, handling monetary transactions, etc.
2.16 Transportation costs including storage
2.17 Information costs for data collection
2.18 Miscellaneous costs for agency operations, meetings
2.19 Costs for project implementation, including expenses for guests
2.20 Public relations-related expenses
2.21 Education and training
2.22 Data collection or study
2.23 Prizes
2.24 Registration costs and costs related to court cases/ hearings
2.25 Membership charges, Federation of FLIAs
2.26 Compensation/damage costs paid
2.27 Food costs for overtime work
2.28 Inspection cost for rough rice
2.29 Others

Costs borne by FLIA

1. Financing of project
   1.1 Project cost equated to government subsidy
   1.2 Restoration of damaged facilities
   e.g. flood damaged
   1.3 Installation of durable facilities
   (3 years and over)

2. Farming improvement - with the use of chemicals, farm tools, etc.

3. Providing for item without a current budget

Special Project Expenditures

1. Expenditures for the Funds of the Federation of FLIA
2. Commitment Charges for the Federation of FLIA

3. Money for the Repair Funds of the Federation of FLIA
4. Other Expenditures
    4.1 Interests paid by FLIA
    4.2 Losses from resale of bonds
    4.3 Donations
    4.4 Losses due to disaster
    4.5 Others

Table 1

GNP and Industrial Origin of GNP, 1980-84

	1980	1981	1982	1983	1984
GNP (US$ billion)	61.2	67.2	70.8	75.1	81.1
Per capita GNP (US $)	1,605	1,735	1,800	1,880	1,998
GNP (billion won, at current prices)	37,205.0	45,775.1	51,786.6	58,279.7	
Agriculture, Forestry and fisheries	5,372.5 (14)	7,403.1 (16)	7,680.3 (15)	8,166.5 (14)	
Manufacturing and mining	11,226.5 (30)	13,804.6 (30)	15,255.3 (29)	17,175.7 (30)	
Others	20,606.0 (55)	24,567.4 (54)	28,851.0 (56)	32,937.5 (56)	

Source: Bank of Korea, National Income Accounts, 1984.
Economic Planning Board, 1985.

As cited in ADB, Economic Survey of Republic of Korea, May 16, 1985.)

Table 2

Utilization of National Land, 1983.

Type of Land	Area (hectares)	Percent of total land area
Cultivated Land	2,167,000	21.9
Paddy field	1,316,000	(13.3)
Upland	851,000	(8.6)
Forest Land	6,547,000	66.1
Wooded	6,282,000	(63.4)
Denuded	240,000	(2.4)
Uninvestigated	25,000	(0.3)
Others	1,195,000	12.0
Total National Land	9,909,000	100.0

Source: Korea, MAF. The Yearbook of Agriculture and Fisheries, 1984.

Table 3

Land Utilization for Food Crops, 1971-83
('000 ha)

Year	Total Cultivated Land Area	Food Crops											
		Rice		Wheat		Barley & Miscellaneous Grains		Pulses		Potatoes		Total Food Crops	
		Area	(%)[a]	Area	(%)[a]	Area	(%)[a]	Area	(%)[a]	Area	(%)[a]	Area	(%)[b]
1971	2,271.3	1,190.4	52.4	768.5	33.8	99.6	4.4	337.8	14.9	163.3	7.2	2,559.6	112.7
1972	2,242.3	1,191.1	53.1	777.4	34.7	85.5	3.8	340.1	15.2	147.4	6.6	2,541.5	113.3
1973	2,241.3	1,181.7	52.7	712.7	31.8	91.6	4.1	369.7	16.5	138.2	6.2	2,493.9	111.3
1974	2,238.4	1,204.4	53.8	745.1	33.3	72.8	3.3	333.4	14.9	121.5	5.4	2,477.2	110.7
1975	2,239.7	1,218.0	54.4	760.9	34.0	73.4	3.3	332.7	14.9	146.3	6.5	2,531.3	113.0
1976	2,238.2	1,214.9	54.3	752.2	33.6	66.6	3.0	312.4	14.0	136.1	6.1	2,482.2	110.9
1977	2,231.2	1,230.0	55.1	545.6	24.5	64.9	2.9	326.5	14.6	127.3	5.7	2,294.3	102.8
1978	2,221.9	1,229.7	55.3	575.4	25.9	54.9	2.5	313.8	14.1	112.6	5.1	2,286.4	102.9
1979	2,207.1	1,233.2	55.9	489.1	22.2	49.3	2.2	276.8	12.5	94.9	4.3	2,143.3	97.1
1980	2,195.8	1,233.0	56.2	360.4	16.4	52.7	2.4	255.5	11.6	92.4	4.2	1,994.0	90.8
1981	2,188.3	1,223.9	55.9	374.4	17.1	50.5	2.3	272.0	12.4	91.1	4.2	2,012.0	91.1
1982	2,408.1	1,188.1	54.5	339.2	15.6	57.4	2.6	242.2	11.1	80.6	3.7	1,907.5	87.5
1983	2,166.6	1,228.5	63.8	351.0	18.2	42.1	2.2	232.1	12.1	72.4	3.8	1,926.0	88.9

[a] Percent of total area planted to food crops.

[b] Percent of total cultivated land area.

Sources: Korea, MAF. Yearbook of Agriculture and Forestry Statistics, 1982.

Korea, National Agricultural Cooperative Federation, Agricultural Cooperative Yearbook, 1984.

Table 4

Area, Yield and Production of Paddy and Upland Rice, 1978-1983.

Year	Total, all Rice			Paddy, Rice			Upland Rice		
	Planted area (ha)	Yield (ton/ha)	Production (tons)	Planted area (ha)	Yield (ton/ha)	Production (tons)	Planted area (ha)	Yield (tons/ha)	Production (tons)
1978	1,229,750	4.71	5,797,128	1,219,071	4.74	5,779,142	10,679	1.68	17,980
1979	1,233,234	4.51	5,564,808	1,224,157	4.53	5,545,763	9,077	2.10	19,045
1980	1,233.308	2.88	3,550,257	1,219,841	2.89	3,529,540	13,197	1.57	20,717
1981	1,223,892	4.14	5,062,975	1,212,258	4.16	5,039,557	11,634	2.01	23,418
1982	1,188,073	4.36	5,175,073	1,175,964	4.38	5,105,963	12,109	1.99	24,210
1983	1,228,481	4.40	5,404,045	1,219,645	4.42	5,387,740	8,836	1.85	16,305

Source: Korea, National Agricultural Cooperative Federation, Agricultural Cooperative Yearbook, 1984, p.28

Table 5

Distribution of Korean Farm Households,
by Size of Cultivated Land, 1983.

Size Category (ha)	Percent of Farm Households
Less than 0.5	31.2
0.5 - 1.0	35.9
1.0 - 1.5	19.6
1.5 - 2.0	8.0
Over 2.0	5.3

Source: Korea, Ministry of Agriculture and Fisheries. Statistical Yearbook of Agriculture Forestry and Fisheries, 1984, pp.32-33.

Table 6

Fifth Five-Year Plan Projections

	Actual 1981	Projected 1986	Ratio 1986/81
Rural Population ('000)	9,999	9,100	0.91
Agricultural Employment ('000)	4,806	4,410	0.92
Area of Cultivated Land ('000 ha)	2,188	2,201	1.01
Paddy land	1,308	1,344	1.03
Upland	880	857	0.97
Developed Infrastructure ('000 ha)			
Irrigation	915	1,031	1.13
Consolidated land	383	530	1.38
Reclaimed upland	185	196	1.06
Reclaimed tideland	7	27	3.86
Reforestation	5,630	6,350	1.13
Mechanization ('000)			
Power tillers	350	470	1.34
Tractors	4	12	3.00
Rice transplanters	15	100	6.67
Power sprayers	365	525	1.44
Harvesters/combines	20	180	9.00
Farm Chemicals ('000 MT)			
Fertilizers	830	910	1.10
Others	34	36	1.06
Production ('000 MT)			
Rice	5,063	5,900	1.16
Barley	916	1,015	1.11
Corn	145	170	1.17
Soybeans	257	308	1.20
Oilseeds	65	138	2.14
Fruits	1,026	1,382	1.35
Vegetables	7,788	10,090	1.30
Meats	389	682	1.75
Milk	494	953	1.93
Fish products	2,811	2,900	1.03
Farm Household Income ('000 W)[a]	3,687	5,481	1.49
Farm Income	2,476	3,427	1.38
Nonfarm Income: amount	1,211	2,054	1.70
share (%)	33	37	1.12
Gross Agricultural Product (billion W)[a]	7,576	8,835	1.17
Share of GNP (%)	18	15	-

[a] 1981 prices

Source: World Bank. "Republic of Korea Agricultural Sector Survey", Report No. 4709-KO, 1984, p 24.

Table 7

Status of Irrigation in Paddy Fields in Korea

Year	Total Area of Paddy (000 ha)	Irrigated Paddy			Irrigated Paddy as % of total paddy		
		FLIA ooo ha	Non-FLIA ooo ha	Total ooo 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	929	35	36	71

[a] Consisting of 298 thousand ha under large scale projects, and 160 thousand ha under medium scale projects.

Source: Korea. Ministry of Agriculture and Fisheries. Statistical Yearbook of Agriculture Forestry and Fisheries 1984, p.35.

Table 8

Area of Paddy Field by Irrigation Facilities, 1983.

Type of	Total Benefited Area		Medium and Large Projects (FLIA)		Small Projects (Irrigators' Group)	
Irrigation Facilities	Hectares	%	Hectares	%	Hectares	%
Irrigated Area	928,500	100.0	458,800	100.0	469,700	100.0
Reservoir	478,100	51.5	325,800	71.0	152,300	32.4
Pumping/ Drainage Station	162,200	17.5	117,800	25.7	44,400	9.5
Weir	121,200	13.1	11,900	2.6	109,300	23.3
Infiltration Gallery	23,600	2.5	2,600	0.6	21,000	4.5
Tubewell	14,700	1.6	0	0.0	14,700	3.1
Other facilities	128,600	13.9	700	0.2	127,900	27.2

Source: Yearbook of Land and Water Development Statistics, 1984.
Agricultural Development Corporation,
Ministry of Agriculture and Fisheries,
Republic of Korea.

Table 9

Domestic and International Rice Prices
(thousand won per ton polished rice)

Rice Year[a]	Government Purchase Price (1)	Import Cost CIF (2)	Import Cost Adjusted to Farm Gate[b] (3)	Domestic/International Price Ratio (1 - 3)
1975	197	204	238	.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 Nov. 1 of previous calendar year, and continue through Oct. 31 of the current calendar year.

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

Source: Col 1 and 2: World Bank. "Republic of Korea Agricultural Survey", April 1984 (Report No.4709-Ko), Table A9, and Korea. Economic Planning Board. Major Statistics of Korean Economy 1985, pp 76 and 301.

