Financing Irrigation Services in the Republic of Korea

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INTRODUCTION

Agriculture and the Korean Economy

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

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

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

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

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

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

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

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

Table 3.2. Use of national land, 1983.

Type of land	Area (ha)	% of total land area
Cultivated land	2167000	21.9
Rice fields	I3I6000	(13.3)
Upland	851000	(8.6)
Forest land	6547000	66.1
wooded	6282000	(63.4)
Denuded	240000	(2.4)
Uninvestigated	25000	(0.3)
Others	I 195000	12.0
Total forest and other land	7742000	78.1
Total national land	9909000	100.0

Source: Ministry of Agriculture (1984).

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

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

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

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

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

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

Year	Total rice[a]			Lowland Rice			Upland rice		
	A	B	C	A	B	C	A	B	C
1978	1229750	4.71	5797128	1219071	4.74	5779142	10679	1.68	17980
1979	1233234	4.51	5564808	1224157	4.53	5545763	9077	2.10	19045
1980	1233305	2.88	3550257	1219841	2.89	3529540	13197	1.57	20717
1981	1223892	4.14	5062975	1212258	4.16	5039557	11634	2.01	23418
1982	1188073	4.36	5175073	1175964	4.38	5105963	12109	1.99	24210
1983	1228481	4.40	5404045	1219645	4.42	5387740	8836	1.85	16305

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

[a]Unless otherwise specified, "rice" refers to "unmilled rice."
Source: National Agricultural Cooperative Federation (1984:28).

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

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

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

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

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

Souce: Ministry of Agriculture and Fisheries (198432-33)

Agriculture and the Fifth Economic and Social Development Plan

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

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

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

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

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

Irrigation Systems Development

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Source: Agricultural Development Corporation (1985).

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

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

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

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

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

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

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

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

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

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

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

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

CAPITAL COSTS OF IRRIGATION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Source Agricultural Development Corporation.

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

Table 3.14. Construction costs of five mediumscale irrigation projects.

Project district	Total cost[a] (Million won)	Benefited area (ha)	Cost ha (Million won)
Chunseo	lx20.1	258	1.1
Sewol	378.1	66	5.7
Kosan	xs4 1	122	7.0
Hoam	831.4	121	6.9
Samduk	657 0	123	5.3

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

OPERATION AND MAINTENANCE COSTS

Budgetary Procedures for the Provision of O&M Funds

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Expenditures for O&M

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

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

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

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

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

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

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

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

Desired Expenditures for O&M

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

Control over Expenditure Decisions

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

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

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

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

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

Output Price Policies

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

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

Price Policies for Inputs other than Water

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

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

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

Tax Policies

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

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

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

In the absence of the detailed farm records needed for the calculation of the taxable income, a farmer may elect to have the taxable income based on standard yield and expenditure figures. For rice, the standard yield depends on the class of farmland, and is converted to value terms at the government price of rice. Deductible production expenses include all direct production expenses, excluding the value of family labor. It has been suggested that the use of standard yield and expense figures results in taxable incomes which are low relative to actual cash incomes (Harris 1979348).

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

Table 3.16. Farmland tax rates, 1985.

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

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

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

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

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

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

Nature and Magnitude of Direct Irrigation Benefits

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

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

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

Some postproject evaluations have also reported large increases in yields as a result of irrigation. In an evaluation of the results of a United States Agency for International Development (USAID) loan-financed report of some 66 small-scale irrigation projects, it was noted that the average increase in yields in 14 projects visited was 2.4 metric tons of polished rice/ha, with increases in the individual projects ranging from 1.5-3.6 tons (Steinberg et al. 1980:4). These figures, however, represent the change in yields between 1974 and 1979 as reported by farmers when questioned by the evaluation team. No attempt was made to assess the reliability of these estimates, or to separate the effect of irrigation from other factors affecting yields. An evaluation of the results of several medium-scale irrigation projects financed under a World Bank loan reported increases in rice yields ranging from 1.0-1.3 tons of polished rice/ha, with the average increase being 1.1 tons (Kim 198248). Again, however, the increase (which the report attributes entirely to irrigation) is simply the difference in yields before and after the project.

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

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

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

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

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

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

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

[c] Based on data for FLIAs.

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

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

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

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

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

Calculations based on Kim's data are presented in Table 3.19. The last line of Estimate 1 presents Kim's estimates of the increase in net income due to irrigation. These range from 663,000-8 19,000 won/ha. Also shown in the table are the major components underlying the estimated increase in net income.

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

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

[a]Polished rice.

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

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

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

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

Source: Kim (1982).

