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Predicament and Countermeasures for the Management and Maintenance of Rural Water Conservancy Facilities

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Abstract The major problem of rural water conservancy facilities during its management and maintenance is in the "been used, under no control" state. And the main reasons of this state are the public belonging property, investment by a single subject, and lack of effective supervision and management mechanism. Since rural water conservancy facilities is used in small scale and has the features of rural "acquaintances community", a balanced long-term interest mechanism for the management and maintenance of rural water conservancy facilities is established for interest-related parties. On short-term view, the most effective measure is to bring the operational status of rural water conservancy facilities into the evaluation indicators of the local government.

Key words Rural water conservancy facilities, Management and maintenance, Acquaintances community, China

Water conservancy is the lifeblood of agriculture. And water conservancy facility plays an important role in improving the agricultural production and living conditions, reducing the production cost of rural residents, ensuring the stability of agricultural production, and promoting the growth and development in rural areas. After the investment and construction of water conservancy facilities, achievement of the designed efficacy depends not only on the type, quantity and quality of water supply facilities, but also on the appropriate management and maintenance of water conservancy facilities. The inappropriate management might reduce the period of use of water conservancy facilities, affect the achievement of designed efficacy, and lead to the invalidation of water conservancy facilities due to partial damage. Thus, water conservancy facilities might become the obstacle to the rural development. Problems in the management and maintenance of rural water conservancy facilities are put forward. Reasons for the difficult management and maintenance of rural water conservancy facilities are analyzed. Specific ideas for the management and maintenance of rural water conservancy facilities are introduced.

1 Problems in the management and maintenance of rural water conservancy facilities

The major problem for rural water conservancy facilities during its management and maintenance is the "been used, under no control" state. According to the relevant laws, the people's government at township level should be responsible for the supply, management, maintenance and jurisdiction of infrastructure. During the planned economy era, China implemented the comprehensive and centralized management of rural so-

cial, political and economic affairs, and the top-down management with different categories. Under the highly centralized administrative system at that time, specified administrative departments were in charge of the construction, management and maintenance of infrastructure according to the types of infrastructure. Infrastructure investment, management and maintenance system gradually lost its institutional foundation under the people's commune due to the implementation of household contract responsibility system. After the implementation of household contract system, peasant households were busy developing the production of their own. Thus, their dependence on grassroots government decreased. Moreover, the rural tax and fee reform reduced the source of income for the township government; and reform of rural institutions weakened the responsibilities of township government in infrastructure construction, management and maintenance. At present, although there are still departments responsible for specific infrastructure management, they are basically in the state of "having stations but no working staff". Water conservancy facility is one of the most important infrastructures in rural areas, the management and maintenance of which are also facing the same problems.

Some related studies also confirm this. For instance, research on the management of water conservancy in Zhecheng County, Henan Province by Wei Fengyun *et al.* shows that a total of 23 water conservancy management stations are basically paralyzed. Wages of the managers involved in rural work is 70% of the wage standard in the year 1997; some are paid according to the standard in the year 1995^[1]. Wang Fuzhen, the member of the National Committee of CPPCC of Shouyang County, Shanxi Province, points out that since the 1980s, farmland water conservancy has been in the lack of effective conservation and management and small water conservancy facilities in rural areas have basically been in an unsupervised state^[2]. Through the investigation on the status of water con-

servancy facilities in Yinzhou District of Zhejiang Province, Ding Guolan points out that the flood control capacity is low, the water conservancy facilities are aged and need to be repaired, and the water administration and water control systems need to be strengthened^[3]. The State Council Research Office also points out that after implementing the household contract responsibility system, the construction, management of utilization of some small-scale water conservancy engineering are out of connection. Rural water resource facilities are in the "been used, under no control" state. Water conservancy projects are damaged at different degrees with serious attenuation of benefit^[4].

During the research on the traditional agricultural regions of eastern Henan Province, it is found out that the improper management and maintenance of water resource facilities not only can not exert the functions, but also damage the agricultural production activities, and become an obstacle for the agricultural production. For instance, river ways in farmland are established for the irrigation and drainage. However, since river ways are out of repair for long years, some rivers are blocked; some riverbanks are damaged; some river ways are full of straws, weeds and other wastes. In rainy days in summer, rainwater flows backward to the farmland, so that river ways can not store water. In the spring of 2010, most areas of China have suffered from drought disasters. Governments at different levels have invested enormous human and material resources to combat drought. And Premier Wen Jiabao has also participated in this battle. In fact, maintenance of river ways needs little human and material resources. Governance with divided responsibility can achieve good long-term gains. However, due to the absence of subject, farmland water conservancy with huge investment is utterly useless.

