The economy analysis of small and

medium irrigation area management participated by

private and innovation on water rights system

— Case study: the water management mechanism's changes of Changgang irrigation area

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Abstract: Currently, water resources of China's irrigation areas is less efficient, the reason is the backward irrigation management system, system innovation deficiency. As well as the use property rights of water resources is not clearly defined, so water resources can not be rationally allocated ,leading to waste, abuse. Based on these problems, we investigated Changgang irrigation area for water management mechanism' changes and private participation in irrigation area management, in Lanxi county, Heilongjiang Province, and analyze the using efficiency of agricultural irrigation water. Conclusions show that through the establishment of water market, the performance of water-saving can greatly enhance, moreover, innovation of water management system is to ensure that the operation of irrigation area is long-term and effective.
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1. Introduction

China is a large agricultural country in the world, and the irrigation water is also mass. Until 2005, the national irrigated area is 0.848 billion mu, accounting for 55 % of cultivated land, the farmers of relying on irrigation water for production up to 0.4 billion , and output 75% of the food, 90% of the cash crops of country's total. In the total water resources which can be utilized, agriculture accounted for the majority of water. In 2005, the total national agricultural water consumption is more than 75%, that means1.25m^3 irrigation water to supply the average 1kg food. At the same time, due to a large population, vast territory, water amount per capita and per mu have extremely limited. In recent years, especially the scarcity of water resources, coupled with the backward management

system in a lot of irrigated areas: egalitarian practice of everybody eating from the same big pot, works aging and lack of maintenance, difficulty to collect water charges, water using can not be guaranteed, so that agricultural irrigation are faced with severe challenges. Such as Changgang irrigation area in Heilongjiang province was founded in 1964, the design irrigated area up to 15 thousand mu, and the irrigation area station belongs to public institution. In 1980, the irrigation was forced to stop due to mismanagement; by transformation, the irrigation area continued to operate during 1989-1997, but difficulties in collecting water charges, management department is indebted, in 1998 ,the irrigation area once again stop. After that, the pumping station equipment is idle, and workers lay off; 18,000 farmers rely on the irrigated areas are in an

extremely difficult life. In this way, the irrigation area which the state has a cumulative investment up to nearly a thousand million is into a standstill. Therefore, the innovation of the small and medium-sized irrigation area management system is imminent.

In China, the management of small and medium-sized irrigation area has been formed in the planned economy, the state take charge of funds from projects maintenance and water charges collection; with the current transition to the market economy has become more sophisticated, the innovations and practices of irrigation area management system did not try before. Five years ago, the success transaction of the water resources property rights, in Dongyang City and Yiwu City, Zhejiang Province created a beginning for water rights transactions in China, and provide a operable the policies basis and experiences during practice; However, due to property rights transactions is not complete or theory need further exploration, the water rights transaction of Yiwu and Dongyang are too high to appear new trouble. Abroad , many theories can be drawn on in solving the issue of in public resources and property rights, such as Elinor Ostrom 's "The government of public affairs" ,which ,in the focus on small-scale common pool resources, in a large number the basis of experience and case studies, develop the system theory of self-organization and management in public affairs, moreover has opened up a new path for the people facing public choice, but also avoid the degradation of public affairs, protect public affairs, and realize the sustainable use of public affairs, thus enhance human well-being, provide the basis for self-governance system. What inspired by her research is: we need to think about how to avoid the degradation of public affairs in China, and to save the already degraded public affairs, such as irrigated areas water shortages. She also explored the possible of self-governance common pool resources outside the government and the market ,from the perspective of game theory, particularly for " the game

implementation for self-financing ", and think that there is a no complete privatization, no complete control of government power, the user of public water resources formulated and implement the contract of common pool effective using through self-financing .She investigated the origin of a series of groundwater basins system in the south of the Los Angeles area. She analyzed the region's "pumping competition", which led to degradation of groundwater resources. Seeing that producers carried out a lot of litigation in order to get rid of the bad pumping competition, but it does not solve the problem, finally, established autonomous public enterprises, which can properly manage groundwater resources .On the basis of a number of public enterprises, finally formed a "multi-center public enterprises game", such as the most effective organization, "civil society" to be set up (Elinor Ostrom, 1999). This has opened up new ideas for the management of China's small and medium-sized irrigation area. Through degradation of water resources empirical research, Michael McGinnis aimed at providing the basis of a viable system for the sustainable development of human society, "Multi-center Governance", that is, development is at all levels, in all places simultaneously, and not just some political center. The base of comprehensive and sustainable development depends on the autonomy governance capacity of the local community, as well as multi-center governance and multi-level system framework on that basis, which will no doubt help us to further reflection and to promote the "decentralization" changes. That is, small and medium-sized irrigation area is no longer relying on government, and this situation must be broken. In the study of system performance, Dealessi concluded that "the structure differences of the resources use right o have a systematic, foreseeable impact for the behavior "(Dealessi, 1980). Irrigation development will have to face the issue of governance, so human resources and other resources are made use of to take measures, besides using the appropriate irrigation techniques,

arranging appropriate systems and organizations (Coward, 1980). While Elinor Ostrom study the design principles of long-lasting irrigation systems, for the water rights of irrigation water in Valencia, Spain as cases, noting that the strict privatization of water rights in many countries within the broader system framework is not a viable. If authorized to providers and users of irrigation water in the design of their own system, combined the arrangements principle for collective choice and the minimum recognized principle of the organized right, which is feasible reform in the many countries system framework. In this way, we can look forward to many of those who inspire the most will find solution what they are facing their most prominent problem (Elinor Ostrom, 1999). These concepts that foreign scholars explore the public resources and property rights, provides a reference for the innovation of management system in China's small and medium-sized irrigation areas.

2. The Existing Problems of State-Owned Small and Medium-Sized Irrigation Areas

2.1. Water Rights Fuzzy

Alchain defined property rights as: "It is the right that the society implements an application right to choose economic goods" (Alchain, 2002). From an economic point analysing, the property rights is not a general material entities, but rather refers to conduct relations of mutual recognition arising from the use of materials. It is used to define the people in economic activities how to benefit or impair, as well as the rules that how to compensate. Therefore, in order to complete the function definition, the property rights must be clear, which is the basic conditions of normal market mechanism, which is the prerequisites of effective use, exchange, preservation and management of resources and investment. Water is no exception. First of all, the fuzzy water right result to weak external constraint of irrigation area water ,the quantity of water withdraw mainly restricted by natural factors, especially in the upper region, often excessive mining water, waste serious, the phenomenon of "pumping competition" is widespread. Secondly, the fuzzy water right lead to unknown property rights, so water rights can not be transferred, water can not flow from the low-value areas to the high-value areas, reducing the total income of society, in fact, the allocation resources is distorted.

2.2. The Low Water Price and Difficult to Collect

A long time, the standards of water charges is generally low, shown in the Table 1, the difference between water supply costs and the water price subsidizes by government. In this way, on the one hand, people form the ideas that the water is a priceless resource and waste water during in the production and life; On the other hand, investment in rural water projects can not be recovered compensation, totally depending on government subsidies, so the national burden is growth, while supply water projects are run-down, hard to sustain. What is worse is that during the period of economic transition in recent years, reducing government subsidies every year, funding for operation of irrigation area management deep into a low-level "trap"; even in the harvest year, due to the backward mechanism, unclear responsibilities and rights, the result that it is difficult to collect water charges , furthermore forming a vicious circle.

