Research and Suggestions on Deepening the Comprehensive Reform Pilot of Agricultural Water Price in Irrigation Districts

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Abstract. As water resources become increasingly scarce and agricultural water demand continues to rise, deepening the comprehensive reform of agricultural water pricing has emerged as a crucial pathway to promote water conservation in agriculture, enhance water use efficiency, and achieve agricultural modernization. Taking the pilot irrigation district in Yudu County, Jiangxi Province as an example, this paper explores the reform's background, implementation, and challenges, focusing on water pricing management systems, the formation mechanism of agricultural water pricing, and the operation and maintenance mechanisms of irrigation districts. It identifies problems existing in the comprehensive reform of water pricing, such as outdated management methods and inadequate mechanisms. Finally, the paper proposes further measures and suggestions for the pilot irrigation district of agricultural water pricing reform, providing actionable insights to advance agricultural water pricing reforms and improve water use efficiency.

Keywords: agricultural water pricing; reform; pilot irrigation district; Yudu County;

1 Introduction

In order to fully implement the spirit of the 20th National Congress of the Communist Party of China and thoroughly carry out the water management approach of "giving priority to water conservation, achieving spatial balance, conducting systematic governance, and exerting efforts on both fronts," the Ministry of Water Resources requires irrigation districts with good infrastructure to take the deepening of the comprehensive reform of agricultural water pricing as a key measure[1]. By innovating construction management models and investment and financing methods, it aims to build a series of modern irrigation districts that are "equipped with perfect facilities, water-saving and efficient, scientifically managed, and ecologically sound" through "exerting efforts on both fronts"[2]. As one of the main commodity grain and vegetable bases in Yudu

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County, the Gaopi Irrigation District occupies a very important position in the county's national economic development. It plays a crucial role in agricultural production and economic development throughout the region and is also an important part of the county's rural revitalization and integrated development[3]. It is a key medium-sized irrigation district in the county. The Yudu County Water Conservancy Bureau has organized a pilot project to deepen the comprehensive reform of agricultural water pricing and promote the construction of modern irrigation districts, with the vegetable base in Tantou Village of the Gaopi Irrigation District as the pilot site.

Agricultural water pricing reform is a critical component of addressing water scarcity and promoting sustainable agricultural practices. This study investigates the reforms in Gaopi Irrigation District, emphasizing water pricing mechanisms, operational management, and policy frameworks. Specifically, the study seeks to analyze the effectiveness of current water pricing reforms, identify the barriers and propose actionable strategies for improvement.

2 Status of the Comprehensive Reform of Agricultural Water Pricing in the Pilot Irrigation District

2.1 Implementation of the Quota Management System for Total Water Consumption in the Irrigation District

Yudu County has implemented the strictest water resources management system, enforcing total control over agricultural water use and implementing quota management. Clear control indicators for agricultural irrigation water use efficiency and annual total agricultural water use have been established. Combining the continued construction and supporting facilities, as well as water-saving renovations of the irrigation district, and infrastructure construction such as high-standard farmland development, metering facilities and information construction have been incorporated into the project's synchronous design, implementation, and acceptance, laying the foundation for the reform of agricultural water pricing in the irrigation district.

2.2 Improvement of the Agricultural Water Pricing Formation Mechanism

To alleviate the burden of water fees on farmers, fully mobilize their enthusiasm for water use, and encourage water conservation, precise subsidies are implemented for agricultural water prices, water-saving incentives, and tiered water pricing that exceed the quota[4]. Exploration of categorized water prices and tiered water pricing will be actively carried out. Reasonable determination of various water use prices, taking into comprehensive consideration water consumption, production benefits, and regional agricultural development policies. Agricultural water use is subject to quota management, with tiers and price increases reasonably determined based on actual conditions, and a progressive pricing system for exceeding quotas is gradually being implemented.

Awareness of water conservation is enhanced, promoting agricultural water conservation and fully leveraging the role of market and price factors in water resource allocation and water demand regulation.

2.3 Establishment of the Operation and Maintenance Mechanism for the Irrigation District

By the end of 2017, Yudu County had basically completed the reform of the management system for small-scale water conservancy projects, clarifying the ownership of all water conservancy projects and transferring use rights and management rights to maintenance units, farmer water user associations, rural collective economic organizations, and others. A funding guarantee mechanism for the maintenance of water conservancy projects has been established and improved, broadening funding channels for the construction and maintenance of farmland water conservancy projects and encouraging social capital to participate in their construction and maintenance[5].