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

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

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

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

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

Estimates of Farmers' Ability to Pay for Irrigation Services

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

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

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

Project and basis for estimate	Water charges as percentage of:			
	Total gross income	Incremental gross income	Total net income	Incremental net income
1. Im Jin (projections)				
a. Average, all sources of increased agricultural income	n.a.	n.a.	6.7	13.0
b. Average, composite farm	4.6	9.3	6.4	11.7
c. Average, rice farm	6.7	16.8	9.3	20.9
2. Pyongtaek-Kumgang (projections)				
a. Average, farm with rice-barley rotation	13.9	25.8	25.4	32.1
3. Average, 15 small-scale projects (*ex post* evaluation)	n.a.	11.6	n.a.	n.a

n.a. = not available.
Sources: Ahmad, Perez, and Kanamori (1983), World Bank (1969), and Steinberg et al. (1980).

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

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

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

	District in which project is located				
	Chunseo	Sewol	Kosan	Hoam	Samduk
Estimate 1: Based on reported total increase in yields					
Incremental net income/ha, 1982 ('000 won)	819	666	721	719	663
Incremental net income/ha, adjusted to 1983 prices ('000 won)	880	715	774	172	712
Average water charges, 1983 ('000 won/ha)	196	196	146	166	136
Benefit recovery ratio (%)	22	27	19	22	19
Estimate 2: Based on increase in land values					
Incremental net income/ha, 1982 ('000 won)	371	181	262	512	706
Incremental net income/ha adjusted to 1983 prices ('000 won)	398	194	281	549	757
Average water charges, 1983 ('000 won/ha)	196	196	146	166	136
Benefit recovery ratio (%)	49	101	52	30	18

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

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

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

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

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

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

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

Implications of Alternative Policies

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

Rough estimates of average costs and returns to irrigated rice production in Korea for 1983 are presented in Table 3.23. These are based on the estimated average yield of irrigated rice, average water charges for irrigation, and average costs of production for rice as estimated by the Ministry of Agriculture and Fisheries on the basis of its annual Production Cost Survey of Agricultural Products. The returns shown represent the returns to all family resources (land, labor, capital, and management) assuming that all land is owned by the family. In situations where part of the land is rented, the returns would be correspondingly lower.

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

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

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

Item	*Assumed* policy conditions				
	World rice prices[a] with actual water charges	Actual rice prices with water charge raised to 100% cost recovery, assuming:		World rice prices[b] with water charges raised to 10% *cost* recovery, assuming:	
		moderate investment cost[b]	high investment cost[c]	moderate investment cost[b]	high investment cost[c]
Gross receipts	6500	6500	6500	6500	6500
Water charges for O&M	506	334[d]	334[d]	704[d]	704[d]
for capital repayment	148	1476	2285	3112	4819
in-kind labor contributions	(48)	(23)	(23)	(48)	(48)
Other purchased current inputs, excluding labor	1488	706	706	1488	1488
Hired labor	751	356	356	751	751
Returns to family-owned resources[e]	3607	3628	2819	445	-1262

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

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

[c]Assumed to be 9,000,000 won/ha, which is equivalent to an annualized value of 1,15 1,840 won/ha (based on Table 3.29).

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

[e]If family owns all land farmed.

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

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

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

[a]Unmilled rice.

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

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

[d]Noncash item.

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

fMinistry of Agriculture and Fisheries (1985:299).

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

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

Sources: [a]National Agricultural Cooperative Federation (198484); [b]National Agricultural Cooperative Federation (198482); [c]National Bureau of Statistics (1984451); [d]National Agricultural Cooperative Federation (198484); [e]National Agricultural Cooperative Federation (198481); [f]1978 estimate of US$270 taken from World Bank Social Indicator Data Sheets (World Bank 1984a) and converted to 130,680 won at the 1978 exchange rate of 484 won/dollar. Using the Implicit GDP Deflator, this was converted to 252,000 won at 1983 prices.

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

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

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

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

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

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

DIRECT METHODS OF FINANCING IRRIGATION SERVICES

Policy Principles

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

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

Financing Mechanisms

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

Assessment, Billing, and Collection Procedures

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Enforcement

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

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

fees (Shim **1985).** The current penalty is equivalent to five percent of the charge if payment is made within the first month after it was due. For each succeeding month, an additional 2 percent penalty is added, but with a maximum penalty limit of 15 percent. If a farmer has not paid when this ceiling is reached (i.e., the charge is six months overdue), the FLIA can initiate legal proceedings to sell the assets (excluding farmland, which by law cannot be sold for nonpayment of taxes) of the farmer to recover the charge. Wade **(198287)** notes that in such situations, the police can sequester assets of the farmer valued at the amount owned, and *can* sell them after 15 days if the farmer has still not paid. It appears, however, that this procedure is very rarely implemented, as most small-scale farmers have few assets that could be sold.