Table 10

Capital Cost of Agricultural Development Projects
Completed by ADC Prior to 1985

Project	Mid-point of Construction Period	Construction Cost/ha (000 won)	Cost/ha adjusted to 1983 Prices [a]
Imjin	1979	6,375	9,688
Pyongtack	1973	2,044	11,815
Kumgang	1973	1,385	8,006
Kychwado	1976	5,008	10,678
Yongsang I	1975	2,357	6,994
Nahtonggang	1981	6,397	6,664
Kyongju	1975	4,312	12,795
Changnyong	1978	7,650	14,461

[a] Based on the Wholesale Producer Price index, treating the entire cost as if it were incurred at the mid-point in the construction period.

Source: Korea, Agricultural Development Corporation. ADC 1985.

Table 11

Capital Cost of Farmland Improvement and Expansion Projects Completed in 1983

Type of Project	Area (ha)	Cost/ha (000 won)	Nominal Subsidy as % of total cost		
			Central Govt.	Local Govt.	Total
Land Consolidation	10,030	5,940	57.1	22.9	80.0
Drainage	2,737	3,320	91.7	0.0	91.7
Slopeland Reclamation	694	3,340	31.2	0.6	31.8

Source: Calculated from Korea, ADC Yearbook of Land and Water Development Statistics 1984, Table 15.

Table 12

Capital Cost of Irrigation Water Development Projects Under Construction or Completed in 1983.

Type of Project	Area (ha)	Cost/ha (000 won)	Nominal Subsidy as % of total cost		
			Central Govt.	Local Govt.	Total
Reservoirs[a]	2,708	8,540	67.9	5.8	73.7
Pumping Stations	5,895	2,740	61.9	6.1	68.0
Weirs	1,226	1,340	48.7	17.0	65.7
Infiltration Galleries	487	1,750	61.5	20.0	81.5
Tubewells	1,693	2,270	74.1	18.4	92.5

[a] Excludes data for projects not completed in 1983.

Source: Calculated from Korea, Agricultural Development Corporation, Yearbook of Land and Water Development Statistics 1984, Table 14.

Table 13

Capital Cost of Im Jin Project, by Project Component

Item	Pumping Station	Land Consolidation	Conversion of Upland to Paddy	Drainage	Total
Area served (ha)	5,738	3,500	30		5,803
Total cost (million won)	26,463	16,742	74	2,528	45,807
Capital cost/ha (thousand won)	4,600	4,800	2,500		7,900
Nominal central government subsidy (% of total cost)	72.3	81.2	75.7	100.0	77.1
Amortization payment (won/ha)	70,357	49,435	32,067		99,527

Source: Agricultural Development Corporation.

Table 14

Construction Costs of Five Medium Scale Irrigation Projects

Project District	Total Cost[a] (000 won)	Benefitted Area (ha)	Cost per ha (000 won)
Chunseo	1,582,401	258	6,133
Sewol	328,697	66	4,980
Kosan	742,558	122	6,087
Hoam	722,883	121	5,974
Samduk	571,217	123	4,644

[a] In 1981 prices

Source: Kim, Bong-Koo. Evaluation Study on Medium Scale Irrigation Project Under IBRD Loan. Korea Rural Economic Institute Evaluation Report, December 1982.

Table 15

Operation and Maintenance Expenditures by Size of Project, and for Selected FLIAs, 1983.

Description	Benefitted Area (ha)	Direct O&M Costs won/ha	Direct O&M Costs % of total	Administrative Costs won/ha	Administrative Costs % of total	Other O&M Costs won/ha	Other O&M Costs % of total	Total won/ha
Average, all FLIAs	4,321	56,500	34.5	78,000	47.6	29,300	17.9	163,800
Average, medium scale projects (72 FLIAs)	2,036	56,500	34.5	83,600	51.0	23,900	14.6	164,000
Average, large scale projects (5,000-20,000 ha)[a] (28 FLIAs)	7,216	59,300	35.4	77,700	46.4	30,600	18.3	167,600
Average, very large projects (over 20,000 ha) (3 FLIAs)	32,139	50,400	32.4	70,300	45.2	34,900	22.4	155,600
Ki Ho FLIA	12,450	41,900	26.2	88,000	55.0	30,000	18.8	159,900
Pajo FLIA	9,430	37,500	32.5	53,000	45.9	25,000	21.6	115,500
Pyong Taek FLIA	16,056	73,000	39.4	75,800	40.9	36,700	19.8	185,500
So San FLIA	5,141	38,800	24.4	73,700	46.3	46,700	29.3	159,200

[a] Based on Planned Development Area.

Source: Calculated from Korea, Agricultural Development Corporation. Yearbook of Land and Water Development Statistics 1984, Tables 9 and 12.

Table 16

Production of Paddy Rice, by Variety

Year	Planted Area			Yield		Production
	Traditional (000 ha)	Tongil (000 ha)	Tongil as % of total	Traditional (MT polished rice/ha)	Tongil (MT polished rice/ha)	(Tongil as % of total
1978	290	929	76	4.4	4.9	78
1979	480	744	61	4.4	4.6	62
1980	616	604	50	2.9	2.9	49
1981	891	321	26	4.1	4.4	28
1982	790	386	33	4.1	4.9	37
1983	801	419	34	4.2	4.8	37

Source: Korea, Ministry of Agriculture and Fisheries. Statistical Yearbook of Agriculture Forestry and Fisheries 1984, pp 90-91.

Table 17

Farmland Tax Rates on Various Incomes, 1985.

Level	Income Subject to Tax (in million won)	Corresponding Land Tax (in won)
1	< 1.8	Amount x 6%
2	1.8 to < 2.5	108,000 + amount in excess of 1.8 million won x 8%
3	2.5 to < 3.5	164,000 + amount in excess of 2.5 million won x 10%
4	3.5 to < 4.8	264,000 + amount in excess of 3.5 million won x 12%
5	4.8 to < 6.3	420,000 + amount in excess of 4.8 million won x 15%
6	6.3 to < 8.0	645,000 + amount in excess of 6.3 million won x 18%
7	8.0 to < 10.0	951,000 + amount in excess of 8.0 million won x 21%
8	10.0 to < 12.5	1,371,000 + amount in excess of 10.0 million won x 24%
9	12.5 to < 15.5	1,971,000 + amount in excess of 12.5 million won x 27%
10	15.5 to < 19.0	2,781,000 + amount in excess of 15.5 million won x 31%
11	19.0 to < 23.0	3,866,000 + amount in excess of 19.0 million won x 35%
12	23.0 to < 29.0	5,266,000 + amount in excess of 23.0 million won x 39%
13	29.0 to < 37.0	7,606,000 + amount in excess of 29.0 million won x 43%
14	37.0 to < 47.0	11,046,000 + amount in excess of 37.0 million won x 47%
15	47.0 to < 60.0	15,746,000 + amount in excess of 47.0 million won x 51%
16	60.0 and above	22,376,000 + amount in excess of 60.0 million won x 55%

Source: Official Guidelines for Agricultural Land Tax, 1985.
Gyong Gi Province.

Notes:

1. Income subject to tax is the farmer's income (- Total revenue from production - Total cost of production inputs) minus the tax exemption of W 1.44 million.

2. Example:
If the farmer's income is W 5.44 million, his tax is computed as follows:
Amount of income subject to tax = W 5.44 million - W 1.44 million
= W 4.0 million

From the table, his tax bracket is within W 3.5 million and < W4.8 million multiply by 12%, which is equal to W 264,000 + W 0.5 million x 12%, or W 324,000.

Table 18

Estimates of the Importance of Farmland Taxes on Rice Land, by size of farm, 1984

Farm Size (ha)	Average Gross Receipts (000 won per household	Average Management Expenditure (000 won per household)	Average Net Income (000 won per household)	Average Taxable Income[a] (000 won (per household)	Farmland Tax (000 won per household)	Farmland Tax (000 won per ha)[b]
Less than 0.5	2,260	938	1,322	0	0	0.0
0.5 - 1.0	2,124	665	1,459	19	1	1.3
1.0 - 1.5	2,805	870	1,935	495	30	20.0
1.5 2.0	3,301	912	2,388	948	57	32.6
Over 2.0	5,075	1,510	3,565	2,125	134	67.0

[a] Equals net income minus the basic farmland tax exemption of 1,440 thousand won.

[b] Based on the mid-point of the farm size category.

Source: Korea, MAF. Report on the Results: Farm Household Economic Survey, Production Cost Survey of Agricultural Products, Food Grain Consumption Survey, 1985, p.318.

Table 19

Irrigated and Non-irrigated[a] Rice Yields[b], by Province, 1983.

Province	Irrigated Rice (ha)	Irrigated Rice as % of Total Rice Area	Reported Yields[c] Irrigaed Rice[d]	Reported Yields[c] All Rice	Implied Yield of Non Irrigated Rice[e]	Implied Average Difference in Yield Between Irrigated and Non-irrigated Rice
Gyeonggi	119,000	64	4.43	4.08	3.46	0.97
Gangweon	43,100	70	4.06	3.84	3.33	0.73
Chung Bug	54,100	63	5.07	4.59	3.77	1.30
Chung Nam	143,600	76	4.86	4.80	4.61	0.25
Jeon Bug	127,400	71	4.95	4.82	4.50	0.45
Jeon Nam	151,900	68	4.72	4.60	4.35	0.37
Gyeong Bug	157,000	76	4.73	4.48	3.69	1.04
Gyeong Nam	120,700	72	4.27	4.21	4.06	0.21
All Korea	928,500[f]	71	4.69	4.48	3.97	0.72

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

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

[c] Jeju province not included, as it has less than 1,000 ha of irrigated rice.

[d] Based on data for FLIAs.

[e] Assumes average irrigated yield in non FLIA areas (Irrigation Groups) is the same as in the FLIA areas.

[f] Total includes Jeju province plus rice areas in 4 cities which are not part of any province.

Source: Korea, Agricultural Development Corporation. Yearbook of Land and Water Development Statistics 1984, pp 17 and 299.
Korea. MAF Statistical Yearbook of Agricultural Forestry and Fisheries 1984, P.76.

Table 20A

Estimated Effect of Irrigation on Net Income from Production of High-Yielding Varieties of Rice in Five Medium Scale Projects, 1982.

Estimate 1: Based on Reported Increase in Yields

Item	District in which Project is Located				
	Chunseo	Sewol	Kosan	Hoam	Samduk
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

[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 per ha

Source: Based on data presented in Kim, Bong-Koo, Evaluation Study on Medium Scale Irrigation Project under IBRD Loan. Korea Rural Economics Institute Evaluation Report, December 1982.

