

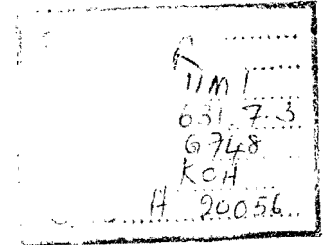
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International Workshop on Participatory Irrigation Management
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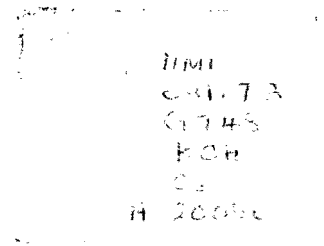
INTERNATIONAL WORKSHOP ON PARTICIPATORY IRRIGATION MANAGEMENT : BENEFITS AND SECOND GENERATION PROBLEMS

Columbia
February 9-15, 1997

Country Paper



Problems on Participatory Irrigation Management in Taiwan



By

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February 1997

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INTERNATIONAL WORKSHOP ON PARTICIPATORY IRRIGATION MANAGEMENT: BENEFITS AND SECOND GENERATION PROBLEMS

Problems on Participatory Irrigation Management in Taiwan

Summary

The history of developing large irrigation schemes in Taiwan could be traced back up to the Dutch colonial period from 1609 to 1661; since then Taiwan's irrigation system has been under another four Governments' management. Ming-Chung/ Dynasty from 1662 to 1683, Ching Dynasty from 1684 to 1895, Japan from 1895 to 1945, and the Republic of China after World War II from 1945 up to now. In the last 388 years, the irrigated area in Taiwan has increased from 8,400 ha in 1600s to the highest of 560,000 ha in 1940s, and decreased to 360,000 ha now. The period of Ming-Chung/Chin Dynasty was the only period that irrigation systems were developed and operated by the users, i.e. a real and whole participatory irrigation management under subsistence agriculture. After adopting mass rice production as the policy for foreign exchange earnings or savings, and food self-sufficiency or food security in 1908, the Government started to involve deeply in the development and management of irrigation systems. As of today, this policy has been prevailed for 90 years, the Government has never stopped trying to leave irrigation systems to be managed by water users themselves when the cost of operation and maintenance (O&M) of irrigation systems was found to be a heavy burden to the public. The trial has ever been partially successful to some extent, water users were able to participate in the most of irrigation management in the last five decades, and they were able to share average 55% of O&M cost before 1990 for 20 years. However sharing O&M cost by water users had been declined rapidly since late 1980s and was dropped to almost nil after early 1990s when the income of rice producers became comparatively lower than the non farmer, and the democratic sense in this Country rose. Mainly based on the social and political consideration, the Government has taken full financial responsibility to manage the irrigation schemes and suspended the authority of Irrigation Association to collect water fee from farmers after 1990. The traditional virtue of users-pay-the-cost in the culture of operating irrigation system has gradually died out in Taiwan. This political and social decision has profoundly affected the policy of participatory irrigation management in the long run. In particular, in the eve of participation in WTO and GATT, this high subsidy policy on maintaining the utility of irrigation system has become a burden and barrier for the national economic development. Justifications for continuing this policy to support the rice dominated agriculture production are: to maintain food security, to preserve rural ecological and environment, to keep a cushion for the adjustment of supply and demand of labor forces, and to maintain social and political stabilization. While the change in irrigation management structure is still in processing, the lesson learned from Taiwan's experiences will not be only to enjoy the academic curiosity, but also to provide recommendations to the policy maker on how to work out a better participatory irrigation management program in the process of transferring responsibilities for managing public irrigation system to the water users.

I. Introduction

Taiwan, an island oblong in shape with a total area of 35,961 km², about 142 km in width and 383 km in length, is located in the West Pacific Ocean, east of the mainland China. It is bisected into a western plain and a rugged eastern mountain area by a center mountain range which extends almost the entire length of the island from north to south. Approximately three-fifth of the total area are mountains. The Cultivated land of 870,000 ha. Represents only 24 per cent of the island.

The climate of Taiwan is subtropical and characterized by high temperature, heavy precipitation, and violent winds. All 61 rivers on the island are short, steep, flashy and weak in geological structure. They take their rise in the central mountain range. Annual precipitation over the island averages 2,510 mm, or a total volume of about 90,000 million m³ per year; annual surface water potential is estimated to be 37,000 million m³, ground water potential 2,500 million m³, and hydraulic power potential 12 million kw. The northeast monsoon prevails from October through March of the next year. About 80 per cent of precipitation fall from May to October, mostly provided by storms and typhoons. The period from November to the following April is a dry season during which agricultural production is dependent upon intensive irrigation.

The high temperature, with an annual average of 26°C to 28°C, provides a rather long growing period which favors two crops of rice a year if water resources available.

II. Evolution of Agriculture Connection to Irrigation in Taiwan

Taiwan has enjoyed a high economic growth in the last four decades. This growth will enable Taiwan as a member of industrialized countries before the end of this century even sooner than this forecast (Klein 1986). Despite Taiwan's economy had just recovered from the destruction of World War II from late 1940s to early 1950s, at that time, Taiwan economic development was highly relied on agriculture sector, which counted for one-third of the net domestic products, 56 per cent of the total employment, 92 per cent of exports. In 1995, the same sector contributed for only 3.5 per cent of the net domestic products, 10.6 per cent of the total employment and 4.7 per cent of the total export. Agriculture has played different role and experienced a drastic structural adjustment in the modernization of Taiwan economy. Given irrigation is just a part of agricultural activities, policy on the management of irrigation system in Taiwan has also made several significant changes correspondingly to reflect the above-mentioned structural adjustment. It is essential to understand the stages of agricultural development prior to study on how Taiwan maintains the utility of irrigation systems by all means of participatory irrigation management.

According to Yu-Kang Mao and Chi Schive (COA, 1991), the large scale agricultural development in Taiwan can be divided into two main stages, i.e. prewar or colonial and postwar stages. Major development took place in the initial, then the result of development was destroyed and deteriorated during the War in the first main stage; rehabilitation of the

deteriorated agriculture in the beginning, then a series of structural adjustments in agricultural development undertook. Following Taiwan proceeding to the semi- industrialized economy, a being squeezed agriculture finally turned to a support needed agriculture nowadays in the second main stage. The status of development is described below:

A. Prewar(Colonial) Stage (1895 to 1945)

Taiwan was colonized by Japan from 1895 to 1945 until it was restored to the Republic of China after World War II. A typical colonial development prevailed in this stage, i.e. to make agricultural sector more productive for export. Within this 60 year colonial period, agricultural development could be further divided into following three sub stages. They are:

1. **Initial Sub-Stage (1913 to 1921):** Detailed survey on the land with potential for agricultural use was undertaken, and about 180 private irrigation schemes were put under Government's supervision in 1901, then a total of 198 irrigation schemes including 18 schemes developed by the Government were transferred as the official irrigation schemes under Government's close control. Cultivated and irrigated land were expanded from 690,937 ha and 242,000 ha in 1913 to 752,000 ha and 364,000 ha respectively in 1921. The average annual growth rate of total agricultural production was 2.0 per cent. Most private irrigation schemes were forced to be donated to the public.