Table 1. The Water Prices of Different Periods, Water Supply Costs and Subsidies Rate in Changgang Irrigation Area

Year	1990	1995	1997	2003	2007
Water price（yuan/m^3）	0.020	0.022	0.025	0.030	0.035
Water supply cost（yuan/m^3）	0.030	0.040	0.047	0.050	0.058
Subsidy rate（%）	18.0	8.0	0	1	0

2.3 The Performance of Managers to Pursue in Office

Irrigation system is invested, constructed and managed by the government, the managers' earnings origin from wages and allowances of the country, rather than from the farmers by providing service quality. Term limits and job promotion system for irrigation managers make them focus more on keeping good relations with superiors and maintain the short-term benefits of irrigation systems. When the irrigation managers work only to please their superiors rather than to meet the needs of local farmers, they do not have enough motivation to obtain extensive and accurate information. Irrigation managers have more incentive to seek funding for the development and construction of new irrigation systems, without caring disruption to the existing irrigation system and careless maintain, because the development of new irrigation systems to maintain the old irrigation system easier to demonstrate their achievements ,and can obtain a higher appreciation and job promotion. As a result, their main task is to run higher-level departments, in charge of maintenance funds for projects or project investment, even a little work performance has become the law code of work promotion. During 10 years from 1985 to 1995, Changgang irrigation area has 5 managers, whose short-term behavior caused a serious loss for the collective economy.

2.4 The Management System can not meet the Objective Requirements of Reform and Development of Irrigated Areas

Like the majority of small and medium-sized irrigation areas, Changgang irrigation area belongs to the state, no any changes in four or five decades. The irrigation area management department attach to the county (city) Water Bureau. Irrigation area manager ,water user, the township government, village committees are not standing the common "interests" base, so that farmers did not actively participate in management of irrigation areas; in water bills to pay,

particularly in drought years, farmers have emotional conflict. Irrigation commissioned township government or village committee to collect, for the officials to create the opportunity for rent-seeking behavior; the farmers also have a lingering fear. Therefore, the irrigation area management system should meet the objective requirements of reform and development, in the market-oriented economy, to encourage farmers to actively participate in irrigation water management and engineering maintenance, to make irrigation area managers, farmers water users, the township government, village committee, and other water managers to play all the enthusiasm and creativity.

3. The Innovation of Water Management System for the Irrigation Area

The management system of Changgang irrigation area has reformed for five years, constant exploration, and the system searching for novelty step by step. Only in 2 years, it has established 12 responsibility systems, 26 management systems, 9 contract management ordinance, and 3 statutes. The establishment of these rules-based systems made the whole irrigation area orderly management, and users actively participate in irrigation area management, fully mobilize each person's enthusiasm and creativity.

3.1 The Principle of Institution Innovation: Comparing Costs and Benefits

Whether innovation or change of any system can be realized, the profit of the system change and comparison of the system cost are key factors. Drawing on Coase's property rights ideas, considering transaction costs, "the initial definition of the legitimate rights will have an impact on operating efficiency of the economic system. The right is a kind of adjustment, than the other arrangements will generate more output." Therefore, detailed analysis to actual results, select the appropriate institution arrangements. The output of system arrangements depends on comparison of operation proceeds and operation costs of the system.

Only when the expected return is greater than the expected costs, system change will ultimately realize. Changgang irrigation area's practice illustrates this point. In theory, it is not hard to see:

The total output of common system (I) = system (I)'s proceeds - system (I)'s transaction costs

The total output of property rights system (II) = the system (II)'s proceeds - system (II)'s transaction costs

It is clear that the condition that the arrangements of system (II) are more efficient than system (I) is that the output of system (II) greater than the system (I), namely:

System (I)'s proceeds - system (II)'s proceeds > system (I)'s transaction costs - the system (II)'s transaction costs

Analysis results showed that a prerequisite of smooth changes in water resources management system, is the proceeds of the system operation is a corresponding increase to transaction costs, and to choose the clear water property rights arrangements to achieve maximization value, that have two functions, that is increase the proceed of the system operation and reduce the transaction costs of the system operation.

3.2 Clarity the Idea of Water Resources Property Rights

The managers of Changgang irrigation area know the concept "water rights" in the end of 2001, and a small number of farmers water user know "the right to water" clarity in the end of 2002. The main water right problem in Changgang irrigation area is How to dispose the water savings of the irrigation area; properly dispose can bring what earnings for the people of water conservation. To resolve this problem, it must be clear on whether the water savings have usufruct and the transfer right.

"Water Law" states that "Water resources belong to the state, that the whole people", "water in the ponds and reservoirs of the agricultural collective economy, are collectively owned". From the semi-open access to the exercise of collective water rights, it is the basic direction of water rights change. The basic meaning that irrigation water right becomes collective water right, endow the irrigation area with use right and profit

right, and allow moderate transfer right. From a management view, the water rights of irrigation area is, through the form of organization consultation and signing protocol by public agency and public consultations, the right that the public basin give specific irrigation area a certain number and quality water resources; from the irrigation area itself, this water rights means that irrigation area as using water group, in a certain water basin, according to their own population, resources, potential development and other factors, have the rights of access and consumption for certain amount and quality of the water. At the same time, it should be noted that the water rights of irrigation area must be shared by all residents, and entrust public institutions to manage; Irrigation area should have an initial water quality, that is, the initial water rights; For agriculture saving water ,irrigation area should have the proceeds right and transfer right; The law is the most commonly used method to define property rights of natural resources, also including water resources, and legal intervention can produce scale economies of defining property and reduce transaction costs.

The specific ideas to clarity irrigation area property rights:

First, trading water is introduced. We should establish goods attributes of supplying water conservancy project, to establish the sale relations between water user and provider. In accordance with the contract, irrigation water management department supply water. The farmers use irrigation with some compensation, and all farmers should pay some water charges in the early year in advance. In the survey, almost all rural households know that water is a commodity, and there are 2/3 of farmers could still point out the current water price and price policy of irrigation water.

Second, the farmers are directly involved in the management of irrigated areas. The water user associations require water users to participate in all-round management, including the investment

construction of irrigation project in water association field, operation and maintenance management, participation in water plan and allocation, and the democratic supervision of water users associations and water supply sector. The water user associations in irrigation area increase the transparency of democratic decision-making, making farms to understand association election, payment of wages and the proportion of management costs in water prices. Farmers recognize that active participation in the association to ensure that their views can be adopted, their desire of increasing their own quality to improve.

Third, between the water user associations and rural economic development has shown a benign interaction. Many aspects have improved, such as channel's construction and maintenance, timeliness water supply, farmers' democracy supervision, the relations between the associations with the water sector; so that the water management departments reduce inappropriate interventions to irrigation activities. The unreasonable burdens on farmers reduce. The property rights have a clear relationship, a substantial reduction in society transaction costs, promoting faster development of the rural economy.

Fourth, the interest compensation mechanism is established. The core of the interest compensation mechanism is to protect the interests of farmers, especially the poor and the damaged, and bring water-saving incentives to the farmers. In addition to saving water and reducing the cost, compared to the original means, farmers are able to gain more revenue, thus we can achieve the dual purpose of agriculture water-saving and benefit for farmers .In the Government's support, introduced water-saving incentives to the water user associations and farmers. The compensation channels of benefits are: the financial transfer payment, income of water market, investments and subsidies of the State to water facilities.

