IRRIGATION PRICING AND MANAGEMENT

ANNEX 5

Indonesia

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Indonesia

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LIST OF ACRONYMS AND ABBREVIATIONS

AID	Agency for International Development
APBN	Central government sectoral budget for irrigation
BULOG	National Logistics Agency (for rice procurement)
DGWRD	Directorate General of Water Resources Development
DPU	Department of Public Works
GDP	Gross Domestic Product
GNP	Gross National Product
HYV	High Yield Varieties
IBRD	International Bank of Reconstruction and Development
IPEDA	Land tax
KPIP	Kali Progo Irrigation Project
LNG	Natural gas
M	Million(s)
O and M	Operations and Maintenance
PROSIDA	Proyek Irigasi IDA (an executive body of DGWRD)
PU	Public Works
P3A	Name for Water User Associations in Indonesia
PPL	Ministry of Agriculture extension field staff
WUA	Water User Association

CURRENCY EQUIVALENTS

US$ 1.00 = Rp. (Indonesian Rupiah) 11,000 .

WEIGHTS AND MEASURES

1 hectare (ha)	= 10,000 m^2 = 2.471 acres
100 hectares (ha)	= 1 km^2
1 kilogram (kg)	= 2.204 pounds
1 metric ton (MT or t)	= 1,000 kg
1 kilometer (km)	= 0.621 miles
1 square kilometer (km^2)	= 100 ha
1 millileter (mm)	= 0.04 inch
1 cubic meter (m^3)	= 0.061 cubic inch
1 liter	= 1.066 quarts

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Indonesia

A. Background

1. Economic background

a. Macroeconomic conditions and policy

Following a period of rapid expansion in the 1970s, Indonesia's economic growth slowed down in 1982 and 1983. Several factors were responsible for the adverse economic developments, the most important of which was the international recession which depressed demand and reduced prices, significantly for oil, but also for the country's traditional agricultural commodity exports. The government's speedy though cautious response included such measures as the adoption of an austere budget for 1983-84, reduction in subsidies on petroleum products, devaluation of the Rupiah by 28 percent and far-reaching tax reform. Nevertheless, the real Gross Domestic Product (GDP) growth rate increased only slightly from 4.2 percent in 1983 to 4.5 percent in 1984. Furthermore, the cautious mood persists both in the government and among the business community in 1985.[1]

Sectoral value added for the years 1979-82 is shown in Table 5-1 which also shows total value of GDP for those years. The percentage distribution of GDP by sector of origin is also shown for 1982. The agricultural sector is the largest, contributing more than 29 percent to overall GDP. It is followed by commerce and the manufacturing sectors which contribute 17.5 percent and 15.4 percent respectively. Indonesia's per capital Gross National Product (GNP) was estimated at US$ 560 in 1983.

The agricultural sector demonstrated improvement between 1983 and 1984 led by the largest rice crop on record, and followed by impressive gains in output of cassava, peanuts, coconuts, tea, palm oil and soybeans. Real output in the agricultural sector as a whole grew about 5 percent between 1983 and 1984, but the manufacturing sector did not do as well.[2] Although fertilizer and cement showed continued growth, electronics, textiles and vehicle assembly were in recession. Clearly, there is now substantial surplus capacity in the manufacturing sector with many factories producing at less than 50 percent of capacity.[3] Possible causes are the Government's licensing policies and a degree of over-optimism on the part of foreign investors in the early 1980s which led to over-investment. When consumer demand fell away in 1982, industries such as clothing, footwear and motor cycles were particularly hard hit.

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[1]The World Bank, Indonesia: Policies and Prospects for Economic Growth and Transformation (Washington, D.C.: The World Bank, April 1984).

[2]Peter McCawley, "Survey of Recent Developments," Bulletin of Indonesia Economic Studies, April 1985.

[3]Ibid., p. 9.

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Table 5-1: Gross Domestic Product by Sector of Origin at Constant 1973 Market Prices
(Billion Rp.)

Sector	1979	1980	1981	1982	Distribution of GDP 1982 (percent)
Agriculture	3,256	3,425	3,595	3,668	29.8
Farm food crops	1,909	2,073	2,261	2,294	
Farm non-food crops	402	417	430	459	
Estate crops	231	233	244	285	
Livestock, forestry and fisheries	714	702	660	630	
Mining and quarrying	1,047	1,035	1,069	940	7.6
Manufacturing	1,395	1,750	1,878	1,901	15.4
Electricity, gas and water	69	78	90	106	0.9
Construction	562	639	720	758	6.2
Commerce	1,681	1,852	2,043	2,159	17.5
Transport and communications	560	609	677	717	5.8
Banking	180	208	231	258	2.1
Public administration and defense	805	972	1,076	1,115	9.0
Other	610	647	678	703	5.7
TOTAL GDP	10,165	11,215	12,057	12,325	100.0

Source: The World Bank, Indonesia: Policies and Prospects for Economic Growth and Transformation, (Washington, D.C.: The World Bank, April 1984).

Few data are available on the construction and service sectors (wholesale and retail trade, transport and government) which comprise 50 percent of the economy. Performance estimates differ but it seems that the construction sector held up well under the recessionary conditions for a time.[4] However, it is expected to slow down with government spending decreasing on development projects which provide the bulk of contracts in the construction sector. With manufacturing in recession and declining imports it is also likely that wholesale and retail trade will also be effected.

Despite these setbacks, the economy has exhibited some resilience. For example, oil and natural gas LNG production rebounded in 1983 growing 6 percent after having declined 12 percent in the previous year. Inflation was restricted to 12 percent in 1983 despite the cost-push shocks engendered by the rise in domestic oil prices and the devaluation of the Rupiah. Inflation dropped to 8 percent in 1984 and was expected to remain below 10 percent in 1985-86.

The balance of payments situation is also favorable. In the first nine months of 1984 Indonesian exports grew by 8 percent and imports fell by 14 percent as compared with the same period in the previous year. This resulted in an increase in the balance of trade surplus and a reduction in the current account deficit. For fiscal year 1983-84, the current account deficit is estimated at about US$ 4.2 billion (equivalent to 6 percent of GDP) compared with US$ 7.3 billion in the previous year. The foreign exchange reserves at the end of December 1984 amounted to a comfortable US$ 10 billion. There has been a significant change in export revenue composition with the share of non-oil exports growing from 11 percent to 17 percent in two years. Part of the decline in the import bill can be attributed to the success of the Government's import substitution policies and part to the effects of reduced demand accompanying the recession.

Indonesia's medium-term growth prospects depend to a large degree on developments in the international economy, particularly on the world oil market which is difficult to predict. Slow growth in export revenues is expected since a large proportion will be contributed by oil. The outlook is more optimistic for non-oil exports which are projected to grow 6 percent per annum until 1990. Overall GDP growth is expected to be about 5 percent and investment growth is projected at over 5 percent during 1986-90. These rates will be achievable if the import intensity of investments is reduced below recent levels.[5]

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[4]See, for example, McCawley, "Survey"; and the World Bank, Indonesia: Policies and Prospects.

[5]The World Bank, Indonesia: Policies and Prospects, p. x.

Employment creation is the most serious developmental problem confronting Indonesia given a population growth rate of 2.7 percent per annum. This implies that 1.8 million people will be added to the labor force every year during the 1980s. Although no dramatic increases in unemployment are expected, certain policy implications follow for sustaining employment and gains in achieved income levels. One of these pertains to the agricultural sector since it will continue to be the principal source of employment. Efforts should be made to increase cropping intensities in irrigation areas and to diversify crop production and raise yields in rainfed agriculture to sustain labor demand.6

b. The agricultural and rural sector

(1) Current situation and outlook

The agricultural sector is of overwhelming importance in Indonesia as nearly 80 percent of the population lives in rural areas and agriculture is the main source of income for about two-thirds of rural households and one-tenth of urban households. The country has 15.6 million smallholder families who produce subsistence and cash crops on 15.8 million ha. There are also 1,800 estates on 2.2 million ha that produce mostly rubber, sugar, tea, palm oil and tobacco. Developments over the past 15 years have caused agriculture's share of GDP to decline from 40 percent to 30 percent between 1968 and 1981. In the same period, agriculture's share of exports dropped from 45 percent to 33 percent mainly because of the increased value of oil exports. However, agriculture remains a vital element of Indonesia's economy.7

Although agriculture's share of total employment has declined, it still employs 61 percent of the labor force. In the 1980s, agriculture is the largest single source of employment. Land reclamation and irrigation development outside Java promise to provide continued employment in agriculture on increased smallholder area, while rehabilitation of irrigation systems in Java are also encouraging for employment provision in agriculture on that island.

One of the major objectives of government policy in the agricultural and rural sector is food self-sufficiency, particularly in rice. Other objectives are the improvement of rural employment and incomes; supply of rice to urban consumers at a "reasonable" and relatively stable price; promotion of agricultural exports, especially of smallholder tree crops; and sustainable use of Indonesia's land, water and other natural resources.

6Ibid, p. 11.

7The World Bank, Staff Appraisal Report. Indonesia: Sixteenth Irrigation Project (Washington, D.C.: The World Bank, 1982), p. 2.

Rice is the country's primary food crop followed by cassava, corn and sweet potatoes. Other important crops are palm oil, coconut, rubber, sugar and soybeans. Output of major agricultural commodities and annual rates of growth are shown in Table 5-2. The keystone of Indonesia's agricultural policy, attainment of self-sufficiency in rice production, was achieved in 1984 when output amounted to just under 25 million tons. This was an increase of 3 percent over the previous year, a somewhat slower pace than the average of 6 percent per annum achieved over the previous five years.

