



## **PRECONDITIONS FOR THE POPULARIZATION OF PIM IN THE LOWER YELLOW RIVER IRRIGATION AREA**

**Cheng xianguo<sup>1</sup>, Jiang binzhou<sup>1</sup>, Fengxing<sup>2</sup>, Jin Ming<sup>1</sup>**

### **ABSTRACT**

The Lower Yellow River Irrigation Area (LYRIA) in the Yellow River plain downstream is the largest connected irrigation area by 98 separate irrigation districts. The total irrigation area is about 2147.33 thousand hm<sup>2</sup>. Differing from the popularization of PIM in many other countries and many other parts of China, PIM can hardly be found in the LYRIA. This paper analyzed the reasons of difficulty for wide spread of PIM in LYRIA and put forward the preconditions for the popularization of PIM in LYRIA. It mainly consists of the following aspects: Firstly, improving infrastructure construction and consolidating the hardware supportive base; Secondly, Reforming the existing management system through market mechanism; Thirdly, Well establishing Water Rights Markets to promote water price formation mechanism and adopt end water price; Fourthly, Managing the surface and ground water in a holistic way; Fifthly, Enhancing capacity building and improving water resources management capability; Finally, Improving the policies, laws and regulations system and promoting association regulations construction, etc.

### **1- BRIEF INTRODUCTION OF YELLOW RIVER DOWNSTREAM IRRIGATION AREA**

The Lower Yellow River Irrigation Area (LYRIA) refers to the irrigated area where the water sources for irrigation comes from mainstream of the Yellow River ranging from Tiao HuYu to the estuary. This irrigation area distributes in a strip-like way along the two banks of the Yellow River. LYRIA covers three river basins (including the Yellow River, Huaihe River and Haihe River), including 86 counties in 17 cities of Henan and

---

1- Cheng Xianguo, male, born in 1965, senior engineer, major in water resources management and water saving research. Yellow River Institute of Hydraulic Research, YRCC 453003;

2- Upper and Middle Yellow River Bureau, YRCC

Shandong provinces. The beneficiaries total to 52.71 million, with population density of 573 persons per square kilometer, among which 43.72 million are farmers, accounting for 82.9 percent of the total.

LYRIA is China's important base for food, cotton and oil seed crops, which plays a significant role in guaranteeing the stable and high yields for the two provinces during the last several decades. The main crops include wheat, maize, rice and cotton, etc. According to the 'Yearly Water Resources Statistics Book' of the two provinces, the annual irrigation water quantity is 15.97 b m<sup>3</sup>. The percentages from the Yellow River, local surface water and ground water account for 51%, 10% and 39% of the total respectively. The usage of water is mainly for agriculture, industry and township domestic consumption, agriculture use accounting for 92% while industry and domestic accounting for 5% and 3% respectively.

Heretofore, 137 irrigation projects have been built in the downstream of the Yellow River including 97 sluices, 16 siphons and 24 pump stations. The total diverted flow capacity is 4250m<sup>3</sup>/s. There are 98 irrigated regions with each area above 10 thousand Mu (1 Mu equals to 667 m<sup>2</sup>), including 11 larger-scale regions with each area above 1 million Mu, 26 large-scale irrigation regions with area between 0.3 and 1 million Mu, 61 middle-sized irrigation regions with area below 0.3 million Mu. The farmlands in the area totals to 3.891million ha with designed irrigated area 3.579 million ha, actual irrigated area 2.147 million ha. After years development, three main types of irrigation ways have been formed like gravity irrigation, pump irrigation and sources-replenishment irrigation.