3.3 The Establishment and Design of Water Rights' Transfer Mechanism

The core of the water rights market is to build transfer market of water rights in irrigation area, that the water rights are authorized by the government, to allow the independent operation and circulation. The water user who didn't own or lack of water rights can own water rights through the system of water rights transfer. The circulation of water rights can improve the efficiency of resource allocation, because there is no effective circulation system of water rights, so water rights will be long-term stay in the owner of the existing water rights, if it lasts for a long time, the phenomenon of low efficiency will occurs. Through circulation system, water rights can be obtained by owners who can be good at management and efficiently make use of water resources, which can always ensure the efficient allocation and effective use. The circulation of water rights can sale the water of irrigation areas to the outside, as well as the transfer between farmers in irrigation areas.

(1) The external circulation of water rights

As mentioned earlier, to sell water outside will increase the economic benefits of farmers, but in reality, the business of selling water can not do by the scattered farmers, but by the completion of the collective farmers. The prerequisite of selling water is to require the consent of every member, who agreed to the principle of consistency, that is all farmers must have requirements to sell the water. Therefore, it is necessary to establish water associations, a wide participation and information disclosure can reduce transaction costs and management costs. In addition, farmers' views in the region have a significant impact on collection system of water prices. The external circulation of water rights should pay attention to the following questions:

First, the calculation of the water charges uses the following formula:

$$P = (B + R + E) / W$$

Where: P is the water price; B is the annual cost of water conservancy construction; R is the maintenance and management cost of water conservancy facilities; E is the energy consumption cost of water conservancy

facilities; W is the total water quantity of irrigation areas.

Second, when selling water outside, the irrigation area collectively sell water and collect water charges, and the member shall not operate this business alone.

Third, the income of selling water is allocated by the extent of every member's contribution. Here, the contribution volume is equivalent to the reducing amount of the crop. The revenue of selling water will be allocated to members as a reward. The reward of every member as follows:

$$M = P \times G$$

Where, M is the rewards of members; P is the price of selling water; G is the contribution volume of selling water.

Fourth, selling water is uniformly carried out by the irrigation area. Every member (farmer) can not buy water from irrigation area in a lower price, to transfer in a higher price.

Fifth, the management institutions of the basin have the implementation of the monitoring mechanism to water right transfer in irrigation areas.

(2) The internal circulation of water rights

The internal circulation of water rights is water right transfer between different farmers in the irrigation area. The farmers in the same irrigation areas have a stable flow and relatively fixed position, and the consultation and design management of water rights' circulation are lower than the external circulation in transaction costs. The water right transfer just consults with the parties, by approved with the farmer's water association.

3.4 The Benefits of Structure Adjustment from Single to Multi-center Treatment

Changgang irrigation area is divided into a number of drainage domains that the main is branch drainage and large-scale dou drainage. Every drainage domain established a farmers association whose executive board member and chairman is elected alone, who can execute independent powers in the drainage area, the formulation and implementation the rules of

water fees and channel maintenance, construction of the multi-center governance structure, that is, "define the main body of construction and management, improve the functions of members participation and management, regulate the standard the volume of water measured water charges to ,determine financing channels and clear the interests relationship of all parties ".There are three water user associations, 1.5 million mu irrigation area, accounted for 80% of total irrigation area. In the multi-center governance structure, the water users association is the responsibility body and decision-makers in irrigation system. They make rules of water users in the drainage area, that is, they have obligation of water distribution, channels maintenance, the collection of water charges.

(1) Solve the collection of water charges

First of all, as a water user, he should sign water charges contract with the water management department, and have the duties of water using and payment. If only using and non-payment or less payment, it will be subject to sanctions. In such incentives rules, they made two kinds of water charges collection. One is round fee, that is, if the awareness in payment is not strong or difficult to collect, one watering received a water fee, or purchase water in water vote that according the planned water amount, water user buy water vote in advance. Another is collection of water charges in acres, that is, in the base of water amount and actual irrigation areas in the dou drainage, the water price in the round water is the standard, and water users is unit. According to the irrigation areas, one watering received a water fee by the area. In these rules, if you do not pay, you have no right to water. If you want to pay less, you will have less water. In the past, some "nail households" don't pay water charges, harming the interest of water management department, so water management department don't have any way; now the integration of water supply and water charges, water fees and water amount is directly linked to the interests of water users, so non-payment will be against the interests of other

water users and "nail households" will be severe sanctions by the water users association. Inspired by such a system, we can put an end to many phenomenon of wasting water resources.

Secondly, as the household of water supply, association must provide an efficient and equitable water supply services to water user, in order to alleviate the difficulty of charge. In the original supply management system, the management and maintenance of channels is to rely on masses workers. The masses did not have any incentive mechanism to channel maintenance. The phenomenon that people use water and don't mend channel is very serious problem, leading to channel siltation and serious water supply problems. The efficiency of water management department decline year by year and farmers are not satisfied with the water service, having a direct impact on enthusiasm of payment and conservation of water resources. After irrigation reform, the association established public rules that water users commonly manage, in the ways of raising capital, or collection of management fee by mu. For example, after the establishment of water user associations, the farmers raise more than 7000 Yuan, establish two new regulators, clear the channels of water blocking .In the three branch canal, water users adopt a proposed approach, and charge 1.3 Yuan maintenance costs per mu for project maintenance and protection. These effectively ensure the project facilities in good condition, so it is possible that water users association provide a good service, solving the "free-rider" phenomenon in the maintenance and management of public affairs. This creates a good foundation for the sustainable operation of irrigation areas.

Third, in the multi-center governance structure, the water user associations can more effectively and accurately determine the real needs of farmers for irrigation water. Each executive committee can more clearly understand that each water user's land area and different needs, to eliminate the gap in time and quantity due to agricultural products the structure and

geographical factors, providing a impartial management, allocating effective services of water supply. Water user associations regularly publish the accounts, increasing transparency of collection of water charge, avoiding the emergence of the "gray" water charges. In this case, people used reasonable water and pay the reasonable costs, so it is great to mobilize positive of the masses to pay water charges.

(2) The water users from initiative water-saving to passive

In the shortage of water resources, farmers' high expenditure of water charges, as managers, another responsibility of water users association is to meet the water supply needs of water households and reduce the expenditure of farmers. Therefore water user associations have to consider optimal allocation of water resources and the incentive to save water. From the beginning of 2002, irrigation areas established the irrigation system of "water, moisture, dry planting, water allocation" in order to save water resources. The irrigated area increased by 0.4 million mu, meanwhile diversion works have no major changes, saving 50 million cubic meters water in the three year.

