Development and Outlook of Irrigation Water Management in Taiwan

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ABSTRACT

In Taiwan, irrigation management business has been carried out for over three hundred years and the management was done to satisfy the society throughout the period. To maintain this contribution "Irrigation Associations" (IAs) were formed. Because these associations were successful in irrigation water management, it was very easy for farmers to get water for irrigation and they trusted the associations; yet, they have tended to forget that kind of success came from these associations, so that the farmers are now unfamiliar with the irrigation association.

During the past several decades, the economic structure of the society has changed; from one of agriculture to industry. The position of the agricultural production economy has weakened gradually; based on this situation, the irrigation associations are going to improve their functions to adopt to the present conditions, but in the meantime the people cannot support them. The farmers have asked the government to create a good environment for agricultural production and the irrigation associations are making strong attempts to change their services to the farmers.

This paper presents the development of the organization of the IAs during the past hundred years and points out the essentials of the management model of the associations in the past years. It submits a good model of the irrigation associations to be adopted in the future. The authors hope that the irrigation associations can work out problems on scientific management, business computerization, modern structures, multiple-finance supply and younger staff, and make a strong organization in the future.

INTRODUCTION

Water and land are the important sources that should be developed for agricultural production. The land source for cultivation is too small and the density of population is too high. Furthermore, the water source is influenced by the environment, and the rate of utilizing of the water source is only about 21 percent. Because the sources of water and land are very much limited, we have to adjust the water sources first to develop Taiwan's agricultural production and its economy. The organization of irrigation associations to construct structures for controlling water sources are the best way to increase Taiwan's agricultural production.

IAs were organized by the farmers themselves a long time ago. The duty of IAs in irrigation water management was to allocate the natural water for agricultural production, and they had much experience in contributing to the economy and to a stable society in every era from the Sung Dynasty. Irrigation water management was carried out by 17 IAS in Taiwan. Meantime, they had to change the method of water management, and although the society has progressed era by era, and it is difficult to solve this problem, yet we have to make an effort to do so.

CONTRIBUTION BY IRRIGATION ASSOCIATIONS

Irrigation business was started from the Yuan Dynasty. People of the Yhe Han race immigrated to Taiwan for reclamation, established simple irrigation systems in small farmer groups, and, later on, depending on the change in the political type of society organization, economic structure, etc., the organization for irrigation was changed. Irrigation organizations were run by private people in the Ming and Ching Dynasties and the irrigation equipment also belonged to the private people. They could be sold at any time, and there was no management at all in the irrigation practices. When Taiwan was occupied by Japan, the Japanese forced the private people to donate their properties for public irrigation business and they had to continue supplying the fund to improve the irrigation system. It became the "Water Combination Group" to strengthen control [Taiwan people]. After Taiwan was gained independence from Japan, the Group came under democratic principles, and management was dedicated to work, with a reasonable sharing of expenses with farmers. The association was reorganized and improved many times, and came to be known as the

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"Irrigation Association." The association contributed to recovering the agricultural production, stable production, increase in production, safeguarding farmers' income, lifting up the farmers' position, economic reconstruction of the society, and, therefore, IAs not only completed the irrigation and drainage management but contributed to the economy and politics of the society. The contributions by IAs are given below.

Economic Phase

Because water resources are influenced by the natural environment, its utilization is not so high, yet we have to control it appropriately. IAs have good structures and a strict organization for utilizing water on irrigation and drainage, so that we have a high agricultural production which has been stable throughout the years. We have the ability to assist in the development of industry and right now we have progressed well in our economy.

Societal Phase

We have had an agricultural society in our country for a very long ago period, and its activities were focussed on developing society. There was only the organization of a water combination group in the village concerned with agricultural activities, and the group carefully established an irrigation system based on moral principles, resulting in no further quarrels among the villagers. They lived and worked in peace and were content with life, and this traditional virtue still exists in the village, which is sadly lacking in the city life.

Political Phase

Although the IAs belong to the farmers themselves its organization style was changed with according to political responsibility, era by era. At the first, the association was invested by private persons or on demand in a district. As it was a private commercial unit it was also managed privately. When Taiwan was occupied by the Japanese, the government got involved in the association in order to control the foodstuff produced by the farmers. When Taiwan became independent, i.e., when it became a democratic era, the association was an autonomous group where everything belonged to themselves, and the operation and maintenance of the irrigation and drainage systems was the same before. However, governments utilized IAs to [stay] foodstuff production, to [cultivate] the economy, etc., so that IAs constitute the stable power of the society.