Both the area planted to rice (including multiple cropping) and yield increases have contributed to expanded output. A combination of factors is responsible for this success including extended and improved irrigation, changes in rice growing technology (use of high yielding varieties (HYV) and fertilizers) and government price incentives. Assuming continuing investments in irrigation and supporting services at present levels, rice output is projected to grow at a rate of 3.5 percent per annum through 1990, resulting in estimated output of 28.5 million tons in that year. Already, management of surplus rice stocks is posing two major problems for the National Logistics Agency (BULOG), the Government's rice procurement agency. The first problem is storage and the second that of maintaining the floor price of rice in rural areas given the expected glut.[8]

Production of palawija or non-rice crops increased sharply in 1984, contributing toward a real growth rate of 5 percent in agriculture as a whole. The long-term trend for rate of growth in palawija crops is not quite so encouraging. Since little support has been given to palawija production, output has been low by world standards. The problems associated with palawija production on large estates are lack of adoption of HYVs, low fertilizer usage, poor management and lack of marketing arrangements. Smallholder farms have the additional problem of lack of credit availability and extension services.[9] Further, secondary crops are less intensively managed compared with rice and farmers tend to forego secondary crop production as intensity of rice cropping increases. However, secondary food crops are important in that they provide a third of total staple food calories consumed and more than that for the very poor. Clearly, they cannot afford to be neglected.

(2) Price policies

Price levels for rice and fertilizer reflect substantial economic and budget subsidies that arise from the Government's price policies. The objectives of the price policies originally formulated in 1969 were as follows: First, to establish a

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[8]The Government's commitment to direct purchase of rice from farmers at guaranteed prices is an important welfare objective.

[9]McCrawley, "Survey", pp. 2-9.

Table 5-2: Production of Selected Agricultural Crops, 1979-84
(000 tons)

	1979	1983	1984	Annual Growth Rates 5 years 1979-84	1983-84
Food Crops					
Rice	17,872	23,961	24,701	6	3
Maize	3,606	5,095	5,412	7	6
Cassava	13,751	11,651	14,702	-1	26
Sweet Potatoes	2,194	2,044	2,257	--	10
Peanuts	424	469	535	3	14
Soybeans	680	568	783	--	38
Fisheries					
Sea	1,318	1,600	1,670	5	4
Inland	430	520	549	5	6
Large Estate Cropsa					
Palm Oil	642	907	1,038	10	14
Palm Kernals	108	161	141	7	-12
Tea	125	113	116	-1	3
Smallholder Cropsb					
Rubber	898	1,230	1,107	4	-10
Sugar	1,601	1,693	1,769	1	4
Coconuts	1,582	1,607	2,015	3	25
Coffee	228	302	309	5	2
Cloves	35	45	56	8	24
Pepper	47	40	41	-2	2
Tobacco	87	120	121	5	1
Cotton	1	8	40	c	c

[a]Predominantly estate crops; figures given are for estate and smallholder production combined.

[b]Predominantly smallholder crops; figures given are for estate and smallholder production combined.

[c]Very high due to low base.

Source: McCawley, "Survey of Recent Developments," Bulletin of Indonesian Economic Studies, April 1985.

floor price high enough to stimulate production; second, to establish a ceiling price that would ensure a reasonable price for consumers; and third, to maintain sufficient range between the two prices so as to provide traders and millers reasonable profit after holding rice stocks between crop seasons. The policy also intended to ensure equitable regional rice distribution and parity between domestic and world prices. In practice, these policies have resulted in substantial economic and budget subsidies, particularly for fertilizers.

As Table 5-3 shows, Indonesia's domestic price for rice generally stayed below the import parity price between 1970-82 except when the world price was well below its long-run trend level. This implies an economic subsidy to rice consumers. The World Bank projects the world rice price to increase significantly between 1982 and 1990 and thus, if the domestic price of rice in Indonesia remains unchanged in real terms it will continue to stay below the long-run import parity price through the decade.[10] As a result of not pricing rice at its economic cost (as represented by the world market price), consumption will be overstimulated and production and farmer incomes will be depressed.

Domestic fertilizer prices of urea and triple superphosphate were less than half their import prices until November 1983. There were also substantial subsidies for ammonium sulphate and potassium chloride. This provided an offsetting economic subsidy to rice producers but implies budget costs to the Government. The total budget cost of fertilizer subsidies in 1981-82 was estimated at US$ 360 million which was equivalent to 30 percent of the development budget for the agricultural sector.[11] (The estimate of US$ 370 million does not include the implicit subsidy to fertilizer production due to pricing of natural gas below its economic cost.) Given no increase in real price, the subsidy is projected to be about US$ 500 million by 1990.[12] The second smaller budget subsidy arises because BULOG's selling price for rice does not adequately reflect the full cost of storage and marketing.

The World Bank has shown that under alternative price policy scenarios which involve reduced subsidies and compensating rice price increases for farmers, Indonesia could substantially reduce budget subsidies while maintaining rice self-sufficiency and farm incomes.[13] The long-run inflationary impact of higher prices for rice would range from 1-4 percent, the impact occurring gradually over a number of years.

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[10]The World Bank, Indonesia: Policy Options and Strategies for Major Food Crops (Washington: The World Bank, 1983), p. 55.

[11]Ibid., p. vii.

[12]Ibid.

[13]Ibid, p. 64.

Table 5-3: Trends in Imported and Actual Rice Prices in Jakarta
(US$ per ton)

Year	Imported Rice		Actual Jakarta Retail
	FOB Bangkok (25% broken)	Cost of Retail Jakarta	
1970	125.3	148.64	112.4
1971	93.9	115.45	109.3
1972	103.6	127.45	119.0
1973	116.3	175.76	205.2
1974	493.2	558.69	242.2
1975	311.8	380.49	262.7
1976	222.3	263.37	309.6
1977	237.4	287.33	319.6
1978	327.9	382.22	318.8
1979	308.3	362.00	272.5
1980	403.9	466.40	319.0
1981	416.4	470.10	325.0
1982	271.6	320.90	348.0

Source: The World Bank, Indonesia: Policy Options and Strategies for Major Food Crops (Washington, D.C.: The World Bank, 1983).

2. Irrigation development

a. General

The high priority attached to irrigation development in Indonesia is primarily in order to become self-sufficient in food production, particularly in rice. Irrigated agriculture is also an important source of income in rural areas and is necessary in the planning of new areas of transmigration and settlement in the less intensively cultivated Outer Islands. Indonesia has a monsoon climate that provides 1,500-3,000 mm of rainfall per annum, but supplemental irrigation is necessary. Although total rainfall is adequate for paddy rice production, distributional variation results in periods of inadequate moisture for optimum rice production. At such times, availability of irrigation improves production while dry season production of rice is impossible without irrigation. On the other hand, drainage is equally important in Indonesia because excessive rainfall causes crop damage in some parts of the country.

b. Current status of irrigation development

There are essentially three types of irrigation systems in Indonesia--technical irrigation, semi-technical irrigation and simple irrigation.[14] 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 a number of points. All such structures are permanent. Semi-technical systems have fewer permanent structures, only one measuring device and supply and drainage systems are not always fully separate. The simple irrigation systems, sometimes known as desa or village systems, are theoretically not under Government control but are constructed, operated and managed by the villagers. They generally have semi-permanent or temporary structures and have no water measurement or control devices. The areas covered by the different types of systems are shown in Table 5-4. Groundwater development is fairly limited but is being expanded in certain parts of Java. There is also some private investment in small wells and pump sets, while the Government has started pilot schemes using large tubewells.

The potential area for irrigation development is about 5.4 million ha. Another 350,000 ha of swamp development area exists, primarily in Sumatra and Kalimantan, which is more properly regarded as drainage rather than irrigation area. The total nominal service area of existing irrigation systems under the control of the Department of Public Works (DPU) is about 4.2 million ha. The DPU is responsible for the operation and maintenance (O and M) of this area as far as the tertiary outlet, while below that level farmers are responsible for

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[14]Some classifications added "wild" irrigation but the data on this is limited.

Table 5-4: Types and Areas of Existing Irrigation Systems
(million ha)

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

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

their own O and M. There are less reliable estimates of the irrigated areas managed at the local level by the farmers alone, independent of the government. Estimates put the area at about 1.2 million ha. The actual area of irrigated land is reduced by the quality of the available irrigation. The DPU estimated in 1977 that approximately one million ha of existing government controlled systems (or 25 percent of the total area) was in need of augmented water supplies, rehabilitation, tertiary or on-farm canals. Of this area, Sumatra accounted for about
420,000 ha, Java for 294,000 ha and Sulawesi for 145,000 ha.

The geographical distribution of irrigated area between regions as shown in Table 5-4 indicates that 62 percent of the total is in Java which also has more technically advanced systems than the other islands. Although Java has only 7 percent of Indonesia's land area, its rice production supports 66 percent of the population. Hence, the extent of irrigated areas in Indonesia are in reasonable balance with the broad distribution of population, although not exactly so. This is because irrigation development depends upon a variety of factors other than demography including accessibility to water sources, topography and soils.

Most of the irrigation systems are supplied by run-of-the-river diversion. Of the few large dams and reservoirs in existence, the largest is Jatiluhur in West Java which has a command area of 304,000 ha and is administered by a special Authority. There are also other large systems in downstream coastal areas that depend upon a single dam, barrage or weir but a larger proportion of irrigated area is supplied by relatively small upstream systems which are highly interdependent. In other words, they draw on the same rivers and catchment areas for their water. This complicates the administrative task of the DPU for a Section Office having responsibility for an area of 20,000 to 40,000 ha may have more than 25 separate systems to administer. Indeed, irrigation in Indonesia is highly diverse topographically, culturally and administratively both among the islands and within particular regions and provinces.

Typical problems generally encountered in irrigation systems are excessive silt deposits in weirs, intakes and canal structures that result in capacity losses. Erosion is also a problem along canal banks and on inspection roads. In some places, where farmers maintain drains, they dam them to provide an additional water supply pool and cause flooding in other places.

c. Past trends in irrigation investment

There was little investment in irrigation development in Indonesia in the first three decades after independence resulting in serious deterioration of some physical structures to the extent that by the mid-1960s many of the large systems were becoming inoperable. Lack of controlled and equitable water distribution caused severe competition among users and further deterioration from deliberate

destruction of gates and canal banks. A major rehabilitation program was started in the late 1960s focused on Java. With support from external donors such as the World Bank, diversion structures and canal systems were reconstructed. In the late 1970s, the focus shifted to development of new irrigation in the Outer Islands, mostly for transmigration and settlement schemes. In Java, more emphasis was given to tertiary system rehabilitation and reorganization through increased attention for improved O and M and technical training for staff.

