

# Review and Prospect of Initial Water Rights Allocation Mechanism in the River Basin

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## ABSTRACT

The formation of a comprehensive set of practical and operable initial water rights allocation mechanism in a river basin can provide important support for promoting high-quality economic development in a river basin. By comparing the initial water rights allocation mechanism in the river basins of developed countries, it can be seen that the UK implements a government-led water rights allocation mechanism for the unified management of water resources in the river basin; the US implements a water rights allocation mechanism combining administrative and river basin management; and Japan implements a water rights allocation mechanism with sub-sectoral administration and centralized coordination. China's initial water rights allocation mechanism in a river basin mainly includes the government-led administrative allocation mechanism, market allocation mechanism and user participation allocation mechanism. In the context of climate change, the adaptive water rights allocation mechanism that strengthens the dual control actions of total water content and intensity, integrates administrative allocation and market allocation, and gives full play to the motivation of water resources stakeholders has become the mainstream research direction. The existing initial water rights allocation in a river basin needs to implement the green development concept of "water-based production" and carry out in-depth research on the optimal adaptation of the initial water rights and industrial structure in a river basin. To this end, the "three-step" adaptation framework of "adaptation scheme design based on the adaptation model — adaptation scheme diagnosis — adaptation scheme optimization" is proposed, with a view to providing some references for the improvement of the initial allocation of water rights in the river basins of China.

**Keywords:** River basin, Initial water rights, Allocation mechanism, Adaptation, Framework.

## 1. INTRODUCTION

Based on China's national conditions and water conditions, strengthening water resource management and optimal allocation have become a major national policy to ensure national water security. In order to meet the increasingly serious challenges of water resources and environmental issues, China's water rights system has been under study and exploration since 2000. In 2005, the State Council made the construction of a national water rights system a key element of deepening economic system reform. In 2006, the "National Medium- and Long-term Scientific and Technological Development Plan (2006-2020)" highlighted the priority theme of "optimal allocation and comprehensive development and utilization of water resources", and the "Eleventh Five-Year Plan for National Economic and Social Development"

proposed "the establishment of a national initial water rights allocation system and a water rights transfer system". In 2011, the "Decision of the State Council of the CPC Central Committee on Accelerating Water Resources Reform" proposed the implementation of the strictest water resources management system. Since 2012, the State Council has issued a series of relevant policies, such as "Opinions of the State Council on Implementing the Strictest Water Resources Management System", "Assessment Measures for Implementing the Strictest Water Resources Management System", "Action Plan for Water Pollution Prevention and Control", "Overall Plan for Reforming the Ecological Civilization System", and "Proposals of the Central Committee of the Communist Party of China on Formulating the 13th Five-Year Plan for National Economic and Social Development", which put forward a series of policies to strengthen

water resources management and implement a double control action plan for total water resources consumption and intensity in order to establish a sound initial water rights allocation system. The initial water rights allocation mechanism in a river basin, as an important element in the construction of the national initial water rights allocation system, has aroused strong reactions in the water conservancy and academic circles. The initial water rights allocation in a river basin is the initial allocation of water resources use rights to provinces, regions, industries or sectors, irrigation districts, water user associations or water abstractors, taking into account economic water rights, social water rights, natural water rights and environmental water rights. Clarifying the initial water rights allocation mechanism in a river basin is a necessary means to establish a sound national initial water rights allocation system and resolve the water conflicts among stakeholders related to water rights, and is an effective way to improve the rational allocation and efficient use of water resources system, water resources protection and river and lake health protection system.

## **2. RESEARCH REVIEW OF INITIAL WATER RIGHTS ALLOCATION MECHANISMS IN THE RIVER BASINS OF DEVELOPED COUNTRIES**

Since the concept of water resource management in a river basin was introduced in 1908, developed countries and scholars have accumulated a wealth of experience in the active exploration of water rights allocation mechanisms. According to their own national conditions and water characteristics, developed countries have developed their own water rights allocation mechanisms, involving a combination of administrative areas and river basin management, government and market, supply and demand and multi-objective integrated management, water quality coupling and sustainable water resources management, resource-based and asset-based combination [1].

