Introduction of Irrigation Organizations and Innovative Irrigation Policy in Taiwan

Kuo-Hua Lin
Section Director Council of Agriculture, Executive Yuan, Taipei City, Taiwan,
E-mail:kuohua@mail.coa.gov.tw
Ren-Huang Wang,
Assistant Researcher, Kaohsiung District Agricultural Research and Extension Station, Council of Agriculture, E-mail: rhwang@mail.kdais.gov.tw

Executive Summary

Our government began to implement the new policy strategies mentioned above, aimed to guide the Irrigation Association members toward adjustments of water supply system and farming practices. This paper gives an overall review of the current policy such as "Fallow Land Revitalization Policy" and "Golden Agricultural Corridor" . These policies are important in improving the existing agriculture-related issues. It requires multi-governmental organization cooperation to succeed. In other words, to solve these issues we must integrate various perspectives, for example to include water resources, agriculture, economic, and society. In our country, we have to design cross-sectoral collaboration policy to solve such a complex issue. But this is a long-term challenge and need to be examined regularly to ensure the effectiveness of policies, and to develop relevant adjustment strategies.

1. The situation of irrigated agriculture in Taiwan

1.1Water Resources

Taiwan is located in the eastern edge of the Asia Continent, off the China mainland, southeast of the main islands of Japan and north-northwest of the Philippines. There are altogether 118 river systems on the island Taiwan, mostly running to the east and the west.

The yearly rainfalls in Taiwan between 1949 and 2007 amounted to approximately 2,480 mm or 89.3 billion cm^3 in volume, which was about 2.5 times of the world's average. Taiwan accordingly is categorized as the region of abundant rainfall. Owing to the present dense population (around 23 million), however, in terms of the averaged share of annual precipitations per capita the amount is merely 4,074 cm^3, which is less than one-fifth of world average . In this regard, Taiwan is therefore a region of water scarcity. About 78 % of the island's rainfalls in each year usually occur between the wet season months of May and October, which sources from plum

rains, storms and typhoons. And during the months of dry seasons the total rainfall amount is just around 22 % of the yearly sum. According to the long term rainfall records in Taiwan, amounts of annual rainfalls varied drastically, with the average recurrences of severe dry years to occur about every 10 years; yet the milder dry years to occur every 2 to 3 years. Therefore the hydrological uncertainties in Taiwan are quite acute. In Taiwan the approximate region-wide annual evaporations are approximately 1,250 mm in the northeast, 1,600 mm in the west, 2,000 mm in the south and 1,250 mm in the east regions. The highest monthly evaporation rates happened usually in July. According to related statistics, on an average there were about 3.5 events of typhoons striking Taiwan in one year in the past decade, which accounted for 65 % of the total incidents of natural disasters.

The total water consumption is approximately 17.74 billion m^3, agricultural water use consumes the majority of available water in this country. During 2002 ~ 2006 around 11.31 m^3 of water were used for irrigation each year, of which about 80% was directly drawn from rivers and ground surface runoffs, 10% from reservoirs and various ponds, and another 10% from groundwater. However, as a result of expansion of industrial zones and urbanization, irrigation water quality has been increasingly menaced by the industrial and rural husbandry wastewater as well as urban sewerage since 1980s. Monitoring of the water quality in the sources and canals therefore has become one of the major routine works of the following associations.