In the late 1970s, irrigation accounted for about 5 percent of the total national budget including routine expenditures and foreign aid. In 1977-78, the local currency development budget allocated to irrigation was about 9.5 percent. Between 1974-75 and 1977-78, the development budget for irrigation increased at an average annual rate of about 50 percent or 35 percent in real terms. The Government's investment in irrigation during Repelita III and IV are shown in Table 5-5. Expenditure on rehabilitation is budgeted to account for about 29 percent of the total, and expenditure on large scale systems is budgeted for about 27 percent. Rehabilitation accounts for 27 percent of the area being developed and tertiary development for about 11 percent. The largest incremental production is expected to come from large scale systems and tidal and swamp development.

d. The role of irrigation in agricultural development

The primary use of irrigated land in Indonesia is for rice production while palawija crops are grown during the dry season where irrigation systems are incapable of delivering adequate water supplies for rice cultivation. Table 5-6 shows that the area of harvested rice increased from 6.36 million ha to 7.23 million ha between 1968-76. There was a corresponding decline in the area of dry land rice harvested (0.5 million ha) but 0.4 million ha were added to total area harvested either by extension or irrigation areas or increased cropping intensity on irrigated areas. Paddy production from irrigated areas increased at an average rate of 4 percent per annum compared with a rate of increase of total production of about 3.8 percent per annum.

As shown in Table 5-6, per ha yield of paddy on sawah areas has been double that on dry land areas, a significant part of the difference being attributable to irrigation. It is important to remember that yield increases do not depend upon irrigation alone. But significant improvements can be achieved on irrigated land when combined with increased fertilizer use and other improved cultivation and water management practices. In addition, rice cropping intensity is higher on land with more sophisticated irrigation systems. Thus, cropping intensity on Java and Bali, where irrigation is most highly developed, was 1.5 in 1976, but it was only 1.16 in the rest of Indonesia.

Table 5-5: Investment and Irrigation Area Developed for Repelita III and IV

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

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

[b]Seems very high because large amounts of project preparation costs have been included. The real value of unit costs should be the values in brackets.

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

Table 5-6: Harvested Area, Production and Average Yield of Paddy Rice, 1968-76

	Area Harvested (million ha)	Paddy Production[a] (MT)	Yield[a] (t/ha)
		Irrigated and Wet Land[b]	
1968	6.36	16.10	2.53
1972	6.61	18.72	2.84
1976	7.23	22.63	3.13
Average annual growth rate 1968-70 to 1974-76	1.9%	4.3%	2.4%
		Unirrigated and Dry Land	
1968	1.66	1.88	1.13
1972	1.31	1.56	1.19
1976	1.14	1.54	1.35
Average annual growth rate 1968-70 to 1974-76	-4.8%	-2.4%	2.4%
		Total Irrigated, Wet Land, Unirrigated and Dry Land	
1968	8.02	17.95	2.24
1972	7.90	20.28	2.57
1976	8.37	24.17	2.89
Average annual growth rate 1968-70 to 1974-76	0.9%	3.8%	2.9%

[a]Production and yield are in terms of rough paddy.

[b]Refers to irrigated and rainfed sawah. (Sawah refers to all rice fields, irrigated or rainfed, which have low banks or bunds built around them to retain water.)

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

e. Future development potential in irrigation

Table 5-7 summarizes the areas identified as having potential for irrigation development. Of the total 5.8 million ha, about 5.1 million ha or almost 90 percent will involve construction of new irrigation or swamp development projects on islands other than Java. On Java, the intent is to concentrate on more intensive system rehabilitation including construction of tertiaries. Another objective is to increase cropping intensities by augmenting dry-season water supplies. On the Outer Islands more emphasis is planned on new construction and swamp and tidal reclamation. New construction is intended to stress small and medium sized projects which are an important part of the Government's program of regional development, food production and income distribution. Some of these will be the "Sederhana" type of project which are described in Section C.2.[15]

B. National Irrigation Administration and Policy

1. Organization of the irrigation administration

a. The Directorate General of Water Resources Development

The chief government agency responsible for irrigation development is the Directorate General of Water Resources Development (DGWRD) of the DPU. The agency is responsible for planning, direction and supervision of a variety of activities including rehabilitation of existing irrigation systems, flood control, river basin planning and development, development of new irrigation and reclamation of swamp lands. Figure 5-1 shows the DGWRD's organization for accomplishing these tasks. The main functions of the DGWRD are performed by six directorates and a number of executive bodies. The various directorates are in turn organized along functional lines. The Assistant Director General is responsible for a range of administrative activities while the Directorates of Programming and Planning, and Logistics are responsible for support activities. Separate executive agencies exist or are formed to manage special projects funded by external agencies such as the International Bank for Reconstruction and Development (IBRD). Proyek Irigasi IDA (PROSIDA), which was established to execute IBRD-assisted projects, is an example of one such agency.

Legally, responsibility for irrigation development is decentralized and the Provincial Public Works Departments are an integral part of the provincial government, the central DPU providing only "technical guidance." However, the Provincial Dinas PU is responsible for operating the budget provided by the central Ministry as well as its own provincial budget. Decentralization is not strictly maintained in actual practice because of the considerable expansion of

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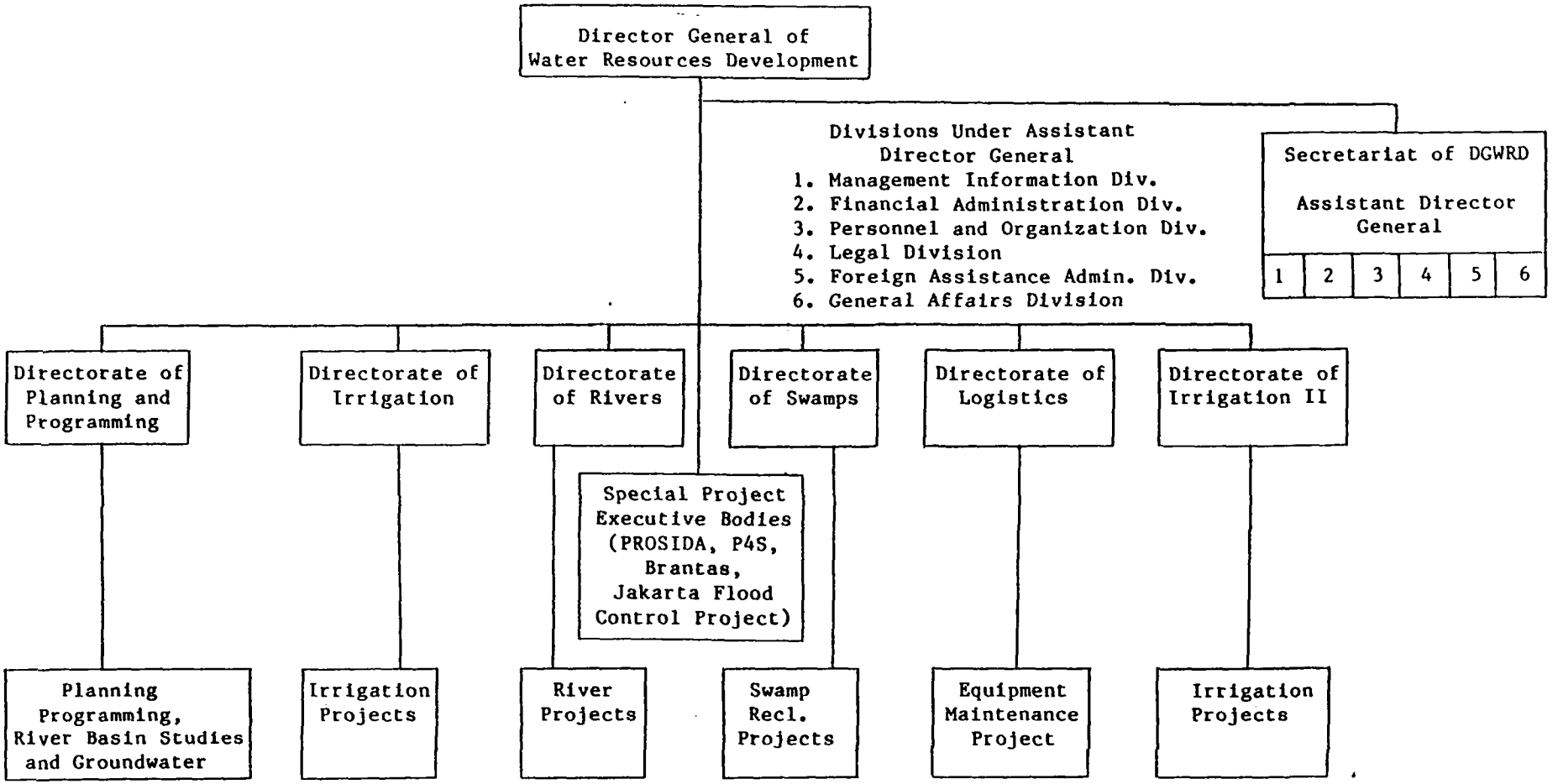
[15]Briefly, the Sederhana Program was designed to build and rehabilitate small-scale irrigation systems.

Table 5-7: Areas Identified for Potential Future Irrigation Development
(million ha)

Province	Gravity Irrigation: New Development	Gravity Irrigation: Rehabilitation	Swamp and Tidal	Groundwater	Total
Java	0.42	0.59	-	0.05	1.06
Sumatera	1.90	0.09	0.81	-	2.81
Kalimantan	0.68	0.02	0.62	-	1.33
Sulawesi	0.34	0.04	-	-	0.39
Nusa Tenggara	0.08	0.01	-	-	0.09
Maluku	0.16	-	-	-	0.16
Irian Jaya	0.01	-	-	-	0.01
TOTAL[b]	3.59	0.76	1.44	0.05	5.84

[a]Includes Madura and Bali.
[b]Totals may be incorrect due to rounding error.