By comparing the water rights allocation mechanisms of developed countries such as the UK, the US and Japan, it can be seen that the UK implements a government-led water rights allocation mechanism for the unified management of water resources in a river basin, and allocates water rights according to a management system that combines unified management of a river basin and

privatization of water services. In the United Kingdom, common law provides for the ownership or use of riparian land to determine the ownership of water, which is generally applied to areas with abundant water resources; the United States implements a water rights allocation mechanism that combines administrative management and river basin management, and establishes a hierarchical management system for water rights that is spontaneously regulated by the market. In the 20th century, the western United States began to use the rule of priority right of occupancy, which determined the priority of water use by the time of occupying water resources, and stipulated that "the people who occupy a body of water and put it into the beneficial use enjoys the priority to use water resources". This type of water rights allocation rule has solved the problem of water allocation in arid areas to a certain extent, but it is not applicable to areas with rapid economic development and a sharp increase in new water users; Japan has implemented a water rights allocation mechanism with sub-sectoral administration and centralized coordination to ensure clear rights and responsibilities and perfect coordination of "multiple management of water resources". The Japanese Permitted Water Rights Rules provide for the specification of the maximum amount of water to be used by each user as the permitted use of its water resources by means of an administrative permit. Permitted water rights are mainly allocated administratively by the government, which can give full play to the government's regulatory role and better guarantee the fairness of water rights allocation, but ignore the role of water use efficiency and comprehensive benefits to a certain extent.

Along with the impact of global climate change on water resources, the study of climate change and the uncertainty of water system environment has become a hot issue of international concern, and the mechanism of adaptive allocation of water rights has emerged. The adaptive allocation mechanism of water rights ensures the integrity and coordination of water resource system by continuously adjusting water resource management actions and directions to meet changes in water ecosystem functions and economic and social development characteristics [2]. In the context of climate change, the adaptive allocation mechanism of water rights has become a mainstream research direction by strengthening the dual control actions of total water use and intensity, integrating administrative allocation and market allocation, and giving full play to the motivation of water resources stakeholders, and its main research

results focus on conceptual ideas, analytical frameworks, and methodological responses. The adaptive allocation mechanism of water rights has many uncertainties. Through the continuous improvement of the existing water rights allocation mechanism, it can adapt to the rapid changes in socio-economic conditions and the environment [3][4][5][6][7], involving the allocation subjects, allocation targets, allocation technology system [8][9][10], emphasizing the clarification of the uncertainty and driving mechanism of the water resources system environment. Finally, adaptive countermeasures for the vulnerability of water resources are put forward [11][12][13].

### **3. RESEARCH REVIEW OF INITIAL WATER RIGHTS ALLOCATION MECHANISM IN THE RIVER BASINS OF CHINA**

The establishment of a water rights allocation mechanism that effectively promotes the efficient use of water resources is a key path to accelerate the innovation of initial water rights allocation practices in China's river basins. Based on China's national and water conditions, national water administration departments and academics have conducted hot studies and in-depth discussions on the initial water rights allocation mechanism in river basins, which mainly includes government-led administrative allocation mechanism, market allocation mechanism and user participation allocation mechanism, whose advantages are reflected in controlling the total amount of water use, improving water use fairness, improving water use efficiency and sewage performance, reducing the burden of water users and improving water use efficiency and effectiveness, respectively. However, how the government-led administrative allocation mechanism coordinates the interests of water resource stakeholders and improves water use efficiency, how the market allocation mechanism strengthens the government's coordination and supervision of market-based instruments and prevents market failure, and how the user participation allocation mechanism ensures that water users' associations are supervised by water users and receive supervision, management and operational guidance from the government and business authorities are the main dilemmas facing by three water rights allocation mechanisms. For this reason, scholars have proposed that the initial water rights allocation in a river basin should establish an integrated allocation mechanism of government macro-regulation, quasi-market

operation and user participation, and strengthen the extensive participation of water resource stakeholders by embedding a political consultation mechanism in the initial water rights allocation process in a river basin [14][15], coordinate the conflicting interests of water resource stakeholders, and improve water use efficiency and overall water use efficiency, thus providing a more effective mechanism for improving the initial water rights allocation in a river basin, and providing a feasible idea for the initial water rights allocation practice in the river basins of China.