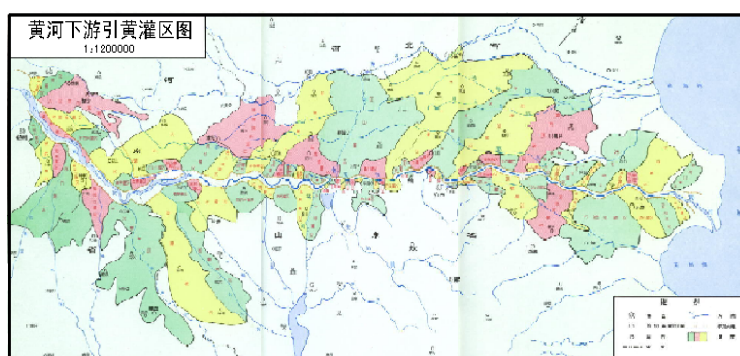


Fig.1 Distribution of LYRIA

## 2- THE STATUS OF PARTICIPATORY IRRIGATION MANAGEMENT IN LYRIA

Participatory Irrigation Management was introduced into China in the nineties with World Bank funded projects, and was piloted in Tiesan irrigation region of Hunan province and Zhanghe irrigation region of Hubei province respectively. Based on the World Bank Project principles, some preliminary outcomes and experiences have been achieved in China through establishment of economically independent irrigation and

drainage zones, and promoting farmers participation in the irrigation management

Comparing with rapid development in other regions, participatory irrigation management is in a slow development stage in the downstream of the Yellow River. According to data, only not more than 200 water user associations has been set up before 2005 in LYRIA, which mostly don't function well as they should.

### **3 CAUSES FOR DIFFICULTIES IN EXTENSIVE REPLICATION AND SCALING UP OF PARTICIPATORY IRRIGATION MANAGEMENT**

#### **3.1. INSUFFICIENT HARDWARE SUPPORT**

Most of the irrigation projects in the lower Yellow River were constructed in the fifties or sixties with low design standard and quality. There are only main transport canals and structures in many irrigation regions without tertiary canals and secondary canals. The canal systems are unlined mostly and the control structures are brick-made. After several decades' operation, the canals and structures become aged and badly damaged, with high seepage and low irrigation efficiency. According to statistics, the irrigation efficiency decreases as low as 0.4 to 0.5, the aged irrigation structures account for 29% to 42% of the total and the aged canals account for 38% to 70% of the total. Since 1998, although the State invested fund to restructure the large-sized irrigation system for water saving and counterpart structures, most part of the irrigation infrastructures are still lag behind.

In irrigation water monitoring, water amount from village to farmers has not been measured although water from county to towns has been done. Because of the shortage of water monitoring, water fee was calculated depending on cultivated land area or the numbers of every family. Therefore, farmers manage to use water as more as possible and cause serious problems of wasting water.

#### **3.2. LAGGARD MINDSET AND INSUFFICIENT SUPPORT FROM THE GOVERNMENT**

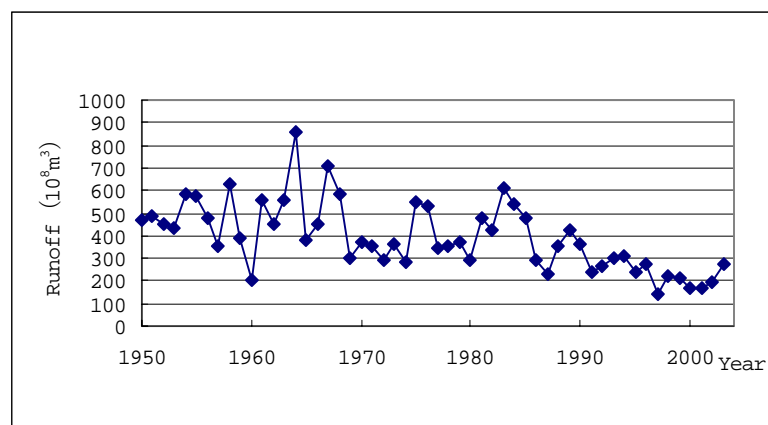
Since the household responsibility system has been adopted for a long time, the independent farming model has taken root in farmers' mind, plus laggard mindsets and low knowledge, resulting in lacking cooperative awareness, incentives and initiatives to protect legitimate rights and participate public affairs. Local governments' too-much and excessive interference discounts the extension of PIM. The fact that the reform of water use system involves so many stakeholders contributes to the difficulties in applying PIM. For instance, village and township levied the water fee. It is prohibited to embezzle the fund and increase the fee by excuse. But in reality, it always happens due to the fact that, to some extent, it eases the financial tension of townships and villages.