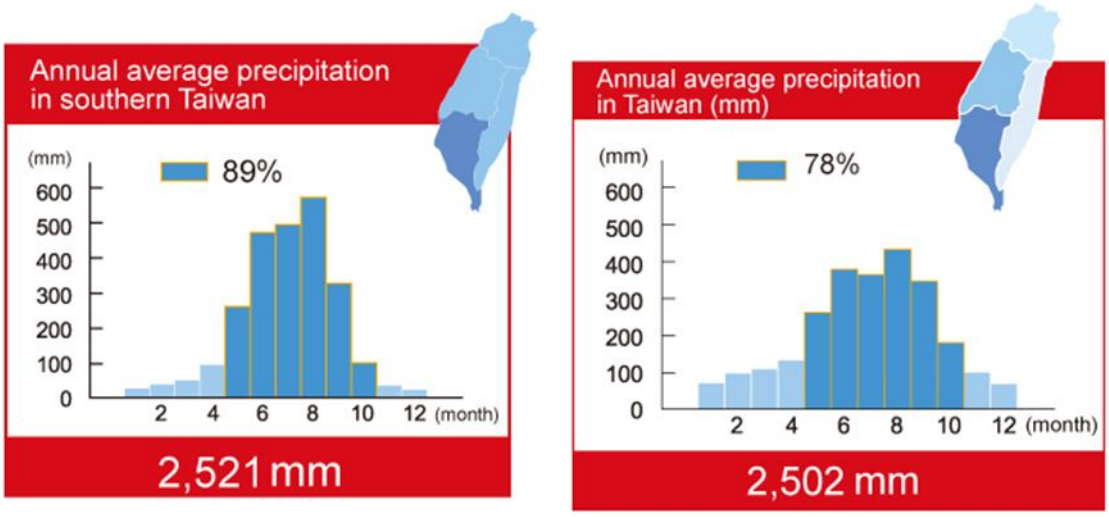

Fig.1 Averages calculated of data from 1949 to 2009

1.2Irrigation Association

While agriculture has been the economic foundation of the country, the irrigation undertaking has played one of the vital roles in the agricultural sector. The role

ensures good quality and adequate supply of agricultural water, and give fully play in supporting the modern agricultural tri-functions. As the irrigation in Taiwan has been developing for quite a long time, the technologies related to its infrastructures and associated operation and management have advanced to quite a high level.

The Irrigation Associations (IAs) in Taiwan nowadays are generally organized on the basis of river systems as well as local geographic, environmental and economic conditions, pursuant to the laws. Currently in Taiwan there are 17 Irrigation Associations, and around 3,000 employees. According to the Organic Act of the Irrigation Association, these Associations should be committed to fulfill the following six major functions:1) Construction, improvement, maintenance, and management of irrigation and drainage facilities, 2) Prevention and repair of disasters/damages to the irrigation and drainage facilities, 3) Fund raising and foundation establishment for the needs of irrigation undertakings, 4) Research and development of irrigation and drainage benefits, 5) Support to relevant government policies in connection with the land, agricultural, industrial and rural reconstruction policies, 6) Other activities as legally designated by the competent authority. In 2012, the infrastructure of irrigation includes a total length of about 44,000 km of irrigation canals and 25,000 km of drainage ditches. (Table.1 and Fig.2)

Table1 Irrigation Canals & Drains

Irrigation Canals							**Drain**	**Total**
Leading Canal	**Primary Canal**	**Secondary Canal**	**Sub-Secondary Canal**	**Tertiary& Quaternary Canal**	**Tunnel**	**Sub Total**	**25,793**	**69,883**
411	3,665	4,837	5,336	29,841	105	44,090		