2 Cause analysis of the difficult management and maintenance of water conservancy facilities

2.1 Properties of public goods of water conservancy facilities Few people worry about the management and maintenance issues of private goods, because the owners or users of private goods will do their best to take care of their goods for their own interests. Management and maintenance of water conservancy facilities need further research, because theoretically water conservancy facilities belong to rural public goods, that is, they have the characteristics of "non-competitive and non-exclusive consumption"^[5]. The public goods property of water conservancy facilities leads to two results. One is the market failure of the supply of water conservancy facilities. There is the phenomenon of "Home Supply of Small Hydraulic Engineering"^[6], which indicates the shortage of market supply and the special importance of water conservancy facilities during the agricultural production. The other is that after the establishment of water conservancy facilities, they become public resources due to their property of public goods and might become the "tragedy of the commons". In other words, people would like to enjoy the convenience brought by water conservancy facilities, but are not interested in the operational status and

management of water conservancy facilities. After G·Hardin published his paper, "tragedy of the commons" becomes a pronoun of the difficult management of public resources. In fact, Aristotle also said a long time ago that the things used most commonly get the least care, because people only care about their own interests and rarely consider the public interest^[7]. Property of public goods of water conservancy facilities leads to the market failure during the construction, management and maintenance. Thus, it is necessary to adopt the non-market approach in order to realize the effectiveness of supply, management and maintenance. According to the Local Public Goods Theory, local governments should take the responsibilities of supply, management and maintenance of water conservancy facilities.

2.2 Single supply main body of water conservancy facilities With the development of society and technology, the Public Goods Theory also achieves its enrichment and development. For instance, due to the development of technology, public goods which were hard to charge can easily achieve the exclusiveness of consumption. Due to the consumption exclusiveness, private supply of public goods becomes a reality. Thus, paying fees for the consumption of public goods has ensured the return on investment of public goods. Public goods with private investment can also obtain better management and maintenance. However, rural areas are usually located at remote areas with low population density and poor economic capacity per unit land area. And water conservancy facilities mostly need long-term large amount of investment and are the projects with low economic return. Therefore, water conservancy facilities can hardly attract the non-government investment. In fact, governments are the overwhelming majorities of investment main bodies of water conservancy facilities. Supply system of water conservancy facilities in China is from top to bottom, that is, the supply quantity, type and mode are determined and implemented by the governments at different levels. As the supply main body of water conservancy facilities, it is the responsibility of government to manage and maintain the water conservancy facilities. However, due to the lack of management and maintenance funds and the corresponding constraints and evaluation mechanism and the government inaction, water conservancy facilities with huge establishment funds can hardly escape the fate of "tragedy of the commons".

2.3 The lack of effective constraints and evaluation mechanism Government organizations at different levels adopts the "pressurized system"^[8]. Under this system, governments of higher levels implement economic and political rewards and punishment on governments of lower levels. One-vote negation system is usually adopted in the evaluation of these tasks and targets. In other words, once a certain task or target is not finished, the score of the whole year becomes zero and the governments of lower levels will be punished. Thus, assessment and evaluation by higher levels of government are the most effective constraint. According to the investigation results, evaluation on local governments by the governments of higher levels can be divided into three aspects, such as general objective, e-

conomic and social development objective, and social development and social stability objective. To be specific, the economic and social development objective mainly pays attention to the construction of scheduled projects, rarely cares about the operation and utilization of established projects. The daily work of local government often revolves around the goals and tasks of the governments of higher levels, which can hardly implement long-term, constructive, developmental and maintenance work. Therefore, it is concluded that this is one of the most important causations for the ineffective management and maintenance of water conservancy facilities in China.

3 Management and maintenance ideas of water conservancy facilities

3.1 Bringing the management and maintenance of water conservancy facilities into design planning Due to the public goods properties, water conservancy facilities have been in the "been used, under no control" state ever since its establishment. According to the current investment and management system, investment projects of water conservancy facilities are generally established based on the cooperation between related investment sector and local government. After the construction is completed, local government owns the water conservancy facilities, and local residents have the right to use them. But no one cares about their management and maintenance. Therefore, it is suggested that we should bring the management and maintenance of water conservancy facilities into the feasibility program; the management and maintenance scheme should be made ever since the planning of water conservancy facilities. Management and maintenance funds should be reserved under the participation of investors, grassroots governments and community residents. Moreover, government should explicit the rules of use, the management and maintenance rules, and the head person of responsibility, define the rights, responsibilities and obligations of each party, assign the inspector for water conservancy facilities, and ensure the operation of water conservancy facilities.