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



IRRIGATION PRICING AND MANAGEMENT: INDONESIA

Figure 5-1: Organization of the Directorate General of Water Resources Development

new irrigation construction much of which has been financed by foreign aid agencies in the past decade. This has necessitated a large proportion of the total budget being provided by the central Ministry including for the Sederhana and Tertiary Development Program. In addition, many of the special centrally funded projects are directed from the center. There are separate project offices for the larger centrally funded projects which are often better equipped and include senior staff seconded by the center. Even the Provincial Government budget provided for minor rehabilitation and for O and M are largely funded by Central Government grants which often are earmarked for specific purposes.

There is no agency for irrigation administration at the Kabupaten level though most Kabupatens have Provincial Dinas PU offices attached to their secretariats. However, their legal responsibility is confined to roads, bridges and sanitation.

b. The Ministry of Agriculture

The Ministry of Agriculture's important responsibilities in irrigated agriculture include provision of extension advice on water management at the farm level; organization of farmers into water user associations (WUA) known as P3As; in some areas, physical organizational improvement of tertiaries; and, as mentioned above, participation in planning irrigated cropping patterns and seasonal water schedules through membership on the Kabupaten Irrigation Committees. The Ministry of Agriculture's extension field staff (PPL) are supposed to advise farmers on improved farm-level water management. They are members of the Provincial extension service and come under the supervision and training of a senior official at the sub-province level who is designated as a "subject matter specialist" in water management.[16] The program is funded through the general extension budget. Since the institution of the Tertiary Development Program, the PPLs have also been made responsible for the establishment of the P3As.

In the past, the Ministry of Agriculture had other functions in irrigation but these activities have been steadily reduced. For example, until 1979-80, the Ministry administered tertiary development of the Sederhana projects but this activity has now been taken over by the DPU. Before that, there was a Directorate of Rural Irrigation within the Ministry whose function was to provide technical assistance to communally managed systems, but this was closed in 1969.

[16]The Ministry of Agriculture's sub-district offices do not correspond with those of the DPU.

c. Local government

Although, theoretically, irrigation is a Provincial Government responsibility, the only formal linkage at the Kabupaten level is through the Bupati through his chairmanship of the Irrigation Committee.[17] In addition, some funds from Kabupaten budgets are used for minor irrigation investments on both DPU and communally managed systems. In at least one province, that of East Java, the Kabupaten dinas PU has responsibility for planning and supervising construction of minor irrigation works funded by Inpres Dati II.

2. Funding flows for irrigation in Indonesia

Approximately three-fourths of the funds for irrigation at the provincial level are provided by the Central Government and there is a complex relationship between the Central and Provincial Governments on financial matters. The flow of funds from the Central Government is shown in Figure 5-2, but it is important to remember that additional direct revenues are raised at the Provincial and Kabupaten levels.

The largest portion of irrigation financing is provided through the sectoral budget (APBN) of the DGWRD directly to the provincial public works agencies. Project proposals from the Provincial DPU are appraised and recommended by the provincial authorities but final selection is by the Central Government after a negotiation process. The main budgets are as follows:

- The Subsidi Daerah Otonom which is a routine budget for salaries and allowances of permanent civil servants employed by the Regional Government but paid by the Ministry of Home Affairs. This comprises 46 percent of total Regional Government revenue and 22 percent of the national routine budget;

- The Inpres Dati I or Provincial Development Grant is a multi-purpose grant provided by the center for development projects in the provinces. There are both fixed and discretionary components. Through DATI I, funds are available for irrigation rehabilitation and upgrading, and for O and M. Awards are made on the basis of weightings by population, size of cultivated area and length of existing roads in each province; and

- Dati II or the Inpres Kabupaten which is allocated on a per capita basis and is not earmarked, though most of it is spent on infrastructure development.

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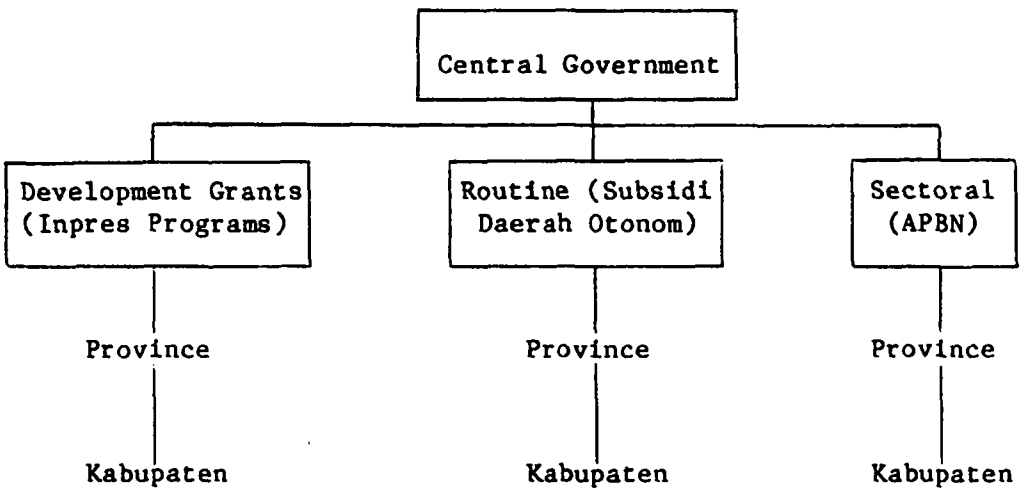
[17]This Committee is composed of village administrative and irrigation officials who together decide cropping patterns. The two sets of authorities are generally separate.



IRRIGATION PRICING AND MANAGEMENT: INDONESIA

Figure 5-2: Funding Flows from the Central Government to Province and Kabupaten Levels

The irrigation development budget for Fiscal Year 1980-81 is shown in Table 5-8. The APBN provided Rp. 200.3 billion of which Rp. 110.5 billion was earmarked for new construction, Rp. 69 billion for rehabilitation and Rp. 20.8 billion for swamp and tidal area development. In addition, Rp. 66.9 billion was budgeted for construction and rehabilitation from foreign aid sources. At the provincial level, total funds available from Central Government sources were Rp. 38.8 billion. Of this, Rp. 7.4 billion was Inpres Dati I earmarked for rehabilitation and Rp. 19.8 billion for O and M. Additionally, Rp. 8.2 billion represented Subsidi Daerah Otonom for salaries and other routine budget expenses. The main sources of funding at the Kabupaten level and below are the Inpres Dati II (Rp. 7.8 billion) and the Inpres Desa (about Rp. 4.9 billion). These funds are used for small construction and repairs.

Funding of irrigation from Kabupaten direct revenues is almost negligible and in 1980-81 amounted to Rp. 0.8 billion. For tertiary construction a special employment creation program provides funds through a special APBN to finance the cost of labor intensive channel construction complementing the DPU. This amounts to about Rp. 14 billion. In addition, the Agriculture Ministry provides an APBN allocation of Rp. 266 million to assist the formation of P3A under the national Tertiary Development Program.[18]

Examination of recent trends in financing show a significant increase in grant allocations to Provincial Governments for O and M. In the five years prior to 1980-81, they increased from Rp. 5.6 billion (about Rp. 1,500 per ha) to Rp. 19.8 billion (over Rp. 4,000 per ha). Allocations for rehabilitation have risen more slowly and there has been a decline in funding from other sources such as the Ministry of Agriculture and Inpres Dati II. This suggests a shift towards greater dependence upon Central Government funding.[19]

3. Irrigation policies and practice

a. Irrigation management

(1) Organization for O and M

(a) The Government's management structure

Responsibility for operating and maintaining irrigation systems in Indonesia is divided between the Government and local communities. The major irrigation systems, including intake structures, primary and secondary canals and related structures are the responsibility of the Provincial Government, although in practice as

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[18]Bottrall, Financing Irrigation, pp. 18-20.

[19]Ibid., p. 21.

Table 5-8: Official Financing of Irrigation Development 1980-81

Source of Funds	Purpose	Government Expenditure	Foreign Aid	Total
Central Government				
Public Works	New construction	110.5	34.3	144.8
	Rehabilitation	69.0	29.6	98.6
	Swamp and tidal	20.8	3.0	23.8
Agriculture	Tertiary	0.3		0.3
Manpower	Tertiary construction	13.9[a]		13.9[a]
	and rehabilitation	15.7		15.7
Provincial Government				
Public Works	Rehabilitation	7.4		7.4
	O and M	19.8		19.8
	Dati I	2.2[a]		2.2[a]
	Other	9.4[a]		9.4[a]
Agriculture		0.5[a]		0.5[a]
Kabupaten				
	Inpres	7.8		7.8
	Local taxes	0.8[a]		0.8[a]
Desa				
	Inpres desa	4.9[a]		4.9[a]
TOTAL		269.1	66.9	336.0

[a]Estimated.

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

noted in Section 1.a. above, the Central Government is also involved. System maintenance from the tertiary turnout to farm ditches is the responsibility of the farmers who are guided and supervised by government officials.

The organization of the typical irrigation district is based on a command area of 60,000-100,000 ha of irrigated land. Officials at this level are responsible for the design of minor rehabilitation works, construction supervision, assessment of O and M priorities and Section supervision. Below that level the Section or seksi usually comprises 20,000-40,000 ha under the charge of a section head (Kepala seksi) who is instrumental in planning, executing and monitoring day-to-day O and M activities. This is shown in Figure 5-3. Section staff provide the main contact with the Bupati who is the executive of the Kabupaten. At the 5,000 ha level the Sub-section Office provides administrative and operational support while ditch tenders or juris at the 700-1,000 ha level make direct contact with village level water officials. The juris are the most junior members of the DPU's field staff. Water distributors at the village level are known by a variety of names such as ulu-ulu, jogotirto, raja bondar, etc. Regular DPU staff above the juru level are classified as Central Government employees and their salaries come out of a routine budget at the center.