In fact, IAs are organized by the farmers themselves and they have to serve the members of the association who are also farmers. The services rendered are listed below.

Deciding on Irrigation Projects

The association decides on an irrigation project based on the basic data on precipitation, hydrology, water source, soil, crop, etc., and carries it out in the irrigation system.

Investigating Water Requirement in the Service Area

Investigate how much of the water sources can be utilized in the growing season, consider the water source such as reservoirs, ponds, rivers and groundwater, and then, investigate irrigation requirement of the service area.

Maintaining Irrigation Order

Because of the long experience of IAs in water management in Taiwan, they not only figure out the optimum irrigation requirement to some cropping patterns but also have a methodical irrigation institution by which according to the canal system, kinds of crop, etc., irrigation order and time are arranged. Therefore, there are no more quarrels between farmers regarding water distribution.

Irrigation Water Quality under Surveillance

Irrigation water quality was very good several decade ago but because the industrial and city drainage water is drained to the irrigation canal system its water has been polluted. Therefore, irrigation water surveillance stations have to be established and the surveillance works undertaken by the IAs.

Maintaining Drainage System in Service Area

Where are drainage systems are located at the end of irrigation canals, the IAs have to keep conveyance water freely. The natural condition of water resources is also not so good as there is much rainfall during the typhoon season from June to September. The drought season is from October to May. Although there are many flood and drought disasters, because the IAs maintain the system very well, rich foodstuffs are harvested every year.

THE HISTORY OF THE IA ORGANIZATIONS IN TAIWAN

Although Taiwan has abundant rainfall which is unevenly distributed the previous generations had to store some water for use during drought periods to have a stable agricultural production. The "Taiwan Prefecture Book" says that a simple irrigation water storage project named "Shen-Juo-PO" was located at Wen-Ying-Li in 1660s and that it was built by a farmer named Sen-Juo Wang. There were many irrigation projects constructed by individual persons. Although they were private properties management of these irrigation projects was very rough. Establishing public irrigation systems was carried out in the period when Taiwan was occupied by the Japanese, which were, later on, organized as "Water Combination Groups". It was the beginning of organized irrigation management. In 1945, the name of the irrigation group was changed to irrigation association. In 1948, the name of the "Flood Control Association" combined with the IA, was changed to "Water Conservancy." In order to lift the farmers position, give them the profits, agricultural production was increased, thus giving birth to a prosperous farmer economy. At this time, the name was changed again to Irrigation Association (IA) which is continued to date. From 1975 to 1982, to strengthen the associations, the government took over their management. The history of the irrigation management is given below in detail.

The Yuan (1977-1968), Ming (1368-1643) and Ching (1644-1911) Dynasties

Irrigation business began in the Yuan Dynasty when people of the Han race migrated to Taiwan gradually, reclaimed land along the sea and constructed canals and reservoirs for irrigation. Most of the ponds were located along the sea and they were more fertile.

The First Era

At the first, the people did not know how to cultivate but after the people of Han race migrated to Taiwan, they used the method of simple intake of water from rivers or blocked water for irrigation and just diverted the water to the field, but there was no irrigation.

The Dutch and Spanish Era

The Dutch and the Spaniards arrived in Taiwan during the Yuan Dynasty (1977-1968). They planned to make commercial business enterprises in Taiwan but could not do well and changed their plan to do reclamation work which was the method introduced from Java and Indonesia together with the people of the Han race.
The population of the Han race was about 25,000 and the rice area was about 6,516 morgen (6,000 ha) with a sugarcane area of about 6,000 ha. The scale of irrigation activities at that time can thus be imagined. The irrigation storage constructions had Ruoh-Tsan-Po, Holang-PO, ON-Mo-Tsao pond, etc., in that period but the irrigation contribution and commercial management were very rough.

The Jeng-cherng Gong Era

Cheng-gong Jeng [lived] in Taiwan in 1661. In order to pacify his army, he constructed many irrigation structures for developing agriculture to increase production. He constructed 70 dikes for storage of water, intake of water from rivers and lakes, and also 5 canals, the longest one about 7-8 km. He also constructed dikes in 35 places in low land for storing water. Water conservancy was in a small scale during that period. He also began operation and maintenance activities of irrigation systems.