3 Issues in the Comprehensive Reform of Agricultural Water Pricing

3.1 Inadequate Pipeline Infrastructure and Outdated Management Methods

The installed branch pipeline accessories, such as gate valves and household water meters, have suffered from immersion and rust, leading to errors in metering data and water leakage, which have impacted the progress of the comprehensive reform of agricultural water pricing in the irrigation district. The current lack of informatization in pipeline management has made it difficult to control water supply, allocate water quantities, and monitor water volume. There are very few information collection points in the irrigation district, and the overall management level is low, which restricts the further advancement of the comprehensive reform of agricultural water pricing[6].

3.2 Imperfect Agricultural Water Pricing Reform Mechanism

The agricultural water pricing system still deviates significantly from the new water pricing management approach and requires further refinement. There is insufficient management of water use at the terminal level, and the engineering maintenance capabilities of farmer water user associations are lacking. The personnel of farmer water user associations tend to be older, have limited educational backgrounds, lack professional knowledge in water conservancy, have few opportunities for training and learning, and have no experience in water conservancy management.

4 Suggestions for Reform Measures

4.1 Deepening and Improving the Water Fee Collection Mechanism

During the annual irrigation period, an investigation and statistics should be conducted by administrative villages or regional contractors to gather information on crop cultivation by each water user within the village area. Detailed records should be kept, including the water user's name, irrigation area, crop type, and irrigation method, and these should be registered to form a basic information ledger for water users. After the irrigation period, water usage should be promptly summarized based on metering data to create a water usage ledger.

Based on the basic information ledger and water usage ledger submitted by each administrative village, each township should calculate the water fees and create a township-level water fee collection ledger. Townships should issue notifications for water fee collection to all water users through WeChat public accounts, radio broadcasts, text messages, and other forms. Water fees for large agricultural enterprises and village economic cooperatives should be paid directly to the townships, while fees for individual farmers should be collected by the water user association and then submitted to the townships in a unified manner.

4.2 Improving the Precision Subsidy and Water-Saving Reward Mechanism

Deepening the Precision Subsidy Mechanism. The precision subsidy mechanism for agricultural water use should be improved, emphasizing the importance of "water fee collection" and adjusting the conditions for the issuance of precision subsidies. The principle of "collect first, subsidize later" should be adopted to urge townships and villages to effectively promote water fee collection. Townships should comprehensively assess the effectiveness of agricultural water pricing reforms at the village level according to township assessment methods and distribute subsidy funds to village collectives or water user associations. During the distribution of precision subsidy funds, a public notification system should be implemented, and assessment results and subsidy amounts should be promptly announced to the public for social supervision.

Strengthening the Implementation of Water-Saving Reward Mechanisms. Based on total agricultural water use control and quota management, rewards should be given to village collectives, water user associations, and large agricultural enterprises that adopt water-saving measures, manage water use well, and promote agricultural irrigation conservation, in order to enhance their initiative in water conservation.

4.3 Improving Water Management Mechanisms

Implementing Total Quantity Control and Quota Management. Based on irrigation water quotas and actual irrigation conditions, improve water use quotas by optimizing

and adjusting regional planting structures and breeding scales. Determine irrigation water quotas for various grain and economic crops in irrigation districts by category. Implement total quantity control and quota management, refine irrigation district water management systems, formulate annual water supply plans, advance the construction of digital twin irrigation districts, and further implement irrigation district water management through the application of information systems.

Establishing an Agricultural Water Rights System. Gradually allocate water use quotas to rural collective economic organizations, farmers' water user associations, and individual farmers, and assign them to specific water sources based on irrigation water quotas. Clarify water rights and implement total quantity control and quota management. All water rights holders should be registered uniformly, and water rights certificates issued by the water administrative department of the irrigation district, indicating usage, total quantity, duration, transferable water volume, and transfer conditions.

Establishing a Water Rights Trading Mechanism. Through engineering construction and deepening comprehensive reforms of agricultural water pricing, agricultural water users can provide more raw water to users with greater marginal benefits, implement water rights trading, and activate the water market.