2. **Agricultural Transformation Sub-Stage (1921 to 1937):** Rapid expansion of agricultural production had been made by increasing crop yields, expanding cultivated and irrigated land, increasing multiple cropping along with more improved crop varieties and fertilizer used. The multiple cropping index went up from 120 in 1921 to 137 in 1937. The yield of rice reached 2,200 kg/ha in 1938. The irrigated land increased from 364,000 ha in 1921 to 528,000 in 1937. An average annual growth rate of agricultural production was 4.3 per cent in this stage. Most of large irrigation systems, such as Chia-Nan and Tao-Yuan Irrigation schemes were completed in this stage. By the announcement of "Order for the Organization of Irrigation Collaboration Group" as the legislative basis, all irrigation systems in Taiwan were re-organized into 109 Irrigation Collaboration Groups. Farmers were organized into sub-collaboration group based on irrigation system. Farmers were responsible to contribute labor for maintaining on-farm irrigation and drainage system as well as to pay cash for administration and major O&M works for on-farm system. The sub-group leader was elected by the farmer. O&M for the main conveyance irrigation and drainage system were still undertaken by the Government.

3. **Depression Sub-Stage (1937 to 1945):** This stage was in the World War II period. Input for agriculture was minimal due to lack of financial and other resources, and rehabilitation for typhoon damages including irrigation system and other infrastructure was almost impossible. The average negative annual growth rate for agricultural production was about 4.9 per cent. Taiwan agriculture was in mess and disorder at the end of War. Although few irrigation systems were directly destroyed by war, due to shortage of funds for O&M and damage rehabilitation, about 50 per cent of irrigation systems was out of functioning at the end of this

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stage. Farmers' contribution to O&M became the major resources for keeping irrigation system operational.

B. Postwar Stage (1945 to Now)

Taiwan was restored to the Republic of China in 1945. Since then, Taiwan has progressed from a rehabilitation of damages to a semi-industrialized economy. During the progress, the agricultural sector has played different roles and made various policy changes and structural adjustment to accommodate the need of economic development. The status of change and adjustment in various stages are briefed below:

1. Rehabilitation Sub-Stage (1945 to 1951) : The agricultural production in Taiwan was down to less than half of the pre-war peak at the end of the War. The deteriorated economic situation was worsened by large influx of people from mainland China, sky-high inflation, serious shortage of food and basic necessities, heavy defense burden, and social and political instability. Every effort was made to repair damage and maintain national stabilization. Land reform program, the most effective incentive to the agricultural production, was introduced in 1949 and completed in 1953. Increase in farm inputs as fertilizers and strengthening farmers' organizations including irrigation association had substantially expedited the rehabilitation. By 1951, agricultural output started to surpass the pre-war peak. The total agricultural production increased at a rate of 19.2 per cent a year between years 1946 and 1950. The total irrigated land increased from 498,000 ha in 1946 to 518,000 ha in 1951. A cooperative irrigation management body namely Irrigation Collaboration Association was introduced in this stage and the Chairman of the body was elected by the water users. The total 109 irrigation collaboration groups were reorganized and merged into 39 Irrigation Collaborative Associations. Participatory irrigation management was successfully implemented by means of democracy. This Irrigation Collaborative Associations were re-organized to 40 Irrigation Committees in 1948. The main purpose of the reorganization was to enhance management efficiency following the Government increased in financial support.

2. Steady Growth Sub-Stage (1952 to 1965): After agricultural production had been back to the normal in 1951, it started to grow steadily at 5.1 per cent per annum. The growth was attributed to the expansion of cultivated area and enhancement of yield. Toward the end of this stage, the industrial sector started outpaced the agriculture, and the agriculture was facing a need of change in its structure. Total cultivated area increased from 876,000 ha in 1952 to 882,000 ha in 1965; and irrigated area decreased slightly from 518,000 ha in 1951 to 503,000 ha in 1964. Rice (brown rice) production reached a historical high in 2.34 million metric ton in 1965. The agriculture shared Taiwan exports at 91.9 per cent of which sugar and rice accounted 81.4 per cent in 1952. This share was gradually declined to 61 per cent the end of this stage. 40 Irrigation Committees were merged and re-organized into 26 Irrigation Associations in 1956. The main objectives of re-organization were to combine all small irrigation schemes which shared water resources of the same river into one Irrigation Association so as to minimize the disputes over the use of water; and to merge small Irrigation schemes with poor financial and technical conditions to a larger and better ones for facilitating mutual support among irrigation

schemes. This re-organization was considered to be successful and had last the longest for 20 years without change until 1975. Participatory irrigation management was successfully implemented, however it did not mean that irrigation management could sustain without Government's financial support. In general, about 60 per cent of total expenditures including minor part of development and rehabilitation and major portion of O&M was shared by the water users.

3. Transition Sub-Stage (1966 to 1974): The rapid industrialization started at mid 1960s and the number of farm labor began to decrease as a result of labor outflow from rural to urban industry area. Taiwan's agriculture experienced labor shortage at the peak which called for a farm mechanization to cope with the new situation. The significant structural change in agricultural production can be observed from changes in agricultural inputs and productivity; in the period of 1952-1960, land productivity rose by 35 per cent, labor by 27 per cent, while capital only 13 per cent; in 1960s to 1970s, labor productivity rose by 61 per cent and 97 per cent in both decades, capital productivity has recorded least growth rate of 28 per cent in the 1960s, and even decreased 26 per cent when more capital became available (Y.K. Mao & Chi Schive 1991). This was a transition stage that Taiwan's economy had transited from agriculture to industry dominated era. A New Agricultural Development Policy was announced in 1969 to provide more supports to reduce cost and ease other difficulty in agricultural production as well as more incentive to maintain farmers' minimal income. The growth of agricultural production declined slowly from 6.2 per cent in 1966 to 4.2 per cent per annum in 1974. Since then, agricultural has never developed comfortably without Government's support. The irrigated area also decreased from 500,000 ha in 1966 to 437,000 ha in 1974. In the same token, the operation of Irrigation Associations also encountered financial difficulty due to the increase in O&M cost because of labor shortage and the willingness of sharing O&M cost was decreasing at that stage because of the decreasing in farmer's income. The Government started to increase the rate of subsidy in the engineering cost for the development and rehabilitation of irrigation, drainage and flood alleviation works. (B, 11)

4. Semi-Industrialized Sub-Stage (1975 to 1989) : The competitive use of labor, land and water between agricultural and industrial sectors became increasingly acute. As no free market for land and water existed, outflow of land and water resources from agriculture to industry could not be proceeded through market mechanism, by which the industrial development cost became unreasonably high. Regardless of declination in agriculture, the rice production has recorded the historically highest of 2.7 million metric ton in brown rice in 1976. The growth rate of agricultural production declined steadily from 4.3 per cent in 1975 to 3.0 per cent in 1988. As being squeezed for long time, the agriculture was becoming a close support required sector. Many squeezing agriculture policies, such as Land Tax in kind, rice-fertilizer barter system, compulsory rice purchase, and land surtax in kind had been abolished in this stage. Maintaining food security and farmer's minimal income was the policy guidelines for conducting agricultural development. The supportive rice price (or guarantee price) program was introduced. As a result of these contradictory programs, the problems of rice surplus emerged. The food security target was adjusted to 2.5 million metric ton (brown rice). While continuing guarantee rice program, guarantee price for non-rice crops (such as corn and

soybean) program also lunched. When rice production could not be decreased to the targeted level, retirement program for paddy rice producers was also implemented. Internal democratic sense rose gradually, the agricultural problems were no longer totally resolved by the economic theory. In order cope the problems of rural recession, a seven years' Expediting Rural Reconstruction Program lunched in 1974 and was implemented in this stage. Among others, the improvement of rural infrastructure including farm road, irrigation and drainage facilities, flood alleviation and tidal control works had been carried out. During this period, the election of Chairmen of Irrigation Association and representatives of member assembly meeting were suspended. These Chairmen and representatives were appointed by the Government. Performance of Irrigation Association was considered to be one of the best periods in the entire postwar stage. After seven years, the election of Chairmen and representative of assembly were restored. The financial difficulty in the management of irrigation associations found again toward the end of this stage. Water pollution emerged as a serious problem either in rural environment or for irrigation water quality as a by-product of industrialization to the agricultural sector.

