

# 專 論

## 臺灣農田水利設施維護管理之財務結構

### Financial Structure Concerning the Maintenance of Watercourses for Water Management in Taiwan

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#### 摘 要

- 臺灣之大部分灌溉設施由農田水利會營運管理，其所需經費包括徵收費用及政府補助。在徵收四種費用中，主要一項為會員繳納之普通會費。其標準依據各地不同用水情形而定，並由政府規定每公頃每年稻穀最高 270 公斤（原為 300 公斤），最低 20 公斤，並以稻穀價格計收。
- 上項普通會費標準早在 20 年以前規定，目前所徵收之金額逐漸不敷農田水利會營運管理之需，故政府為不增加農民之負擔，每年提供補助以代替調整會費標準。惟政府每年之補貼不定，一般而言，仍不足所需，此種情形，自然影響設施之維護管理工作。
- 農田水利設施必須經常維護其正常之供水功能，雖徵收費用有限，且政府補貼不定，但農田水利會仍為農業發展而盡力配合。
- 鑒於人事費、工資、材料費等不斷在增加，水利會將難以順利推行其營運管理工作，亟待政府之支持或調整會費標準，然此一問題頗為複雜，需要多方面共同研究解決。
- 本文係提出國際灌溉排水協會 1984 年在美國舉行第十二屆大會之論文，在本學報轉載。

#### Abstract

Irrigation systems in Taiwan are mostly operated and managed by irrigation associations (IA). For financing their regular operations, the IAs collect fees and receive government subsidies. Among the four kinds of fee collected by the IAs, the major one is the ordinary membership fee paid by all the members. Its rate, though different according to water uses, has a government-fixed upper limit of 270 kg (originally 300 kg) and a lower limit of 20 kg of paddy per hectare per year, which are collected in cash according to the prevailing price of paddy.

The ordinary membership fee was rated more than 20 years ago. Hence, its total collection is insufficient to finance IA operations year by year. To make up for this deficit, the government has annually provided subsidies instead of adjusting the rate in order not to increase

the burden of farmers. However, the amount of government subsidies, which depends on the availability of its annual budgets, is generally not sufficient to meet actual requirements. Such a policy has affected the maintenance of watercourses to the detriment of water management practices.

Watercourses and related structures should be maintained in good shape or improved to obtain a higher reliability of water management. A case study shows that water conveyance losses could be minimized to a certain degree, and irrigation could be performed more efficiently, if watercourses were well maintained. In spite of unstable financing from the government, the IAs have managed to keep pace with the promotion of agricultural development.

Owing to the ever-higher personnel expenses, labor wages and material prices, it has become more and more difficult for the IAs to fulfill their responsibility in irrigation operation and management. It behooves the government to provide steady financial support. Otherwise, it is desirable that the present rate of ordinary membership fees be properly adjusted. This is a complicated problem that needs to be solved through a multi-disciplinary approach.

## 1. Introduction

Taiwan has about 500,000 ha irrigated lands, of which 85% are under the jurisdiction of irrigation associations (IA) organized by the farmers who are benefited from irrigation facilities. There are now 17 district IAs established according to water regions and a joint IA responsible for the coordination of IA activities.

The major functions of IAs are construction, improvement and maintenance of irrigation/drainage facilities as well as water management. Financial sources for new-construction and large improvement projects come mainly from government subsidies and partially from loans as local matching funds. Loans are repaid with interest by project beneficiaries, whose repayment ability is contingent upon both the amount of loans extended and the degree of benefits derived from the project. The financing of new construction projects is not discussed here, it being not concerned so much with the subject of this paper.

In principle, the expenses annually required for watercourse improvement and maintenance, and consequently for better water management should have been fully covered by the total collection of various fees. However, the collection of ordinary membership fees, which accounts for a large portion of each IA's annual revenues, is inadequate. This has greatly affected the maintenance of watercourses, and thus is discussed in detail.

Watercourses and related structures are important infrastructures, which should always be kept serviceable to supply water for agricultural production. Taiwan, however, is an island located in the sub-tropical region with strong winds and heavy rains in typhoon seasons that are easy to cause damage to the water delivery systems. It is, therefore, necessary to perform proper and timely maintenance work to make the water delivery systems highly reliable for more efficient water management. At present, how-

ever, the rate of ordinary membership fees is rigidly fixed and the policy of government subsidization unstable. This situation has given rise to financial problems among the IAs.