(3) The effective institutional arrangements provide an effective incentive

Coase in his article "Social cost question", proposed the importance of definition and arrangement of the rights in economic trade. He believes that when A damaged B (the external of Pigou said), people often considered that how to stop A. Most approach is to request A to compensate B or tax A, or even to stop A (Coase, R, 2002). This theory has a great deal of inspiration to district reform: establishing water user associations, effective rules and regulations to restrain and coordinate the responsibility and rights of members, to form a clear mechanisms of incentive , mutual supervision, and mutual benefit. Practice has proved that the governance structure of multi-center self-management can provide at least three kinds of effective incentives. The first is incentives of choose collective. The multi-center governance structure of water users' self-management stimulates the

responsibility of each water user. The most water users affected by the rules of the game can participate in the establishment and revision of rules. Therefore, water users strictly abide by the incentive of rules. The second is the effective supervision and classified sanctions. This can timely detect the offenders and punish the offenders who do not act in accordance with the rules of the game by other water users. The third is the resolution mechanism of conflict .This can transform dissatisfaction caused by the contradictions of water supply for the Government and the Association to the internal of the Association or between the Association and irrigation management departments. Water users use their own water, self-management, self-settlement of the conflict from all sides. Letting water users know that the benefits that they comply with the requirement is at least equal to the cost of collection, this is very important. After reform, the collection rate of water charges reaches more than 97% every year. The general contradictions between water supply and payment in the agricultural water supply has been fundamentally resolved in the link of water user association. In the multi-center water management structure, water users realize self-management that the government can't manage efficiently, so the continued operation of irrigation area has a reliable basis.

4. The Design of Water Market in the Irrigation Area Established under the Multi-center Management structure

4.1 The Establishment of Main Body of Water Market

Water user associations play a very important role in the establishment of multi-center governance structure. As mentioned above, the water users association as a spokesman for the interests of water users will sign the fee contract with water management department, and bear the responsibility of water using and payment. When the water price increased, the association will reduce water demand according to

their situation of water using; when the price of water decreases, water user associations will increase in water demand in accordance with the goal of maximizing the interests. By measuring the relationship between the costs of water saving and the cost of water using and the relationship between the income of increasing water and the cost of water using , water users will decide whether increase or decrease water amount; that water user associations with "economic man" of the features can be used as market main.

Secondly, the establishment of water user associations will be effective in the internalization of externalities, and enhance the effectiveness of the market. Water users use their own water, the self-management, including water distribution and channel's construction and maintenance, solution contradiction from all aspects by self, such as a nail households, water collection, raising maintenance fund, and common labor, avoiding the phenomenon of "free-rider" in the maintenance and management of public affairs.

Therefore, multi-center management structure of the irrigation area objectively cultivates the market body to adapt the changes of the market, laying an organization foundation for the water rights market.

4.2 The Nature Division of Irrigation Water Market

If the irrigation areas exist the basic right, according to the basic water rights whether are allocated to specific water users associations, water market of irrigation area can be divided into two cases to discuss.

(1) Not allocate the basic water rights to the water user association

This case refers to the country allocates the basic water rights to the irrigation area , while the irrigation areas do not specifically allocate water rights to the various water user associations, the basic water right only retained in the irrigation area. Because the basic water rights have a high guarantee, the initial basic water rights also have a low water price, so the basic

water rights are water rights which include the interests. The existence of the basic water right affected the income level of irrigation areas and the water supply rate of irrigation areas.

The basic water rights have some impact on the water supply rate of the irrigation area. The guarantee rate of the basic water right is high. Therefore, the more basic water rights, the higher guarantee rate in the irrigation area.

If the basic water rights are not assigned to the water user associations, so when the irrigation areas increase new area, the interests of the original irrigation area will be damaged, because their interests of basic right will be shared by the new users.

(2) Allocate the basic right to water user associations

If each water user associations have the basic water right, so the water rights market of the irrigation area exists transfer of the basic water rights.

The advantage of the basic right is more obvious in shortage of water resources, which is mainly high guarantee rate. In addition, the initial basic water rights are low price, but including commitment fee.

The benefits of allocating the basic water rights to water user associations is: when extending new irrigation areas, can protect users interests of the original irrigation area.

Under normal circumstances, within the same irrigation area the transfer of the basic water right should be inactive. This is reasoned that in accordance with in the same irrigation area, the planting structure is similar and the difference of the interests is not large.

Based on the above analysis, the transactions of irrigation water market are divided into two situations. One is the transactions between the irrigation areas management agencies and the water users associations. The other is basic water rights transaction between the water users association.

The first is the nature of a monopoly market. Water (water rights) is supplied by irrigation area management agencies. Based on supply and demand situation of water market determine their supply and

demand of water rights market in the basin. The supply of irrigation water market is the demand of water right market in the basin. The demander of irrigation water market is the water users association. The market type, can be seen as the right to water market, water can also be seen as a commodity market. The trading price of market is water price of full cost, not only reflecting the price of water right.

The second is the nature of free competition markets. The supplier and demander are the water users. However, this situation will depend on whether the irrigation area allocated basic water rights to the user.

4.3 The Demand and Supply Analysis of Water Right Market in the Irrigation Area

The demand and supply analysis of water right market have similarity with general merchandise. According to the supply and demand relationship of commodity, we can analyze supply and demand of water right market.
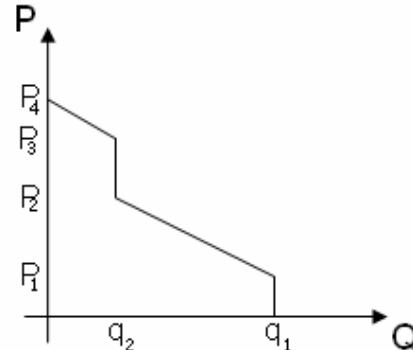
(1) The demand for water rights

Figure 1 The Demand Curve of Single Household Water

Figure 1 is the demand curve of single household water. When the price is less than p_1, the water quantity stabilizes at q_1. The reason is that in the existing circumstances, the factors including leakage losses are basically stable. If too much water will also result in floods and the water table rising, making household subject loss which is not done in rational economy. When the price lies between p_1 and p_2, the water quantity will gradually reduce with the price increasing. In this interval, the water quantity is sensitive to water

price. When the price lies between p_2 and p_3, the water quantity stabilizes in the q_2. Because the water users are in the existing planting structure, the effective using water will not significantly change with the price. When the price continues to rise, water users will not afford the expenditures, so water users will reduce the area of planting crop, or even completely stop draining water.

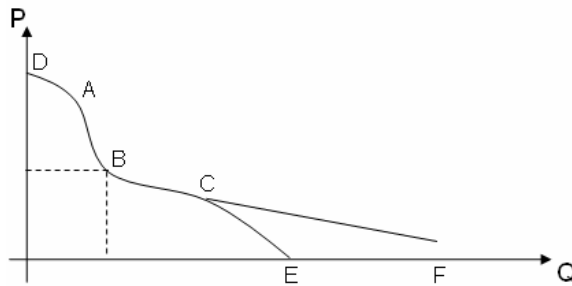The demand curve of irrigation area facing is shown in Figure 2:

Figure 2 The Demand Curve of Irrigation area Facing

When the potential water users outside the existing water users to participate in irrigation area market isn't considered, the demand curve of the irrigation area facing is DABCE. If we consider the potential water users, the demand curve may be DABCF.