5. Delicate Agriculture Sub-Stage (1989 to 1997): The importance of agriculture in national economy was gradually missing since the beginning of this stage. The annual growth rate of agricultural production at 3.0 per cent in the period 1985 to 1988 was dropped to 0.3 per cent in the period 1989 to 1992, and -3.0 per cent in 1994 (damaged by typhoon and drought), and 3.7 per cent in 1995. The agricultural production as the percentage of GDP was declined from 4.1 per cent in 1988 and 3.5 per cent per in 1955. The National food security was adjusted downward from 2.5 million metric ton (brown rice) in 1977 to 1.6 million metric ton per annum in 1996. This downward adjustment was mainly attributed to people's change in food consumption patterns and the Government was no longer willing to handle too much excessive rice. Direct per capita rice consumption in Taiwan has shown a downward trend, 134 kg per person per annum in 1974, 100kg in 1980, 60.7kg in 1993. To tackle the problems of excess rice and maintaining farmer's minimal income, the Government has launched the second Rice Diversification Program, and extended the guarantee purchase program to the non rice crops following the completion of the first six years' program in 1989. The agricultural production in this stage was becoming more and more delicate that the price and profit of products are the farmer most concerned. Rice production was not very profitable but less labor consumption with a assured minimal income. Under this circumstance, irrigation management was in an embarrassing status, the Government was only interesting in improving irrigation management efficiency to save some amount of water resources for diverting to the non-agricultural purpose; not for the increase in rice production when the development cost of new water resources was becoming increasingly expensive. But the resistance for diverting irrigation water to non-irrigation purpose was very high. Therefore the Government would not provide sufficient funds to subsidize the operation of irrigation system. In 1994, the 17 Irrigation Associations were re-organized again. Without adjusting irrigation systems, the election of Chairmen were suspended and the farmer's representing assembly meetings were abolished. Instead, the Chairmen were appointed by the Government and the Farmer's Representative Assembly Meeting was replaced by a Association Affairs Commission Meeting, all commissioners were selected by the Government. In the meantime, the Government ordered the Associations to suspend the collection of membership fee which was used to be the unique revenue of O&M

cost from Association's members. The Government provided the same amount of membership fees to the Irrigation Associations to undertake the regular O&M works. In addition, Government also provided 100 per cent subsidy for the cost of flood damage rehabilitation and improvement of irrigation and drainage facilities. As a result, farmers were no longer required to pay any cost for the use of water, and their participation in irrigation management was reduced to the on-farm. This was a political decision designed to reduce the rice production cost but it profoundly affected the management of irrigation systems in the long run.

C. Problems Remained in Agriculture

When rice surplus was found to be a problem in late 1980s, rice production as well as the management of irrigation association became a burden or even a barrier to the national economic development. After applying to the World Trade Organization (WTO) in 1990 in particular, the agriculture of Taiwan has proceeded with several structural adjustments. Among others, the focus of rice production policy is being placed on less self-sufficiency and giving a greater emphasis on developing a more balanced and diversified sources of supply. Irrigation management is being affected profoundly by the change in this rice policy. Maintaining the utility of irrigation association in Taiwan in the future will be mainly based on the minimal food security, and rural environmental and ecological consideration.

Problems remained to be resolved for the agriculture in Taiwan are : (i). A relatively lower income for farmers; (ii). The impact of trade liberalization; (ii). The aging of labor force; (iii). Over production of certain products; (iv) Pollution induced deterioration of production environment; and (v) National food security and social stabilization. Problems for irrigation are: (i) The request to release equivalent amount of water from the save of decreased irrigated area based on new rice production policy to the non-agriculture purpose is becoming acute; (ii) water pollution resulted from industrialization; and (iii) Escalated high O&M cost caused some irrigation association financially at the edge of bankruptcy.

A summary of the evolution of rice dominated agricultural development and its correlation to the evolution of irrigation management in Taiwan after War World II is shown in **Appendix 1**.

III. Participatory Irrigation Management in Taiwan

Taiwan's irrigation management has been considered to be one of the most effective in the world. Regardless of its institutional design and arrangement being kept changed according to the different stages of agricultural development, the successful experiences gained from Taiwan, in particular, on farmers' participation in irrigation management, complementarity of interests between individuals, reduction of asymmetries involved in the use of authority, and the existence of domains of autonomy (Wai Fung Lam, 1995), would be referable to the policy designers in different part of the world in the processing of transferring responsibility for managing public irrigation systems to the water users through formation of irrigation

associations. At least, examining the problems encountered nowadays in Taiwan's irrigation management would provide a better opportunity for a new irrigation association to be formed to avoid the repetition of similar difficulty found .

A. Evolution of Taiwan's Irrigation Systems

In Dutch colonial period, irrigation schemes were managed as a business company, and farmers were just the employee of the company, participatory irrigation management was not necessary. In Ming/Chung and Chin Dynasties, irrigation was just for subsistence farming, irrigation schemes were usually developed either by private rich farmers or by the cooperative of community. The Government involvement in irrigation management was minimal at limiting to the issuance of canal license, settlement of dispute over the use of water. This was the only period that the initial investment and O&M costs for irrigation schemes were able to be recovered by 100 per cent without any subsidy from the Government. The colonial Government of Japan had taken full responsibility for the improvement of old irrigation schemes and the development new schemes; and O&M for main off-farm irrigation and drainage systems; Farmers' cost sharing and participation in irrigation management was merely on the level of on-farm systems. In the era of the Republic of China, the institutional arrangements for irrigation management was designed to let farmer fully participate in, including the election of Chairman of Irrigation and the representatives of Member Assembly Meeting. Correspondingly, farmers were requested to share 100 per cent of O&M costs; 40 to 60 per cent of development and improvement costs. But after 1994, the Government provided funds for covering 100 per cent of O&M and engineering costs; and election of Chairman and representative of assembly meeting were suspended. Farmers' participation in irrigation management was deprived down to the levels of on-farm system similar to the Japan colonial period. A summary of the evolution of the utility of Irrigation Association in Taiwan is provided in **Appendix 2**.

B. Institutional and Legalistic Arrangements for Irrigation Management

The heavy investment on irrigation development, the sophisticated engineering infrastructure, and delicate water delivery planning do not tell the full story of the success of irrigation management. The institutional design and arrangements to enable water users' participation in irrigation governance and management involved both cost and benefits are one of the major premises for maintaining the utility of irrigation system rather a long period.

In the early development, no formal cooperative group was formed. During the period of Ming/Chung and Chin Dynasty, Laws and regulations were written as: (i) Announcement of Irrigation Affairs to permit irrigation construction and settle irrigation dispute; (ii) issuance of canal licenses for an official acknowledgment of ownership of irrigation system; and (iii) issuance of Seal of Irrigation System to permit the collection of water fee. In the Japanese colonial period, many additional laws and regulations were enforced, On "Taiwan Public Irrigation Works Regulations (1900)", all major private irrigation schemes were organized into Irrigation Body recognized as a legal entity under Government's supervision. "Taiwan Irrigation Association Order (1921)" transformed all Irrigation Body into Irrigation Associations. The superintendent of the Association and also the Chairman of the Board of

Counselors were appointed by the Government. Half of the Counselors were appointed and remaining half were elected. The right of the Irrigation Association to collect water fees was similar to that of taxation (Ko, H.S & G. Levine 1972). Regardless of Irrigation Associations having been re-organized for more 11 times since their first establishment, the basic institutional structure had not been much changed. Every time of re-organization reflected the degrees of Government's involvement and support to this organization, or the extent of participatory irrigation management the Government designed to permit.