Upgrading Metering Facilities. To accurately measure irrigation water use and implement total quantity control and quota management, select metering facilities suitable for local conditions based on the principles of affordability, simplicity, and meeting the needs of water management and metering fees. Establish water use ledgers. Combined with ongoing supporting and water-saving renovation projects in irrigation districts, construct automatic water measurement facilities at water conveyance inlets at various levels within the irrigation district to achieve precise measurement of main and branch pipelines, enable online measurement of agricultural water use, and facilitate remote data transmission for monitoring normal water supply flow and pressure.

4.4 Improving Irrigation District Operation and Maintenance Mechanisms

Clarifying Property Rights of Newly Built Projects. As modernization of irrigation districts continues, newly built projects are gradually completed, and further supplementation and improvement of the property rights ownership of these projects are required. Clarify the property rights of irrigation and drainage facilities within the irrigation district according to the principle of "who invests, owns, benefits, and bears the burden" and related requirements.

Promoting the Creation of Standardized and Normalized Management in Irrigation Districts. To promote standardized and normalized management in irrigation districts, ensure the continuous operation and effectiveness of projects, and better serve agricultural production, rural life, and ecological environments in irrigation districts,

combine the requirements of safety management, operation management, economic management, information management, and other standards to achieve meticulous, precise, and strict management of each specific project, ensuring long-term effectiveness of standardized management construction in irrigation districts.

To ensure that the quality of irrigation district management personnel meets job management requirements, formulate and actively organize the implementation of vocational skills training plans, strengthen the construction of the talent pool in irrigation districts, optimize the personnel structure, and innovate talent incentive mechanisms. Irrigation district management units should combine their employee training plans and annual work objectives and tasks, requiring key position personnel to hold certificates for their positions, technicians to undergo training before taking their posts, and organizing management team training to meet the needs of modern irrigation district management.

Strengthen the construction of the talent pool in irrigation districts, optimize the personnel structure, innovate talent incentive mechanisms, formulate vocational skills training plans, and actively organize their implementation to ensure that the quality of irrigation district management personnel meets job management requirements. Irrigation district management units should combine their employee training plans and annual work objectives and tasks, organize management team training, require key position personnel to hold certificates for their positions, and technicians to undergo training before taking their posts, to meet the needs of modern irrigation district management.

Optimizing Irrigation District Maintenance Systems. Comprehensively promote and improve standardized and normalized management in irrigation districts, establish a mechanism with comprehensive agricultural water pricing reform as the focus, optimized scheduling of irrigation and drainage projects and scientific allocation of irrigation water as means, and beneficial operation of irrigation districts as the goal. Improve the irrigation district management service system with irrigation district management units as the core, farmers' water user associations as the link, village-level water managers as the foundation, and large-scale agricultural operators as supplements.

4.5 Investment and Financing Mechanisms

Establishing a Mechanism for Investing in Irrigation and Water Conservancy Projects through Investment and Financing Platforms. Focus on projects and match different investment and financing models for fundraising based on the characteristics of irrigation district construction projects. Strengthen fiscal and state-owned asset linkages and expand state-owned asset platforms to leverage financing advantages. Explore financing models such as real estate investment trusts in the field of irrigation and water conservancy infrastructure, and use fiscal funds for support and rewards to promote state-owned assets' participation in the modernization of irrigation districts and the construction of agricultural product industry carriers within irrigation districts.

Establishing an Independent Operation, Construction, and Management Mechanism for Large-Scale Farming and Breeding Operators. For large-scale farming and breeding operators within irrigation districts who have transferred land, promote their independent responsibility for the daily operation and maintenance of various irrigation and water conservancy facilities on the transferred land. The government encourages large-scale farming and breeding operators to adopt water-saving measures, invest in water-saving facilities such as sprinkler and micro-irrigation systems, and utilizes water-saving reward and subsidy mechanisms to provide water-saving incentives to water-saving farming and breeding operators.

5 Conclusion

This study demonstrates the critical need for comprehensive agricultural water pricing reform to address water scarcity and enhance sustainable agriculture. Through the case of Gaopi Irrigation District, it identifies key challenges, including outdated infrastructure, systemic weaknesses, and limited stakeholder engagement.

The proposed recommendations provide a practical framework for improving water management practices and refining pricing mechanisms. Measures such as digital infrastructure integration, refined water pricing syustems, and local capacity enhancement can boost efficiency and conservation.

Future reforms should focus on systematic implementation, continuous monitoring, and collaborative policymaking to ensure scalable and sustainable outcomes. Aligning technical innovations with socio-economic conditions remains key to building a resilient, water-efficient agricultural sector.

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