DA paragraph shows that when the water price is too high, the water users can't afford, so the water quantity will drastically reduce. AB paragraph shows that when the water price at a higher price range, the price elasticity of crops' water consumption is small, so water quantity don't significantly reduce with the price increasing. BC paragraph shows that when the water price maintains at a lower price range, due to adopt the necessary water-saving measures of allocating water management and anti-seepage treatment, a significant reduction in water reduce the expenditure of the water charges . In this paragraph, water using is sensitive to water price and price elasticity is great. CE paragraph shows that when the water price maintain at a low status, water quantity will increase, but due to reach the limit, using more water will lead to excessive loss of

water, so water quantity will also be stabilized. CF paragraph shows that when the water price maintains at a very low position, the potential water user require joining to the irrigated areas, so the water quantity will increase. However, due to the inherent cost factors of reclaimed irrigation area, the increase water quantity will in a certain limit.

(2) The supply of water right

The supply of water right in irrigation area can be divided into two situations. One is when the supply of water right is in certain, or only accordance with national water right to distribute indicator, or when the outside water supply far from impact of the price, or this impact can be negligible, the supply curve is a straight line perpendicular to the horizontal axis, as S_1 shown in the Figure 3. The second situation is when there is water right market outside the irrigation area; the outside water supply is obvious influenced by the prices. When the prices rise, the supply of water rights increases. When the prices decline, the supply of water rights declines, as S_2 shown in the Figure 3.
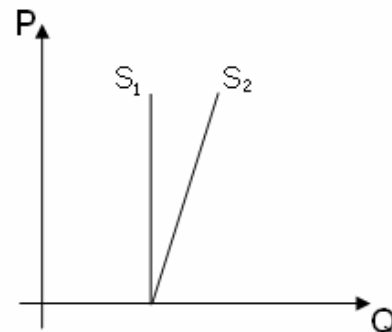

Figure 3 The Supply Curve of Irrigation Area Facing

When the supply curve of irrigation water rights is S_1, the demand curve is the D, and then the equilibrium price is the P_1, because the supply curve is the vertical line, that is when the supply of water right is in certain. When the price is less than P_1, the demand greater than Q_1, thus the supply can't meet the demand. When the price is higher than P_1, the water demand less than Q_1, thus give rise to the phenomenon of lack of demand. When the price is P_1, the demand is equal to the supply, thus all the limited water resources is exactly allocated.

When the supply curve of irrigation water rights is S_2, the demand curve is the D, and then the equilibrium price is the P_2, because the supply curve is the slash, that is the supply of water right will increase with prices rising, when the price is less than P_2, the water demand is greater than Q_2, thus the supply can't meet the demand. When the price is higher than P_2, the demand for water rights less than Q_2, thus give rise to the phenomenon of lack of demand. When the price is P_2, the demand is equal to the supply, thus all the limited water resources is exactly allocated

Due to the slope of supply curve is different, in the same demand curve, the market equilibrium price is different. As in the Figure 4, when the supply curve is S_1, equilibrium price is higher than the price when the supply curve is S_2.
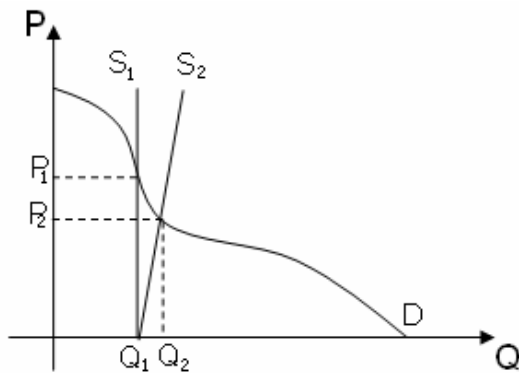

Figure 4 The Balance of Irrigation Water Market

4.4 The Control and Regulation of Irrigation Water Market

In order to control selecting water, the Government can generally take two measures. One is limiting the supply, reducing the indicators of selecting water right. The other is suppressing demand, primarily through raising the water price, also reducing the demand for the Chief. When the Government or the relevant department restrict the amount supply of water right in a certain irrigation areas, as shown in the Figure 5, thus equilibrium price of water rights market will rise. When the supply curve changes from S_1 to S_3, and the limited supply water of water rights reduce

from Q_1 to Q_3, thus the equilibrium price balance of water right increase from P_1 to P_3.
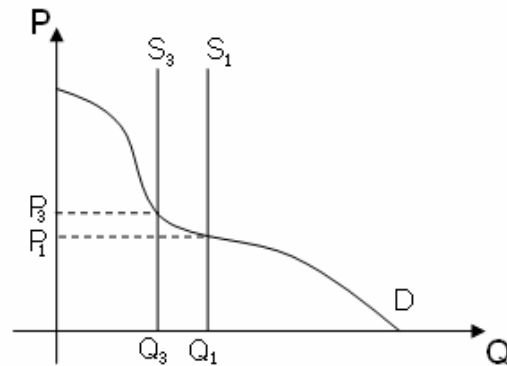

Figure 5 The Control of Water (Right) Market - Restrictions on the Supply of Water Rights

When the Government or the relevant department wants to curb demand by raising the water price, as shown in the Figure 6, the price level raises from P_1 to P_3, the water demand will reduce from Q_1 to Q3.
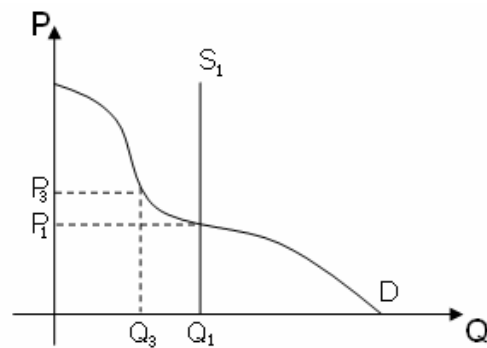

Figure 6 The Control Water (Right) the Market - to Raise the Price of Water

At present, Hulan River locates in the upper of Changgang irrigation areas. Due to the convenience of selecting water in the irrigation areas, the water quantity is rich, the state of the supply curve and demand curve shown in Figure 7. The D and S_1 do not intersect, that is, without taking into account the price and t water rights indicators, all needs can be met. In that case, for the need of macro-management, the Government need restrain the using water in the upstream to ensure continuous flow in the downstream. At this time, price control can suppress the demand for water rights. Assumed that the supply of water

resources isn't affected by the price, as shown in the Figure 7, the demand can be met in full, thus the demand is decided by the price. When the price is the P_3, the demand is the Q_3. This is the effect of price control.
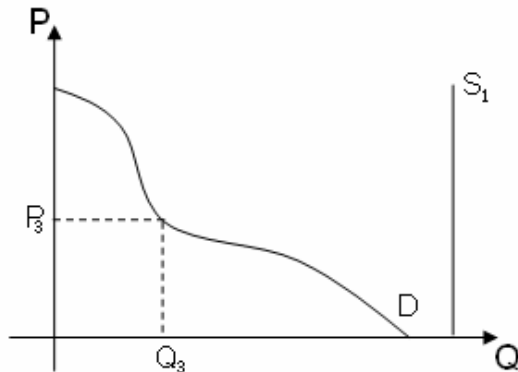

Figure 7 The Control of Water (Right) Market - a Simple Price Control

5. The Operation Rules of Irrigation Area Water Market

(1) Procedures

In accordance with the demand, water user association purchase water rights from the irrigation area, irrigation areas make advantage of the channels and appropriate measuring water facilities to allocate water according to the declaration of selecting water rights. Water users pay water charges in accordance with the water price (containing the cost of water conservancy project's construction and maintenance, management fees, distribution management fee, measurement costs).