After World War II, the control and regulation of water use and distribution in Taiwan was based on the provision of "the Water Law" and "By Laws" effective in Mainland China since 1942. The legalistic basis for the organization of Irrigation Association was based on "the Organizational Rules of Irrigation Associations" which was approved and promulgated for enforcement September 17, 1956. The detailed institutional structure and operational procedures were similar to the status before World War II, except the following main differences (Ko, H.S & G. Levine 1972): (i) a more democratic base; (ii) all member-representatives, instead of appointed counselors, were elected; (iii) Chairman of the Association, instead of appointed superintendent, was elected by farmers; (iv) Collection of membership fee, instead of water fee, was no longer considered as taxation of Government.

C. Complementary Hardware Investment

The above mentioned institutional set-up had played a very important role in the success of irrigation management; but it did not tell the full story. A heavy investment provided for the rehabilitation of irrigation and drainage facilities damaged during the War in the beginning, then the development of new water resources such as Shimen, Pai-ho and Tsengwin reservoirs, and ground water development program to increase the irrigated area and/ or cultivated area took place. In the meantime, the improvement and modernization of irrigation, drainage, flood alleviation and tidal control facilities aiming at enhancement of water delivery efficiency and increase in durability for flooding damage and tidal intrusion had been carried out, such as sophisticated rotation irrigation works and land consolidation programs were carried out. Furthermore, training program for farmers and the staff of Irrigation Association, and adoptive research for agronomy and irrigation methodology (particularly for non-rice crop irrigation in the diversified paddy field) had significantly contributed to the success of irrigation management. Without proper institutional set-up for water management, the effects of intensive investment in the hardware of irrigation and drainage facilities would be discounted, while lack of adequate investment in hardware, a well designed institutional set-up could not demonstrate its efficiency. Fortunately, the complementary hardware investments had come along timely with the establishment of the high participatory institutional set-up for irrigation management. The success of irrigation management was actually a joint effort of institutional and the sophisticated facilities.

D. Degree of Farmer's Participation in Irrigation Management

In general, the water users of Irrigation Association were able to participate in making operational policy on: what extent of improvement and development for irrigation facilities they

needed as well as what extent they should pay for the investment. In addition to a consensus to be reached in the member assembly meeting, the agreement of more than 50 per cent of individual beneficiaries should be obtained for any major investments for development which farmers were used to share an average of 40 per cent of initial investment and 100 per cent of O&M cost. Different levels of rotation irrigation would be strictly implemented whenever drought occurred by the joint effort of water groups, the cooperative farmer organization at on-farm level, and the staff of Irrigation Association.

Cost recovery for 100 per cent O&M and about 40 per cent of engineering investment was no longer considered to be the taxation, therefore Association staff had to collect membership fee for O&M, and special engineering fee for engineering investment twice a year from the member to form the annual revenue of the Association. The percentage of fees collected became an indicator to reflect the satisfaction of service the staff of Association offered. Farmers were used to defer the payment to file their complain until a satisfaction could be promised. This indicator became an important tool for the Government to evaluate the overall performance of an Irrigation Association as well as for Chairman to assess the performance of his staff.

Disputes over the use of water could be settled among farmers and Association staff in most cases; but serious violation interfering with irrigation operation could be treated as a criminal case in the court. The Association might sue the member in court for payment delayed for three months after due for collection, but the suit was based on civil laws on debits and credits.

IV. Problems on Participatory Irrigation Management in Taiwan

A. Dilemma on the Existing Institutional Set-up

There were 39 Irrigation Associations when they had been established after World War II. Through five times' major adjustment in jurisdiction areas, the existing 17 Irrigation Associations were finally adjusted in 1975 from the original 39. As mentioned before, the trend of area adjustment was inclined to combine small Associations into larger ones, by which the disputes over the use of water could be reduced, and financially and technically mutual assistance among small and large ones could be enhanced. As of now, the adjustment made is considered to be appropriate and further adjustment is not required. In terms of area size, they are varied from the smallest of 324 ha to the largest of 78,000 ha. The average size is about 23,500 ha. No evidence can be shown that any optimal size for the operation of an irrigation association could be identified.

The institutional set-up of existing 17 Irrigation Associations in Taiwan was formed based on "the Organization Rules of Irrigation Associations" revised and enforced in 1993. But this set-up has been considered to be inconsistent with the principle of democracy as well as the policy on encouraging participatory irrigation management. In this connection, the

Legislative Yuan (the Law making body of Taiwan) passed a Bill in 13 July 1995 at requesting the Government to revise the above mentioned Organization Rules again. The revision of the Rules ought to be submitted to the Legislative Yuan and be enforced before 8 November 1997. This means that the institutional set-up of the existing 17 Irrigation Associations would be changed again at the end of this year. The status of organization and financial management for 17 existing Irrigation Association in the Year 1995 is shown in **Appendix 3**.

While the Government is in deliberation to formulate a acceptable institutional set-up for the existing Irrigation Associations, the members of the Irrigation Association are all at guessing what the Association will be. Why the legislative Yuan had passed the revision of the Organization Rules in 1993 and suggested to revise the Rules again in 1995 ? The main differences of institutional set-up between the existing one and the old set-up which had been adopted for more than four decades would answer the question. The said differences are:

- (i). The Chairman of the previous Association to be elected by farmers was replaced by the President of the existing Association to be appointed by the Government;
- (ii). The Member Representative Assembly Meeting of previous Association was replaced by the Association Affairs Committee Meeting consisting of three kind of commissioners including member commissioners, Expertise Commissioners, and Official Commissioners; all commissioners were appointed by the Government. Previous member representatives were all elected by the members; and
- (iii). The authority of the Association to collect the membership fees which was used to be collected from the members as the main source of revenue for O&M cost was suspended; the Government Budget provided equivalent amount of membership fees to each Irrigation Association.

The main points that the Legislative Yuan and the society did not fully support this institutional arrangement are: (i) Farmer's participation in irrigation management was reduced to only at on-farm level; (ii) the appointment of the President of the Association and Commissioners of Committee was against the spirit of democracy; (iii) Farmers' paying nothing at using water is unfair to the farmer who is not the member of the Association; (iv) a heavy financial burden to the Government; and (iv) Increase in subsidy on O&M fees is contradictory to the principle of reducing agricultural subsidy for applying the membership of WTO.

However, the justifications for adopting the existing institutional arrangements when the Legislative Yuan passed the revision of Organization Rule in 1993 were based on: (i) Suspension of collecting membership fees from farmers was one of the ways to reduce the farmer's production cost so as to narrow down the income gap between farmers and non-farmers; (ii) Suspension of membership fee collection will reduce the working burden of the Association; (iii) An appointed president of Association and commissioner of Committee were expected to have a better position to perform more cooperatively with the Government, and the budget could be implemented at the manner of austerity; (iv) suspension of election of the

Chairman and member representatives has the merit to reduce the Association's over involvement in political activities and to minimize the politician's influence to the Association's affairs.