## 2. Collection of Fees

With the approval of competent authorities as stipulated in the Water Law of the Republic of China, the IAs are organized in accordance with the General Rules Governing the Organization of Irrigation Associations. They are public juridical persons allowed to collect various kinds of fee as their financial sources for the operation and maintenance of irrigation systems as well as for their administrative and personnel expenses.

### 2.1 Law and Rules

The Water Law and the General Rules Governing the Organization of Irrigation Associations are the legal basis for the collection of fees, and the Organizational Regulations of Irrigation Associations are the guideline for execution.

#### (1) Water Law

The law was promulgated by the National Government on July 7, 1942, and lastly amended and put into effect on February 2, 1974. It consists of 99 articles in 10 chapters. Article 89 of Chapter 8 provides for the collection of fees by irrigation associations. It reads in part:

“The sponsor of water conservancy projects may charge fees from the users according to the conditions of use of the water conservancy works. The authority-in-charge shall fix the maximum and minimum rates of the fees referred to in the preceding paragraph, and submit them to superior authorities for decision.”

#### (2) General Rules Governing the Organization of Irrigation Associations

The general rules were promulgated on July 2, 1965, and lastly amended on December 17, 1980. They consist of 41 articles in 7 chapters. The articles that concern the collection of fees are:

Article 25. Ordinary membership fees shall be collected from all the members that are benefited from irrigation and drainage systems. Those who request more irrigation water or water through pumping shall pay additional fees according to the degree of benefits.

Article 28. Irrigation associations may also collect fees from the users of irrigation facilities and surplus water. The fees thus collected shall be a portion of their revenues. Article 29. The superior authority shall decide the rates of various fees and work out measures for collection.

#### (3) Organizational Regulations of Irrigation Associations

These regulations were promulgated on November 17, 1955, and amended on March 27, 1982. They consist of 98 articles in 6 chapters. Article 84 reads in part:

“Fees from ordinary members and from the users of irrigation facilities and surplus water shall be calculated in terms of paddy and collected in equivalent cash according to the official paddy price.” It stipulates the following rates of fees:

- a. For the cultivated lands benefited by both irrigation and drainage systems, the rates of ordinary membership fees will be set between an upper limit of 300 kg and a lower limit of 20 kg of paddy per hectare per year according to cropping patterns, yields, irrigation costs, benefit degrees, etc. For the cultivated lands benefited only by drainage systems, the ordinary membership fee will be reduced by half.
- b. The rate of fees to be collected from the users of irrigation facilities and surplus water will not be less than the maximum rate of ordinary membership fees, subject to the decision to be made at a meeting of IA members’ representatives.
- c. Additional fees will be collected from those members who ask for supplying more irrigation water, with the rate of such fees to be determined according to the degree of benefits.
- d. For those cultivated lands irrigated by water through pumping, additional fees will be collected according to the actual cost of operation and maintenance.

## 2.2 Kinds of Fees

In compliance with the above-mentioned regulations, the following four kinds of fee are collected by the IAs as their major financial sources for the management and maintenance of irrigation systems:

### (1) Ordinary Membership Fees

Ordinary membership fees are paid by all the IA members at different rates, which are determined according to cropping patterns and areas with irrigation water generally supplied by gravity methods. The rates are set as specified in paragraph 2.1(3), but have since 1971 been lowered by 10% (i.e. from 300 kg to an average of 270 kg of paddy per hectare per year for the upper limit) in order to minimize the burden of farmers.

The market price of paddy is lower than the official price. At the request of farmers and with the approval of the government, the IAs have since 1979 collected ordinary membership fees in cash fixed according to the market price. The difference between the market and official prices is subsidized by the government.

### (2) Pumping Irrigation Fees

In many cases, water for supplementary irrigation has to be pumped from rivers, drains or wells. This is particularly true of high lands where water cannot be supplied by gravity methods. Therefore, extra charges in addition to the ordinary membership fee are paid by those members who agree to use pumps for the irrigation of their crop-lands. Generally, the pumping irrigation fees are determined according to the actual cost of pump operation and maintenance.

### (3) Additoinal Irrigation Fees

Usually, irrigation water is supplied to the fields for the originally registered crops. If water sources are available, farmers may request more water to improve the growth of their original or other crops, but have to pay additional irrigation fees according to the degree of benefits.

### (4) Other Fees

These include the fees collected from those who lease IA's facilities or use surplus water for other purposes than irrigation. The amount of such fees is only a minor portion of each IA's annual revenues.

## 2.3 Methods of Collection

Fees are assessed annually and collected in two installments after the harvest of the first and second rice crops. There are different ways for individual farmers to pay the fees.