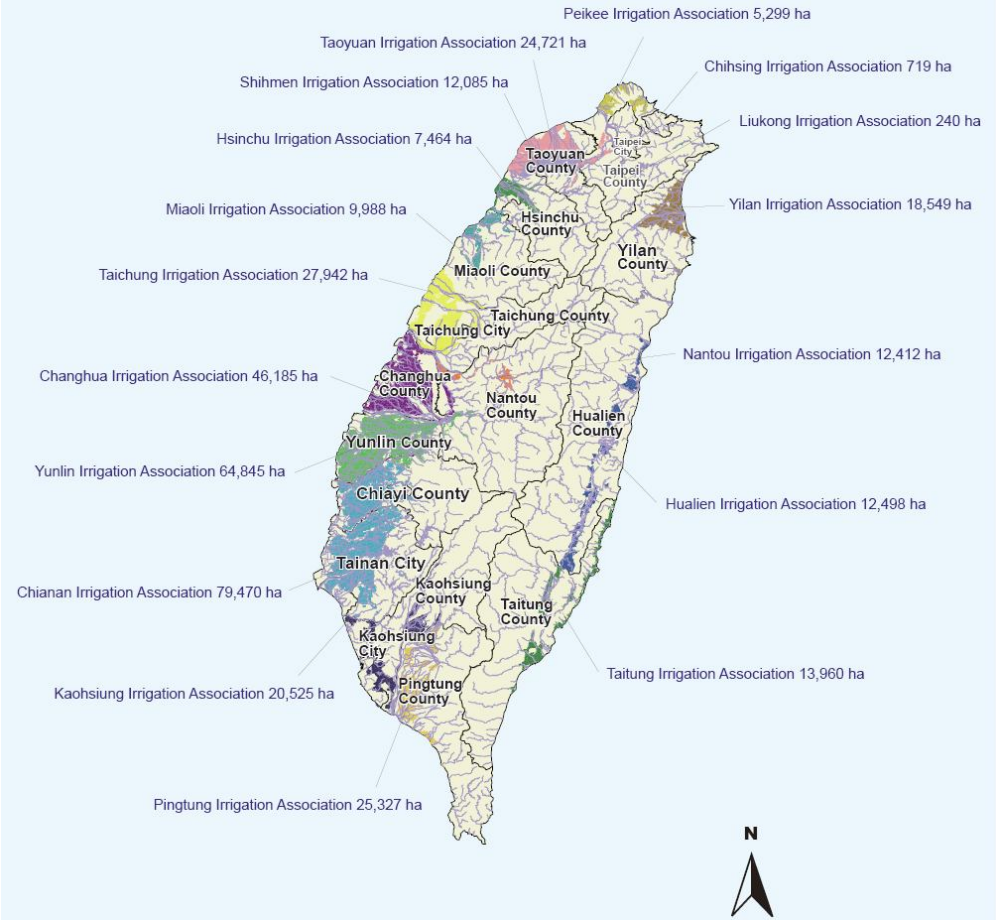

Fig.2 Irrigation Association in Taiwan

In order to perform their legally prescribed functions, the Association Affairs Committee (AAC) of an IA is responsible for review and approval of the IA's important events such as annual budgets and settlement statements. The chairman of IA is responsible for the overall management and operations of the IA, with the administrative assistance from the general manager and technical assistance from the chief engineer. Pursuant to the prevailing law governing the organization of IAs in Taiwan promulgated in June 2001, the chairman and the members of the AAC of an IA are directly elected by the IA's members. While the chairmanship is limited to two consecutive terms, the AAC membership can be continued so far as a member is successfully elected into the AAC. The tenures of both chairman and AAC members are the same, i.e., four years for each term. But, with regard to the membership fee payments, the said law still stipulates that the Government is obliged to pay the IA members' membership fees to respective IAs, as subsidies to the farmers members. The association's functions are carried out by eight divisions and offices in each IA's head-office designated respectively with distinctive responsibilities. In the fields of an IA's domain, there are work stations to be in charge of the irrigation and drainage

systems operation and maintenance (O&M) of the association-owned facilities, but may be assisted by the irrigation groups normally composed of the members whose farms are located within a tertiary unit. Up to 2010, the total irrigation area of these 17 IAs amounted to 382,229 ha; and the registered number of IA members was tallied as 1,265,384 who were divided into 3,487 irrigation groups and further into 11,252 sub-irrigation groups.(fig.3)

The O&M of irrigation systems are the main activities of the irrigation associations. Each association every year has to formulate annual irrigation schedule per scheme, especially for large scale schemes even per primary and secondary canals. The irrigation water therefore is not delivered on demand, but rather on fixed timetable, as the majority of average farm plot sizes are in general small (<1.0 ha), and most of the irrigation schemes are of run-of-the-river sources which flows are usually very low and unreliable in dry seasons. The irrigation schedules per annum for each crop season for respective irrigation schemes are announced two to three months in advance by concerned irrigation associations.

Traditionally the participative irrigation management (PIM) scheme was ever practiced in the IAs. The irrigation schedules for respective tertiary blocks were drawn up by relevant work stations in the beginning and then discussed with IA members in the irrigation group meetings. The meeting conclusions were then referred to by the work stations for modifying the draft irrigation schemes.