B. Problems Found in the Operation of Existing Irrigation Associations

Major or minor changes in the institutional set-up for Irrigation Association were the most usual trial to tackle the operational problems whenever difficulties in operation occurred. There were three major organizational changes before World War II and Six times after War. Every change was often accompanied with the injection or withdrawal of financial support and with the permission of different degree of participation in irrigation management. The dilemma of the existing institutional set-up for the Irrigation Association mentioned above was also the trial of the Government to resolve the problems for the operation of Irrigation Associations. Problems found are summarized below:

1. Financial Difficulties: Since the establishment of Irrigation Association, financial difficulty was often a problem in the management of Association. The problem became more and more serious followed the declination of agriculture after mid 1970s and early 1980s. The causes of difficulties are: (i) the sophisticated irrigation facilities had been constructed during agriculture steadily growing stage, which required intensive maintenance and periodical improvement; after the declination of agriculture, budgetary allocation for the engineering improvement became less and less; the requirement of O&M costs were also escalated due to the higher price escalation in that period; shortage of O&M funds became a common problem for almost every Irrigation Association; (ii) legislatively, the collection of membership fees for O&M has set a ceiling of 300 kg paddy rice equivalent cash (later the ceiling was reduced to 270kg); under low- rice-price policy, the price escalation of rice was often far lagging behind the escalation of labor wages, construction materials, and staff salary which are the main O&M costs; membership fees collected have never been sufficient to undertake adequate O&M; (iii) the staff productivity rose by only 18 per cent in the last three decades and staff's salary rose by 92 per cent (at 1995 price) in the same period; and compared to agricultural labor by 97 per cent in 1970s (by farm mechanization); the difficulty to rise the productivity of Association's staff has resulted in that the portion of personnel expenditures to the total O&M budget has increased rapidly; in 1994, personnel expenditures were 70 per cent of total O&M budget, and in 1998, it will increase to about 100 per cent in some Irrigation Association (such as Yun-Lin Irrigation Association).

The financial difficulties of Irrigation Associations were also found very serious in 1974. In order to inject more financial assistance, the Government had suspended the election of Chairman and Member Representatives for 7 years, namely Strengthened Irrigation Association. At the end of this period, the status of Association operation had been found significantly improved. Lesson learned from this case, an appointed Chairman was considered to be more capable of managing the Association effectively. The financial crisis has been happening again since 1992, therefore the Government has tried to adopt the model of strengthened irrigation association to re-organize the Association.

2. The Surrender of Water Right to Non Agricultural Uses: According to the Water Law (1942), the water right belongs to the State; and the first priority for the use of water is given to the domestic water supply, second to the agriculture then the industry. The Government has the power to re-allocate water right to the others whenever the water right holder is found to be no longer required the water totally or partially with appropriate compensation to be paid by the new user to previous holder. The target of food security has been reduced from 2.5 million metric ton of paddy rice per annum to 1.6 million metric ton at the end of 1990s. The irrigated area of the Irrigation Association is also being decreased from 434,000 ha in 1975 to 398,000 ha in 1995. The decrease in irrigated area should decrease the water right proportionally. The request to surrender part of water right to the non-agricultural use is becoming stronger.

From economic point of view, irrigation sector has used about 56 per cent total available water on this Island annually in 1994 against the contribution to GDP at about 2.5 per cent from the irrigated paddy rice. The unit water return of agriculture might be several hundred times less than industry. Most of the economic planning agencies do not agree to continue the provision of adequate financial support to Irrigation Association whenever they found difficulty to request the Association to surrender part of water right to the emerging industrial sector.

Under this demand, farmers reflected quite emotional and considered that, they had obtained the water right legally for few decades or even several hundred years; regardless of belonging to the State, they have invested the development cost to enable to use the water; except reasonable compensation, they do not surrender their water right simply under Government instruction. Furthermore, under the situation of financial difficulties nowadays, they have to return the previous intensive irrigation management which they can not offer to do so when they surrender the water right. They prefer to keep the water right and speculate that food may become expensive in the near future and water right will be very precious if adequate compensation can not be received.

Water Law is totally silent in the definition of appropriate compensation when water right needs to be transferred. According to the experience of last decades, the development cost of unit cubic meter of water requires about NT\$20 to 50, the average at NT\$ 35 (US\$1.28 equivalent) per cubic meter. The industrial sector is willing to provide the compensation only at NT\$ 2 to 5 per cubic meter, i.e. 10 per cent of the development cost. Several Irrigation Associations have already surrendered their water right of reservoir temporarily to the industrial sector with above mentioned low compensation.

Given low productivity of water in irrigation or agricultural sector, if the compensation for transferring water right is based on the development cost of new water resources, likely the high water consumption industry would lose its competitiveness internationally. What is the appropriate compensation for surrendering the water right remains a serious problem unresolved in the operation of Irrigation Association.

3. Water Pollution : Water pollution is a very serious side effect of the result of industrialization. This problem to the Irrigation Association was first found serious in the early

1970s. Several larger Irrigation Associations even established their own laboratories and monitoring stations to monitor the water quality and identify the sources of pollutants. The laws or Regulations to prevent or prohibit the pollution at that time was not ready or not perfect. No authoritative agencies available could specifically handle the pollution case at that time. A serious violation to the water pollution could be sued to the Court on civil case. Problems was becoming seriously following the degree of industrialization. In the early 1980s, Environmental Quality Control and Natural Resources Protection Authorities and related laws were available; but these laws had seldom been enforced effectively. For maintaining the competitiveness of industry, the Government is often under pressure from the industrial sector to relax the Law of Water Quality. Water pollution will continue as a problem to the operation of the Irrigation Association.

4. Drastic Changes in the Institutional Set-up: Since the establishment of the Irrigation Association, whenever problems occurred and the Government intended to solve, the Irrigation Association was usually being re-organized. Most of re-organization was limited to the suspension or recovery of election of Chairman and member representative, i.e. changes in the degree of farmer's participation in financial contribution and/or irrigation management. But the trials made last five years by following previous models were found still not acceptable to the public. The democratic sense of the society, and the macro economic position of irrigation and agriculture were the main causes that the Irrigation Association was hardly to be re-organized in as such acceptable to the society. Academic and research institutes are undertaking several studies on making drastic change in the institutional set-up for the future Irrigation Association.

Among others, the proposed drastic changes include: (i).Partially or totally privatizing the operation of the Associations; (ii).Diversification and entrepreneurial operation of the Association; and (iii). Merging the Association into the Government's agencies. The issues and difficulties of implementing these changes are summarized as followings: (i) Lack of legislative basis for the changes; (ii) Uncertainty of financial sustainability; (iii) Complexity of the ownership of the Association's properties; (iv) Lacking the qualifications as the civil servants for most Association's staff; and (v) With the privileges of tax exemption for the Association, entrepreneurial operation is an unfair competition to other private entrepreneurs. The studies are still going on; but the final decision on the re-organization will mainly be based on political and social consideration rather than economical factors.

5. Political and Social Embeddedness: Association's staff has historically played an active role in almost every social and political activity in the rural area. In particular, the arising of democratic sense in Taiwan, winning the election has become the first priority for the Government to conduct the most social and economic developments. The result of election in the last decade had shown that the organization of the Association could manipulate at least 20 per cent or even more of voting ballots. Politicians have never forgotten to share this cake of votes; and do every effort to show their favor to the staff and the Associations. Chairman or higher Officials do have the opportunity to be nominated and elected as a congressman or some other important political position. The merit of involvement in local and national political activities is to provide the mechanism or channel to influence the Government's policy on the

operation and management of the Association, so as to protect Association member and staff's benefits. In February 1993, a bill was passed in the legislature that would change the Irrigation Association into the Government's agencies within the following three years. This bill was totally a political decision to show in favor of Irrigation Associations. When the exercise of turning the Association into Government agency was still going on, most of Chairmen and higher rank officials of Associations were ^{found} not qualified to be as the civil servants, the bill was therefore withdrawn and the on-going exercise was canceled by the influence of the Association. This reflected the fact that the Association has already embedded in the rural politics.