The practice of initial water rights allocation in river basins is subject to the influence of various factors such as political stability, social equity, economic development, technical means and ecological environmental protection, etc. Drawing on the international experience, many scholars have conducted in-depth research on the formulation of the principle of initial water rights allocation in river basins. The principles of prioritizing water for domestic use, guaranteeing food security, respecting history and the current situation, sustainable development, leaving a margin, guaranteeing ecological water, and using water to determine production have become key principles [15][16]. A model that combines the incentive mechanism of water conservation and cluster chain industry is also further introduced into the initial water rights allocation practice to improve the initial water rights allocation mechanism [17].

Considering water problems such as water scarcity, water environment pollution, water ecology degradation, and frequent water and drought disasters brought about by climate change, population growth, economic development, and intensified human activities, adaptive water rights management provides an effective way to effectively address these problems and challenges. Scholars have mainly focused on adaptive water rights allocation mechanisms and evaluation methods [18][19][20][21][22]. Among them, the adaptive allocation mechanism of water rights is a binary mechanism combining administrative and market allocation [18]. The evaluation methods mainly include collaborative evaluation method [19], multi-objective decision-making method, cost-benefit analysis method [20], flexible suitability evaluation method [21], and suitability assessment method based on PSIR model [22].

#### 4. CONCLUSION

The study on the initial water rights allocation mechanism in a river basin is a product of reflection and conclusion of the initial water rights allocation practice in a river basin. The reform of the initial water rights allocation practice and management system in China at this stage follows the international trend of water resource allocation management development. In view of the new situation of "water-based" green development concept and rigid constraints of water resources, and relying on the existing initial water rights allocation mechanism, it is urgent to implement the concept of "water-based" green development in the initial water rights allocation process and improve

the suitability of the initial water rights in a river basin for the optimization of industrial structure. In this regard, based on the existing initial water rights allocation mechanism in a river basin, it is suggested to take the initial water rights allocation practice in a river basin as the guide, strengthen the rigid constraints on water resources, and build a framework for the adaptation of initial water rights in a river basin and industrial structure optimization. According to the "three-step" adaptive management idea of "adaptive scheme design based on the adaptive model — adaptive scheme diagnosis — adaptive scheme optimization", the study on the adaptation of initial water rights in a river basin and industrial structure optimization is carried out. (see Figure 1).