Since Section and district offices are organized on a hydrological basis their boundaries often do not correspond with the Kabupaten administration or with other administrative units at that level, such as the Agriculture Department. This is particularly true in Java. In Bali and Sumatra, the administrative areas of the DPU Section fall within single Kabupatens, while in South Sulawesi many Section Offices cover two or more Kabupatens with small irrigation systems and their boundaries coincide with those of the Kabupaten.

The main administrative difficulty that arises where Kabupaten and Section boundaries do not coincide is with the work of the interdepartmental Irrigation Committees that require cooperation between the DPU Section office, the Kabupaten administration and/or agriculture. The Committees meet twice a year prior to the wet and dry seasons to discuss planning for cropping patterns and water scheduling within the Section command area. The local Bupati chairs the meetings, the DPU's Section Head is the secretary and members include the head of the Agriculture Department in the Kabupaten level. Irrigation system performance monitoring is also effected by overlapping authorities for information on irrigated areas under each crop and yields are aggregated to the Kabupaten level which keeps data on both rainfed and irrigated agriculture. It is, therefore, extremely difficult to estimate irrigated production. Finally, water distribution activity that relies heavily on good communication between local government irrigation agencies, agricultural extension agencies and the final user is also hampered.

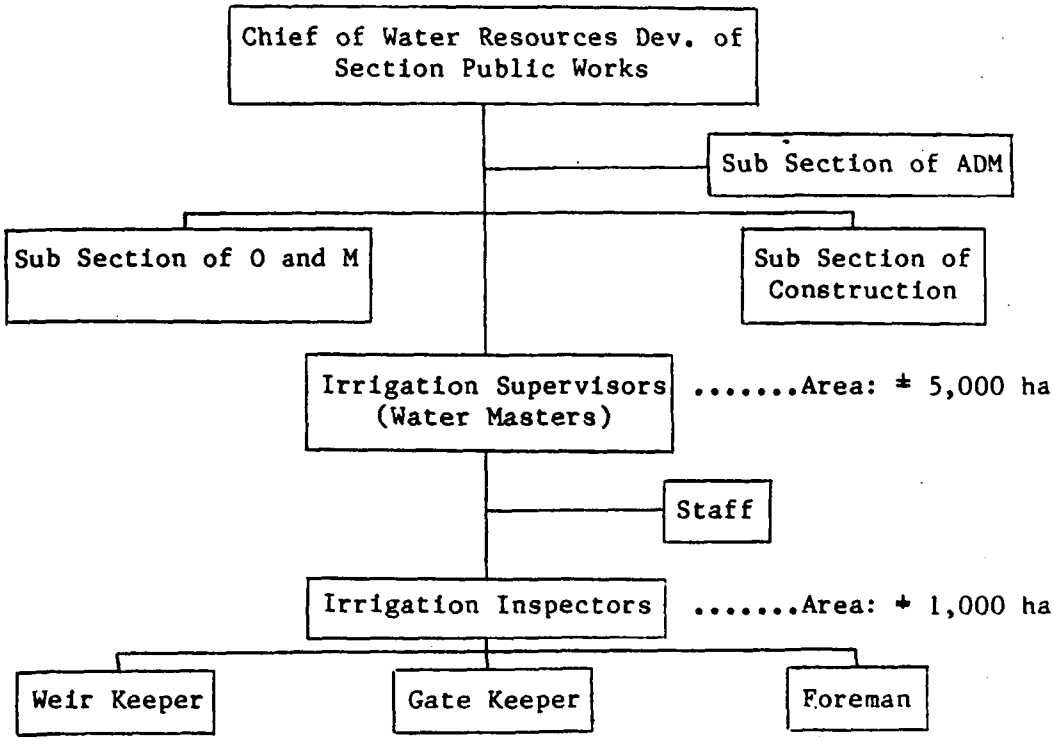

Figure 5-3: Organization of District Public Works for Irrigation Administration

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

(b) Farm level management

Water distribution and application at the farm level varies between the wet and dry seasons. During the rainy season, water is generally supplied through the tertiary and quartenary channels on a continuous basis and farmers take it at their own discretion. Institutional control is at a minimum. As supplies decline during the dry season, institutional control on the system is increased and farmers can no longer make unsupervised withdrawals. Water is then distributed among farmers under the supervision of the village irrigator helped by the WUA if one exists.

During the dry season, one of the methods used to match reduced irrigation water supplies to demand, is to reduce the amount of land planted to rice. Hence, cropping decisions are very important and are made at the village level by the village administration and the WUA. Water allocation to various groups of farmers are also made and the cropping decisions are implemented by the village irrigator.

Water distribution in rice paddies is by means of quartenary channels. Rice is grown in small submerged basins that are formed by bunds laid out parallel to the ground contours--the distance between bunds decreasing with increasing land slope. Superimposed on the paddy pattern are the property boundaries, generally normal to the slope and to the supply channel. To apply water to the land, farmers introduce water in the basin nearest to the intake point on the supply channel. Water then spills from the higher to the lower basins until the last basin within the property unit is irrigated. Farmers do not normally use field channels within individual property units.

Management at the tertiary level is legally specified as the responsibility of the desa (village). Village irrigation systems have historically been disaggregated into small management units of 10 ha. It is not uncommon to see a tertiary flanked by two quartenary channels running parallel over long distances. Such physical design helps clearly define a social group of farmers, their water rights and obligations to maintain channels. Since farmers get water only through the quartenary channels, farmer groups are responsible for maintenance of quartenary channels. The village administration maintains tertiary channels because water from them is used for domestic and agricultural purposes. Increasingly, formation of WUAs is being encouraged to obtain farmer participation in O and M on government irrigation as well as on the traditional village systems.

In Indonesia, there is a lengthy and well-documented tradition of irrigation systems managed by WUAs. The associations have different names in various parts of Indonesia, being known as Dharma Tirta in Central Java, Mitra Cai in West Java and Subaks in Bali. In Bali, the Subak is a social organization whose members help maintain canals and dams, distribute water and participate in religious ceremonies. The area of the Subak varies from 10 to 300 ha and the number of members from 50 to 600. Since the boundaries of the organization do not

correspond to the political boundaries of the villages, members of a Subak are not necessarily from the same village. The organization has its own rules and regulations that govern rice cultivation and crop rotations for rice and dry season crops, resolution of disputes among members and the performance of religious ceremonies.

Data on WUAs and their membership is difficult to obtain. In any case, membership most likely varies a great deal. However, information on WUAs in selected provinces is provided in Table 5-9. Even where there are no formal WUAs, farmers often organize themselves for voluntary labor (goyong rotong) to clean and maintain farm level canals and ditches. Although there is no formal charge for O and M, farmers make contributions in money, labor or in kind to the ulu-ulu who is responsible for village irrigation affairs. Sometimes these payments are quite substantial. Data on some payments for ulu-ulu services by farmers are provided in Table 5-10.

The growing emphasis on O and M improvements has been accompanied by efforts to establish WUAs under the assumption that where farmers are organized for the effort O and M will be improved. However, the process of establishing functioning WUAs is difficult for several reasons. Where construction and rehabilitation work have already been completed it is difficult to convince farmers that they must be responsible for maintaining a system that was constructed by the government. This has happened, for example, in the Tertiary Development Program which intended that farmers would assume responsibility for O and M once system rehabilitation or construction was completed. Farmer associations were formed for this purpose. These organizations sometimes replaced the traditional ones. However, they did not often obtain farmer support. The problem was that the program was directly funded by the Central Government whose objective was to speed up the process of rehabilitation in the interest of maximizing farmer benefits through improved efficiency and equity of water distribution at the farm level. Central Government expenditure in 1980-81 alone amounted to Rp. 49.3 billion. But there was a tradeoff involved, for farmers were reluctant to assume support for systems they did not regard as their own. A possible solution would be to slow down the process of tertiary construction and rehabilitation and attempt to get farmers involved by contributing whatever they can in the form of land and labor.[20] Other difficulties involved in establishing viable WUAs include the fact that irrigation boundaries do not correspond with political boundaries and there is sometimes conflict between the village administrative leader and the water leader elected by the farmers.

[20]Interview with Mr. Peter Sun, World Bank.

Table 5-9: Water User Associations in Selected Provinces, 1977-78

Province	Name of the WUA	Total Number of WUA	Total Member Farmers	Total Area (ha)
Bali	Subak	1,262a	NAb	98,673
Java Central	Dharma Tirta	928	254,398	128,215
East	NA	1,358	NA	NA
West	Mitra Cai	2,568	138,081	171,460
Sulawesi South	NA	113	NA	NA

[a]The figure is for 1979.
[b]NA = Not available.

Source: A.J. Nyberg and Dibyo Prabowo, Status and Performance of Irrigation in Indonesia and the Prospects to 1990 and 2000, Working Paper, Southeast Asia Project, IFPRI, February 1982.