Over embedded with politics, the services of Association to the farmer was found being diluted, which was one of the reasons that the productivity of Association's staff could not be risen. Some large Associations are even so powerful that they can rule over the Government supervision and influence the Government's policy to do in favor of Association. This is a result of excessive participation and over embeddedness with politics.

6. Missed Traditional Virtue: Recognizing the Irrigation Associations are legally owned by and formed by farmers; and supervised by the Government, their legal status as juristic entities entitle to a high degree de jure autonomy and also public authorities such as the power to levy water fee, i.e. membership fee (Wai Fung Lam, 1995). In February 1993 as mentioned above, when the bill was passed to change the Irrigation into the Government's agencies within the following three years in the legislature, the bill had attached with a condition that all membership fees should be paid by the Government. Since then, farmers were on longer required to bear any cost for receiving water from the Association's irrigation system, and the traditional virtue of Users-pay-the-Cost prevailed for more than 75 years in the culture of operating a public irrigation system has died out. Nevertheless this political decision has the merit of maintaining farmers' minimal income and the Government are also able to pay for the farmer, the practice of using water without charges has profoundly affected the operation of Taiwan's Irrigation in the long run. The major impacts are: (i) Farmers have missed the sense of ownership of irrigation system, and summoning for volunteer for maintaining irrigation facilities is becoming difficult; (ii) Farmer has lost a tool to request the Association to improve their services by deferring the payment of membership fee; and (iii) the staff's motivation to provide a better ^{service} is missing when collection of water fee farmers is no longer required for a staff. Some scholars suggested to recover the collection of membership fee even a minimal amount and most Government officials involved also agreed with , but it has become a political issue which is usually not resolved by theory.

V. Conclusion: Issues for Deliberation

Participatory irrigation management does have the merits of enhancing effects of irrigation and relaxing the financial burden of the public; but the excessive participation might potentially lead the irrigation management to conflicts or rent-seeking activities. Cognizant of the this fact, the question, then, turns to how to work out a balance between merits and costs involved in the farmer's participation. This is the very first issue for deliberation in the process of transferring responsibilities of managing public irrigation systems to the water users via the formation of irrigation associations.

The attempt would be eventually in vain if the formation of irrigation association and enhancement of farmer's participation in irrigation management is just to get rid of the financial burden. Lesson learned from Taiwan, the formation of irrigation association might result in relaxing the financial burden to the public in the initial stage; but the increase in the burden again could not be avoided when the enhancement of the productivity of irrigation management can not catch up the price escalation of the cost of irrigation management.

The argument has often been put forward in Taiwan that the present sophisticated irrigation and drainage facilities, which the success of irrigation management is attributed to, are required. When higher profits in rice production will not likely come from higher yields, but rather from economically efficient method of production. Sophisticated irrigation facilities with a higher efficiency and higher O&M costs, ^{follow} The issue of the relevance between irrigation efficiency and management cost should not be ignored. Whether sophistic irrigation facilities are needed requires for deliberation when taking into account the future O&M costs.

The issue of water pollution has generally been over looked in the old irrigation systems. When it becomes an issue, it is always to be too late to find a preventive measure, and any remedial measure has never really solved the problem. Prior to formation of irrigation association, this issue should be included for deliberation either via legislative approach and/or the technical solution on the design of water source system.

A fixed cropping pattern for an irrigation system has remarkable merits on the system design as well as irrigation management. But it may build in the negative incentive when the price of crop is the most compelling factor for the farming profits. The irrigation system should be so designed that enable the system to practice more flexible crop diversification. If the irrigation association can not be organized together with farmer association, the capacity buildings for the planning of optimal diversification should be imbedded in the organization.

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The Summary of the Evolution of Rice Dominated Agricultural Development and Its Correlation to the Evolution of Irrigation Associations in Taiwan