(2) Treatment measures of lacking of water

When there is bound, water not enough, the demand of water right to all the water users can not be fully met. While the measures may include: reduction in the same proportion; administrative restrictions on certain water; improve water price and suppress some water; determine the order of using water in accordance with water rights priority. These measures have their advantages and disadvantages.

(3) The management of irrigation project

Trunk and other major distribution channels and water facilities must be managed by the irrigation area. The water users associations is difficult to manage, so it is essential that the water right market should put the management of water conservancy project such as channels management into the incentive mechanism of irrigation area.

5. The economic analysis of irrigation water use efficiency after the establishment of water markets

According to the above, if water markets and the structural design are established, the water use efficiency of Changgang Irrigation Area will greatly enhance, benefited from the effective operation in practice and guidance in theory. According to four different kinds of circumstances, to discuss farmers profits, the result is: through the establishment of water market (although the quasi-market), according to per cubic meter charges, but also transferring the savings of the water resources , is conducive to water conservation and to play economic performance. Specific analysis is as follows:

5.1 The Conditions Assumption

(1) Farmers as the economic men, pursuit maximization profit. Farmers have the land area of T, which do not transfer and cultivated a single crop.

(2)The actual water loss in the process of irrigation is G (contains fields surface evaporation, underground infiltration, irrigation management losses), this part of the water loss can not be avoided, only reduce by taking certain measures; the supply water loss of not water-saving investment is G_0; the conservation water of carrying out water-saving investment is g; water-saving investment is I, which is a function of g.

While $G = G_0 - g$

$I = I(g)$ (I 'and I "are greater than 0)

(3)The water demand of farmers $X = G + W$. W is the water demand of crop natural growth. The assumption that the region with plenty of water, farmers can get all the water they need, and the water consumption of the

farmers does not exceed the allocation of water X_0, while the remaining water, X_0-X.

(4)The crop yield is Q, whose production function is $Q = Q (W, T)$, that element is a variable, that is, the volume of water input is variable. The input of water W and yield Q is the decline law. The price of crop unit production is P.

(5) Farmers can not influence the price of water, but can choose yield to influence profit.

5.2 The Analysis of Farmers' Profit in the Four Different Situations

(1) According to land area, collecting water charges, the water price per unit area is P_0, and the water trading market does not exist

In this case, the farmers subjectively believe that the price water per cubic meter is zero, so they will not take any water-saving measures with costs, and to maximize the use of water resources. Π_1 represents the profits of farmers in this case:

Π_1 = sales revenue – the cost of using water -the cost of saving water

$= P \cdot Q (W, T)-P_0 \cdot T-I (g)$

The water balance conditions of farmers to pursue profit maximization: $\Pi_1 = P \cdot Q = 0$

$$\Pi_{1g} = I' = 0$$

That is, when the profit of the farmers is the biggest, the marginal benefit of using water is equivalent to the marginal cost of water-saving, and is equivalent zero. Marginal benefit of using water means adding one unit water brought the changes of the output. The marginal cost of water-saving means the cost of farmers saving one unit water.

Π_1 = sales revenue – the cost of using water –the cost of saving water = $S_{oa}-P_0 \cdot T$ (Shown in Figure A, S for area)
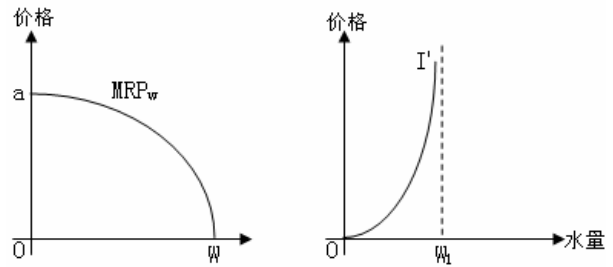

Figure 8 The Farmers' Profits of Charged by the Area and No Water Transaction Market

In Figure 8: OW represents crop water use; OW1 represents the loss G_0 of water in no water-saving measures; the volume of water-saving g is zero.

(2) According to land area, collecting water charges, the water price per unit area is P_0, the existence of water trading market, and the trading price of water is P_a per cubic meter.

Assume that if farmers are willing, he can sell some or all of allocation water to the non-agricultural sector. In this case, farmers will take the necessary measures to save water. Π_2 represent the profits of farmers in this case.

Π_2 = sales revenue + the revenue of selling water – the costs of using water - the costs of saving water = $P \cdot Q (W, T) + P_a \cdot (X_0-W-G_0 + g)-P_0 \cdot T-I (g)$

The water balance conditions of farmers to pursue profit maximization:

$\Pi_2 = P \cdot Q-P_a = 0$

$\Pi_{2g} = P_a-I' = 0$

That is, the marginal benefit of using water = the marginal benefits of saving water = trading price of water

$\Pi_2 = \Pi_2$ = sales revenue + the revenue of selling water – the costs of using water - the costs of saving water = $S_{oab} + (S_{bcW3} + S_{odeW2} + S_{W1fgX0})-S_{oPab}-S_{oeW2}$, shown in Figure B.
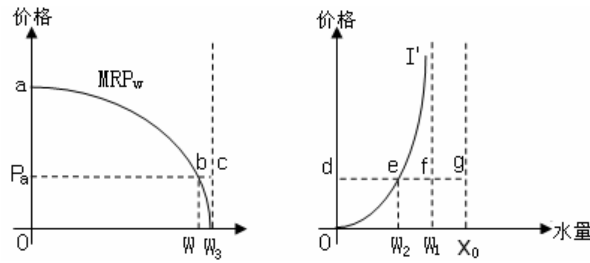
Figure 9 The Farmers' Profits of Charged By the Area and Existing Water Transaction Market

Figure 10 The Farmers' Profits of Charged By Cubic Meter and Existing Water Transaction Market

In Figure 9: OW represents the actual water of the crop using; WW_3 represents water quantity of the crops reducing; W_1X_0 represents the remaining water in no water-saving measures, that is, (X_0-G_0); OW_2 represents the saving water g in adopting water-saving measures; W_2W_1 represents water losses G in actual irrigation.

(3) Collecting water charges by per cubic meter P, no water trading market

In this case, farmers will take water-saving measures to reduce the cost of planting. Π_3 represent the profits of farmers in this case.

Π_3 = sales revenue – the cost of using water - the cost of saving water= $P \cdot Q (W, T)-P \cdot (W + G_0-g)-I (g)$

The water balance conditions of farmers to pursue profit maximization: $\Pi_3 = P \cdot Q-P = 0$

$$\Pi_{3g} = P-I'= 0$$

So, $P \cdot Q = P = I'$, that is, for production, farmers invest the water until the marginal revenue of the water is equal to the marginal cost of saving water.