- (1) They may pay the fees at the working stations of their respective IAs.
- (2) They may pay the fees at the local banks or credit departments of farmers' associations specifically entrusted by the IAs.
- (3) They may pay the fees to the authorized staff of IAs (including heads of irrigation groups) who go to their homes for the collection.

## 2.4 Status of Collection

Owing to industrialization and urbanization, the area of croplands served by IAs has gradually decreased. In 1980, it totaled 410,000 ha. The collection of ordinary membership fees therefrom amounted to an equivalent of 86,000,000 kg of paddy or 77% of the total annual fees collected. The four kinds of fee actually collected in FY1978-81 are shown in Table 1.

Table 1. Collection of Fees by IAs (Unit: NT\$1,000)

Description	FY1978	FY1979	FY1980	FY1981	Average	%
Ordinary membership fees	774,671	690,966	750,600	697,160	728,349	76.65
Pumping irrigation fees	143,405	154,167	164,097	182,414	161,021	16.94
Additional irrigation fees	67,269	64,307	65,213	40,725	59,379	6.24
Other fees	1,145	1,221	1,717	2,099	1,545	0.16
Total estimated	986,490	910,661	981,627	922,398	950,294	100
Total actually collected	972,591	897,690	969,574	904,700	936,139	98.51
% of actual collection	98.59	98.58	98.77	98.08	98.51	98.51

Source: Data supplied by the Joint Irrigation Association

Exchange rate: US\$1.00 = NT\$40.50

### **3. Disbursement**

In principle, the annual budget of an IA is drawn up to meet the requirement for all the expenses in relation to the construction, operation and maintenance of irrigation facilities. As a nonprofit organization, however, the IAs have to use all the fees collected from their members to carry out whatever functions may be imposed upon them.

#### **3.1 Regulations**

The disbursement of each IA's revenues is not only governed by relevant regulations but audited and reviewed by government agencies as well. The following are fundamental rules in this regard.

##### **(1) General Rules Governing the Organization of Irrigation Associations**

Article 31. All the fees collected from the members of irrigation associations shall be used for the construction, improvement and maintenance of irrigation facilities and for the defrayment of administrative and personnel expenses, with surplus, if any, reserved for use against depreciation or repairs.

Article 33. The accounting procedures of irrigation associations shall be decided by the government agency concerned, and their annual budgets of revenues and expenditures shall be drawn up and executed in accordance with the accounting procedures.

##### **(2) Organizational Regulations of Irrigation Associations**

Article 85. The annual budget for the maintenance, improvement and replacement of irrigation facilities shall amount to 1.5-2.0% of the current total value of the irrigation facilities. Personnel expenses shall be included in the budget to meet the needs of payment for the approved number of staff. . . . .

Article 94. In case the irrigation associations are not able to carry out their functions, the government shall render financial and technical assistance. The amount of government subsidies shall not be less than 1.5% of the current value of irrigation facilities.

#### **3.2 Major Disbursement Items**

##### **(1) Personnel Expenses**

This includes salaries for staff, wages for temporary laborers, housing allowances, insurance premium, retirement pay, etc.

##### **(2) Expenses for Maintenance and Improvement of Irrigation Facilities**

This includes all the costs for the engineering construction, improvement, repair and maintenance of watercourses and related structures.

##### **(3) Expenses for Irrigation Operation and Management**

This includes per diem and transportation fares for irrigation operators, wages for field laborers, costs for materials, and electric bills for pumping irrigation.

(4) Expenses for Local Irrigation Groups

This covers allowances for heads of the irrigation groups organized by farmers themselves, expenses for carrying out duties, meetings and work contests, and wages for ditch tenders.

(5) Expenses for Pre-engineering Studies

This covers expenses for engineering investigations, surveys, planning and designing before project implementation.

(6) Expenses for Financial Operations

The includes per diem, transportation fares, costs for materials, wages for temporary workers, etc.

(7) Administrative Expenses

This includes expenses for equipment, stationery, electricity, gas, water, repairs, etc.

(8) Reserve Funds

A certain percentage of the surplus from the annual IA budget should be reserved for use against the depreciation of irrigation facilities.

(9) Other Expenses

This includes payments of interest on loans, expenses for cooperation with other agencies, and miscellaneous disbursements.

### 3.3 Status of Disbursement

The annual disbursement of IA revenues (i.e. their total collection of various fees) is shown in Table 2. Among the disbursement items, personnel expenses rank the highest. Other major disbursements are for the operation and management of irrigation systems, for the maintenance and improvement of irrigation facilities, and for the support of local irrigation groups.