### 3.3. CONSTRAINS FROM ADMINISTRATIVE SYSTEM AND OPERATION SYSTEM

The irrigation administration in LYRIA is conducted separately within each district. There are four levels in terms of the irrigation administration system, the top level is provincial water administration department, following up is the county (city) water administration department, township water administration sectors constitutes the third level, and the village water administration commission ranks the fourth level. Such a system results in organizations' overstuffed, low efficiency and functionally duplicating. Due to the accountability, obligation and rights are not clearly defined for each level the water administration organizations become loose with a mess management. The irrigation management model formed in the planned economic context does not fit the market economic requirement, which make it tough to solve such kinds of problems as project aging, insufficient investments, uncertainty of responsibility in the regards of water diversion and transportation and management, laggard maintenance, difficulties in levying water fee and misuse of water fee, etc.

### 3.4 THE LOW WATER RESOURCES AVAILABILITY AND NO HOLISTIC WATER RESOURCES MANAGEMENT

The Yellow River runoff is the main source for the irrigation in LYRIA, the fluctuation of Yellow River runoff affects water availability of Yellow River downstream directly and hence water supply situation to the LYRIA. The discharge through the section of Hua yuankou is gauged to represent the actual availability of flow in the downstream of the Yellow River.



**Fig. 2** The measured yearly runoff of Huayuankou Hydrology station

It shows in the Graph 2 that the water flow in the lower reach of the Yellow River has been decreasing since fifties, resulting in ever-lowering of the irrigation water assurance rate. The situation was more directly reflected by the river' drying up. The first incident of drying up happened in 1972 in the downstream. Thanks to decrease of rainfall and

increase of industry water consumption since eighties, the drying up occurs almost every year when it enters nineties, especially, the whole reach within the territory of Shandong province is dry in 1981,1995,1997. There are 13 drying-up incidents in the section Lijin Hydrological Station in 1997, when the total days with no water in the river bed amounted to 226 days, and there was not water flow into the sea in 330 days. The total river length of dry riverbed is up to 704 km, accounting for 90% of the total length of the downstream.

The ground water resources accounts for one-third strong of the irrigation water resources, which plays active role in guaranteeing the water supply to irrigation area. But in the context that the withdrawal of ground water is in disorder state, there is no possibility to manage the water resources of the Yellow River flow, local surface water and ground water in a holistic way, which triggers setbacks for farmers to participate in the irrigation management.

#### **4. THE PREREQUISITES FOR WIDE SPREAD OF PIM**

##### **4.1. IMPROVING INFRASTRUCTURE CONSTRUCTION AND CONSOLIDATING THE HARDWARE SUPPORTIVE BASE**

Established projects and corresponding counterpart facilities such as measurement meters or gauge are necessary to facilitate PIM. Hence, for the end to create sound climate to implement and extend PIM, it is required to map out preferential policies to diversify fund source and intensify investment on the irrigation projects, aiming at boosting the strength in irrigation area extension and water volume measurement facilities construction. Water user association should be established based on hydrological unit rather than administrative unit to facilitate water management. As for trans-boundary canal system, it is advised to set up controlling structures and water gauge along the boundary so as to easily control water supply and measure discharge.

##### **4.2. REFORMING THE EXISTING MANAGEMENT SYSTEM THROUGH MARKET MECHANISM**

Such phenomenon as insufficient cost recovery, lack of maintenance, infrastructure aging, ever-lowering service quality, agriculture produce reduction, farmers' dissatisfaction and reluctant to pay water bill widely exist, which, in reality, develop a vicious circle that cannot be addressed in the context the government directly involves in irrigation management. The existing irrigation management system and operation mechanism can not fit the market economic requirement. It is inevitable to establish a wholly new irrigation management system and operation mechanism for the sake to address the situation featuring excessive administrative hierarchy and governments interventions, difficult in levying water fee.

The popular model of irrigation management decentralization to farmers is a good practice. It aims at mitigating government financial burden, lifting productivity and improving irrigation efficacy through making improved irrigation management more closely associating with farmers' real needs. Farmers should enjoy some administrative rights and authority and participate in the irrigation management and decision-making, which will have impact on their future development and livelihood.