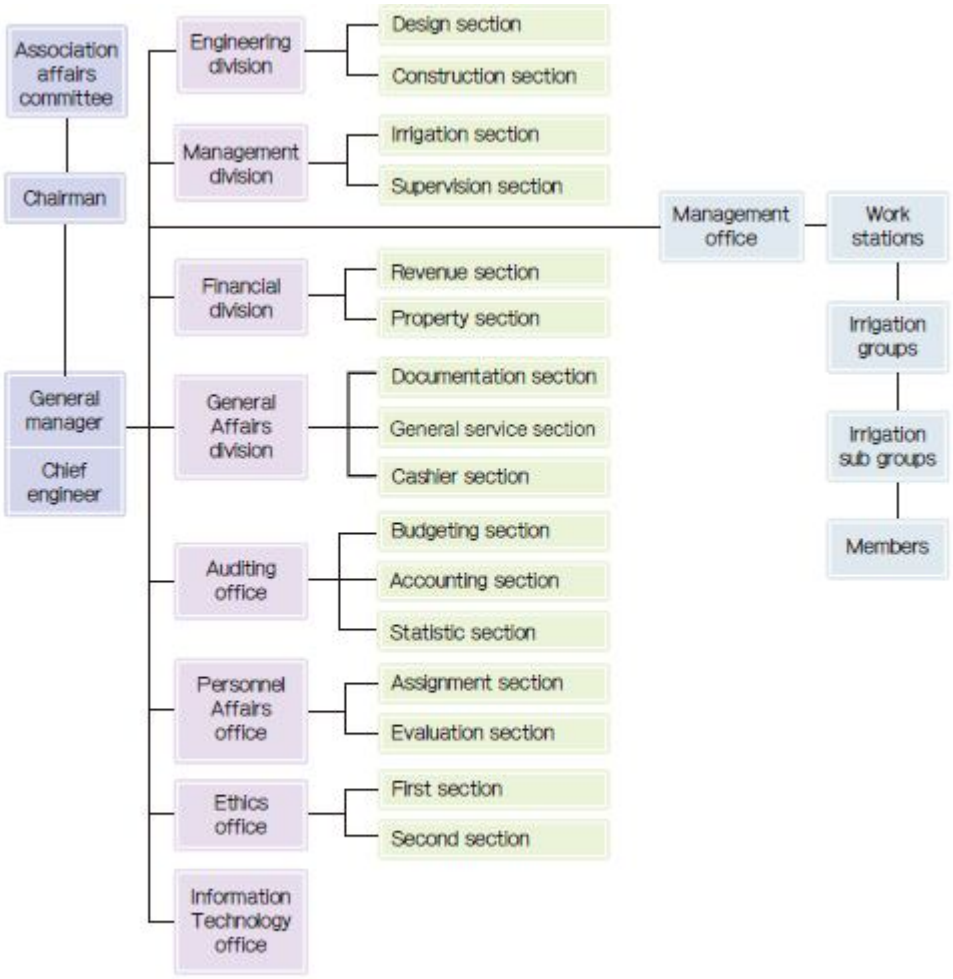

Fig.3 Irrigation Association's Organizational Structure Chart

1.3 Irrigation Association Finance

Regarding the financial sources of the IAs in Taiwan, legally they should be mainly originated from the annual membership fees and charges of uses of irrigation and drainage facilities, and subsidies from the Government aiming at renovation and improvement of existing major works. However, since about two decades ago, the annual revenues from membership fees have been subsidized by the Government, initially an amount of about 30%. Since 2001, in line with the revised law governing the IA organization as mentioned previously, the total amount of the membership fees has been fully allocated from the Government's budget. In addition, the budgets for the repairs of major works caused by natural disasters such as storms and floods have been also financed by the Government.

As a result of IA members' inability to pay for the service fees, the Council of Agriculture has been subsidizing the irrigation services since 1994 . In 2011 alone, the subsidies totaled USD 160 million, which amounted to 43% of IAs' total funding.

(Fig.4)

