FINANCING IRRIGATION SERIVICES IN INDONESIA

INTRODUCTION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IRRIGATION FINANCING POLICIES AND PROCEDURES

General Policies

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

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

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

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

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

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

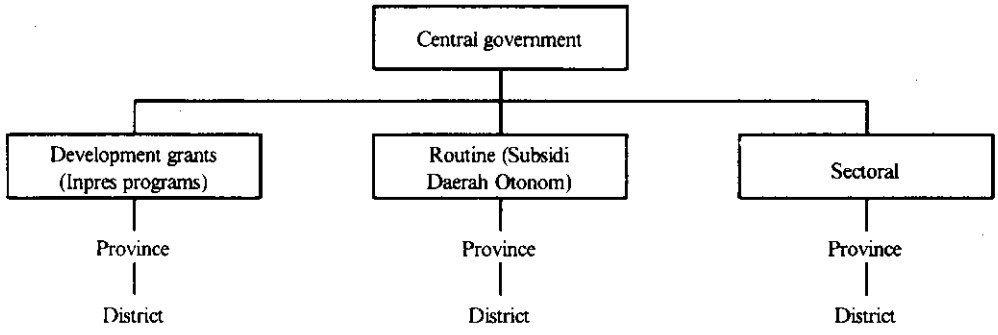
In 1985, a law creating a Land and Building Tax (PBB) was passed. This new tax, which was supposed to come into operation on 1 January 1986, will replace IPEDA; during a transition period to last to the end of 1990, however, some of the features of IPEDA will remain (Indonesia 1986).

Budgetary Procedures

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

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

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



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

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

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

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

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

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

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

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

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

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

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

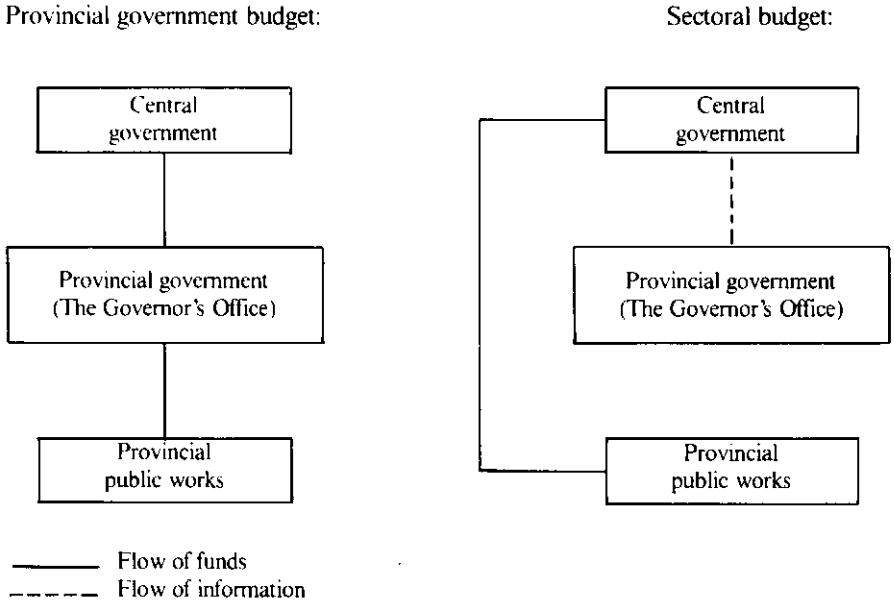
Central government		
New construction	144.8	
Rehabilitation and improvement	106.0	
Tertiary construction and rehabilitation	13.9	
Swamp and tidal development	23.8	
O&M	19.8	
Routine budget (salaries)	8.2	
Miscellaneous	2.1	
Total	318.6	(94.8%)
Provincial government		
Inpres Dati I (discretionary portion)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

Source: Derived from Table 2.2.

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

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

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



Source: DGWRD (1984).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CAPITAL COST OF IRRIGATION

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

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

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

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

OPERATION AND MAINTENANCE COSTS

Expenditures for O&M

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[d]Department of Public Works.

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

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

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

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

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

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

Source: Pasandaran (1985).

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

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

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

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

Source: Pasandaran (1985).

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

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

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

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

Desired Expenditures for O&M

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

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

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

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

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

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

Source: DGWRD (1983).

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

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

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

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

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

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

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

Source: Gadjah Mada University (1982).

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

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

Control Over Expenditure Decisions

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

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

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

Effects of Price and Tax Policies

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

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

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

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

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

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

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

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

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

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

Irrigation Benefits

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

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

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

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

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

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

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

Source: Gadjah Mada University (1982).

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

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

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

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

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

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

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

[c]Islam tax.

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

[e]Local market price.

Source: Directorate General of Food Crops (1984).

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

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

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

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

[a]Irigasi or irrigation districts.

Source: Directorate General of Food Crops (1984).

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

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

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

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

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

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

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

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

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

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

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

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

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

[e]If family owns all land farmed.

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

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

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

[a]Figures from Table 2.18.

[b]Calculated from Table 2.20.

[c]If family owns all land farmed.

METHODS OF FINANCING IRRIGATION SERVICES

Direct Methods of Financing Irrigation Services

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

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

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

Indirect Methods of Financing Irrigation Services

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Secondary Income of Water Users' Associations

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

RELATIVE CONTRIBUTION OF FARMERS TO IRRIGATION FINANCING

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

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

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

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

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

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

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

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

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

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

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

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

EVALUATION OF FINANCING POLICIES

Efficiency in Water Use

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

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

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

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

Efficiency in Investment

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

Efficiency in Management

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

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

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

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

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

Income Distribution between the Public and Private Sectors

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Income Distribution within the Private Sector

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

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

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