Table 20B

Estimated Effect of Irrigation on Net Income from Production of High-Yielding Varieties of Rice in Five Medium Scale Projects, 1982

Estimate 2: Based on Reported Increases in Land Values Due to Irrigation

Item	District in which Project is Located				
	Chunseo	Sewol	Kosan	Hoam	Samduk
Value of high class land, irrigated (000 won/ha)	12,200	11,041	12,403	17,805	13,815
Value of high class land, non irrigated (000 won/ha)	10,346	10,134	11,093	15,246	10,285
Increase in land value due to irrigation (000 won/ha)	1,854	907	1,310	2,559	3,530
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) [a]	613	270	436	840	1,166
Yield increase due to irrigation as % of total yield increase [b]	47	26	38	73	106

[a] Assuming the same changes in production costs as reported in Table ...A

[b] Total yield increase is reported in Table ...A

Source: Based on data presented in Kim, Bong Koo, Evaluation Study on Medium Scale Irrigation Project under IBRD Loan. Korea Rural Economics Institute Evaluation Report, December 1982.

Table 21

Estimates of Proportion of Increases in Income Needed to Pay Water Charges 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 (projection)				
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. Pyong Taek-Kumgang (projections)				
a. Average, farm with rice-barley rotation	13.9	25.8	25.4	32.7
3. Average, 15 small projects (ex port evaluation)	N.A.	11.6	N.A.	N.A.

N.A. = not available.

Source: Calculated from:

(1) ADB "Project Completion Report of the Imjin Area Development Project (Loan No. 208-KOR) in the Republic of Korea", December 1983.

(2) World Bank. "Korea : Pyongtaek-Kumgang Irrigation Project," Report No.PA-6a, March 3, 1969.

(3) United States, Agency for International Development. "Korean Irrigation". A.I.D. Project Impact Evaluation Report No.12, December 1980.

Table 22

Estimates of Benefit Recovery Ratios for Farmers Growing Modern Rice Varieties in Five Medium Scale Projects

Item	District in which Project is Located				
	Chunseo	Sewol	Kosan	Hoam	Samduk
Estimate 1: Based on reported total increase in yields.					
Incremental net income per ha, 1982 (000 won)	819	666	721	719	663
Incremental net income per 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 per ha, 1982 (000 won)	371	181	262	512	706
Incremental net income per 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

Source: Calculated from Tables 20A and 20B, and from Kim, Bong Koo, Evaluation Study on Medium Scale Irrigation Project under IBRD Loan. Korea Rural Economics Institute Evaluation Report, December 1982.

Table 23

Estimates of Average Water Charges and Average Increases in Gross Income, by Province, 1983.

Province	Average Increase in Gross Income (000 won/ha)	Average Water Charge (000 won/ha)	Water Charge as % of increase in gross income
Gyeonggi	679	176	25.9
Gangweon	511	160	31.3
Chung Bug	910	169	18.6
Chung Nam	175	138	78.9
Jeon Bug	315	142	45.1
Jeon Nam	259	141	54.4
Gyeong Bug	728	158	21.7
Gyeong Nam	147	152	103.4
All Korea	504	156	31.0

Source: Col 1.: Calculated from Table 19.

Col 2 : Korea, Agricultural Development Corporation. Yearbook of Land and Water Development Statistics, 1984, p.300.

Table 24

Average O&M Costs and Water Charges, per ha of Assessed Area, by size of project and for selected FLIA, 1983

Description	O&M Cost (Won/ha) (1)	Average Water Charges (Won/ha) (2)	kg paddy per ha (3)	Water Charge as % of O&M Cost (2 ÷ 1) (4)
All 103 FLIAs	168,200	156,300	310	92.9
Medium scale projects (72 FLIAs)	169,800	156,100	310	91.9
Large scale projects (5,000-20,000 ha) 28 FLIAs)	172,700	158,600	315	91.8
Very large projects (over 20,000 ha) (3 FLIAs)	156,500	137,800	273	88.1
Ki Ho	160,100	148,700	295	92.9
Pa Jo	161,300	188,600	374	116.9
Pyong Taek	188,500	201,700	400	107.0
So San	162,700	155,300	308	95.5

Source: Calculated from Korea, Agricultural Development Corporation. Yearbook of Land and Water Development Statistics, 1984, Tables 11 and 12.

Table 25

Source of Revenues, by size of project and for selected FLIAs, 1983
(000 won per ha of assessed area)

Description	Water Charges	Other Revenues	Total Revenue	Revenue from Water Charges as % of total revenue
All 103 FLIAs	151,600	48,200	199,800	75.9
Medium scale projects (72 FLIAs)	155,800	56,100	211,900	73.5
Large scale projects (28 FLIAs)	158,100	42,700	200,800	78.7
Very large projects (over 20,000 ha) (3 FLIAs)	132,100	47,700	179,800	73.5
Ki Ho FLIA	148,100	65,400	213,500	69.4
Pajo FLIA	183,100	57,600	240,700	76.1
Pyong Taek FLIA	194,500	41,900	236,400	82.3
So San FLIA	153,600	62,400	216,000	71.1

Source: Korea, Agricultural Development Corporation. Yearbook of Land and Water Development Statistics 1984, Table 12.

Table 26

Hypothetical Annualized Cost of Irrigation Services, assuming net construction costs of 5 million won/ha (Won/ha)

	Total Cost	Cost to FLIA
Net construction cost	5,000,000	1,500,000 [a]
Design (3% of net)	150,000	0
Supervision of construction (10% of net)	500,000	0
Sub total	5,650,000	1,500,000
Interest during construction [b]	1,725,000	0
Total cost at end of construction	7,375,000	1,500,000
Annualized value	743,800 [c]	52,000 [d]
Annual O&M Costs	185,000	170,000
Total Annualized Cost	928,800	222,000

[a] Assumed to be 30 percent of total.

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

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

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

Table 27

Distribution of Hypothetical Annualized Total Cost of Irrigation Services, by amount of capital investment

Amount of Capital Investment (000 won/ha)	Hypothetical Annualized Total Cost of Irrigation Service (won/ha)[a]			% of Costs Paid by FLIAs		Farmers through Water Charges	
	Total	Paid by FLIAs	Paid by Farmers through Water Charges[b]	O&M	Capital	O&M	Capital
3,000	631,300	201,200	150,900	100.0	3.6	80.7	0.0
5,000	928,800	222,000	166,500	100.0	5.0	89.0	0.0
7,000	1,043,520	242,800	182,100	100.0	6.7	97.4	0.0
9,000	1,336,840	263,600	197,700	100.0	6.8	100.0	1.1

[a] Calculation of total costs and costs paid by FLIAs based on Table 26.

[b] Assumes direct water charges represent 75% of total revenues of the FLIA.

Table of Contents

Nepal

1. Introduction and Background

1.-01 Nepal ranks as one of the poorest countries of Asia with annual per capital income estimated to be about US$140. Over 85 percent of the population is dependent on agriculture for its livelihood, and agriculture provides over 52 percent of Nepal's GDP (Ministry of Finance, 1985). The agricultural resource base is severely constrained because only 22 percent of the land area is cultivable. Much of the approximately 14 million hectares of surface area is at high elevations where the climate is not suitable for agricultural production. The majority of the cropped area is devoted to the production of food grains, with rice being the most important in terms of area cropped, production, and diet preference. Table 1 presents the area cropped, total production, and aggregate yield levels of the major grain crops in Nepal.

1.-02 Yield levels are low, particularly when compared to Southeast Asian countries, but also in comparison to other South Asian countries. Whereas 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 (ADB, 1982). Table 2 shows how yields of the major grains have generally declined between the 1960s and 70s as cultivation has been extended to marginal areas less suited for crop production.

1.-03 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 key elements in a strategy for increasing agricultural output through the intensification of production.

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

1.1 Irrigation Development

1.1.1 Types of Irrigation

1.1.1-01 Nepal consists of three separate geographic and climatic regions running parallel from east to west. These are termed the plains (terai), hills, and mountains, and the differences in climate among them are primarily due to the effects of vastly different levels of elevation. The climate in the terai and much of the hill area is suitable for intensive agricultural production provided that irrigation is available. Both the government and farmers have recognized for some time the importance of irrigation development. Of a total of approximately 1.9 million hectares of potentially irrigable land, nearly 650,000 hectares currently receive irrigation. Table 3 shows the status of irrigation development in the terai 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.

1.1.1-02 While there is potential to nearly double the area irrigated in the hills with an increase from 170 to 300 thousand hectares, most of the undeveloped potential and nearly 70 percent of the developed irrigation is in the terai. Of the estimated 1.6 million hectares that could be irrigated in the terai, less than 25 percent is irrigated. Much of the ground water irrigation potential has yet to be developed--less than 60,000 of a potential 428,000 hectares is irrigated from underground sources. The potential area to be irrigated from ground water sources accounts for more than 20 percent of the total irrigation potential.

1.1.1-03 Nepal is somewhat unique in 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 hectares to as large as 10,000 hectares. Some are centuries old, and the majority have been in operation for 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 hectares.

1.1.1-04 Nearly all of the irrigation in Nepal has been developed for the irrigation 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, a function of the water supply. 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 these 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).

1.1.2 Irrigation Institutions

1.1.2-01 There are a number of government agencies which are involved in the financing and construction of irrigation systems. Some of these also are responsible for the management of systems they develop, but others are not. A brief description of each of the institutions and their involvement in irrigation development and management follows.

1.1.2-02 Department of Irrigation, Hydrology, and Meteorology (DIHM). DIHM was established in 1952 with technical assistance from India and has been completely manned by Nepali 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, DIHM 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.

1.1.2-03 DIHM is the primary agency engaged in irrigation development in Nepal. Its activities are concentrated on the investigation, design, construction, rehabilitation, operation and maintenance of systems with service areas larger than 500 hectares in the terai and larger than 50 hectares 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 projects.

Year	Number of Projects
1985-86	59
1984-85	63
1983-84	62
1982-83	59

1.1.2-04 Irrigation Systems under the Development Board Act. Not all of the large-scale irrigation projects are developed and managed by DIHM alone. Some of the large projects, particularly ones funded through foreign loans, are governed by a project board formed under the Development Board Act of 1956. These project boards include representation of the water resources, finance, land reform, and agriculture ministries. The National Planning Commission, Department of Agriculture, and DIHM also each have representation on the boards. Regional directors of DIHM and DOA 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 are involved in the process. They also allow for some autonomy in personnel requirement and financial flexibility. These boards are empowered to set their own water charges and to prescribe the collection method.

1.1.2-05 Farm Irrigation and Water Utilization Division (FIWUD). FIWUD was established in 1973 under the Department of Agriculture. It began its work in the terai with pump irrigation systems and has installed 46 tubewells serving an estimated 7,000 hectares. FIWUD installs the tubewell, 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 projects of DIHM in the terai, including some Command Area Development Projects. FIWUD

has also begun developing small gravity irrigation systems in the hills which are turned over to the farmers upon completion.