Table 5-10: Farmers' Payments to Village Irrigation Officials--Some Examples

Run-of-the-River	Average Seasonal Rate (per ha)	Crop Seasons	Total Annual Payments (RP./ha) (@ Rp. 100/kg rice)
1. Bali:			
a. DPU system	200 kg rice	2 x rice	4,000
b. Communal system	10 kg rice	2 x rice	2,000[a]
2. Pekaten Sampean, E. Java - DPU system	30-50 kg rice	2 x rice or 1 x rice plus 1 x polowijo	6,000-10,000
3. Sragen/Solo region, C. Java - Dharma Tirta communal system	115 kg rice	3 x rice	34,500
4. Lake Toba region, N. Sumatra- communal system	20 kg rice	2 x rice	4,000
5. Sidrap, S. Sulawesi, DPU system	50 kg rice	2 x rice	10,000
Pumps			
6. Kediri-Nganjuk, E. Java, DPU Tubewells	hourly charges for fuel consumption and operator (Rp. 250-600/ha)	2 x rice or 1 x rice plus 1 x polowijo	25,000-40,000
7. Sedrap, S. Sulawesi, communal low-lift pumps	100 kg rice	2 x rice	20,000

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

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

(2) The cost of O and M

O and M costs are difficult to estimate, they vary with the type and status of irrigation systems. Thus, for example, O and M costs would differ between technical, semi-technical or simple systems. They would vary, as well, depending on whether or not rehabilitation had taken place, and contrary to expectation, O and M costs might even increase after rehabilitation depending upon the level of upgrading. A study conducted by the Gadjah Mada University Team concluded that current allocations were insufficient for efficient operation of systems or for attaining their useful life.[21] They proposed that main system O and M costs should be about Rp. 13,000 per ha annually and an additional Rp. 7,000 was required if tertiary systems were included. Most officials contacted by the present team estimated that main system O and M requirements were Rp. 15,000 per ha. In 1981-82, the Directorate of Irrigation issued guideline figures for provincial government use in proposing main system O and M budget requests. The total amount suggested was Rp. 13,145 which is equivalent to Rp. 15,000 in inflated 1983-84 prices.

Data from the Gadjah Mada University study showed that for the Pemali Comal Area of Central Java actual expenditure on O and M was as follows: 48 percent on salaries and wages and almost 39 percent on O and M of channels, hydraulic structures and inspection. At the tertiary level, farmers contributed additional amounts in cash and kind as well as contributing labor whose imputed value was Rp. 3,460 (see Table 5-11). In total, farmers provided about 18.6 percent of total O and M expenditure on the main and tertiary canals not including the imputed value of their required contribution of labor.

b. Cost recovery

(1) Types and levels of charges

(a) Direct charges

(i) Farmer payments

Although it is not recorded in official budgets, farmers in Indonesia make significant contributions towards the cost of O and M, especially for communal systems and for the tertiary sections of DPU systems. The subaks of Bali are self-financing and WUAs in Java and some of the Outer Islands are also quite active and successful in terms of cost recovery. Farmers

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[21]The Gadjah Mada University Team, Executive Summary: Study of Regional Capability to Finance the O and M Costs for Irrigation Systems in the Prosida Projects in the Pemali-Comal Area, Central Java and in the Bantimurung and Lanrae Project Areas, South Sulawesi, May 1982, pp. IV-21.

Table 5-11: Comparison of Actual and Proposed O and M Costs of Gung Irrigation Section (Pemali-Comal Central Java) (Rp./ha)

Cost Allocation	O and M Cost	
	Actual	Proposed
Main Irrigation System		
Wages and salaries	4,442	5,027
Transport	149	395
Office supplies	276	221
Routine O and M		393
O and M[a]	3,170	5,748
Other	1,037	850
Subtotal	9,074	12,634
O and M Cost at Regional and Provincial Levels[b]	1,815	2,520
Tertiary Irrigation Level		
O and M		4,750
Ulu-Ulu and P3A salaries	—	1,200
Subtotal	2,490	5,950[c]
TOTAL	13,379	21,104

[a]Includes channels, hydraulic structures and inspection.
[b]Estimated at 20 percent of main system O and M cost.
[c]Includes actual farmer payments in cash and kind and imputed value (Rp. 3,460) of own-labor contribution required.

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

generally make two types of payments. The first is a payment to the local irrigation official such as the ulu-ulu for water distribution services and the second is the labor contribution known as goyong-rotong for maintenance of irrigation and drainage channels. Since payments are usually made in kind there is a built-in protection against inflation. Bottrall suggests that farmer payments are considerable in some places and that this must be taken into account when considering potential increases in farmer contributions towards irrigation investment in the future.[22]

Reference has already been made to farmer payments in the Pemali Comal area that amounted to Rp. 2,450 per ha per year. Amounts of farmer contributions in other regions of Indonesia are shown in Table 5-10. Collections at the tertiary level are generally good because of community pressure and because they are made in kind. Table 5-10 shows considerable variation in the amount of payments made in different places. This is due to a variety of factors. In Bali, for example, the charges appear relatively low but they disguise the fact that in the first case, the official also receives payment in the form of subak land. On the second system, labor contributions are very high. Payments in Central Java are much higher because they include charges for capital costs of tertiary improvements in addition to regular O and M. On the pump irrigation systems, farmers are willing to pay the much higher costs arising from the high fuel charges because of the higher returns obtainable from use of this type of irrigation. On the basis of these data, Bottrall concluded that farmers are both willing and able to pay for irrigation when they are offered a service that they perceive is worthwhile because it results in a net profit to them.

(ii) IPEDA

The IPEDA is a land tax aimed at recovering some of the benefits resulting from improved productivity due to irrigation. Water users pay the IPEDA in addition to the payments made for O and M at the tertiary level. For the purposes of this tax, irrigated paddy land is classified into 15 productivity classes and non-paddy rural land into 17 classes. The land classification, along with rice prices and land values, are incorporated into the formula for calculating the IPEDA which is set at 5 percent of the value of net annual production from paddy land, or 5 percent of the annual rental value on nonproductive land.

Usually collections are made annually after the main harvest. Collectors in the rural areas (excluding estates) are desa government officials. After collection, deductions are made for the collector and for deposit at the provincial level and the remainder which amounts to 72 percent of the total is transferred to the kabupaten. IPEDA revenues are legally permitted to be used for infrastructure development for raising food production which includes irrigation,

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[22]Bottrall, Financing Irrigation, p. 27.

transportation, flood control and energy distribution. The bupati or head of the kabupaten has considerable discretion over how the IPEDA is spent since there are no specific regulations governing spending allocations for different categories of development purposes. Field survey data from the Gadjah Mada University Study indicate that a very small percentage of the tax is spent on agricultural development and much less (possibly one percent) on irrigation development. (See Table 5-12.) The IPEDA is basically regarded as a development fund and not for O and M.

(b) Indirect cost recovery

Government policy with respect to subsidies on fertilizers and rice prices was discussed in Section A.1.b. Indirect cost recovery results from the incremental rice production being procured by the Government at a price lower than the import price as it effects a savings in foreign exchange. Improved irrigation is one of the factors contributing to increased production, and as such, this represents an indirect cost recovery mechanism. However, due to the complexity of the consumer and price subsidies, it is difficult to estimate the amount of the indirect cost recovery. It should be pointed out that it is not necessarily desirable to continue subsidies for the purposes of cost recovery because of the distortions that result. In fact, reduction of the fertilizer subsidy would increase net revenues to the Government, thereby making increased funds available for irrigation while reducing price distortions.

(2) Collection rates

From the point of view of improved O and M at the tertiary level, collection rates in the form of payments in kind and of contributions of voluntary labor are generally good, primarily because of the impact of community pressure. This is particularly true where there are traditional WUAs such as in Bali and Java. On the other hand, formation of WUAs is more difficult as is cost recovery on systems which farmers regard as being provided by the central government. Collection of the IPEDA, an alternate source of funding for irrigation development, is also not a problem. But such a small portion of this tax currently goes toward irrigation that it has not so far been of much importance. Even when a portion of the IPEDA is allocated for irrigation, it is not usually made available for O and M purposes. However, the IPEDA is a promising potential source of funds and changes could be made that would allow an increase in the tax to be used for main system O and M. Both USAID and the World Bank are examining the possibility of earmarking a portion of the IPEDA for O and M. Recently, the World Bank has succeeded in securing agreement to do this on the West Tarum Canal project near Jakarta.[23]

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[23]Mark Svendsen provided this information.

Table 5-12: Utilization of IPEDA[a] in Two Regencies, 1978-79

Type of Expenditure	Tegal Regency, Central Java		Maros Regency, South Sulawesi	
	Amount (000s Rp.)	Percent	Amount (000s Rp.)	Percent
Agricultural infrastructure development[b]	12,000	2.90	4,388	5.06
Transportation infrastructure	63,122	15.23	24,532	28.29
Public utilities	210,865	50.90	26,305	30.34
Other	128,287	30.97	31,490	36.31
TOTAL	414,274	100	86,715	100

[a]Land tax.
[b]Includes irrigation O and M, fish ponds, slaughter houses, etc.

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

C. Irrigation Projects

1. Kali Progo Irrigation Project

a. Background

(1) Description

The Kali Progo Irrigation Project (KPIP) is a national project which provides year around irrigation to 35,259 ha of land located in the lower Progo Basin contiguous to the city of Yogyakarta in central Java. The project area surrounds the city and lies in the Special Province of Yogyakarta.

The project is the culmination of work started in 1970 when the United Kingdom Overseas Development Administration supported a study of the Progo Basin. The Progo Basin lies on the south slopes and adjacent coastal plain of the 3,000 meters high cone of Merapi, an active volcano. The basin has an area of 327,000 ha of which 103,000 ha is cultivated (sawah) and grows at least one crop of rice each year. The lower basin is essentially contiguous with the Special Province. The Upper basin skirts the volcano toward the west and lies in Central Java Province. Following the study's recommendations, designs and construction started in the lower basin under a national project created in 1973 by order of the Minister of Public Works. This work proceeded using local funds for construction with equipment and services supplied by UK until 1978 when the World Bank provided a US$ 52 million loan to support the US$ 70 million KPIP. Previous investments totaled Rp. 10,000 million by Indonesia with a UK contribution totaling L 1,080,000.[24]

Irrigation services are classified as technical, semi-technical and non-technical. Technical systems supplement streamfed areas with government-run intakes and major canals. Semi-technical systems are those in which the intake structures remain under government control but the canals come under the village. Non-technical systems are fully village controlled. Besides the 35,000 ha in the lower basin under technical irrigation, technical and semi-technical systems serve another 20,000 ha in the Upper Basin. About 37,000 ha have non-technical service and 11,000 ha are rainfed.