Evolution Stages	Land Reform	1st Four Year Plan	2nd ~4th Four Year Plan	5th Four Year Plan	6th Four Year Plan	7th Six Year Plan	8th Four Year Plan	9th Medium Term Plan	10th Medium Term Plan	11th Six Year Plan
Period	1945-52	1953-1956	1957-1968	1969-1972	1973-1976	1978-1981	1982-1985	1986-1989	1989-1993	1994-2000
Nos. of Years	8	4	12	4	4	6	4	4	5	6
Objectives	1 National Security 2 Food Self-Sufficiency 3 Social Stabilization 4 Foreign Exchange Savings from Food Importation	1 National Security 2 Agr. as Basis for Economic Development 3 Social Stabilization	1 Balancing Agr. and Industry Development as the National Economic Development Strategy 2 Food Self-Sufficiency 3 Social Stabilization	1 Full Scale Industry Development 2 Food Self-Sufficiency 3 Social Stabilization	1 Balancing Agr. & Industry Development 2 Food Self-Sufficiency	1 Priority in Industry Development 2 Food Security 3 Narrowing Income Gap between Farmer & Non Farmer	1 Renewing Industry Structure 2 Food Security 3 Steady Growth of National Economics	1 Food Security 2 Reducing Inflation	1 Food Security 2 Reducing Inflation	1 Food Security 2 Environment Preservation 3 Enhancing Competitiveness 4 Balancing Development in Agr. & Industry
Main Agr. Strategy & Policy	1 37.5% Land Rent Discount Program(1949) 2 Sale of Public Land to the Tiller(1951) 3 Tillers Owned Farming Land (1946) 4 Payment of Land Tax in Kind(1946) 5 Payment of Public Land Rent in Kind(1946) 6 Purchase of Fertilizer in kind (1949)	Variety Improvement, Insect & Disease Control, Improvement to Irrigation to attain the Increase in Rice Production	1 Expanding Rice Cultivated Area and Increasing in Unit Area Yield as the Strategy to Continue the Increase in Rice Production 2 Improvement of Agr. Trading & Marketing Facilities, and Infrastructure to Support the Agr. Production	1 New Agr. Development Policy(1969) 2 Improvement of Agr. Prod. Infrastructure to Reduce Production Cost 3 Provision of Incentive to Ease the Difficulty of Agr. Production	1 Expediting Rural Development (9 Programs) 2 Establishment of Food Price Supporting Foundations to Ensure 20% of Profit for Rice Producer 3 Abolishing Prochasing Fertilizer in kind (Rice) System(1974)	1 Lowered Food Security Level on 2.50 million mt 2 Improvement of Rice Production Problem (1977) 3 Continued Rice Price Supporting Program to Maintain Farmer's Minimal Income	1 Commencing 2nd Stage of Agr. Land Reform to Expanding Rice Production Scale 2 Continued Rice Price Supporting Program 3 Shifting Rice to non Rice Program to Reduce Rice Production	1 Encouragement of Shifting Rice Crop to Non Rice Crops 2 Price Supporting Program for Non Rice Crops 3 Maintaining Rice Price Supporting Program	1 Better Utilization of Natural Resources 2 Control Importation of Agr. Product 3 Eighth Program for Agr. Improvement	1 Enhancing Efficiency of Agr. Production 2 Expediting Rural Development 3 Environment preservation to Maintain Ecological Harmony 4 Measures after Participating in GATT 5 Flexibility in Adjusting Rice & Non Rice Program
Major Achievement & Its Outcome	1 Agr. Productions to Pre War Level 2 Food Self-Sufficiency Almost Attained 3 Farmers' Purchasing Power Increased	1 Food Self-Sufficiency Almost Attained 2 Rice had surplus and Started to be Exported for FR Baning	Achievement in Expanding Cultivated Area was limited but the Increase in Unit Area Yield was significant. 95% of Targeted Production of 2,380,000mt was Reached	1 Shortage of Rural Labor and Increase in Wages, Rice Production Decreased 2 Agr. Growth Rate Decreased	1 Rice Production Reached Historical High of 2.7 million mt(1976) 2 Overcame World Food Crisis	1 Price of Agr. Product Decreased 2 Farmer's Income Lower 3 Rice with Surplus 4 Per Capita Rice Consumption Decreased	1 Rice with Surplus 2 Decreasing in Domestic Rice Consumption Resulting in More Serious Rice Surplus 2 Farmer's Income Increased	1 Higher Rice Price Inhibited Decreasing in Rice Product 2 Farmer's Income Increased	1 Prices of Agr. Products Increased Steadily 2 Farmer's Income Continued to Increase	1 Prices of Agr. Products Continued to Increase 2 Farmer's Income is Increasing Steadily
Affection to Macro Economics & Agr. Development	1 Inflation and Wages Became Higher 2 Real Rice Prices Dropped 3 Farmers' Real Income Decreased	Capital Cumulation via Exporting Agr. Product had Initiated Basic Economic Development & Gained Development Experience & Confidence	% of Industry to GDP in 1966 Started to Exceed Agr. and Its Development Required High Subsidy	Farmer's Income Decreased, Rural Labor Shortage Serious; Agr. Development Encountered Difficulty	Rice Surplus Became a Problem of Agriculture Development	Maintaining Farmer's Became a Difficult Issue for Agriculture Development	Prevailed Contradictory Policy on Rice Price Support & Suppressing Rice Production wasted Agr. Resources	Agr. Productions Lost Its Importance in Macro economics	Food Production Highly Relied on Subsidy	Economics is No Longer an Important Factor For Agr. Development
Economic Growth Rate(%)	12% (1952)	8.1% (1955)	6.4%(1960), 9.1%(1968)	13.4% (1972)	4.4% (1978)	5.8% (1981)	5.8% (1985)	7.3% (1989)	5.9% (1993)	6.1% (1995)
Per Capita GNP at Current Price US\$	196 (1952)	203 (1955)	154(1960), 304(1968)	522 (1972)	1,132 (1978)	2,409 (1981)	3,293 (1985)	7,512 (1989)	10,566 (1993)	12,439 (1995)
Agriculture Growth Rate(%)	11.2% (1952)	2.9% (1955)	0.8%(1960), 7.7%(1968)	4.8% (1972)	12.7% (1978)	1.1% (1981)	3.1% (1985)	1.5% (1989)	6.2% (1993)	3.7% (1995)
Agr. Production as % of GDP	32.3% (1952)	29.1% (1955)	28.5%(1960), 19.0%(1968)	12.2% (1972)	11.4% (1978)	7.3% (1981)	5.8% (1985)	4.9% (1989)	3.7% (1993)	3.5% (1995)
Farm Household as % of Total Population	52.4% (1952)	50.7% (1955)	49.8%(1960), 43.9%(1968)	38.9% (1972)	33.7% (1978)	29.7% (1981)	21.5% (1985)	18.1% (1989)	18.9% (1993)	18.9% (1995)
Agr. Workers as % of Total Employment(%)	56.1% (1952)	53.2% (1956)	49.8%(1961), 45.0%(1968)	35.1% (1971)	29.0% (1978)	18.8% (1981)	17.5% (1985)	12.9% (1989)	11.5% (1993)	10.6% (1995)
Paddy Rice Cultivated Area(ha)	533,643 (1952)	532,688 (44%)	525,580(1960), 537,399(1966)	520,580 (1972)	520,763 (1976)	502,822 (1981)	494,535 (1985)	478,954 (1989)	463,650 (1993)	461,226 (1995)
Paddy Rice Annual Production(mt)	198.7 (1952)	204.4 (1955)	242.0(1960) 301.2(1966)	308.8 (1972)	342.3 (1976)	300.4 (1981)	275.2 (1985)	236.0 (1989)	223.3 (1993)	208.1 (1994)
The Stage of the Evolution of Irr. Association	1. Irr. Collaboration Association 2. Irr. Collaboration Committee	Irr. Collaboration Committee	Irrigation Association	Irrigation Association	Irrigation Association & Strengthened Irrigation Association	Strengthened Irrigation Association	Post Irrigation Association	Post Irrigation Association	Post Irrigation Association	Improved Irrigation Association
Rice Prod. under Irr. Ass. as % of Total Subsidy to Irr. Ass. as % of the Total National Expenditures					76% (1976)	79% (1978)	88% (1985)	97% (1989)	94% (1993)	
					2.27% (1976)	0.38% (1978)	0.32% (1985)	0.21% (1989)	0.18% (1993)	0.17% (1994)

Source: 1. Agricultural Evolution Stages are summarized from Dr. Lee Y. H's, The Analysis of Rice Production and Trade (Taipei, 1996)

Appendix 2

The Summary of the Evolution of the Utility of Irrigation Association in Taiwan(I)

Evolution Period	Dutch Colonization	Ming-Chung Dynasty	Chung Dynasty	Japan Colonization				Republic of China (after World War II)						Remark
				Initial Stage	Public Irr. Scheme	Official Irr. Scheme	Irr. Collaboration Group	Irr. Collaboration Association	Irrigation Committee	Irrigation Association	Strengthened Irr. Association	Post Irr. Association	Improved Irr. Association	
Period	1609-1661	1662-1683	1684-1895	1895-1901	1901-1908	1908-1921	1921-1945	1945-1948	1948-1956	1956-1975	1975-1981	1982-1994	1994-1998	
Total Years	53	22	221	6	8	13	25	4	9	20	7	13	5	
Irrigated Area (ha)	8,400	30,000	63,000	98,000	225,780	278,938	510,800	560,389	486,050	443,205	440,388	490,577	366,300	at the end of period
Irrigation Schemes		24	233	69	181	198	109	39	40	26	17	17	17	
Legislative Basis for Administration	Dutch Colonization Policy	Non Governmental Status	Local Gov't Notice	Land Lease Regulations 1899	Regulations of Public Irr. Schemes(1901)	Regulations of Official Irr. Schemes(1908)	Orders of Irr. Collaboration Group (1921)	Water Laws	Rules for the Organization of Irr. Committee(1948)	Regulations for the Organization of Irr. Association(1955)	Orders for Strengthening Irr. Association(1974)	Regulations for the Organization of Irr. Association(1955)	Revised Regulations for the Organization of Irr. Association(1993)	
Management System	Colonial Business Company	Farmers' Cooperative Body	Farmers' Cooperative Body	Farmers' Cooperative Body	Farmers' Cooperative Body under Gov't's Supervision	Official Irr. Facilities Managed by Gov't	Collaboration Body under Gov't Supervision	Farmers' Autonomous Cooperative Body	Farmers' Autonomous Cooperative Body	Farmers' Autonomous Cooperative Body	Farmers' Cooperative Body under Gov't's Control	Farmers' Autonomous Cooperative Body	Farmers' Cooperative Body under Gov't's Control	
Government's Supervision	By Government Company	No Government's Supervision	Limited Gov't's Supervision	Limited Gov't's Supervision	Closer Gov't's Supervision	Under Gov't Operation	Gov't's Close Supervision	Gov't's Loose Supervision	Gov't's Loose Supervision	Gov't's Close Supervision	Gov't's Close Supervision	Gov't's Close Supervision	Gov't's Close Supervision	Controlled by the Government
Role in Macro Economics	Exporting Rice & Sugar	Subsistence Farming	Subsistence Farming	Food Self Sufficiency	Food Self Sufficiency	Exporting Rice & Sugar	Food Self Sufficiency	Food Self Sufficiency	Food Self Sufficiency	Exporting Rice & Sugar	Food Self Sufficiency	Food Self Sufficiency	Food Self Sufficiency	
Reasons of the Changing in Organization	Taiwan Colonized by Dutch	Dutch expelled by Chung's Army	Ming/Chung Defeated by Chin Dynasty	After Sino-Japan War Japan Colonized Taiwan	Gov't started to control Private Irr. Schemes	Gov't started to Expand In. Schemes	Gov't wanted to Reduce the Burden of Operating Irr. Schemes	After War China Recovered Taiwan	Gov't Tried to Supervise Irr. Ass. Closely	Gov't wanted to Expand Rice Production	Irr. Ass. Encountered Difficulty to Operate	Gov't Wanted to Reduce the Burden	Irr. Ass. Encountered Difficulty to Operate again	
Executing Agency(ies)	Dutch Government	non	non	non	Governors General Office	Governors General Office	Governors General Office	Taiwan Provincial Government	Ministry of Economic Affairs	Ministry of Economic Affairs	Ministry of Economic Affairs	Ministry of Economic Affairs	Council of Agriculture	
Supervising Agency(ies)	Eastern Indo Company	non	non	non	Local Government	Local Government	Local Government	Dept. of Agri. & Forestry	Water Conservancy Bureau	Water Conservancy Bureau	Water Conservancy Bureau	Water Conservancy Bureau	Water Conservancy Bureau	
Assembly Meeting Body	non	non	non	non	non	Management Committee Meeting	Management Committee Meeting	Management Committee Meeting	Management Committee Meeting	Representative Assembly Meeting	Representative Assembly Meeting	Representative Assembly Meeting	Association Affairs Committee Meeting	
Supervisor	Manager of Company	Owners of Irr. Scheme	Owners of Irr. Scheme	Owners of Irr. Scheme	Appointed Supervisor	Appointed Supervisor	Appointed Supervisor	Elected Chairman	Elected Chairman	Elected Chairman	Appointed Chairman	Elected Chairman	Appointed Chairman	