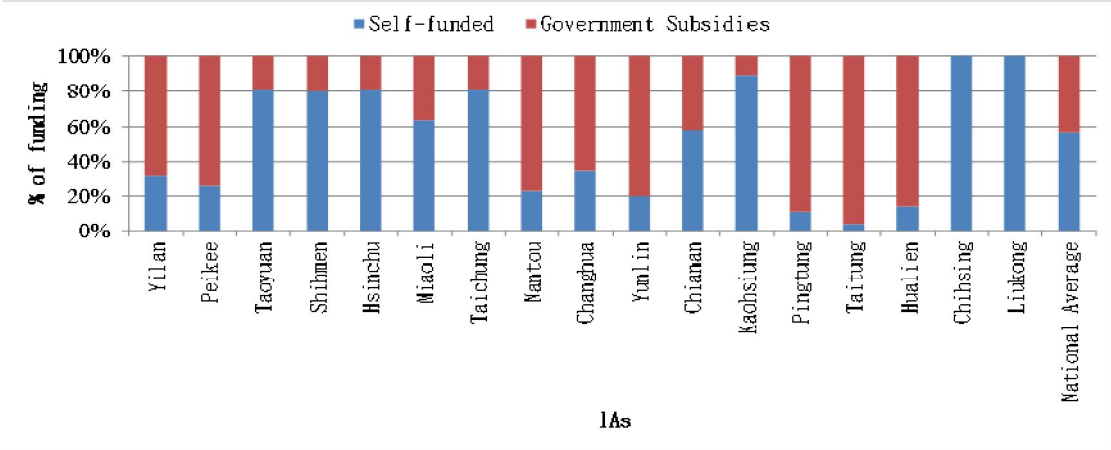

Fig.4 Different financial income ratio in each irrigation Association

2.New Irrigation Policy- Fallow Land Revitalization Policy

2.1 Background

To join the World Trade Organization (WTO), Taiwan government had to open domestic market for rice imports and reconsider proper rice production target, rice industry structure, a balanced supply and demand chain, and minimized impacts for farmers. In sum, there could be concluded into three policy objectives: (a) to evaluate the supply of rice to ensure food security; (b) to reduce the aggregate measurement of support to comply with WTO policies; (c) to ensure the stability of farmers' income and rural economy. In this regard, in the last 20 years Taiwan government has been promoting some policies such as to convert paddy fields into other crop fields or to leave them fallow.

2.2 Policy object

In response to WTO's regulation, Council of Agriculture is planning to revitalize 50,000 hectares of continuous fallow land. The policy measures include encouraging import substitution crop, export potential crop, regional specialty crops, such as corn, sorghum, black beans, and soybeans, etc.

2.3 Policy Project

A. Adjustment of fallow land subsidy mechanism：subsidize 1st or 2nd crop to reduce fallow area.

Originally, paddy fields turned into fallow land or converted into other crop fields were subsidized twice a year, the amount of subsidy depends on whether a paddy field was turned into fallow or into other crop fields. Nonetheless, starting from 2013, farmers receive only one crop subsidy from the 1st or the 2nd crop. In the other

crop, no matter it is the 1st or the 2nd crop, farmers have to plant newly announced crops, or rent their land in order to keep farmland in use.

B. To promote the planting of crops which have import substitution potential or export potential under contracts.
Taiwan's food self-sufficiency rate is lower because flour (wheat), corn, and other grains mostly depend on imports. Hence, Council of Agriculture planned to promote import substitution crops such as corn, soybeans, sorghum, black beans, sugar cane, and specialty crops in some areas to provide farmers more choices to grow on fallow farmlands.

C. Small landlord, Large sharecropper
In Taiwan, the scale of farming operations will need to increase for maintaining profitability. However, land ownership in Taiwan is fragmented and the average area of land holding is smaller than the economical scale of farming operations. "The small landlord, large sharecropper" policy will enable sharecropper to lease several adjacent land parcels from several landlords, so economical scale of farming can be achieved.

In sum, in order to respond to climate change and unstable international food market prices, the Taiwan government begin to promote food self-sufficiency rate policy such as "Fallow Land Revitalization Policy" in order to improve food self –sufficiency rate to 34.9% in 2015.

3.Innovative Policy –Golden Agriculture Corridor

3.1 Background

For the past 20 years, the farmer who cultivation at Changhua and Yunlin County in Taiwan was accustomed to use groundwater to irrigation. But the Taiwan government is increasing attention to the land subsidence problem and the high-speed railway traffic safety. The Executive Yuan who plans to build a "golden agricultural corridor" in the western counties of Yunlin and Changhua in August, 2012. According to the Executive Yuan programs and measures associated with the corridor is expected to reduce ground water pumping by 24 million tons per year, or about half the volume of the Hushan Reservoir of 52.18 million tons. Agricultural tours can also attract around 12,000 visitors per year to benefit local industries.

3.2 Policy Object

In order to reduce land subsidence along the High Speed Rail route in Changhua county and Yunlin county. The Government have been planning to upgrade

farming practices which is to gradually decrease the irrigation use of ground water. It relates to not only changing farmer's individual preferences, but also solving complex policy problems which interrelated with irrigation technologies, agriculture income, water use efficiency and water generations.

The above mentioned complex socio-economic issue is expected to be solved by LOHAS. It is a mean of health and sustainable living life styles and the core value of the new policy. This concept helps to construct new agricultural development model and combined the "new technologies and new industry strategic objectives to build an agricultural water saving, and energy-saving future.

First of all, the new technology used is "the agriculture cloud", which provides marketing information of suitable crops. In addition, our government also plans to set five solar demonstration plant factory, training 1,650 farmers to use new generation technology, import agricultural photoelectric green energy technology leaders in the research and development regime, constructing an energy efficient innovative agriculture--industrial demonstration zone.