The Ching Dynasty Era

In the 1650s, the number of immigrants increased every year, and the reclamation area increases a great deal. The population was about 200,00 to 3,000,000 during the period of 200 years; area cultivated to rice was about 200,000 ha, most of them along the sea coast. The water conveyed from canals could irrigate about 107,000 ha. The

government persisted in the construction of irrigation projects; it also encouraged the private sector to construct irrigation projects [and made operation and maintenance to the irrigation systems.] The large irrigation projects which are still in operation are as listed below.

Pa-pao canal systems constructed by Ja-ling Shih,
Da-chia canal system constructed by Fang-goa Chang,
Lu-Kung canal system constructed by Si-lu Kuo,
Da-An canal system constructed by Chen-fsir Lin, and
Tdsaur-Kung canal system constructed by Chin, Tsaur.

Japan Occupied Era

Taiwan was at one time a colony of Japan. In order to supply foodstuff to the Japanese, the government had to develop agriculture in Taiwan. The first action was of the government was to investigate irrigation systems and announce the combination of public organizations with the private organizations with government supervision. It also started a large fund to develop irrigation business and continued work in the combined irrigation associations [in 1909,]; furthermore private and government irrigation systems were integrated into a Combined Irrigation Association, so that all of the irrigation systems became public organizations, which could collect water fees and purchase land based on public rights. The differences between public and government irrigation systems are mentioned below.

Public Irrigation Systems. A long time ago, irrigation business was considered private property, with rights to purchase and sell freely. As there were frequent flood disasters, it was very difficult to maintain the structures. After Taiwan gained independence from Japan, the public-works-related profits and losses of the public irrigation system were supervised by the government which announced the regulation of public irrigation systems. A legal office named "Combination of Public Irrigation System," was created so that the irrigation organization was provided with legal management rights. This organization which was registered had 619 irrigation systems in 1905, and, later on, it was extended to cover general irrigation systems with an irrigation area of about 40,395 ha.

Government Irrigation Systems. When the project became very large, farmers could not work with limited funds; further, the cost of water and electric power also had to be considered. The result was that the government took over the irrigation system and announced its policy in 1909. The Taur-Yuan and Chia-nan irrigation projects were constructed in 1916 and 1920, respectively, and the irrigation area increased to 247,302 ha.

Irrigation Combined Group. In order to control the agricultural economy in Taiwan during the Japanese occupation, the well-managed private irrigation systems were taken over and controlled by the government. These private systems, together with the public and government systems were combined to form what came to be known as the "Combination Irrigation System" totaling 108 units. As Japan was devoted to developing military equipment during World War II, it could not construct any more irrigation systems Taiwan. For three years, from 1941 to 1943, there were devastating typhoons which destroyed the irrigation structures in Taiwan to a great degree. The irrigation area which was 544,437 ha in 1937 thus decreased to 486,332 ha in 1945. Still further, the irrigation structures in Taiwan were bombed during World War II further reducing the irrigation area to about 260,000 ha.

FORTY YEARS' IRRIGATION BUSINESS AFTER TAIWAN'S INDEPENDENCE FROM JAPAN (1945-1976)

As mentioned above, because almost all irrigation structures were bombed during World War II there were few left which could be used after Taiwan became independent Japan in 1945. The government, after 1945, took three steps to recover and develop the irrigation business. The first step was to raise funds and labor to restore the structures and to complete irrigation projects which were designed before. The second was to construct new irrigation projects and improve the existing irrigation structures, and the third was to develop water resources and effective irrigation and drainage systems to promote the export of agricultural production. The government devoted itself to invest in important irrigation projects; the [larger] project is shown in Table 2. During these forty years, the government 15 reservoirs as water sources. Table 3 shows the increased irrigation area of about 145,784 ha and also the improved irrigation area.

The History of Irrigation Associations in Taiwan

Almost immediately after Taiwan gained independence, it changed 38 irrigation combinations into "Irrigation Committees" in 1948, and added Pin-tun and Dou-liu Irrigation Associations thus forming 40 "Irrigation Committees"

in Taiwan, but because the committees lacked legal background, it was very difficult to carry out irrigation business. Therefore, the government assigned a self-disciplined group legal status following which the name of the committee was changed to "Irrigation Association" so that the 40 committees were integrated to 26 Associations in 1956 (Table 1). From January 1975 to May 1982 the associations managed by the government and received [a nice credit]. After 1982, the associations were managed by farmers again, with the same legal office and self-disciplined group; the association chairman and other office bearers were selected by the farmers themselves.