**Table 2. Disbursement of IA Revenues (Unit: NT\$1,000)**

Description	FY1978	FY1979	FY1980	FY1981	Average	%
Total collection of fees	972,591	897,690	969,574	904,700	936,139	100
Personnel expenses	404,397	462,839	517,520	580,539	491,324	52.48
Expenses for maintenance and improvement of irrigation facilities	224,688	105,549	129,261	50,332	127,458	13.62
Expenses for irrigation operation and management	124,217	118,377	145,870	157,322	136,447	14.58
Expenses for local irrigation groups	92,190	79,075	82,780	54,204	77,062	8.23
Expenses for pre-engineering studies	4,085	3,392	340	314	2,033	0.22
Expenses for financial operations	46,214	40,737	34,311	32,031	38,323	4.09
Administrative expenses	24,741	26,323	35,689	26,479	28,308	3.02
Reserve funds	813	740	1,253	3,479	1,571	0.17
Other expenses	35,353	32,617	22,550	—	22,630	2.42
Balance	15,893	28,041	—	—	10,983	1.17

Source: Data supplied by the Joint Irrigation Association.

## 4. Discussion

In general, the annual budgets of IAs cannot meet their actual needs because of their limited collection of various fees. As a result, they are financially unable to carry out their functions except with government subsidies that have been inadequately provided. This has greatly affected the maintenance of watercourses and related structures. In the collection of various fees and in the disbursement of IA revenues, there seems to have some problems that need to be brought up for discussion.

### 4.1 Rate of Ordinary Membership Fees

Among the four kinds of fee collected by the IAs as their major financial sources, the ordinary membership fee is a key one. It makes up about 77% of the total collection. Therefore, any decision on its rate concerns not only the annual income of IAs but the payment capability of farmers also. The low annual revenue of each IA could be attributed to the following factors:

#### (1) Low Rate of Ordinary Membership Fees

The rate of ordinary membership fees was first fixed by the government in 1955 on the basis of gravity irrigation. Its upper limit of 300 kg of paddy per hectare per year was only 5.4% of the average unit yield recorded at 5,584 kg/ha at that time. While the unit yield gradually increased – 8,770 kg/ha in 1979, the upper rate was lowered to 270 kg of paddy in 1971 or 3.1% of the average unit yield. At present, ordinary membership fees are collected at an average rate equivalent to 210 kg which is only 2.4% of the average unit yield of paddy fields.

#### (2) Small Input by Farmers

The data collected by the Provincial Food Bureau indicated that the average farming cost per ha was NT\$123,091 (US\$1.00 = NT\$40.50) in 1980 while the average ordinary membership fee paid to the IA was NT\$2,337 per ha or only 1.9% of the average farming cost per ha.

#### (3) Low Price of Paddy

The ordinary membership fees for irrigated lands are calculated in kind but collected in equivalent cash according to the prevailing price of paddy. As rice is a staple food, its price is controlled by the government and has been kept comparatively stable to benefit the majority of people. Therefore, the annual increase in the total collection of ordinary membership fees is very small and cannot reflect the ever-rising prices of other commodities. The diminishing of irrigated lands is also a factor that leads to a lesser collection of fees.

#### (4) Complacency in Fee Collection

Table 1 shows a good record of fee collection. More than 98% of the projected amount of fees has been collected every year. This proves that farmers can afford the ordinary membership fees because of low rates. But, it appears that this satisfactory



record has strangled the idea of rate adjustment.

#### **4.2 A Review of Disbursements**

The disbursement of IA revenues is generally unsatisfactory but sound in some cases.

##### **(1) High Percentage Expenses for Personnel**

As shown in Table 2, the average disbursement for personnel expenses in FY1978-81 accounted for 52.5% of the total amount of collected fees. In FY1981 alone, it ran up to 64.7%. Owing to the continuous increase in personnel expenses, it still tends to go on a high percentage.

##### **(2) Low Percentage of Expenses for Irrigation Facilities**

A proper maintenance and improvement of the existing watercourses and related structures could prolong their service life and facilitate water management. This work should be first priority for the IAs to do in order to help achieve the goal of agricultural production. For one thing, new development projects are costly; for another, it takes a long time to realize the benefit of any new venture. Owing to the aforesaid financial dilemma, however, the IAs could spend only about 13.62% of collected fees on the annual maintenance and improvement of watercourses and related structures – a figure that is only 0.17% of the estimated NT\$75 billion value of Taiwan's entire watercourses and related structures. Particularly, the IAs can ill afford to carry out emergency repairs in time after flood damage. Therefore, government subsidies are needed unless the rate of ordinary membership fees is adjusted. A subsidy of about NT\$550 million has been provided annually for this purpose in recent years. This amount is only 0.73% of the NT\$75 billion, still far from the ultimate goal of 1.5% as stipulated in the Organizational Regulations of Irrigation Associations.