1.1.2-06 Ministry of Panchayat and Local Development (MPLD). MPLD, through its regional and district offices constructs small systems, mainly in hill districts. Systems under 50 hectares in area are considered the responsibility of MPLD. 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 MPLD. Much of their work involves providing technical and financial assistance to existing farmer-managed irrigation systems. MPLD does not manage irrigation systems after construction is completed. This is to be done by a local users committee.

1.1.2-07 Agricultural Development Bank (ADB/N). The Agricultural Development Bank 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 tubewells serving an estimated 45,000 hectares have been installed under this program. Over 700 wells have also been constructed where boring for shallow tubewells was not feasible. For 1985-86, the bank has an ivestment program for the construction of 2,300 shallow tubewells and 330 wells, designed to irrigate about 10,500 hectares.

1.1.2-08 ADB/N also provides loans to groups of farmers for the construction of gravity irrigation systems. The systems for which this is done include those implemented by FIWUD, systems for which CARE/NEPAL has provided a subsidy, and some in which only ADB/N and the farmers have worked together. ADB/N has some technical personnel for the implementation of small-scale irrigation projects.

1.1.2-09 Table 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 since it is the lead institution in the development of these projects.

1.1.3 Irrigation Development Budgets

1.1.3-01 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 5 presents the irrigation development expenditures for the past four plans.

1.1.3-02 There is an increasing gap between the irrigation development budget for the construction of new systems and the regular irrigation budget for the operation and maintenance 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 an increasing amount of development expenditure being needed for costly rehabilitation of schemes which have become increasingly inoperable (WEC, 1981). Table 6 presents the regular irrigation expenditure during different plan periods and this expenditure expressed as a percentage of the irrigation development expenditure.

1.1.3-03 While these figures generally show an inadequate level of funding of operation and maintenance through the regular budget, the situation is less precise than the figures would seem to indicate. 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 operation and maintenances of completed projects. 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.[2] 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 (Rs. 65 million in the sixth plan) until it is exhausted, at which time a supplementary request may be made to the Ministry of Finance (WEC, 1981). It is thus impossible to say how much is actually expended in the irrigation sector for operation and maintenance.

2. General Policies Regarding Irrigation Financing

2.-01 The policy concerning the financing of irrigation services differs among the agencies involved in irrigation development. The majority of the construction of new irrigation facilities falls under DIHM. Financing of its

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[2]This was reported in the WEC Irrigation Sector Review and was confirmed in interviews with project managers.

irrigation construction comes of the of general development budget administered by the Ministry of Finance.

2.-02 Through the third plan, the emphasis in irrigation development was on minor irrigation schemes of small and medium scale. Beginning with the fourth plan and the publication in 1970 of a master plan for irrigation development in the terai, 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 costs of operating and maintaining the systems are to be paid by Nepal.

2.-03 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 a water charge. This charge is set by the project board or by DIHM and is assessed in most systems on a per crop per hectare basis. Some systems have gone to an annual charge per hectare. This has been controversial because in most of the systems the area that receives effective irrigation in the dry season is considerably less than that irrigated during the monsoon season.

2.-04 FIWUD requires a 25 percent contribution by the farmers toward the cost of construction of a system. Before the project will be begun, the farmers must deposit in a bank 5 percent of the estimated cost of construction. The additional 20 percent may be borrowed from ADB/N or provided in the form of contributed labor. Upon completion of construction of gravity irrigation schemes, the system is turned over to the farmers who are responsible for its operation and maintenance. FIWUD continues to operate tubewell systems and charges farmers for irrigation.

2.-05 MPLD's policy and procedures are influenced to a large degree by the donor agency funding an integrated rural development project covering the area in which an irrigation project lies. Farmers may be required to provide labor for construction, or the work may be contracted out to small contractors. After completion of the project construction, the farmers are responsible for O&M.

2.-06 ADB/N's investment in irrigation development is on a loan basis with individual farmers in the case of tubewells 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.

3. Capital Cost of Irrigation

3.-01 The capital costs of different irrigation systems vary according to the type as well as size of the systems. The ADB Agriculture Sector Strategy Study has estimated the capital costs of different types of irrigation systems. Five different modes of irrigation development are identified including: (a) run-of-the-river diversion--partial development (includes only diversion and main canal systems), (b) command area development, (c) run-of-the-river diversion--full development (provides full range of irrigation components to the farm level), (d) surface water storage, and (e) tubewell irrigation. These figures, based primarily on feasibility studies, are presented in Table 7.

3.-02 Few data are available concerning the actual per hectare investment costs of systems which have been completed. The Water and Energy Commission and World Bank conducted an evaluation of four Bank-financed irrigation projects which yielded a wide range of cost figures which are reported in Table 8.

3.-03 All of the projects were intended to irrigate the whole command area but were, by the time of the study, irrigating considerably less. This results in a higher than planned per hectare cost of investment for the area actually irrigated. 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.

3.-04 A feasibility study of 5 projects in the western region of Nepal conducted by Gitec Consult (1980) estimated an average development cost of about $3,500 per hectare for the entire 4,650 hectares. The average unit development cost of the four projects deemed viable, covering a total of 2765 hectares, was about $1,650.

3.-05 The cost of a shallow tubewell with a pumpset was reported to be approximately Rs. 9,000 or US$ 750 (Khoju, 1981). These can irrigate 4 to 5 hectares, depending on the availability of ground water, yielding a per hectare cost of US$ 150-200 in 1981-82 dollars. The construction of the distribution channels is done by relatively inexpensive unskilled labor adding little to the development cost.

4. Operation and Maintenance Costs

4.-01 Irrigation projects operated by the government receive their budget allotment for O&M from the Ministry of Finance. Projects estimate their requirements for O&M, and this budget is forwarded to the central office of DIHM. After O&M requirements are collected from all the projects, discussions are held with the National Planning Commission and 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.

4.-02 The irrigation projects 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 Rs. 5,000 can be directly done by the project manager. For maintenance work exceeding Rs. 5,000 but not more than Rs. 25,000, quotations must be invited from interested contractors. When the amount exceeds Rs. 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).

4.-03 Different rules-of-thumb are used to estimate the cost of operation and maintenance on surface and pump irrigation systems. For surface irrigation, the O&M cost is estimated to be Rs. 300 per hectare. The O&M cost for pump irrigation is estimated at Rs. 900 per hectare. In both cases, the O&M cost figures do not include the contribution of the farmers.

4.-04 Several years' budgets for the Narayani Zone Irrigation Development Project (NZIDP), both the Surface Irrigation Phase I and the Deep Tubewell Scheme, are

presented in Table 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 NZIDP reported that the construction under the deep tubewell scheme 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.

4.-05 If it is assumed that in FY 1984/85 and FY 1985/86 the budget for the surface irrigation portion of the NZIDP did not include new construction, then the O&M budget was distributed as follows: salaries and allowances between 30 and 35 percent, services between 13 and 15 percent, and construction 52 to 53 percent. In the case of the NZIDP Pump Irrigation system, spare-parts and electricity are the main components of the O&M cost. These accounted for approximately 75 percent of the O&M costs (P. Pradhan, 1985).

4.-06 A recent study (No-Frills Development Consultants, 1984) computed the O&M expenditure of 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 10. The amount spent for O&M of large projects ranged from Rs. 105 to 207 per hectare while the estimate of the amount needed to enable proper O&M was estimated to range from Rs. 200 to 600 per hectare. For the medium scale projects the expenditure ranged from Rs. 83 to 216 per hectare against an estimated Rs. 175 to 300 per hectare required for proper O&M.

4.-07 The average cost of O&M of tubewell projects was, as expected, higher than that for gravity systems, ranging from Rs. 317 to 714. The amount required for proper O&M was estimated by project officials to range from Rs. 333 to 1,000. Figures for three tubewell projects are presented in Table 11. Two of the three projects were able to spend nearly the amount estimated to be needed for proper O&M. This likely is a result of the fact that the major O&M expenditure in ground water projects is for energy to operate the pumps and for spare parts to repair the equipment. Without these expenditures the tubewells could not supply any water. Maintenance of the distributary canal system for these systems is largely in the hands of the farmers. While the above mentioned

amounts needed for proper O&M in tubewell projects 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 between Rs. 1500 and Rs. 2000 per hectare per annum.

4.-08 Data for the medium scale and tubewell projects show a general increase in the expenditure for O&M in nominal terms over the past five years. However rising costs of labor and materials 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 projects are presented in Table 12.

4.-09 In summary, all projects have reported that the O&M budget was inadequate to carry-out proper operation and maintenance. This agrees with nearly all evaluations which have been made of the irrigation sector which cite as a major deficiency the fact that insufficient resources are allocated to operation and maintenance of existing systems (WEC, 1981; WEC, 1983; ADB, 1982; USAID, 1984).

4.-10 For the FY 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 operation and maintenance. 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.

4.-11 In addition to the budget allocation generally not being adequate, an additional common complaint voiced by project managers was that the budget was not released on time to allow for timely completion of the work (No-Frills Development Consultants, 1984). As mentioned above, irrigation projects 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 operation and maintenance of irrigation systems.

5. Farmers' Ability to Pay for Irrigation Services

5.-01 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 output price policies, price policies for inputs other than water, and tax policies, as well as the cropping intensities and levels of production made possible by irrigation.

5.1 Output Price Policies

5.1-01 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 HMG's price policy with respect to these staple foods can be summarized as:

1. Support for a floor price high enough to stimulate production.

2. Ceiling price protection assuring a reasonable price for consumers.

3. Sufficient range between these two prices to provide traders and millers 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 following factors are usually considered:

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.

4. The cost of production of the crops.

5.1-02 The estimates for the floor price, on the basis of the above criteria, are 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. In addition, it is not announced before planting and has generally remained below the prevailing market price and, thus, has little influence on the farmers' management decisions. 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.

5.1-03 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 it supplies foodgrains in the Kathmandu Valley and to the army and police. The primary objective of the foodgrain distribution policy of the government is to make foodgrains available in deficit areas at a reasonable price. Foodgrains 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 portion to the Nepal Food Corporation at these reduced prices. The proportion that must be sold to NFC has varied and has recently been set for exporters at 10 percent of the amount exported. The authors of one study (Karki and Neupane, 1984) have argued that this tends to depress the market price in the terai area from where grain is exported. 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.

5.2 Input Price Policies

5.2-01 The pricing of agricultural inputs such as HYV seeds, pesticides, and tools is done by the Agricultural Inputs Corporation (AIC) 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 transportation and handling cost to the district offices and a minimum administration cost. Since the transportation cost to the district centers varies considerably, the retail prices of these inputs differ among districts.

5.2-02 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 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, AIC 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 by Table 13.

5.2-03 The subsidy on fertilizer sold to the farmer is substantial, ranging in 1984/85 from 35 to 62 percent of the cost of supplying the different types. Table 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.

5.2-04 Since 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 agriculture than non-irrigated, and more is used in the terai 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. On the other hand, there is little government-owned irrigation in the hills. Hill farmers do invest considerable amounts of resources in the operation and maintenance of their own irrigation systems (Martin and Yoder, 1983).