Secondly, the new industry concept is to build five plant factory that utilize green energy such as solar or wind power, and LED as auxiliary light source. It also mining pesticide-free characteristics, planting leafy vegetables, traditional Chinese medicine, mushrooms and strawberries, the use of the module can be disassembled, each seat The factory build 30-100 Ping ranging future of agricultural science and technology industry this exemplary module marketing abroad. The Council of Agriculture has proposed to increase the subsidies, the establishment of the automatic control system in the factory, to solve the problem of agricultural water resources.

3.3 Policy Strategy

In this policy, based on different water supply conditions, the subsidence regions in Changhua County and Yunlin County are divided into three different areas. Each area has a different suitable for planting crops, and is expected to promote irrigation technology.(Fig.5)

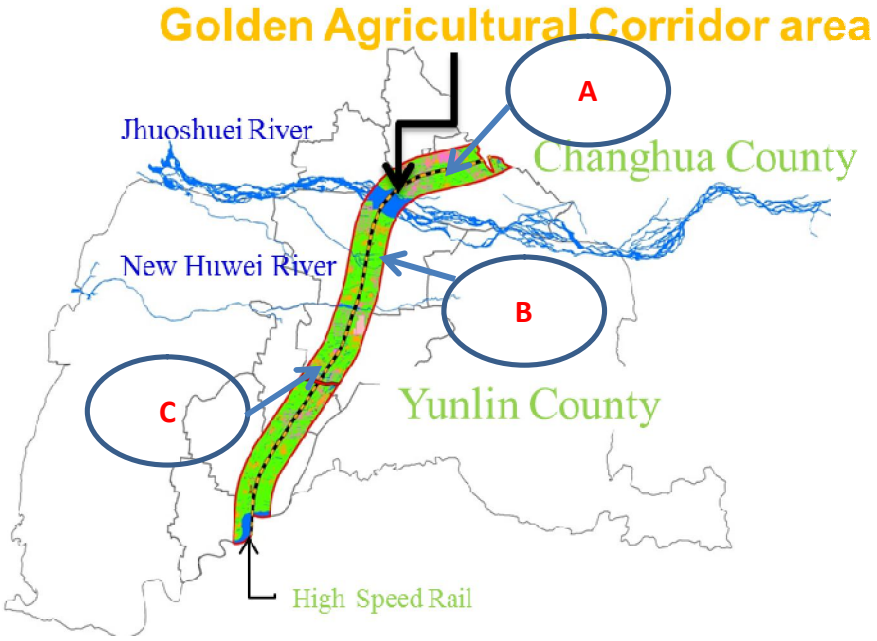

Fig.5 Golden Agriculture Corridor and different promotion area

A. Irrigation water supply is relatively stable at the north of New Huwei Creek (Jhutang Pitou Township Sijhou Township), a great majority of the farms are rice paddies. Government has been promoting new irrigation techniques and water-saving farming practices. There are five core strategies being implemented.

a. The use of automated moisture forecasting system to enhance the efficiency of irrigation.

b. Promotion of Rice Intensification (SRI) of cultivation technology system.

c. Strengthening of irrigation management.

d. High-tech demonstrational greenhouse plant factory .

B. Irrigation water supply is relatively stable at the north of New Huwei Creek (Erlun Township, Siluo town), a great majority of the farms are producing vegetables. .In this area, our government promotes pipeline irrigation, water monitoring system, and water-saving facilities. They also promote irrigation water classification supply management and monitoring mechanisms in these areas.

Lastly, there will be some highly efficient agricultural water industry greenhouse being built as new industry demonstration.

C. At the south of New Huwei Creek is lack of water supply to cultivate high water-consuming crops. Hence, in this area there will be designated as water-saving, and energy-saving dry cropping demonstration zone.

4. Summary

Our government began to implement the new policy strategies mentioned above, aimed to guide the Irrigation Association members toward adjustments of water

supply system and farming practices. This paper gives an overall review of the current policy such as “Fallow Land Revitalization Policy” and “Golden Agricultural Corridor” . These policies are important in improving the existing agriculture-related issues. It requires multi-governmental organization cooperation to succeed. In other words, to solve these issues we must integrate various perspectives, for example to include water resources, agriculture, economic, and society. In our country, we have to design cross-sectoral collaboration policy to solve such a complex issue. But this is a long-term challenge and need to be examined regularly to ensure the effectiveness of policies, and to develop relevant adjustment strategies.