Π_3 = sales revenue – the cost of using water - the cost of saving water= $S_{oab}-(S_{oPb} + S_{efW1W2})-S_{oeW2}$

Shown in the Figure 10, OW represents water using of the crop; WW_3 represents water quantity of the crops reducing water; OW_2 represents the saving water g to adopt water-saving measures; W_1W_2 represents water losses G in the process of the actual irrigation.
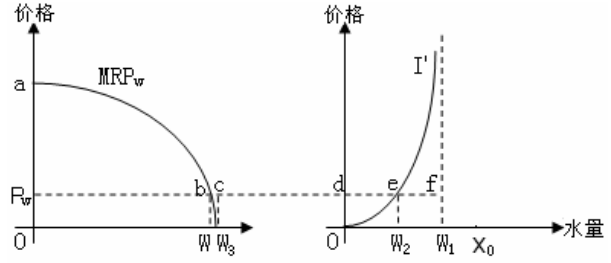
(4) Collecting water charges by per cubic meter P_W and existing water trading market, the trading prices is P_a per cubic meter, and P_a is greater than P_W

Assume that if farmers are willing, he can sell some or all of allocation water to the non-agricultural sector. In this case, farmers will take the necessary measures to save water. Π_4 represent the profits of farmers in this case.

$\Pi4$ = sales revenue + the revenue of selling water - the costs of selling water - the cost of saving water = $P \cdot Q (W, T) + P_a \cdot (X_0-W-G_0 + g)-P (W + G_0)-I (g)$

The water balance conditions of farmers to pursue profit maximization: $\Pi_4 = P \cdot Q-P_a-P = 0$

$$\Pi_{4g} = Pa-I'= 0$$

Farmers choose planting strategy b point according to the water prices of $(P_a + Pw)$, the corresponding water quantity W. The actual planting cost of farmers is S_{oPd} (the opportunity cost is S_{oPac}). Farmers choose water-saving strategy g points starting from the price of P_a, all the saving water used for the transaction.

Π_4 = sales revenue – the revenue of selling water - the costs of selling water - the cost of saving water == $S_{oabw}+(S_{wceW3}+S_{oPagW2}+S_{W1mnXo})-S_{oPwdw}-S_{W2hiW1}-S_{oW2g}$
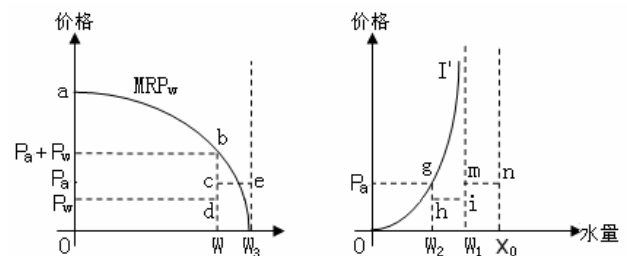
Figure 11 The Farmers' Profits of Charged By Cubic Meter and Existing Water Transaction Market

In Figure 11, OW presents the actual water of the crop using; WW_3 presents the water of the crops reducing; W_1X_0 presents the remaining water in no water-saving measures, that is, (X_0-G_0); OW_2 presents the saving water g of taking water-savings measures; W_2W_1 presents actual water losses G in the process of actual irrigation.

From the above analysis, we can conclude that: Π_1 less than Π_2, Π_3 less than Π_4. Through the water rights market, on the one hand, farmers can transfer water resources of saving, so farmers will have a larger incentive mechanism of water-saving. On the other hand, with the adjustment of agricultural structure, the farmers will plant the crop whose coefficient of water consumption is low, or crops of high efficient. Otherwise, their margins benefit will be lower than the transfer price of water resources. Through the water rights market to transfer income of water resources, it can be used to supplement insufficient funds of water conservancy infrastructure, speeding up the construction of water-saving facilities, to form good circle of agricultural water-saving.

6. The Preliminary Assessment of Economic Performance of the Existing Management System Innovation

6.1 Intuitive Data

In November 1999, Water Conservancy Bureau in Lanxi seeks the views of their superiors and listens to the views of farmers, putting reform program of the irrigation area, which is submitted to county party committee and government, and has been ratified. On April 1, 2000, through the county bid, a senior engineer of the County Water Conservancy Bureau won the bid and signed a contract with the responsible department of Water Conservancy Bureau. The terms of the contract: the responsible people do not pay any costs to the Water Conservancy Bureau; the time limit of

irrigation management rights is 25 years; during this time, the increased buildings and equipments are unconditionally to the Party (government departments); the responsible people must implement employment system for existing employees, and have the right to manage and use all the assets of irrigation areas, but may not sell assets; the responsible people raise funds to resolve funds of equipment maintenance and engineering maintenance by themselves ; ensure to achieve standardization of the irrigation area in 10 years ;in the contract , the two sides' rights, responsibilities and interests have been clearly defined. In 2000, the managers of irrigation area take over responsibility for the management of irrigation area, so the nature of the business has changed, from the state-operated to the privately managed. The management of irrigation area has a series of significant changes. The manager raises 410,000 Yuan to repair projects by self-financing, pre-paid 205,000 Yuan for electricity cost, creating conditions for the resumption of irrigation, preventing seepage of water channels, rebuilding the renovation project, expanding of new irrigation area. The implementation of the employment system, although existing workers fully employed, only one opportunity to work. The implementation of wage reform, the header's wages in irrigation period is 1,500Yuan; 1,200 Yuan for the grouper is per month, 800 Yuan for the managers. The award and penalty system is strictly implemented. In that very year, the irrigation area was 333.3 hectares, and the value of water increased. The water consumption reduced from 1700 cubic meters to 1100 cubic meters per acres, and contract disputes of water greatly reduced. By 2005, due to the change of water management mechanism and innovation of management system, the benefit of irrigation area distinctly improved, guarantee rate is greatly increased agricultural income of farmers is doubled than 1999.The table 2 lists the GDP Y, the total capital K, the total workforce L (including water user and water manager).

6.2 Performance Analysis

If we introduce the data into the economic model, the evaluation of water rights system will be more clearly in Changgang irrigation area during this period. Smith pointed out that there are two basic factors on economic growth: first is the labor of determining productivity that is division of labor productivity; second is the capital of determining the number of productive labor. Stigluos think there are mainly factors that are impact on economic growth, such as the increase in capital accumulation, the improvement of the workers' nature, improvement of the efficiency of resource allocation, technological change and so on. Therefore, in the situation containing technical factors, I believe that the economical performance of water rights system is mainly affected by the capital accumulation of irrigation area, the nature of workers and technical factors.

Table 2 The Statistical Graph of the GDP, the Total Capital, the Total Workforce
in Changgang Irrigation Areas

Year	Y*	K	L
1964	50	150	320
1969	62	165	350
1988	13	300	400
1995	14	340	620
2000	25	400	680
2001	52	480	720
2002	100	650	900
2003	200	800	1000
2004	450	870	1110

Source:《Reform Documentary of Changgang Irrigation Area》(2003); the data in 2004 is estimates ; the data in 1964-1995 is on the basis of annual summary of irrigated area, estimated by the financial officers.