5.3 Tax Policies

5.3-01 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 and machinery. There is no agricultural income tax. The one tax which farmers must pay is the land tax which is levied at different rates according to land classifications. Land is classified according to various factors which affect the 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. The nominal tax rate has changed little since 1968 with the effect that the real tax rate has declined. Table 15 presents the land tax rates.

5.3-02 As Table 16 demonstrates, the land tax is equivalent to only a very small percentage of the agricultural gross domestic product. Furthermore, the proportion of total tax revenues generated from the land tax has been declining.

5.3-03 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 nor other agricultural products including vegetables, fruits, and live animals. On the export of these items there is a one percent export tax.

5.4 Direct Irrigation Benefits

5.4-01 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. The pre-monsoon season crop depended primarily upon the adequacy of the water supply in that season. Total annual yields of grain for the three seasons averaged from 7.5 to 8 tons/ha. Farmers in the same environment but without irrigation grew only one rainfed maize crop per year with yields of less than 3 tons/ha.

5.4-02 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 (APROSC) and the Water and Energy Commission (WEC) have documented the performance of various government-constructed and -managed irrigation projects--large and small and in the hills and terai--in terms of cropping intensity, yields, and farm incomes. The overall conclusion of these studies (APROSC, 1978 and 1982; WEC, 1982) is that there was only marginal improvement in the project areas over the neighboring control areas. More specifically, the WEC study found that:

1. the extent of monocropping (proportion of cultivated area on which only one crop is grown per year) ishigher in project commands than in nearby non-projectareas.

2. while cropping productivities vary considerably among the different areas of study, there is no significant

difference between cropping productivities in nearby project and non-project areas.

5.4-03 Since effective irrigation can clearly enable much higher yields and cropping intensities in comparison to those possible under rainfed conditions, at least two factors likely contribute to the conclusions drawn above. The first, which the studies explicitly state, is that the irrigation systems studied are not well-managed. The second which is not discussed is that the non-project areas with cropping intensities greater than 100 percent may have been irrigated by farmer-managed irrigation systems. In this case the comparison was not between irrigated and unirrigated production but rather between areas irrigated by two different types of irrigation systems.

5.4-04 An Agricultural Credit Review conducted by the Nepal Rastra Bank in 1980 compared yields, cropping intensities, and cost of production between irrigated and unirrigated farms. The study included a sample of over 2,600 households in 14 of the 75 districts including both the hills and terai. Cropping intensities were not found to be as much higher on irrigated than unirrigated 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, non-availability of credit, and lack of extension facilities. Table 17 presents a comparison of the cropping intensities observed, delineated according to region and farm size.

5.4-05 To understand the impact of irrigation, one also needs to know the crops that are actually grown as well as the yield rates for the different crops under different conditions. The major crops that are grown under irrigated conditions are rice and wheat. Table 18 presents the range (over the size categories of farms) of yields recorded for the two regions for these crops under irrigated and unirrigated conditions for both improved and local varieties. The data in the table show that the combination of improved varieties and irrigation result in a significant increase in the yield levels of rice. The impact of these factors on wheat yields, while positive, is of a lower magnitude. Often in the absence of irrigation, the crop grown is maize or millet. The range of yields for unirrigated maize and millet are presented in Table 19.

5.5 Estimates of Farmers' Ability to Pay for Irrigation Services

5.5-01 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. An analysis of the net income from irrigated agriculture will provide an estimate of a farmer's absolute ability to pay for irrigation services. For the Second Command Area Development Project, the net income from crop production under the current irrigation conditions in three irrigation systems was computed. These were projects which were identified for the implementation of command area development and, thus, likely are fairly representative of production in irrigation systems in the terai. The net returns calculated per hectare of irrigated crop production in the two systems which were already in operation are presented in Table 20.

5.5-02 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 operating systems are shown in Table 21.

5.5-03 Of the two sites, Chandra was currently better served by irrigation than Mohana. This can be seen from the percentage of the representative farms' land that is irrigated and is also stated in the report. A comparison of the annual net farm income in the Chandra system with minimum per capita expenditures on food and other essentials will reveal the absolute ability to pay for irrigation services. The minimum annual value of consumption per capita was estimated to be Rs. 1,100.[3] With an average family size of 6, the minimum annual value of consumption per household would thus be Rs. 6,600. The data show that the household with 1.9 hectares of land--slightly over the average in the project area of 1.73 hectares--would be able to pay for irrigation services out of a net income exceeding minimum value of consumption by Rs. 2,883. The household with the smaller sized farm of only 0.6 hectares is not able to meet even half of minimum consumption requirements with

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[3] This is based on a figure of Rs. 3.50 per day per adult, which was reduced to Rs. 3.00 per day to account for the percentage of the population that are children.

income from the family farm and, thus, is not in a position to pay for irrigation services from farm income.

5.5-04 A more pertinent analysis is how much could farmers pay for irrigation services out of the benefits they receive from irrigation. A comparison is needed of the net marginal benefits of irrigation to the farmer, i.e., a comparison of net incomes with and without irrigation. 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 section 5.4 concerning the quality of irrigation management and the actual water status of the area outside the project which is used as the unirrigated area in the comparison.

5.5-05 For this analysis, the data on net returns from crop production from the Second Command Area Development Project will again be used. Since water charges tend to be on a per hectare irrigated per crop basis, the analysis will be done on a per hectare basis. To simplify the analysis it is assumed that a cropping intensity of 166 percent can be achieved on one hectare of irrigated land by growing an irrigated rice crop on the full one hectare and an irrigated wheat crop on two-thirds of a hectare. In the absence of irrigation it is assumed that a rainfed rice crop would be grown over the entire one hectare. Using the net returns per hectare given for the different crops in the study, the incremental net income as a result of irrigation, in the absence of payment of direct and indirect irrigation charges, is computed in Table 22. The analysis is done for the current situation as well as for that estimated to be achieved after completion of command area development.

5.5-06 The returns under the current situation are calculated to be approximately Rs. 2,800 and Rs. 3,550 for the two systems. After the command area development has been done, it is estimated that they will increase to Rs. 5,190 and Rs. 8,180 respectively. The increase is not only due to irrigation but also to the use of improved varieties and more inputs, but when these factors have been paid their financial cost this per hectare increment in net income remains.

5.5-07 There is, thus, considerable scope for payment for irrigation services from the incremental net value of production under irrigated conditions. At a rate of Rs. 60/ha/crop the water charge per hectare would be

Rs. 100 which amounts to between 1 and 4 percent of the incremental net income calculated in Table 22. If the charge were Rs. 100/ha/crop, it would amount to between 2 and 6 percent of the incremental net income. While the small farmer with only 0.66 hectares of land was shown above to be unable, in an absolute sense, to pay for irrigation from farm income, he receives net benefits of more than Rs. 1,800 per year from irrigation under the current situation and would receive from Rs. 3,460 to Rs. 5,460 after completion of the command area development. His total annual water charges would be only Rs. 60 or Rs. 100 under current rates depending upon which rate would be applied in the system.

5.5-08 The per hectare capital cost of run-of-the-river diversion systems was estimated to be between US$ 1,450 and $ 3,200 (1981 prices) or between Rs. 19,140 and Rs. 42,240. Assuming a project life of 50 years and interest rate of 10 percent, the annualized investment cost is between Rs. 1,930 and Rs. 4,260. The lower figure is equal to 69 percent and 54 percent of the net incremental income from irrigation in Mohana and Chandra respectively under current conditions. The higher figure is 82 and 52 percent of the incremental income estimated after completion of the command area development in Mohana and Chandra respectively.

6. Methods of Financing Irrigation Services

6.1 Direct Methods

6.1-01 It has been the policy of the government of Nepal to collect water charges from farmers for irrigation services. Water charges as defined by the Canal Regulation Act (1974) have been in effect in nearly all of the government irrigation systems in both the hills and terai. Prior to the 1960's, farmers were charged a flat rate of Rs. 9 per hectare per year. This was increased to Rs. 60 per hectare per crop. Some, but not all, of the systems under the authority of a Project Board have set the fee at Rs. 100 per hectare per crop. The rates are set either by the Project Board or by DIHM subject to the approval of the Ministry of Finance.

6.1-02 While there is a fairly standard rate structure, it has not been implemented consistently in all projects, and collection of fees has been ineffective. In the Kamala Irrigation Project, water charges 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 Project charges a flat rate of Rs. 200/ha/year irrespective of the number of crops grown. While farmers in the Kankai Project are given free water in the winter to encourage cropping in this season, farmers in the Narayani System 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 system under a project board, charges only Rs. 60/ha/crop instead of Rs. 100.

6.1-03 The Narayani Tubewell Irrigation Project has set the rate at Rs. 100/ha/crop. The groundwater projects managed by FIWUD, on the other hand, charge Rs. 16 per hour of operation of the pump. In FIWUD artesian wells, the water charge varies according to the range of water discharge of the well as shown in Table 23. The wells are categorized according to discharge rates, and a fee per hour of operation is charged. Since the actual discharge may fluctuate substantially from the nominal rate, this does not represent an exact volumetric charge. The fee rate was significantly reduced in 1980.

6.1-04 According to the Director General of DIHM, the setting of the level of the water charges to raise needed revenues is made 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 Rs. 100/ha/crop as was done in the other large systems under project boards. It was also cited as the reason why FIWUD lowered the rates charged for water from artesian wells.

6.1-05 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), 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" (p. 23). Nevertheless, the farmers are very likely involved in O&M at the tertiary level. It is very difficult for system managers to effectively manage the water to that level, and farmers have to become involved if they are to be able to irrigate. The study by No-Frills Development

Consultants (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.

6.1-06 In the farmer-managed irrigation systems, which account for the majority of the irrigated area in Nepal, the farmers provide all the resources for operation and maintenance of the systems.[4] 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/hectare (Martin, 1986). In one 35-hectare system annual labor contributions are approximately 50 man-days per hectare, while cash assessments were Rs. 265 and Rs. 440 per hectare in the two years which the system was observed. If the labor is valued at the local wage rate of Rs. 10 per day, the annual value of resources mobilized from the irrigators for system operation and maintenance is between Rs. 750 and Rs. 1000 per hectare. Even if the labor is costed at only half the wage rate, the value of resources mobilized is between Rs. 500 and Rs. 700 per hectare per year. P. Pradhan (1984) found the value of labor contributions in a farmer-managed system in the terai with an irrigated area of more than 3,000 hectares to exceed Rs. 270 per hectare for only the monsoon rice season.

6.1-07 Clearly farmers are able and willing to pay a significant amount for the operation and maintenance of their irrigation systems. APROSC (1979) found that farmers in the Waling area (Sangjya District) indicated a willingness to pay Rs. 50 per ropani or about Rs. 1,000 per hectare. Farmers in some of the government 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

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[4] 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.

agreed upon amount of water from India.[5] (The headworks and long stretch of the main canal are in India and not under the control of NZIDP or DIHM.) Farmers, in general, have been reported willing to pay the Rs. 60 to Rs. 100 per hectare charge for the dry season crop but question their being billed the same amount for the monsoon season crop (No-Frills Development Consultants, 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.

