

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

INTRODUCTION

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

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

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

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

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

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

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

OVERVIEW OF THE DEVELOPMENT OF KOREAN IRRIGATION INSTITUTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

KEY FINANCIAL ISSUES UNDERLYING THE DEVELOPMENT OF KOREAN IRRIGATION INSTITUTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Establishing Enforceable and Politically Acceptable Irrigation Fees

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Maintaining Financial Autonomy within a System of Government Subsidies

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

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

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

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

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

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

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

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

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

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

CONCLUSIONS

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

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

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

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

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

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

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

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

APPENDIX

FINANCING OF RESERVE FUNDS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(Continued on page 137)

(Annex 2, continued)

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

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

^bNo data available.

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

Annex 3. Rice prices and farm wage rates.

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

(Continued on page 139)

(Annex 3, continued)

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

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

^bFrom 1924-1935, farm wage rates are in *yen* per day; from 1959-1979 they are in *Won* per day.

^cThese figures represent the number of man-days needed to buy 1 ton of milled rice.

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

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

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

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

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

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

^aBased on data on rice prices and rural wage rates in Annex 3, and a milling recovery rate of 0.72.

^bNo data available.

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

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

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

^aThis is the number of associations for which data on collections are available.

^bFees collected in-kind were converted into their equivalent monetary value.

^cFigures are in terms of unmilled rice. For 1971-1984, the figures have been converted from data on cash value.

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

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

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

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

Source: Agricultural Development Corporation 1985.