The system reform, or institution reform, should go beyond the traditional concept that reform mainly focus on staff training and personnel staffing, rather, it should also cover irrigation management structure reform and framework arrangement. Institutionally, some soft aspects should be paid the same attention as that of the hardware of project, since the institution and its framework determine whether the mammoth investment on the projects could yields due profits.

#### **4.3 WELL ESTABLISHING WATER RIGHTS MARKETS TO PROMOTE WATER PRICE FORMATION MECHANISM AND ADOPT END WATER PRICE**

Water is basis for the existing and development of the LYRIA. The water supply should transfer from the need-oriented model to availability-oriented in the perspective of optimization of water resources allocation. The theory of water rights and water market should cover the whole process of irrigation management activities. More serious efforts should be paid to the initial water-use rights distribution, water consumption index, water consumption quota and water price formation mechanism. By introducing water market mechanism spur water users scientifically consume water and water saving.

Deepening the reform of agricultural and industrial water prices, one water price to users and one ticket to users, exploring the measured charge system and canceling water fee collect by per farmland; Exploring and seeking innovative mechanism of water price establishment and water collecting. Consulting with different price departments to study and establish methods of final water price calculation, and extending the range of water price justification. Besides, the standard of water price, which include basic water price, group management and final channel system repaired fee, be popularized to provide a basis of implementing terminal water price; In conditional areas, the price system should be propelled in the conditions of proper conditions.

Government should compensate those irrigation areas that run only on water fees and their water price dose not meet the basic need at present.

#### **4.4. MANAGING THE SURFACE AND GROUND WATER IN A HOLISTIC WAY**

There is a close relationship between the diverted flow from the Yellow River for irrigation, local surface water and ground water from the perspective of supplement and replenishment. All the water resources are managed in a holistic way to lift the irrigation water supply guarantee rate and maximize the efficacy of the water resource of all kinds.

A feasible water price policy should be available to guide water resources prioritized allocation.

#### **4.5 ENHANCING CAPACITY BUILDING AND IMPROVING WATER RESOURCES MANAGEMENT CAPABILITY**

PIM is new thing, which will take some time to be understood, accepted and extended. The training will play a crucial role in the process. Concerning the fact that farmers are the main body in PIM, it should be put in the first place to do publication to farmers, aiming at enhancing farmers' democratic awareness and spontaneous participation in public affairs. Training should also be given to farmers to raise their self-management capability and quality. Two aspects should be the entry point and the focus: (1) How to manage the water issues in line with the association's rules and norms and counterpart laws and stipulations in a order way. (2) How to maintain the projects, allocate water resources, save water, protect water environment and calculate water cost. Only by doing so can the farmer water use agencies be consolidated and develop.

Meanwhile, training should also extend to government officials and managerial staff, making them truly realize the roles participatory irrigation management plays in irrigation management system reform, and spontaneously give strong support Water Users Association. As the grass-root level, the staff in township governments actively cooperating in applying participatory irrigation management will significantly smooth the process in terms of the approach extension.

#### **4.6 IMPROVING THE POLICIES, LAWS AND REGULATIONS SYSTEM AND PROMOTING ASSOCIATION REGULATIONS CONSTRUCTION**

At present, China has "Village Autonomy Laws" and "Implementation Guideline on Hydraulic Projects Management System Reform", which provide law basis on village autonomy and establishment of Water Users Association, NDRC, MOF and MWR as well as governments at all levels also mapped out relevant policies. All the policies safeguard the participatory irrigation management development in a sound and order way.

Water Users' Association is a NGO with independent Law Person qualification, enjoying autonomous management rights and financial autonomy. Though it has norms, which have clearly stipulated its obligations, rights and accountability, some issues might rise in its actual operation Therefore, it is necessary to establish regulations, set up constrictive and supervision system, such as "Water use management regulations", "Project M&O Management Stipulations", "Financial management Regulations", "Water Fee Levy and Use Management", and adopt public Notification System, etc.

## **5. CONCLUSIONS**

5 The participatory irrigation management model has yet been applied widely in the LYRIA. The reasons behind this involve engineering structures, system, mindset and awareness, etc. To make it in place widely, the following should be on the top: to improve infrastructure construction, reform the existing management system, well establish water market, build up irrigation management capacity and perfect relevant policy, law and regulation system and Associations' norms.