THE PRESENT IRRIGATION ASSOCIATION IN TAIWAN

There are 17 irrigation associations in Taiwan right now which belong to the farmers themselves. The Chairman of the association is selected by the representatives selected by the farmers. There are also consultants in all the associations who help the Chairmen in their business. About 2 to 4 meetings are held each year to make or update the administrative policy of the association. But as the knowledge in the field of irrigation management technology increases daily, we have to have higher levels of consultants in modern scientific management knowledge to assist the associations. The government has, therefore, changed the selection policy which now is that two-third of the representatives are selected by the farmers themselves while one-third of them is nominated by the government from experts or professors. The policy was begun to be implemented from June, 1994.

The duties of irrigation association are:

1. Construction of irrigation structures, improvement, and, operation and maintenance of irrigation business.
2. Prevention of disasters and making emergency rescues of irrigation business.
3. Raising funds and to establishing the fund for irrigation business.
4. Studying benefits and development of the business.
5. Carrying out the government policy on agriculture, land, industry, etc.

The organizations of IAs consists of three parts, such as a parliament of representatives. Business is carried out by the association staff. The basic organization of irrigation groups, the duties of parliament are as follows:

1. Examine the regulations of the association as well as the rights and duties of the members.
2. Examine the nonmovable properties of the association.
3. Examine matters connected with borrowings, debts and donations.
4. Examine working projects.
5. Examine the estimation of the budget.
6. Resolution of motions or proposals.
7. Examine the final financial statement.
8. Resolution of proposals of the members.

The divisions of the association which come under the Chairman are Engineering, Management, Finance, General affairs, Personnel Office, Accounting Office, Guidance Service Office, etc.

The basic organization of the irrigation group and the duties of the group are as follows:

1. Maintain and manage farm ditches and drainage ditches.

2. Irrigation water management in their service area.

3. Construct supplement ditches.

4. Manage the gates which are in farm ditches and supplement ditches.

5. Other irrigation business.

The funds used to manage the irrigation business in irrigation association are as follows:

1. Income from member fees.

2. Income from business.

3. Income from properties.

4. Income supplied by the government.

5. Income from donations.

The income given in items 1 and 2 is collected from the members of the irrigation associations, and it is direct income, and the income given in the other items is indirect income. The development of agriculture development has been very poor in recent years resulting in poor income. In order to run the irrigation business smoothly and to reduce the member fees of the farmers, the government raised its supplies to the irrigation associations. From 1993, the farmers stopped paying the member fees. In addition, the government supplies funds for improving irrigation structures and for repairing damaged structures.

FUTURE OUTLOOK OF IRRIGATION ASSOCIATION BUSINESS

The development of agriculture was carried out smoothly by the IAs which are responsible for operation and maintenance of irrigation systems. Foreign consultants who had the latest knowledge in irrigation technology were invited to Taiwan to organize IAs. However, as the societal structure has changed from one of agriculture to commerce, agricultural production has been reduced. As the farmers are unable to pay the expenses for irrigation, the management of irrigation business is in great difficulty right now.

1. As the rural population migrated to the city, some agricultural land were transferred for commercial use, disturbing the irrigation systems.

2. The water sources had to be shared among agricultural use, domestic use and industrial use.

3. Because of numerous factories constructed for industrial development the waste products of these factories pollute the irrigation water.

4. Because trees are felled to cultivate land the resulting watershed influences soil conservation seriously.

5. Collecting sand and gravel from the middle of river bed for use in concrete works results in serious erosion in the lower reaches of the river and in changing the water current from the center of the river. This makes it difficult for farmers to intake water from some places for irrigation purposes.

6. The application of chemical fertilizers and agricultural [medicine] in modern agricultural production, pollutes the soil seriously.

The abovementioned problems are not in irrigation management, but we have to consider the whole agricultural development in the future; these problems can be solved under three principles:

1. Protect the agricultural environment keeping the crops to their normal growth,

2. Promote village development, and

3. Stabilize agricultural production.

For irrigation business, we have to work according to the same three principles also. The government will, therefore, reform the Irrigation Associations to adapt to the present societal conditions, such as scientific management, modernized structures, business computerization, multiple finance, younger people on the staff, powerful organization. Implementing these by the irrigation associations will serve modern agricultural society well.

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