Appendix 3

臺灣地區農田水利會八十四年度組織及財務營運概況
The Status of the Organization and Financial Management of Irrigation Associations in Taiwan in 1995

項目 Items	單位 Units	都會型水利會 Pen-urban Type Irrigation Associations						零星型水利會 Small Scale Type Irrigation Associations						鄉村型水利會 Rural Type Irrigation Associations						總計 Total		
		蘆公 Lu Kong	七里 Chhsin	桃園 Taoyuan	臺中 Tachung	高雄 Kaoshiung	小計 Subtotal	基隆 Keelung	新竹 Hsinchu	南投 Nantou	臺東 Taitung	花蓮 Hualien	小計 Subtotal	宜蘭 Yilan	石門 Shihmen	苗栗 Miaoli	彰化 Changhua	雲林 Yulin	臺南 Tainan		屏東 Pingtung	小計 Subtotal
灌溉面積 Irrigation Area	公頃 ha	324	900	25,983	30,934	18,461	76,602	5,180	6,779	12,902	14,023	12,498	51,382	19,044	21,926	9,872	46,156	66,374	78,422	28,997	270,791	398,775
員工 Staff	人 Persons	32	33	206	245	228	744	29	54	103	96	82	364	133	102	89	341	589	662	225	2,141	3,249
工作站數 Working Stations	站 Stations	2	-	13	23	16	54	4	4	9	9	8	34	10	7	11	32	54	72	18	204	292
會員數 Members	人 Persons	1,062	2,255	51,493	110,248	49,304	214,362	12,340	28,476	35,816	18,421	21,668	116,721	56,350	22,940	40,125	155,846	185,376	188,639	61,575	700,851	1,031,934
水利小組 Water Groups	組 Groups	13	17	339	308	150	827	60	104	109	114	82	469	187	105	119	403	507	672	202	2,195	3,491
水利班數 Sub Water Groups	班 Sub Groups	19	-	2,137	911	400	3,467	353	116	447	973	436	2,325	468	366	602	1,190	1,601	1,918	1,099	7,244	13,036
會務委員總數 Total Commissioners	人 Persons	15	15	21	23	19	93	17	17	19	19	19	91	19	19	17	25	29	31	21	161	345
會員委員 Member Commissioners	人 Persons	-	-	14	16	13	43	12	12	13	13	13	63	13	13	12	17	20	21	14	110	216
機關委員 Official Commissioners	人 Persons	-	-	3	3	2	8	2	3	6	2	2	72	3	3	3	6	3	4	2	24	104
專家委員 Expertise Commissioners	人 Persons	-	-	4	4	4	12	3	2	3	4	4	16	3	3	2	2	6	6	5	27	55
總事業收入(Total Revenue)	臺幣億 NT\$10 ⁸	10.466	3.796	6.250	18.900	15.179	54.591	0.947	2.175	2.347	2.413	2.247	10.128	2.664	3.703	3.155	9.610	12.095	17.658	3.436	52.321	117.041
出售資產盈餘 Revenue from Land Sold	臺幣億 NT\$10 ⁸	2.584	0.959	2.039	13.225	11.053	29.859	0.137	0.284	-	-	0.091	0.512	0.080	0.811	0.874	3.550	3.265	3.694	-	12.274	42.645
政府補助 Government Subsidy	臺幣億 NT\$10 ⁸	-	-	1.217	1.591	1.026	3.834	0.583	0.902	1.851	2.396	2.115	7.846	1.988	0.704	1.697	5.304	8.606	8.400	3.204	29.903	41.583
總事業支出 Total Expenditure	臺幣億 NT\$10 ⁸	6.920	2.336	4.801	11.932	5.510	31.498	0.496	1.505	1.531	1.272	1.133	5.937	1.987	2.271	2.455	7.599	9.090	13.463	3.267	40.133	77.568
用人費 Personnel Expenditure	臺幣億 NT\$10 ⁸	0.241	0.249	1.158	1.270	1.152	4.070	0.202	0.289	0.540	0.468	0.437	1.935	0.665	0.546	0.479	1.717	2.910	3.429	1.184	10.929	16.934
員工數於與灌地比 Staff & Irr. Area Ratio	公頃/人 Ha/Person	10.13	27.27	126.14	126.26	80.97	102.96	178.62	125.54	125.26	146.07	152.41	141.16	143.19	214.96	110.92	135.35	112.69	118.46	128.88	126.48	122.74
人事費與總支出比 Personnel & Total Expend. Ratio	百分比 %	3.5%	10.7%	24.1%	10.6%	20.9%	12.9%	40.6%	19.2%	35.3%	36.8%	38.6%	32.6%	33.5%	24.0%	19.5%	22.6%	32.0%	25.5%	36.2%	27.2%	21.8%
出售資產與總收入比 Land Sold & Total Reven. Ratio	百分比 %	24.7%	25.2%	32.6%	70.0%	72.8%	54.7%	14.5%	13.1%	0.0%	0.0%	4.0%	5.1%	3.0%	21.9%	27.7%	36.9%	27.0%	20.9%	0.0%	23.5%	36.4%
補助與總支出比 Subsidy & Total Expend. Ratio	百分比 %	0.0%	0.0%	25.3%	13.3%	18.6%	12.2%	117.4%	60.0%	120.9%	188.4%	186.6%	132.2%	100.0%	31.0%	69.1%	69.8%	94.7%	62.4%	98.1%	74.5%	51.6%

資料來源：陳子強-農田水利(4期)

Source: Chen Shou-Chiang, Farm Irrigation (No.4, Vol.43)

備註：補助款超過年度支出係未能於年度前決算之工料。Remark: The amount of annual subsidy exceeding the annual expenditure is because part of subsidy for engineering cost can not be used before the end of fiscal year.