3.2 Establishing a participation and management mechanism for the users of water conservancy facilities

3.2.1 Expansion of the theory of public goods and the experiences of reform. Due to the expansion of the theory of public goods, more and more non-pure public goods, such as the local public goods and club goods, can easily achieve the exclusiveness, and can be charged. Thus, the behavior of private supply becomes common. And the private party is responsible for the management and maintenance of public goods, which has received good results. The World Development Report in the year 1994 points out that investment system is the main reason for the low efficiency of infrastructure construction in different countries, pointing out that reform should be implemented in the field of infrastructure, such as using commercial principles to operate infrastructure, encouraging the competition among private sectors, and enlarging the participation of users and other persons involved in the planning, provision and supervision of infrastructure services. According to the different

types of infrastructures, the report puts forward four operation modes, which provide references for the reform of infrastructures in China^[9]. Due to the special importance of irrigation water to agricultural production and the construction of small water conservancy facilities, the use of irrigation facilities is the first to be reformed in the area of rural infrastructures.

Xu Zhifang introduces the experiences of farmers' participation in irrigation management in the world, and points out the reform thoughts of the farmer participatory management and the separation of ownership right from management right of small water conservancy facilities according to the actual situation of China^[10]. Liu Jingjing argues that in a familiar community, exchange and social relationship can solve the problems under different situations based on the investigation on the community management of drinking water in 4 villages of Hebei Province^[11]. Taking the property right reform in three electric pumping stations in northern Jiangsu Province as an example, Zhou Xiaoping demonstrates the feasibility of personal management of water conservancy facilities under the guidance of community^[12]. Elinor Ostrom points out in her paper *Covering the Commons—The Evolution of Institutions for Collective Action* that the acquainted villagers realized the management of public land resources by their long-term relationship and production modes. Since the 1980s, the reform practice of international irrigation management system have verified that Participatory Irrigation Management has become an effective institutional arrangement, which is widely implemented in the world by the World Bank and other international organizations^[7].

3.2.2 Specific ideas. Rural community is a typical acquaintances community, which has several typical characteristics. Firstly, community residents know each other and believe in each other. Most of them cherish the individual or family's reputation in the community. Secondly, with their long-term relationships, community residents have formed specific communication patterns and hidden rules during the process of repeated game. Thirdly, people with great respect deal with the community conflicts and become the actual managers of community. Fourthly, the self-governance system of villagers has cultivated the villagers' sense of participation. And formal system and tradition together play their roles in the management of community affairs.

Based on the theory, case study and analysis motioned above, it is believed that a long-term management and maintenance system for water conservancy facilities with the balance of interests can be established.

3.2.2.1 The wide participation of community residents. By the extensive publicity, education and encouragement, residents' awareness, enthusiasm and initiative of management and maintenance of community water conservancy facilities are improved. Case study also confirms that participation degree of the benefited residents affects the stability of Participatory Irrigation Management.

3.2.2.2 In the long run, community residents have equal opportunity and benefit. The equality of opportunity and interests for community residents is the basis of long-standing participa-

tory management mechanism. Based on the cases put forward by Elinor Ostrom, priority used in turns of the number of years, seasons, months, or the frequency of use, according to the object, characteristic and utilization pattern, is the basic experience for the effective use of public resources.

3.2.2.3 Establishing formal and statutory association or organization. Formal organizations can ensure the management and maintenance of water conservancy facilities. For instance, the Participatory Irrigation Management has statutory "Water User Association", which is responsible for the planning, design, construction, financing, management, inspection and acceptance, and formulation of regulations, as well as the operation, maintenance, monitoring and evaluation of projects.

3.2.2.4 Exerting the functions of hidden rules and traditional informal system in community. If community members care about their reputation, we should encourage them to take good care of the water conservancy facilities, using gossip and reputation to constraint the residents with intent of harm. Michael Heller points out in his book *The Gridlock Economy* that "gossip, shame and fame" is an effective lever to control the gridlock in acquaintances community^[13]. For instance, the village committee or a respected man can ask the villagers to take care of the river ways near their farmland, so as to ensure the flow of river ways.

3.2.2.5 Paying more attention to the fairness than the efficiency. Relevant researches have directly or indirectly shown that during the utilization, management and maintenance of water conservancy facilities, we should try to achieve efficiency goals under the premise of fairness.

3.3 Bringing the operation status of water conservancy facilities into administrative assessment index Current water conservancy facilities have poor operation status; and local governments pay little attention to the management and maintenance. To change this situation as soon as possible, the most effective and direct measure is to bring the operation status of water conservancy facilities into administrative assessment index, and to implement the one-vote negation system for the management and maintenance of public water conservancy facilities. Besides, the residents have the responsibility and power of inspection, monitoring and reporting. Thus, water conservancy facilities with huge investment funds can truly exert their functions.

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