Table 3 The Performance Analysis of Water Rights System

Year	y	α	k	β	l	γ
1969	0.24	0.8	0.1	0.4	0.09	0.123
1988	−0.8	−0.4	0.82	−1	0.14	−0.35
1995	0.08	0.03	0.13	0	0.55	0.071
2000	0.79	0.18	0.18	0.18	0.1	0.736
2001	1.08	0.34	0.2	0.68	0.06	0.973
2002	0.92	0.28	0.35	0.27	0.25	0.756
2003	1	0.67	0.23	1	0.11	0.735
2004	1.25	3.57	0.09	2.27	0.11	0.688

Therefore, the production functions with the technological level as the following:

$$Y(t) = A(t)F[K(t), L(t)]$$

Where $Y(t)$ $A(t)$ $K(t)$ $L(t)$, respectively represents, in the time of t, the production, technical conditions, the capital stock and labor total. Finding Logarithm and derivation to both sides of the production function, shown in the following:

$$\frac{Y'(t)}{Y(t)} = \frac{A'(t)}{A(t)} + \frac{[F'_k(t)K'(t) + F'_L(t)L'(t)]}{F[K(t), L(t)]}$$

$$\frac{Y'(t)}{Y(t)} = \frac{A'(t)}{A(t)} + \frac{F'_K(t)K(t)K'(t)}{F[K(t), L(t)]K(t)} + \frac{F'_L(t)L(t)L'(t)}{F[K(t), L(t)]L(t)}$$

Made,

$$\alpha = \frac{F'_K(t)K(t)}{F[K(t), L(t)]}, \beta = \frac{F'_L(t)L(t)}{F[K(t), L(t)]}, \gamma = \frac{A'(t)}{A(t)},$$

$$y = \frac{Y'(t)}{Y(t)}, k = \frac{K'(t)}{K(-t)}, l = \frac{L'(t)}{L(t)},$$

Thus $\quad y = \gamma + ak + \beta l$

$$y = \gamma + ak + \beta l \quad \gamma = y - ak - \beta l$$

Among them, γ represents the performance of the water rights system; y represents of the GDP growth rate of irrigation area; α represents the elasticity of the total capital to the total capital; k represents the total capital growth rate; β represents the elasticity of the total workforce to the total output; l represents the total growth rate of workforce. The $\gamma, y, \alpha, k, \beta, l$ is the function of t, discretization of time variable, so there are: $\gamma_i = y_i - \alpha_i k_i - \beta_i l_i$

The indicators represent the meaning of the indicators in the phase of i. Therefore, the assumption that technical level doesn't change, through access to the data of each side and each year or some period (seen in the table 2), the performance analysis of water rights system can be drawn on in the Table 3. In the traditional irrigation area management system, the economic performance of system is extremely poor. Adopting new operating system, the economic performances of system gradually increase.

6.3 The Assessment of Water Using Efficiency

1. The water users' awareness of water-saving is relative high. Water users participate in water management of the irrigation area, strengthening the awareness of water conservation. They consciously adjust planting structure, smoothing the land, implementation of lace cultivation and irrigation in small ditches to reduce water quota, a decrease of water loss, to improve the utilization efficiency of water. For example, after the establishment of the association, water quota of some household decreased from 800 cubic meters to 500 cubic meters.

2. Comply with the principle of water rights of the "first come, first served" (first in time, first in right), that is, to ensure the longest occupation of the water rights are not affected by the new occupants, to avoid "pumping race" (in 1970's, in United States, the Los Angeles area didn't well define the water right. On the ground, the owners of the land possess the water rights under the ground. The adjacent pumping water users have a race, and even excessive use and waste.), especially irrigation areas included the well irrigation. Because water rights are not well defined, the possession principle dominated the ownership of the reserves. People have exclusive rights to the pumping water. No pumping water can be pumped by others, resulting in "Pumping competition".

3. Enhanced awareness of the democratic management and decision-making, improve the transparency of Irrigation Water Management. To avoid Village cadres' the phenomenon of free-rider charges, reducing the burden on farmers. Person buys building materials in their own money to mend project is appeared. After the establishment of the Association, supervision mechanism, transparent charges, making financial affairs and expenditure public, reduce costs. Today, water things must be through democratic consultation and decision-making, and stress of fair, reasonable and efficient principle, a reduction of a variety of water disputes. More than 95% of people have reflected that

since the establishment of water associations, the disputes of villages, households, between the households and irrigation station reduce. The phenomenon of destruction of channels, segments chaos, chaotic opening and other chaos have been put an end.

4. To strengthen the irrigation project management, the irrigation project is changed to "public goods" and "quasi-public goods", the major group is responsible for management and maintenance of "branch" drainage, dou drainage is managed by several households. Prior to the establishment of the Association, water conservancy projects are built by the national investment, water management department should be responsible for the maintenance and construction of the project, therefore, farmers are indifferent to maintenance works, not enough measures for water-saving technologies. After the establishment of the Association, the quality of the channel is improved, project management facilities linked to their own interest .In policies we adopt the measures of sub-management and responsibility, so that the farmers actively participate in project management. Utilization coefficient of irrigation water is also greatly enhanced.

5. Saving the major labor of the family, to play the women status, the result of water-saving is significant. Before setting the Association, in general family the men are engaged in seeing, retaining water, irrigation tasks, for the past in the process of competition for water, women, the elderly are in disadvantaged status. When the association is set up, no need for competition, according to a irrigation water quota and irrigation methods and order, equality and fairness make women and the elderly participate in, increasing availability of irrigation water. At the same time, women are in charge of water management, they are patient, meticulous, and significantly effect of water-saving better than men. According to the survey, in the 18 water user, from men management to women can save more than 10% water.

6. The users actively pay water charges. If the association is a shortage of funds, users can pay in advance to make up lack of funds.

7. Conclusions

At present, the water rights of Changgang Irrigation Area are at the initial stage of reform, so many problems need to be improved and deepened. Although the article on the water property rights and the establishment of water market are expected to design in future, but the following questions need to be explored in depth:

In the irrigation areas, land expropriation of other public facilities is not to take part in the form of shares, but one-time low-cost compensation, which is not fair for long-term farmers' land use rights. In the modernization construction, if farmers drive real benefits and long-term gains, it is necessary to transfer farmers' land and long-term investment dividends.

The role of water associations is too narrow, so it should be extended to other community-based management and major activities. If occurrences of major natural disasters, in the process of collective relief, the collective construction of mitigation projects, and drought resistance, water associations should play its role. In particular, some efficient water-related activities, the association should be actively involved.

The field management of women needs to be further mobilized. Practice has proved that, in the management of irrigation systems, the status of women is all the more important. Engaging in the field water management, women have more advantage than men for water-saving methods and the extent of careful awareness. Moreover, the participation of women in water management, not only reflects gender equality, more importantly, water conservation and water efficiency is greatly enhanced.

Water management associations sometimes conflicted with the local government, farmers in a dilemma. First, farmers' burdens are still heavy. The officials of township government are too many, so small-scale peasant economy can not support the huge

superstructure. Second, the township government has too much power, especially in control land, and sometimes penetrated into private affairs. Leading to excessive force asymmetric with narrow tax source, the relationship between farmers and the public servant is feed and fed relationship, not service and serviced relationship.

The property rights reform of irrigation area should focus on three relationships. First, the state-owned assets and the transfer of property rights (define ownership, sell the management right; define the operator's the dispose right of assets invested; define redistribution of benefit of national capital); Second, the tenant's pursuit of profit and the burden of farmers; Third, the interests between he tenant and irrigation area staff.

In the near future, the water rights transfer of irrigation area is mainly short-term, focusing on cultivating different households, within the same irrigation area, transfer of water rights, because short-term trading is relatively simple and easy organization. Long-term transfer, particularly the external long-term circulation of irrigation water right, directly determines the long-term investment in water conservancy construction. Therefore, it is necessary to cultivate operating companies of water conservancy facilities.

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