##### **(3) Expenses for Irrigation Operation and Management**

Usually, the technical staff of IAs controls water delivery at intakes, main canals and laterals, while the irrigation groups organized by farmers are responsible for the distribution of irrigation water from turn-out gates through farm ditches to individual fields. The total amount of expenses for these two categories in the period under review was 22.8%, which is considered reasonable as compared with other disbursements. Actually, water distribution at the farm level has been done well by the IAs in cooperation with the local irrigation groups.

#### **4.3 Maintenance Costs of Watercourses Against Conveyance Losses**

A large amount of conveyance losses might result from deferred maintenance of watercourses. A study was conducted jointly by the National Taiwan University, the Agricultural Engineering Research Center and the Chianan Irrigation Association in 1973 to find out the relationship between maintenance costs and conveyance losses in two districts irrigated by a same reservoir.

### (1) A Study of the Chiayi District

The average conveyance loss was 45.48% measured in six blocks of a 6,812-ha irrigated area having 733,562 m of farm ditches. The Chianan IA usually could not afford to conduct desired maintenance of farm ditches to hold the conveyance loss within an expected amount of 22.66% in average. The excess conveyance loss of 22.76% (weighted mean) amounted to 1,395,531 m<sup>3</sup> of water. If the maintenance cost per unit length of farm ditches were raised from NT\$0.49/m to NT\$1.34/m, the excess conveyance loss of 22.76% would have been offset with a same amount of water saved. In other words, the more costs are provided for the maintenance of watercourses, the less conveyance losses are expected. The following are either total figures or weighted average ones.

- |  |                          |
|--|--------------------------|
| a. Total area:   | 6,812 ha                 |
| b. Total length of farm ditches:   | 733,562 m                |
| c. Conveyance losses of farm ditches:  |                          |
| (a) Actual average loss:   | 45.48%                   |
| (b) Desired average loss:  | 22.66%                   |
| (c) Excess loss:   | 22.76%                   |
| d. Maintenance cost per unit length of farm ditches:   |                          |
| (a) Average cost actually expended:  | NT\$0.49/m               |
| (b) Maintenance cost needed to meet the desired loss:  | NT\$1.34/m               |
| (c) Necessary increase of maintenance cost:  | NT\$0.85/m               |
| e. Effect of increased maintenance cost:   |                          |
| (a) Estimated total amount of water to be saved if water depth at turn-out is 90 mm (90 x area x 22.66): | 1,395,531 m <sup>3</sup> |
| (b) Equivalent value of the saved amount of water estimated at NT\$0.48/m <sup>3</sup> :                 | NT\$669,855              |
| (c) Total increase of maintenance cost (NT\$0.85/m x 733,562 m):   | NT\$623,528              |
| (d) Difference:  | NT\$46,327               |

### (2) A Study of the Matou District

The study covered a 46.04-ha irrigated area with 5,604 m farm ditches (of which 1,030 m were lined with concrete). The Chianan IA usually spent only NT\$2,600 or NT\$0.57/m on the maintenance of earth ditches of 4,574 m long. For this study, the maintenance cost was increased to NT\$11,000 or NT\$2.40/m, about four times the original amount. Results prove that maintenance costs are absolutely in direct proportion to irrigation performance as follows:

- The time of water flow at the beginning stage could be shortened from 8 hours 50 minutes to 2 hours 10 minutes.
- The original irrigation interval of 15 days could be shortened by 6 days or 40%.

## 5. Conclusion

From the above analysis, it is obvious that the total collection of various fees is not enough for the IAs to maintain watercourses and related structures in good shape, even with some subsidies from the government. Under such an unfavorable financial condi-

tion, the IAs have managed to overcome difficulties in the performance of their functions so as to keep pace with the promotion of agricultural production.

The present rate of ordinary membership fees is not too heavy for the farmers to pay. It calls for a study on the desirability of adjustment. It seems that the rate should not be rigidly stipulated in a set of rules and regulations. It should instead be determined on the basis of crop characteristics, water uses, production values, cropping indexes, facility conditions, etc. in individual areas.

An adjustment in the rate of ordinary membership fees may strengthen the financial capability of IAs, reducing their reliance on government subsidies to some extent. However, this is a complicated problem of political and social dimensions, that needs to be solved through a multi-disciplinary approach.

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