6.1.1 Assessment, Billing and Collection Procedures

6.1.1-01 The collection of irrigation charges from the farmers was once done by the land revenue office along with the collection of the land tax, but they refused to continue this without the provision of additional staff (WEC, 1983). Responsibility for assessment and collection of the fees was then shifted to the irrigation project management.

6.1.1-02 Since 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 NZIDP, one of the responsibilities of the leaders of water users groups is to "witness the inspection of irrigated and non-irrigated areas for assessment of water charges and to cooperate in collection of water charges" (B.B. Pradhan, 1982).

6.1.1-03 The bill for irrigation is not sent directly to the farmers. Notification is made to the concerned village panchayat 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 WEC (1983), collection rates in the Chitwan Project were substantially increased by sending the surveyors to also collect the fees from the farmers rather than waiting for them to bring the payment to the project office.

6.1.1-04 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

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[5] Personal communication, February 1985.

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. However, there is controversy when the cultivation is being done by a tenant. In many districts in Nepal, the land rent has been fixed, entitling the land owner 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 land owner would like the tenant to pay the water charge (P. Pradhan, 1985).[6] 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.

6.1.2 Collection Efficiencies and Enforcement

6.1.2-01 The rate of actual collection of irrigation charges from farmers has been very low, whether measured as a percentage of (1) the annual amount budgeted to be collected, (2) the assessed amount, or (3) the amount spent for operation and maintenance. Table 24 compares the amounts collected with that budgeted to be collected. For the past ten years especially, the ratio of the amount of water charges collected compared to the amount budgeted to be received has been very low. Seeing this poor performance, the budget has been considerably reduced despite a steady increase in the total area irrigated by government irrigation schemes.

6.1.2-02 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 25. The ratio of water charges collected to actual O&M costs is extremely low for this sample of projects. It is only above ten percent for Jhanj and Pathraiya. Considering that the expenditure for O&M in these two systems was only 52 and 72 percent of that estimated to be needed to pay for proper O&M (ref. Table 10), the amount collected is insignificant.

6.1.2-03 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

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

that should have been collected, i.e., the assessment.[7] These figures are presented in Table 26 for several systems for the past few years.

6.1.2-04 In all the systems, with the exception of the Narayani Tubewell Irrigation, the percentage of assessments that is collected is very low, but in most of them has improved over time. The tubewell project was able to achieve much higher collection rates than the surface irrigation projects. This is likely due to the fact that it is able to exercise much more control over water delivery. The relatively small figure for total charges assessed in the Chitwan Project suggests that the assessment was not properly made and/or was incomplete. At Rs. 60 per hectare, the assessment in 1982-83 represented irrigation service to only 3,790 hectares. This is less than the area irrigated by some of the pre-existing systems which are being incorporated into the Chitwan Project (WEC, 1983).

6.1.2-05 The farmers in surface irrigation systems have little incentive to pay the water charge. There is no relationship between the payment of fees and the quality of O&M in the system.[8] 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 ear-marked 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.

6.1.2-06 In tubewell irrigation systems the supply of irrigation water can be cut off due to non-payment of

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[7]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.

[8]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 (No-Frills Development Consultants, 1984), and the general manager of the NZIDP 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).

fees. This provides the system managers with an effective penalty to impose in the event of non-payment. 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 non-paying farmer proportional 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. Since 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. However, since property transactions are relatively scarce, this regulation is not an effective enforcement measure.

6.1.2-07 DIHM has proposed a set of irrigation rules and regulations which place a great deal of emphasis on the collection of water charges including incentives for payment and penalties for failure to pay. The water charge is to be paid once a year, and the rate shall be determined on the basis of the following factors:

1. Area of land.
2. Nature of the soil.
3. The volume of water available in the canal.
4. The reason for using water.

The draft of the rules says nothing concerning the level of fees to be charged. It is to be paid in mid-April each year irrespective of the number of crops raised in the year. A five percent rebate will be granted those who pay by mid-February. If the water users group assists in the collection of the water charge, it may keep 3 percent of the amount collected.

6.1.2-08 The regulations place more emphasis on the penalties for late or non-payment of the charges. If the payment is late by not more than one month, a penalty of 5 to 10 percent of the charge shall be imposed. If payment is more than one month but less than two months late, an additional 5 percent penalty will be charged. Finally if it is not paid within 2 months after the due date, it shall be recorded as an account outstanding. The irrigation officer is authorized to seal off the outlet to land farmed by persons who have not paid the water charge

until the outstanding dues have been collected. In the event that payment of the water fee or of fines imposed for failure to observe the rules and regulations established for the security of the irrigation system is not made, either movable or immovable assets are to be seized and auctioned for realization of the amount due. A standing crop may be harvested and sold for payment of the water charges due.

6.1.2-09 Each irrigation project is to have a section for dues collection, and this section shall 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. However, it will also increase the cost of collecting water charges.

6.1.2-10 The farmer-managed systems collect fees from the farmers sometimes to make specific improvements to the system (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 5 percent of the water in the system, he will be assessed 5 percent of the total amount to be raised. Farmer-managed systems also regularly impose fines on members for being absent when 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 was refusing 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.

6.1.3 Collection Costs

6.1.3-01 Very little detailed information is available on the cost of irrigation fee collection. Some has been reported for the NZIDP 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 in the Project Office with annual salaries totaling Rs. 59,520. In addition there are field staff in each of the 6 blocks of the system for collection of the water charges. There are two surveyors and one assistant accountant in each block. The total annual cost of these field staff is Rs. 146,160 (Rs. 24,360 per block). In fiscal year 1984/85, a total of Rs. 204,577 in water charges was collected in the NZIDP Stage I surface irrigation system. The salaries of the field staff alone amounted to 71 percent of the amount collected.

6.1.3-02 For water charge collection in the NZIDP deep tubewell scheme, 3 surveyors, 3 assistant accountants and 1 peon are provided. Their annual salaries total Rs. 56,280. Fees collected in the tubewell scheme totaled Rs. 131,138 in 1984/85. The salaries of the staff directly involved in collecting these charges amounted to 43 percent of the total collected in the tubewell scheme. 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 Rs. 335,715 in water charges in the NZIDP in 1984/85 cost Rs. 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.

6.2 Indirect Methods

6.2-01 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 unirrigated land are very low. In the hills the best irrigated land is taxed at a rate of between Rs. 20 and Rs. 40 per hectare per year, while the tax rate for unirrigated land is between Rs. 5 and Rs. 20. In the terai the tax on irrigated land is approximately Rs. 79 per hectare per year, while unirrigated land is taxed at a rate between Rs. 42 and Rs. 68 per hectare per year. If it is assumed that the average tax rate for irrigated land in the hills is Rs. 30/ha and for unirrigated land, Rs. 12.5/ha, then the annual tax revenue due to irrigation from 178,000 hectares of irrigated land in the hills is Rs. 3,115,000. Assuming

an average tax rate on unirrigated land in the terai of Rs. 55 per hectare, the net land tax revenue due to irrigation of 466,000 hectares of terai area would be Rs. 11,184,000 per year. However, most of this revenue due to irrigation 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 3, approximately 70 percent of the incremental land tax revenue due to irrigation comes from farmer-managed irrigation systems.

6.2-02 The nearly Rs. 14 million net tax revenue that could be raised from irrigated land exceeds by a factor of more than 10 the revenues raised directly from water charges. However, it is unlikely that this much net revenue due to the availability of irrigation is actually realized. 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.

6.2-03 The Nepal Food Corporation (NFC) distributes foodgrain 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 NFC at a predetermined reduced price a percentage of the amount exported. In 1975/76, procurement under this levy constituted 98 percent of NFC's total grain procurement, but by 1980/81 accounted for only 15 percent of it. 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 the present are shown in Table 27. The levy price amounts to approximately 50 percent of the retail price charge by the NFC (Rawal and Hamal, 1984). A one percent sales tax is also charged on grain that is exported.

6.2-04 Since the levy on exports in effect sets aside a quantity of rice for the NPC 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 terai, suggesting that exporters have been successful at passing the burden to the farmer.

6.2-05 As Table 27 shows, the percentage of grain exported that must be sold to the NFC at the levy price is declining, with the result that NFC acquired much less grain at the reduced price for its distribution program. Consequently, a production levy was introduced in 1982/83. Large rice millers, i.e., those with a milling capacity of at least 2 metric tons of rice per hour, are required to sell to the NFC at a levy price 30 percent of the grain they mill. 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 10 percent respectively. Purchases under the production levy program were placed by NFC at 20,000 MT in 1982/83, another 20,000 MT in 1983/84, and roughly 10,000 MT in 1984/85. The effect of the production levy and its incidence are similar to that of the export levy.

7. Relative Contribution of Farmers to Irrigation Financing

7.-01 An attempt was made to calculate a cost recovery index for two hypothetical irrigation systems, one of extensive development and the other with intensive development, taking into consideration both direct and indirect sources of revenues. Production was assumed to be greater in the system with intensive development as was the O&M cost. Table 28 presents the results which show total cost recovery indices of nearly 13 percent for both. Cost recovery as a percentage of O&M costs was 161 and 172 percent in the low and high investment systems respectively.

7.-02 These figures are hypothetical maximums, and actually cost recovery is considerably less. The calculations assume a 100 percent rate of collection of water charges, 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., Rs. 40 instead of Rs. 166. This would reduce the total cost recovery index to 8 and 10 percent respectively and

cost recovery as a percentage of O&M cost to 98 and 130 percent.

7.-03 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 MT of rice were purchased under the levy, indicating that it was applied to only 100,000 MT that were milled. Production in the terai was estimated to be more than 2 million MT. Therefore less than 5 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 Rs. 110 and Rs. 270 to Rs. 6 and Rs. 14 respectively. This reduction, coupled with the lower rates of fee collection would result in total cost recovery indices of between 3 and 4 percent for both. Cost recovery as a percentage of O&M expense would drop to 46 and 44 percent for the low and high investment cases respectively.

7.-04 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 revenues would be reduced by two-thirds. Incorporating this rate results in per hectare revenue from export duty of only Rs. 7 and Rs. 18 in the two systems. This reduces the total cost recovery index to 3 and 2 percent and cost recovery as a percentage of O&M expense to 39 and 32 percent respectively. Table 29 presents the calculation which incorporates these more reasonable assumptions under current conditions.

7.1 Farmers' Participation in Irrigation Management

7.1-01 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 new systems, has the operation and maintenance of government irrigation systems become a matter of concern.

7.1-02 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 desireable to utilize 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 to fully utilize the larger rivers in the terai is beyond the technical and financial capacity of farmer groups.