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

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

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

Collection Efficiencies

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

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

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

Collection Costs

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

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

INDIRECT METHODS OF FINANCING IRRIGATION SERVICES

Secondary Income

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

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

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

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

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

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

Local Taxes

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

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

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

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

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

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

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

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

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

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

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

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

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

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

RELATIVE CONTRIBUTION OF FARMERS TO IRRIGATION FINANCING

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

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

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

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

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

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

[a]Unmilled rice.

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

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

	Total cost	Cost to FLIA
Net construction cost	5000000	1500000[a]
Design (3% of net)	150000	0
Supervision of construction (10% of net)	500000	0
Subtotal	5650000	1500000
Interest during construction[b]	1725000	0
Total cost at end of construction	7375060	1500000
Annualized value	743800[c]	52000[d]
Annual O&M costs	185000	170000
Total annualized cost	928800	222000

[a]Assumed to be 30 percent of total.

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

'Assuming a 50-year life, at 10 percent interest.

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

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

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

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

[b] Assumes irrigation service fees represent 7% of total revenues of the FLIAs.

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

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

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

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

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

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

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

EVALUATION OF FINANCING POLICIES

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

Efficiency in Water Use

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

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

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

Efficiency in Investment

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

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

Efficiency in Management

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

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

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

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

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

Income Distribution between the Public and Private Sectors

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

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

Income Distribution within the Private Sector

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

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

REFERENCES

Agricultural Development Corporation, Republic of Korea. 1984. Yearbook of land and water development statistics 1984. Anyang Kyonggi-Do, Republic of Korea

Agricultural Development Corporation, Republic of Korea 1985. Yearbook of land and water development statistics 1985. Anyang Kyonggi-Do, Republic of Korea.

Ahmad, Naseer; Perez, Antonio T.; Kanamori, Nabou. 1983. Project completion report of the Im Jin Area Development Project (Loan No. 208-KOR) in the Republic of Korea. Manila, the Philippines: Asian Development Bank.

Bank of Korea. 1984. National income accounts. Seoul, Republic of Korea.

Boumphrey, R.S. 1985. Economic survey of the Republic of Korea. Manila, the Philippines: Asian Development Bank.

Gyong Gi Province, Republic of Korea. 1984. Official guidelines for agricultural land tax. Original in Korean.

Harris, Randolph L.P. 1979. Agriculture. In Parvey Hasan and D.C. Rao (eds.), Korea: Policy Issues for Long Term Development. A World Bank Country Economic Report. Baltimore, MD, USA: John Hopkins University Press.

Kim, Bong-Koo. 1982. Evaluation study on medium scale irrigation project under IBRD loan. Evaluation Report. Seoul: Korea Rural Economics Institute.

Ministry of Agriculture and Fisheries, Republic of Korea. 1982. Yearbook of agriculture and forestry statistics. Seoul, Republic of Korea

Ministry of Agriculture and Fisheries, Republic of Korea. 1984. Statistical yearbook of agriculture, forestry and fisheries. Seoul, Republic of Korea.

Ministry of Agriculture and Fisheries, Republic of Korea. 1985. Reports on the results of Farm Household Economy Survey, Production Cost Survey of Agricultural Products, Food Grain Consumption Survey, Seoul, Republic of Korea.

National Agricultural Cooperative Federation, Republic of Korea. 1984. Agricultural cooperative yearbook 1984. Seoul, Republic of Korea.

National Bureau of Statistics, Economic Planning Board, Republic of Korea. 1984. Korea statistical yearbook 1984. Seoul, Republic of Korea: Government Publication Center.

National Bureau of Statistics, Economic Planning Board, Republic of Korea. 1985. Major statistics of Korean economy 1985. Seoul, Republic of Korea: Government Publication Center.

Oh, Ho-Sung. 1978. Customary rules of water management for small irrigation reservoirs in Korea. Journal of Rural Development 1(Nov):96-110.

Shim, Young Kun. 1985. Development of farmland improvement association in Korea. Research report submitted to the International Irrigation Management Institute, Digana, Sri Lanka, December.

Steinberg, David I. et al. 1980. Korean irrigation. AID Project Impact Evaluation Report no. 12. Washington, DC: USAID.

Study Group on Asian Tax Administration and Research. 1983. **Property valuation practices in** selected countries in Asia and the Pacific. Manila, the Philippines.

Wade. Robert. 1982. Irrigation and agricultural politics in South Korea. Boulder, CO, **USA:** Westview Press.

World Bank. 1969. Korea Pyongtaek-Kumgang Irrigation Project. Report no. PA-6a. Washington, DC: Agriculture Projects Department, World Bank.

World Bank. 1984a. Republic of Korea: Agricultural sector survey. Report no. 4709-KO. Washington. DC.

World Bank. 1984b. Social Indicators Data Sheets. Washington, DC: Economic Analysis and Projections Department. World Rank.