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[24]Sources of documentation for this report are DGWRD, "Kali Progo Irrigation Project Yogyakarta," undated 8 p. and "Project Presentation. Kali Progo Irrigation Project-Phase 2. Sermo Dam, Upper Areas and Basin Planning" Departmen Pekerjaan Umum, Directorat Jenderal Pengainan Directorate Irigasi II. Project Irrigasi Kali Progo. Yogyakarta. Undated. 15 p.

Principal service under the KPIP is provided by the 31-km Mataram Main Canal which crosses 30 tributaries emanating from the slopes of the volcano. Some 220 pick-up weirs ranging in height from 1 to 7 meters divert water from tributary streams. On the western side, the 24-km Kalibawang canal conveys Progo water to some coastal areas and to about 1,600 ha along the west (right) bank of the river. This canal is located on steep slopes and crosses a number of deep valleys. The Directorate plans to improve service to the areas served by this canal with its proposed Sermo Dam which would provide 18 million cubic meters of reservoir storage. About 125 km of secondary canals and associated structures were rehabilitated. Water user organizations are being formed to manage the 1,080 tertiary units in the system.

(2) Agriculture in the project area

The Progo Basin has a population of 5 million. Most of the people are farmers and farm holdings are very small, about 0.15 to 0.3 ha. Three crops per year can be grown where water supply is available. Estimated cropping intensity for the project overall is 2.25. Annual yields anticipated after rehabilitation were 8.0 tons per ha dry paddy (14 percent moisture basis) up from 5.1 tons per ha before the project. From conversations with the President of one of the water user associations, who talked about seasonal yields of 9-10 tons per ha wet basis, using 140 kg nitrogen per ha, these targets are evidently being met or are surpassed in some areas. The acting Project Manager reported seasonal yields of 4 to 16 tons per ha, with 4 tons per ha minimal. Non-rice crops are raised for one season on a rotational basis after five to eight seasons in rice. These crops are principally sugarcane and vegetables. HYV rice is planted, although farmers are free--within limits--to choose varieties but the Agricultural Department may advise otherwise. Local rice varieties are subject to disease.

(3) Functioning of irrigation in the project area

The system seems to function very well and is in good condition but it has just been rehabilitated. Tertiary distribution channels are in reasonably good shape and fields are uniformly well watered.

b. Project management

(1) Administrative structure

The project is organized under the Directorate of Irrigation in Jakarta with a Project Manager in the Jogjakarta Headquarters assisted by various staff divisions including Planning and Design, Operations and Management, and Tertiary Development. There are ten separate systems under the project. The project has responsibility for management of the diversions main and secondary

canals, and in some instances tertiary or quartenary channels although these normally are the farmer's responsibility. The management is arranged hierarchically with ditch tenders or jurus at tertiary levels.

(2) Farmer organization and participation

Responsibility for management of tertiary distribution and maintenance has traditionally been with village officials. Beginning in 1980, the KPIP initiated a program to develop water user associations based on hydraulic divisions. The responsibilities of farmers through the WUAs are described in an interview with the President of one of these associations. The Association was organized in January, 1984. The tertiary under this WUA has an area of 70 ha. It has 254 members, 35 of whom are women. Membership is open to whoever is on the land, owner or tenants, in this association, but in some cases, we were told, it may be limited to owners. Officers meet at five-week intervals and the whole association meets annually. Scheduling is worked out. The 70 ha is divided into five rotational blocks and water is rotated one day out of five.

The cropping pattern is discussed and worked out through the WUAs. The organization also maintains discipline and can invoke penalties which are taken in paddy. Deciding upon maintenance and work programs is also a responsibility, but this seemed still to be controlled in part by village officials. During the dry season, water is available for only 55 ha. The WUA decides who shall plant and this is rotated annually. Regarding conflict resolution, the President stated that this is done by the President at any time. There was some expression that in difficult situations the village officials become involved.

How successful formation of WUAs will be is still to be tested. The one examined seemed to be functioning well; however, on this same lateral, the other six tertiaries do not have functioning water user associations.

b. Cost recovery

For main and secondary channels, O and M is fully subsidized by the Central Government except that farmers contribute voluntary labor. The annual O and M allowance is Rp. 15,000 per ha. There seemed to be mixed opinions by the project officials on whether or not this was adequate.

Project officials stated that the charge to farmers for maintenance of tertiary systems was 25 kg of paddy per ha. Members of the association visited, pay Rp. 8,000 per ha annually according to the President. Fees may also be paid in cash or by labor at the rate of Rp. 400 per half day. The President stated that farmers do pay their fees.

2. West Sumatra Sederhana Program

a. Background

The Sederhana Irrigation Program was instituted by the Government of Indonesia in 1974 in order to develop small-scale (no more than 2,000 ha each) low-cost irrigation by rehabilitation or new construction outside Java. This was part of the overall objective of achieving rice self-sufficiency and simultaneously providing increased employment and earnings in the rural areas. It was also intended that at a later stage construction of new systems in more sparsely populated areas would encourage resettlement from Java. Originally, the target was to establish Sederhana schemes on just over a half million ha in a five-year period. By 1981, over 1,800 small-scale irrigation projects had either been rehabilitated or constructed throughout the country.

The United States Agency for International Development (AID) joined this effort in June 1975 with the contribution of a US$ 20 million loan. AID funds were designated for reimbursement of local construction costs, for technical assistance to project management and for training. In 1978, AID financed the Sederhana II project with a US$ 25 million loan and a US$ 4.5 million grant to continued and extend the work of Sederhana I. Some of the projects described in this section were funded by AID.

Despite technical and management problems encountered by the Sederhana program and the uneven development in different places, the program has many advantages. It has been a stimulus to the Provincial Public Works departments who are responsible for implementation. The low cost has enabled a great many farmers to have irrigation who would not otherwise have it. An AID evaluation[25] found that the program had improved water security, facilitated double or triple cropping and increased rice yields. However, some of the problems included poor quality of work that meant high annual maintenance costs and the likelihood of extensive rehabilitation of structures within a relatively short time. On the whole, though, a World Bank review concluded that the program was imaginative and "with the right management, has the potential for improving the welfare of farmers outside Java more quickly than some of the larger, technically more complete, but more expensive and time consuming, irrigation schemes."[26]

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[25]USAID, Sederhana: Indonesia Small-Scale Irrigation, AID Project Impact Evaluation Report No. 29, February 1982, p. 5.

[26]The World Bank, Irrigation Program Review, Annex 2, p. 5.

(1) Description

(a) General

All Sederhana projects were designed and constructed in the simplest practical way. They are run-of-the-river gravity-fed systems consisting of a weir or diversion dam, a headworks canal structure, primary and secondary canals and tertiary and quartenary channels for on-farm water delivery. The size of completed systems varies from less than 50 ha to as much as 2,000 ha although most systems are smaller than 300 ha. Hydraulic design is often based on reconnaissance and topographic surveys with a minimum of detailed site information. This was apparent at some of the projects visited by the team in West Sumatra where the weirs were over-designed. The dams were much larger than was necessary given the water supply on the site. More specific descriptions of the project sites visited by the team follow.

In Sumatra, 95 percent of the irrigation consists of small-scale systems both because of the rugged topography and by virtue of the fact that many of the systems were built by the villagers themselves. The Sederhana program assisted in improving these systems by building more permanent structures. This enabled a cost savings because the traditional systems were temporary structures that were often washed away by annual floods and had to be reconstructed frequently. The program also built canals to improve distributional equity over the field-to-field irrigation practiced prior to the improvements.

(b) Guguk Landuk project

The Guguk Landuk project is located in Kabupaten Solok about 10 km south of Solok city. The system was newly constructed in 1981 at a cost of Rp. 105,980 and consists of the typical diversion weir with a lined canal 3.39 km long. About 25 ha on this scheme obtains water from another system as well. The design irrigation area is about 236 ha and actual irrigated area in the wet and dry seasons amounts to 190 ha. About 95 ha can be irrigated for a third crop. All the irrigated land is in one village with a population of 1,510 and about 400 families.

(b) Bandar Kuok project

The Bandar Kuok irrigation system is also located in Kabupaten Solok about 15 km south of Solok city. The system had been built originally in 1974 but it was rehabilitated in 1979-80 at a cost of Rp. 15,975 for the construction of a 1.5 km lined canal. Design irrigation area is 525 ha and only 70 percent of this is irrigated which amounts to a total of 367 ha for each of three seasons. More of the area could be irrigated if another canal was built. There is some dissatisfaction among the farmers who do not have

irrigation and feel that they could improve dry season farming with increased water supplies. There are four villages in the irrigation area which has 1,445 families and a total population of 5,389.

(d) Guguk Rantau project

The Guguk Rantau project is located 6 km south of Solok city and just south of the Bandar Kuok irrigation project. The project consists of the usual weir and 7.17 km of lined canals and was constructed at a cost of Rp. 265,282. The design irrigation area is 416 ha while actual irrigated area is 319 ha in each of three cropping seasons, the rest being planted in perennials or having settlements.

(e) Punggung Kasiek project

The Punggung Kasiek irrigation scheme is located in a reclamation area. The system was built in 1978 and consists of an upstream weir. At the farm level of the main canal system is lined and consists of three laterals with gates, one of which was not working. The system could provide irrigation for 4,243 ha but only 1,800 ha are now being cultivated. Water availability is not a problem but getting farmers to cultivate reclaimed land is difficult, primarily because of the lack of availability of credit for inputs.

(f) Bulakkan project

The Bulakkan project which was built in 1980 derives its water from two sources--a river and a natural spring. During the dry season, water from the river is used to supplement the spring. There is a weir at the spring site and a lined canal 1.5 km long. This construction improved reliability of the water supply although it did not extend the irrigated area. If the water in the system is well managed, it allows harvesting of two rice crops.