7.1-03 There is, however, considerable scope to expand the area that is irrigated under farmer-management through: (1) investments to enable the expansion of the area served by existing farmer-managed irrigation systems, and (2) turning over of government-built systems to farmer organizations to operate and maintain. The latter would be particularly true of groundwater schemes, but could also be done with all of the government-developed hill irrigation systems as well as some of those in the terai. In order to do this, a participatory development approach would be required which involves the farmers from the very beginning conceptualization of an irrigation project. 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 of systems which they have been doing. Farmers in the Kathmandu Valley, observing DIHM managing some systems, have sought to have DIHM take over the operation and maintenance of their systems. It was reported that under the MPLD program (with the assistance of the ILO) to rehabilitate farmer-managed systems, farmers have resisted reassuming responsibility for the maintenance of the system.[9]

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[9]Personal communication, Louis Rijk, ILO project manager, 1982.

8. Evaluation of Financing Policies

8.-01 The financing policies can be evaluated in terms of efficiency of investment decisions, efficiency of irrigation system management, and equity of resource allocation.

8.1 Efficiency of Investment

8.1-01 Investment decisions will be most efficient in an economic sense if the ones making the decisions 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. 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 ADB/N. 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, projects for investment must meet certain minimum standards of economic efficiency. Feasibility studies always include an estimate of the economic efficiency of the project, but given the weak data base and the assumptions that must be made, these at best weed out the most unattractive projects.

8.2 Efficiency of System Management

8.2-01 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 project 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 the decision whether or not to pay the irrigation fees.

8.3 Efficiency of Water Use

8.3-01 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. However, charging for water per se does not accomplish this. On the contrary, charging a flat fee per hectare irrespective of the amount of water used and/or the crop grown will 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.

8.4 Income Distribution

8.4-01 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, ADB, 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 paid by the farmers is extremely low. The actual rate of farmers' payment of water charges results in no recovery of capital costs from the farmers and a low level of farmer payment for O&M of government irrigation systems.

8.4-02 To the extent that irrigation services are financed from the general treasury, this results in a transfer of income from tax payers 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 those who completely manage their own irrigation system with their own resources to farmers with land in government systems.

Table 1

Area, Production, and Yield of Principal Food Grains (1984/85)

Food Grain	Area (Ha)	Production (MT)	Yield (MT/Ha)
Rice	1,376,860	2,709,430	1.97
Maize	578,720	819,150	1.42
Wheat	449,960[a]	519,960[a]	1.16
Millet	134,370	124,430	0.93

[a] Preliminary

Source: Department of Food and Agricultural Marketing Services (DFAMS). Quoted in Ministry of Finance, 1985.

Table 2

Average Yield of Major Crops During 1960s and 70s (MT/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: DFAMS, Handbook of Agricultural Statistics of Nepal. Quoted in ADB, 1982.

Table 3

Land Use and Irrigation
('000 Hectares)

	Hill	Terai	Total
Land Area	10,750	3,400	14,150
Cultivated Land	1,500	1,600	3,100
Irrigation Status			
1. Land Area Irrigated			
a. Govt.-managed Systems	18	168	186
b. Farmer-managed Systems	160[a]	298[b]	458
	178	466	644
(Of which groundwater)	(-)	(53)	(53)
2. Total Potentially Irrigable Land	300	1,600	1,900
(Of which groundwater)	(-)	(428)	(428)

[a] Includes an estimated 8,000 ha developed by FIWUD and 2,000 ha by MPLD.

[b] Includes 48,000 ha irrigated by ADB/N-financed Tubewells.

Source: Adapted from ADB, 1982 and Table 4 following.

Table 4

Irrigation Development According to Institution

Institution	Area Irrigated (ha)	Percentage of Irrigated Area
DIHM	179,000[a]	27.8
FIWUD	15,000[b]	2.3
MPLD	2,000	0.3
ADB/N	48,000[c]	7.5
Farmer-managed	400,000[d]	62.1
Totals	644,000	100.0

[a]WEC. 1981. Irrigation Sector Review. Kathmandu. and Ministry of Finance. 1985. Economic Survey: Fiscal Year 1984-85. Kathmandu.

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

[c]Pradhan, Sekher. 1985. ADB/N-Supported Irrigation Systems: A Bird's Eye View. Kathmandu.

[d]WEC. Irrigation Sector Review. op. cit. (The ADB/N-, MPLD-, and much of the FIWUD-developed irrigation is also farmer-managed.

Table 5

Irrigation Development Expenditure[a]

Plan	Irrigation Development Expenditure	Percent of Development Expenditure
Sixth	Rs. 3130 million	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.

Sources: WEC. 1981. Irrigation Sector Review.
HMG/Nepal. 1981. A Substantial New Program of Action for Accelerated Development of Nepal.

Table 6

Regular Irrigation Expenditures

Plan	Regular Expenditure	Percentage of Development Expenditure
Sixth	-	0.86[a]
Fifth	Rs. 15.0 million	1.7
Fourth	7.6	2.9
Third	1.3	2.1

[a]Based on first two years of plan period.

Source: WEC. 1981. Irrigation Sector Review.

Table 7

Capital Costs of Different Types of Irrigation Development

Type of Project	Investment Cost[a] ($/Ha)
Run-of-the-River Diversion	
Extensive Development	1,450-2,000
Intensive Development	2,400-3,200
Surface Water Storage	4,500-6,500
Command Area Development	1,200-1,800
Ground Water Sources	
Shallow Tubewells	320-610
Deep Tubewells	1,500-2,400

[a] In constant 1981 prices

Source: ADB, 1982.

Table 8

Investment Cost of Selected Projects

	Kankai	Narayani Stage I	Mahakali Phase I	BLGWP[a]
Nominal Cost [b]	9,265	15,358	2,054	15,250
Real Cost [c]	14,031	27,992	4,118	17,580
Area Commanded	5,350	18,730	5,000	7,500
Area Irrigated	2,100	9,285	2,500	300
Cost/ha Commanded	2,623	1,495	824	2,344
Cost/ha Irrigated	6,681	3,015	1,647	58,600

[a] Bhairahawa Lumbini Ground Water Project

[b] Thousand US$

[c] Thousand 1981-82 US$

Source: WEC, 1982.

Table 9

Narayani Zone Irrigation Development Project Budgets

1. Surface Irrigation Stage I

Fiscal Year	Salaries & Allowances	Services	Construction	Total
1983/84	970,000 (19)[a] [87][b]	139,000 (3) [13]	4,000,000 (78) -	5,109,000
1984/85	1,050,000 (35) [72]	400,000 (13) [28]	1,550,000 (52) -	3,000,000
1985/86	900,000 (32) [68]	421,000 (15) [32]	1,500,000 (53)	2,821,000

2. Deep Tubewell Scheme

Fiscal Year	Salaries & Allowances	Services	Energy	Construction	Total
1983/84	740,000 (15) [28]	1,426,000 (28) [53]	500,000 (10) [19]	2,358,000 (47) -	5,024,000
1984/85	526,000 (11) [18]	1,391,000 (28) [48]	1,000,000 (20) [34]	2,000,000 (41) -	4,917,000
1985/86	603,000 (17) [23]	1,318,000 (36) [50]	700,000 (19) [27]	1,000,000 (28) -	3,621,000

[a] Numbers in parenthesis are percentage of total

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

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

Table 10

O&M Costs of Large and Medium
Scale Gravity Irrigation Projects (NRs.)

Large Projects	Kankai	Susari-Morang	Kamala	Narayani
O&M Budget	1,000,000	6,000,000	525,000	6,500,000
Net Command Area Irrigated (ha)	5,000	30,000	16,500	31,400
Cost per ha	200	200	105	207
Amount Needed per hectare for proper O&M	300	600	200	245
Total Budget Required for proper O&M	1,500,000	18,000,000	3,300,000	7,693,000
Medium Projects	**Manusmaru**	**Jhanj**	**Hardinath**	**Pothraiya**
Average Cost	483,580	455,215	243,112	431,489
Net Command Area Irrigated (ha)	5,800	2,900	2,000	2,000
Cost per ha	83	157	122	216
Amount Needed per Hectare for Proper O&M	175	300	250	300
Total Budget Required for proper O&M	1,015,000	870,000	500,000	600,000

Source: No-Frills Development Consultants, 1984.

Table 11

O&M Costs Incurred in Tubewell Irrigation Projects (NRs)

Projects	FIWUD[a]	BLGWP[b]	Narayani
Average Cost	285,308	3,276,600	2,000,000
Net Command Area Irrigated (ha)	900	7,600	2,800
Cost per ha	317	431	714
Amount Needed per hectare for Proper O&M	333	1,000	770
Total Budget Required for Proper O&M	299,700	7,600,000	2,156,000

[a] Farm Irrigation and Water Utilization Division Projects

[b] Bhairahawa Lumbini Ground Water Project

Source: No-Frills Development Consultants, 1984.

Table 12

Annual O&M Expenditures for Selected Systems

System	Manusmara	Jhanj	Hardinath	Pathraiya	FIWUD	BLGWP
Fiscal Year						
1979/80	367,832	341,446	186,978	707,395	189,684	3,031,000
1980/81	424,459	461,172	201,824	622,210	225,110	3,379,000
1981/82	434,461	438,963	247,800	245,478	260,147	4,170,000
1982/83	664,350	467,246	149,346	250,902	347,999	2,109,000
1983/84	526,749	567,246	249,611	331,460	403,601	3,694,000

Source: No-Frills Development Consultants, 1984.

Table 13

Selling Price of Fertilizer (Rs/MT)

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 Dec. 1975
[b] Effective from Nov. 1980
[c] Effective from April 1983

Source: Agricultural Inputs Corporation.

Table 14

Weighted Average Import and Sales Price of Fertilizer
(NRs./MT)

Year	Import Price	Sales Price	Sales Price as % 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: APROSC. Import Substitution in Nepalese Agriculture.