(2) Agriculture in the project areas

As shown in Table 5-13, the size of an average plot on the irrigation projects in Kabupaten Soloh is less than 5 ha and ranges between 0.28-0.47 ha with families holding from five to ten plots. On the average, just over 60 percent of farmers were owners in their own right on two of the schemes while on the third, 51 percent owned their land. Average farm income was lowest on Guguk Rantau at Rp. 227,000 and highest on Bandar Kuok with Rp. 466,000, most of the income coming from farm revenues and very little from wage labor on and off the farm.

Rice is the predominant crop and extension of irrigation led to an even greater emphasis on rice production to the extent that rice replaced palawija crops wherever water availability made it possible. Data in Table 5-14 show that improved irrigation is associated with increased yields ranging from 7 to 22 percent. It is possible,

Table 5-13: Farm Size, Ownership and Income on Selected Sederhana Irrigation Projects--West Sumatra

Project Area	Average Farm Size (ha)	Average Number of Plots	Percent Owners	Average Farm Income (000s Rp.)	Total Farm[a] Income (000s Rp.)
Guguk Landuk	0.41	4.79	51.16	206.47	261.47
Bandar Kuok	0.47	9.54	60.87	416.17	466.39
Guguk Rantau	0.28	9.77	60.42	168.27	227.02
Punggung Kasiek	NA[b]	NA	NA	NA	NA
Bulakkan	NA	NA	NA	NA	NA

[a]Included earnings from farm and non-farm labor.
[b]NA - Not available.

Source: The Sederhana Assessment Study (Bogor: P.T. Exsa, March 1985).

Table 5-14: Before and After Project Rice Yields and Fertilizer Use on Selected Sederhana Projects--West Sumatra

Project Area	Before Project Rice Yields[a] (kg/ha)		After Project Rice Yields (kg/ha)		Percent Change in Rice Yields		Fertilizer Use (kg/ha)
	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	
Guguk Landuk	2.6	2.6	3.2	3.1	23	19	188
Bandar Kuok	2.7	3.0	3.2	3.2[b]	19	7	175
Guguk Rantau	2.7	2.7	3.3	3.3[c]	22	22	200

[a]Paddy rice.
[b]In addition, a third crop of rice is harvested with a yield of 3.2/ha.
[c]In addition, a third crop of rice is harvested with a yield of 3.3/ha.

Source: The Sederhana Assessment Study, (Bogor: P.T. Exsa, March, 1985).

however, that increased rice yields may be a function of factors other than irrigation including increased fertilizer use, so the statistics should be treated with caution. On the other hand, irrigation has directly increased overall rice production by making possible a third crop in some areas (Guguk Rantau and Bandary Kuok) and greater dry season production in all three sites.

Comparable agricultural data on the Bulakkan and Punggung Kasiek irrigation schemes were available.

(3) Functioning of irrigation in the project areas

On-site inspection of the irrigation systems indicated that all of them were functioning well technically. To the extent that the technical improvement had increased water availability and reliability, farmers in the area were very satisfied. On the Bandar Kuok project where irrigation availability was constrained by the lack of a canal, farmers who did not have irrigation were dissatisfied. The systems themselves were in good condition since most of them had been recently built. They were also fairly well-maintained.

b. Project management and farmer participation

Project management and farmer participation are jointly treated here because small-scale irrigation systems are intended to be wholly managed by the farmers themselves. However, this was not the case on at least four of the projects visited. While it was not possible to determine whether the Bulakkan scheme was officially managed, on each of the other schemes the team met with the official gate keepers. As on the larger irrigation schemes, the juru was responsible for care of the main permanent canal structures while farmers were expected to take care of the farm-level channels.

The Chief Engineer of Public Works (Sumbar) was greatly in favor of improved concrete channels for small-scale irrigation because it saved on land requirements and made it easier to maintain the channels.[27] O and M on the systems visited appeared to be good both on the main systems and the farmer-maintained tertiary and quartenary channels. The leader of the WUA at Punggung Kasiek felt it was difficult for him to secure cooperation of other farmers in weeding and maintaining channels.

[27] Interview with Mr. Sabri Kasim.

The development of viable WUAs was an important element of the Sederhana program. As reported in an audit in 1979, of the 52 systems funded by AID until then, only 20 had organized WUAs.[28] As a supplement to this effort, the High Performance Sederhana Irrigation System (HPSIS) was added to test and refine the participatory approach to development of small-scale irrigation. Some of its motivation derived from the problems encountered by the Sederhana program with respect to destroyed or non-functioning structures, poor O and M and poor design which were attributed to lack of farmer participation in system design and construction. Early involvement of farmers was expected to facilitate farmer participation in O and M after construction. Research on HPSIS sites, while not conclusive, supports this hypothesis.[29]

On the sites visited by the team, there was little evidence that viable WUAs had been established. At Punggung Kasiek, an informal association had been organized with 30 members. Joint management was not a problem because of the adequate water supply and members cooperated on keeping the channels clean. An interview with the organizer indicated, however, that the organization was loose and unstructured and mainly held together by his leadership.

Additional evidence was obtained about a WUA at Bandak Kuok. The association consisted of 78 members and a complete set of officers. Members generally cooperated on cleaning the canals twice a year, but the leader felt he could obtain their cooperation on little else. Neither did the officers participate to an extent. The members did not make any financial contributions to the WUA. The leader of the WUA had attended a training session and felt that he could make improvements if he were given funds directly instead of having to obtain them from the village head. It also seemed that members who were not receiving water during the dry season had little incentive to participate in the WUA. However, the team was unable to find out what proportion of the members were not receiving irrigation water.

c. Cost recovery

The issue of cost recovery for improved O and M is of great concern in the Sederhana program and the formation of WUAs was regarded as a mechanism for ensuring both cost recovery and farmer involvement in O and M. Data were not available on the amount of farmer payments, if any. No payments were collected in the two established WUAs. However, systems were well maintained and farmers contributed their own labor for this purpose. There were no estimates available of the imputed value of these labor contributions. As

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[28]USAID, Evaluation Report, p. 10.

[29]David Robinson, "Farmer Participation in the High Performance Sederhana Irrigation Systems Project in Indonesia, USAID (Jakarta: December 1984).

suggested in Section B.3.b., such contributions can be considerable and farmer ability and willingness to pay is quite evident from more general evidence throughout the country.

D. Summary and Conclusions: Study Issues

1. To what extent is cost recovery through direct and indirect charges a feasible goal in irrigation systems?

In Indonesia, cost recovery is focused on O and M costs and on the basis of the available data, the outlook is encouraging. At the farm level, payments are quite substantial in some places, the farmers making monetary and in-kind contributions and contributing voluntary labor. The WUA at the Kali Progo project was able to collect fees from its members in the amount of Rp. 8,000 per ha or voluntary labor in lieu thereof valued at Rp. 400 per half day of labor provided. On the Sederhana schemes visited, there was no clear evidence of the amounts of farmer payments but they had no difficulty with organizing labor groups for channel cleaning and maintenance several times per year.

Main system O and M in technical systems requires about Rp. 15,000 per ha for adequate maintenance but funds in that amount are not generally available from the central government for the purpose. Some attention is now being given to making increased IPEDA funds available for O and M although the funds are actually for a variety of development purposes and not for O and M. In addition, there are also plans to investigate the potential for raising IPEDA charges but this requires a major land reclassification effort before it can be done.

In Indonesia, direct charges at the farm level, wherever they exist, are an important source of funds for O and M for tertiary and quartenary structures. The indirect IPEDA tax is intended primarily for development purposes although currently some consideration is being given to use it for O and M as well.

2. Do increased farmer participation and control contribute to improved cost recovery?

Wherever farmers participate and feel they have control over the systems in Indonesia, cost recovery does not seem to be a problem. This is particularly the case with traditional systems. However, attempts to establish WUAs on government-funded systems have not been so successful because farmers feel that they should be maintained by the government who built them. Data on this subject were not available from the sites the team visited.

3. To what degree does improved cost recovery depend upon reliable water supply, adequate water supply, water delivery and measurement technology?

Evidence available from the Bandak Kuok Sederhana project suggested that the WUA was unable to collect dues from its members because they did not feel that they had an adequate and reliable water supply. On the other hand, farmer payments in other irrigation areas throughout the country indicate that farmers are both willing and able to pay for irrigation if they feel they have adequate water supplies to ensure good returns. We were unable to obtain information on whether improved water delivery and measurement technology results in improved cost recovery. While the existence of delivery technology makes possible the institution of sanctions against non-payers there is great reluctance to use this.

4. Are increased water charges a necessary and sufficient condition for improved O and M? To what extent does efficiency of water use vary with the cost of water?

The Gadjah Mada study indicated that current availability of funds for O and M for main systems on government projects is not adequate. Therefore, it is important that the government investigate possibilities for securing additional funding for O and M. There is some reluctance to instituting direct water charges as this may be politically difficult but the IPEDA is an alternate avenue for raising revenues. Whether this will be implemented is not clear. Thus, it is necessary to get additional revenues for O and M on government-managed systems but there is no way to tell yet whether this will be sufficient.

One avenue that is being tried to improve O and M is to encourage formation of WUAs below the tertiary level even on the large technical schemes. These have not generally been successful because the farmers are not accustomed yet to paying for O and M on these schemes. On the other hand, O and M on the smaller schemes is generally good and presumably farmers are able to raise sufficient financial and labor resources in various combinations to maintain their systems adequately.

Data were not available on the efficiency issue as related to water charges. But as water is scarce and essential to improved rice production farmers presumably use the water efficiently.

5. Do institutional arrangements whereby farmers participate in and control irrigation systems improve O and M?

In general, the answer seems to be in the affirmative with the qualification that farmers have to feel that it is genuinely their system. This is easier to accomplish on irrigation systems that were built by farmers themselves but much harder to do on systems built or rehabilitated by the government. Farmers generally believe that O and M responsibility should lie with the government if it built or

rehabilitated a particular irrigation system. On the other hand, the government hopes that farmers can be persuaded through training and work with community organizers to accept responsibility for farm-level O and M on government constructed systems. Actually, the process involves changes in attitudes and methods both on the part of farmers and of PU officials.

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