Table 15

Rates of Land Tax, 1985 (NRs./Ha)

Land Classification	Terai	Valleys	Hills	
			Paddy 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 16

Agricultural GDP[1], Total Tax Revenue and Land Tax Revenue[2]

In million Rs

Year	Total GDP	Agriculture GDP	Agriculture as % of Total GDP	Total Tax Revenue	Land Tax Revenue	Land Tax as % of Total Tax Revenue	Land Tax as % of Agr. GDP
1	2	3	4	5	6	7	8
1964-65	5602	3654	65.23	151	43	28.48	1.18
1965-66	6909	4794	69.39	177	45	25.43	0.94
1966-67	6411	4292	66.95	226	57	25.23	1.33
1967-68	7173	4883	68.08	284	83	29.23	1.70
1968-69	7985	5357	67.09	368	79	21.47	1.48
1969-70	8768	5922	67.55	411	88	21.42	1.49
1970-71	8938	6034	67.56	396	76	19.20	1.26
1971-72	10369	7106	68.54	467	83	17.78	1.17
1972-73	9969	6578	65.99	521	75	14.40	1.15
1973-74	12808	8851	69.11	700	97	13.86	1.09
1974-75	14802	9949	69.71	844	91	10.79	0.92
1975-76[3/]	17394	11611	66.75	922	95	10.30	0.82
1976-77	17280	10506	60.80	1102	98	8.89	0.93
1977-78	19732	11752	59.56	1244	87	6.99	0.74
1978-79	22216	13522	60.87	1476.6	59.3	3.99	0.44
1979-80	23351	13688	58.62	1528.8	65.0	4.25	0.47
1980-81	27307	15674	57.40	2035.7	108.5	5.35	0.69
1981-82	30265*	15727	51.96	2211.3	84.1	3.80	0.53
1982-83	33621**	17946	53.38	2421.1	66.7	2.27	0.37
1983-84	38184***	20482	53.64	2132.0	77.0	3.60	0.38
1984-85	41738	21680	51.94	-	-	-	-

Source (1) World Bank Report No.2692. NEP

(2) Budget 1951/52 to 1981/82, HMG/Nepal, Ministry of Finance

(3) These figures are from the new series of the National Planning Commission which assessed GDP at Rs.16.571 million and Agriculture GDP as Rs.11,550 million in 1974/75.

* Revised Estimate
** Provisional Revised Estimate
*** Provisional Estimate

Table 17

Cropping Intensity on Irrigated and Unirrigated Land
(Percent)

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

Notes: Large : Hills - above 1 ha
Terai - above 5.4 ha

Medium: Hills - 0.5 to 1 ha
Terai - 2.7 to 5.4 ha

Small : Hills - 0.2 to 0.5 ha
Terai - 1.0 to 2.7 ha

Marginal: Hills - below 0.2 ha
Terai - below 1.0 ha

IR = Irrigated, UNIR = Unirrigated

Source: Nepal Rastra Bank, 1980.

Table 18

Yields on Irrigated and Unirrigated Farms
(MT/ha)

Region	Crop	Irrigated	Unirrigated
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
Terai	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 19

Unirrigated Maize and Millet Yields (MT/ha)

Crop	Hills	Terai
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.

Table 20

Net Financial Returns from Irrigated Crop Production [a]
(NRs./ha - 1982 prices)

System	Chandra		Mohana	
Status	Current	Post CAD[b]	Current	Post CAD[b]
Crop				
Rice	3,606	6,269	2,401	3,881
Wheat	3,119	6,104	2,549	3,887

[a] Excludes Land Tax and Water Charge

[b] Estimated after implementation of Command Area Development Project.

Source: ADB, Second Command Area Development Project.

Table 21

Annual Farm Budgets in Two Irrigation Systems

System	Chandra		Mohana	
	Farm Size		Farm Size	
	0.6 ha	1.9 ha	0.7 ha	1.9 ha
Cropping Intensity (%)	166	166	184	184
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 (t)[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]	3,615	11,410	2,555	6,866
Production Cost	404	1,927	361	987
Farm margin before land tax & irrigation fee	3,211	9,483	2,194	5,879

[a] Including 5% storage loss

Source: ADB, 2nd Command Area Development Project.

Table 22

Incremental Net Income from Irrigation[a]

System		Chandra				Mohana			
Status		Current		Post CAD		Current		Post CAD	
With Irrigation	Area (Ha)	Net Returns per Ha	Net Returns	Net Returns per Ha	Net Returns	Net Returns per Ha	Net Returns	Net Returns per Ha	Net Returns
Rice	1.00	3,606[b]	3,606	6,269[c]	6,269	2,401[d]	2,401	3,881[e]	3,881
Wheat	0.66	3,119[f]	2,059	6,104[g]	4,029	2,549[h]	1,682	3,887[i]	2,565
Total	1,66		5,665		10,298		4,083		6,446
Without Irrigation									
Rice	1.00	2,117[j]	2,117	2,117[j]	2,117	1,255[k]	1,255	1,255[k]	1,255
Incremental Net Income/Ha			3,548		8,181		2,828		5,191

[a] NRs. - 1982 prices
[b] Yield 2.2 MT/Ha
[c] Yield 3.8 MT/Ha
[d] Yield 1.6 MT/Ha
[e] Yield 2.8 MT/Ha
[f] Yield 1.5 MT/Ha
[g] Yield 3.1 MT/Ha
[h] Yield 1.5 MT/Ha
[i] Yield 2.7 MT/Ha
[j] Yield 1.1 MT/Ha
[k] Yield 0.8 MT/Ha

Source: Calculated from ADB, Second Command Area Development Project.

Table 23

Water Charge in FIWUD-Operated Artesian Wells

Range of Discharge (Cfs)	Current Water Charge/hour (NRs.)	Water Charge/hour Prior to 1980 (NRs.)
0.10 - 0.25	1.0	3.0
0.26 - 0.50	2.0	5.0
0.51 - 0.75	3.0	7.0
Over 0.75	4.0	9.0

Source: No-Frills Development Consultants, 1984.

Table 24

Budget Estimates and Collection of Water Charges (NRs.)

Year	Budget Estimate	Collection	Percentage
1968/69	200,000	240,000	120
1969/70	505,000	175,000	35
1970/71	269,000	171,000	64
1971/72	300,000	219,000	73
1972/73	200,000	22,000	11
1973/74	300,000	348,000	116
1974/75	1,000,000	336,000	34
1975/76	1,000,000	279,000	28
1976/77	2,000,000	610,000	31
1977/78	6,520,000	985,000	15
1978/79	5,500,000	694,000	13
1979/80	5,000,000	1,300,000[a]	26
1980/81	1,500,000	500,000[a]	33
1981/82	1,100,000	600,000[a]	55
1982/83	-	900,000[a]	-
1983/84	-	1,000,000[a]	-

Source: Revenue Administration Training Center, 1982.
[a] Ministry of Finance, 1985.

Table 25

O&M Costs and Water Charges Collected (NRs.)

System	Time period	O&M Costs in Period	Water Charge Collection in Period	Water Charge as Percentage of O&M Costs
Large Irrigation				
Kanka	1982/83	1,348,199	4,992	0.37
Narayani	82/83, 83/84	12,560,000	313,500	2.5
Medium Irrigation				
Manusmara	80/81-82/83	1,523,270	4,859	0.32
Hardinath	81/82-83/84	826,756	58,866	7.1
Jhanj	79/80-82/83	1,708,827	322,405	18.9
Patharaiya	80/81-82/83	1,450,050	174,587	12.0
Tubewell				
FIWUD	81/82-83/84	1,236,857	99,108	8.0
Narayani	83/84	3,482,600	128,295	3.7

Source: No-Frills Development Consultants, 1984.

Table 26

Water Charges Assessed and Collected (NRs.)

System	Year	Charges Assessed	Charges Collected	Percentage Collected
Chitwan	80/81	245,928	9,342	4
	81/82	229,719	28,529	12
	82/83	227,456	118,179	52
Manusmara	80/81	149,669	2,174	1.5
	81/82	153,653	1,893	1.2
	82/83	173,712	792	0.5
Jhanj	80/81	250,000	50,479	20.2
	81/82	250,000	14,259	5.7
	82/83	250,000	67,864	27.1
	83/84	250,000	70,282	28.1
Hardinath	81/82	103,982	15,005	14.4
	82/83	83,586	10,520	12.6
	83/84	110,482	34,338	31.1
Narayani	77/78	104,100	7,145	6.9
Surface	78/79	318,300	5,156	1.6
	79/80	293,900	2,581	0.9
	80/81	659,700	122	0.02
	81/82	1,381,800	-	0
	82/83	1,771,800	102,433	5.8
	83/84	2,422,900	211,277	8.7
	84/85	NA	229,417	NA
Narayani	77/78	46,000	41,777	90.8
Tubewell	78/79	63,600	59,526	93.6
	79/80	18,500	15,878	85.8
	80/81	92,500	61,210	66.2
	81/82	79,200	57,140	72.1
	82/83	154,000	131,214	85.2
	83/84	173,200	96,500	55.7
	84/85	173,200	131,138	75.7

Sources: WEC, 1983 - Chitwan
No-Frills Development Consultants, 1984 - Manusmara, Jhanj, Hardinath.
Water Utilization and Water Collection Unit, NZIDP, 1985 - Narayani Surface Irrigation.
Nippon Koi, 1984 - Narayani Tubewell.

Table 27

Rates of Levy on Export and Levy Prices of Rice,
1975 to present.

Rates of Levy on Export

Mid-February to mid-May 1975	25 percent
Mid-May to fourth week of February 1976	30 percent
Fourth week of February 1976 to mid-November 1976	25 percent
Mid-November 1980 to date	10 percent 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	Rs 139.32/100 kg
Mid-November 1980 to date	Rs 200.00/100 kg

Source: National Food Corporation (NFC), 1984.

Table 28

Estimated Cost Recovery Indices (Maximum)

Type of System	Extensive Development	Intensive Development
Annualized Capital Cost/ha[a]	2,330	3,730
Annual O&M Cost/ha	200	300
Total Annualized Cost	2,530	4,030
Direct Cost Recovery		
Water Charges[b]	166	166
Indirect Cost Recovery		
Incremental Land Revenue[c]	24	24
Miller's Levy[d]	110	270
Export Tax[e]	22	55
Total Cost Recovery	322	515
Total Cost Recovery Index	12.7%	12.8%
Cost Recovery/O&M Cost	161%	172%

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

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

[c] Increase from average rate for unirrigated on Terai (Rs.55/ha) to rate for irrigated Rs. 79/ha.

[d] Rs. 1/kg on 10% of incremental rice production, i.e., 1.1 MT/ha and 2.7 MT/ha from Table 19, Chandra.

[e] 1 Percent of price of milled rice (Rs. 4500/MT) assuming 75% of increment in rice yield is exported. Assume milling efficiency of 60 percent.

Table 29

Estimated Cost Recovery Indices (Realistic)

Type of System	Extensive Development	Intensive Development
Annualized Capital Cost/ha	2,330	3,730
Annual O&M Cost/ha	200	300
Total Annualized Cost	2,530	4,030
Direct Cost Recovery		
Water Charges[a]	40	40
Indirect Cost Recovery		
Incremental Land Revenue	24	24
Millers' Levy[b]	6	14
Export Tax[c]	7	18
Total Cost Recovery	77	96
Total Cost Recovery Index	3%	2%
Cost Recovery/O&M Cost	39%	32%

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

[b] Levy covers only 5% of incremental production. Revenue is Rs.1/kg on 10% of the proportion of incremental production covered. Incremental production is 1.1 MT/ha and 2.7 MT/ha for extensive and intensive development.

[c] Assume export tax collected on one-third of rice exported. Assume 75% of incremental production is exported. Tax equals 1 percent of price of milled rice (Rs.4500 MT) with assumed milling efficiency of 60%.