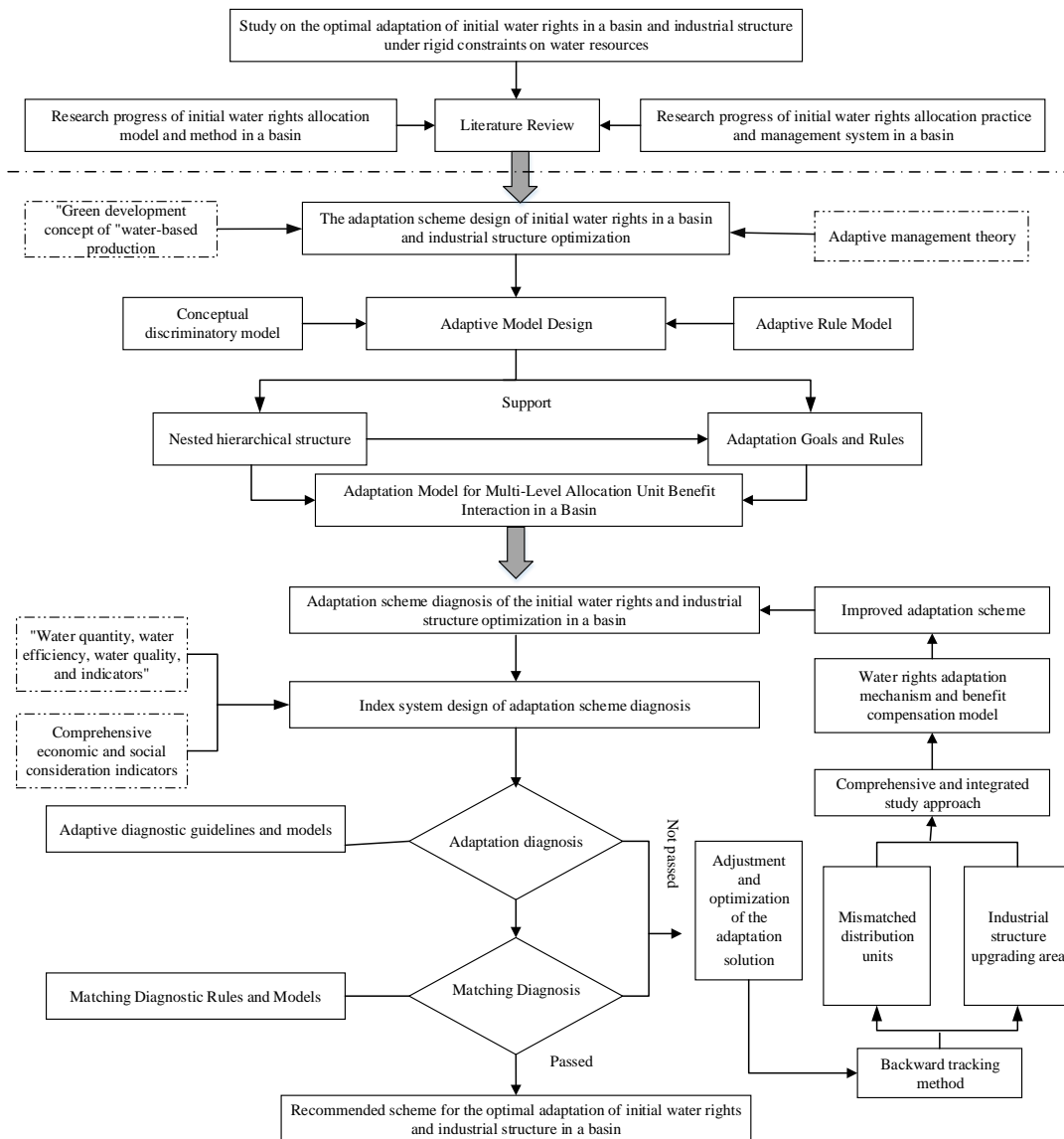


Figure 1 Framework for optimal adaptation of initial water rights and industrial structure in a river basin.

According to "Figure 1", it is suggested to implement the green development concept of "water-based production", and design an optimal adaptation model for the initial water rights and industrial structure in a river basin. At the same time, it is necessary to optimize the existing initial water rights allocation model in a river basin, construct a conceptual discriminatory model and rule model for the optimal adaptation of initial water rights and industrial structure in a river basin, effectively determine the nested hierarchical structure and priority level of the optimal adaptation of initial water rights and industrial structure in a river basin, determine the multi-layer and multi-level allocation units for the optimal adaptation of initial water rights and industrial structure in a river basin according to local conditions, and clarify the adaptation mechanism and principles of the multi-layer and multi-level allocation units in a river basin. Based on the designed adaptation model of initial water rights and industrial structure optimization in a river basin, the adaptation research on initial water rights and industrial structure optimization is carried out in accordance with the "three-step" adaptive management idea of "adaptation scheme design based on adaptation mode — adaptation scheme diagnosis — adaptation scheme optimization". First, it is required to fully reflect the interests of the multi-layer and multi-level allocation units in a river basin, establish an adaptation model for the interaction of the interests of the multi-layer and multi-level allocation units in a river basin, and design an optimal adaptation plan for the initial water rights and industrial structure in a river basin. Second, it is required to couple the initial water rights allocation of "water quantity, water efficiency, water quality" indicators with comprehensive economic and social consideration indicators, construct a comprehensive set of diagnosis for the adaptation of initial water rights and industrial structure optimization, including the adaptive diagnostic criteria for the allocation of water rights at the "river basin-region" level and the high-quality economic development, and the matching diagnostic criteria for the allocation of water rights at the "region-industry" level and the optimization of economic and industrial structure, so as to verify the feasibility and rationality of the adaptation scheme between the initial water rights and the optimization of industrial structure in a river basin. Then, with the use of backward tracking method, the root causes of the unreasonable diagnostic results of the adaptation scheme are investigated. The cyclic coupling

method of "adaptation scheme — diagnosis — adaptive adjustment — adaptation scheme" is adopted to establish the adaptive adjustment mechanism and benefit compensation model of multi-layer and multi-stage allocation units in a river basin, and adjust and optimize the designed adaptation scheme of initial water rights and industrial structure. Ultimately, the suitability of the initial water rights and industrial structure optimization in a river basin will be improved.

## AUTHORS' CONTRIBUTIONS

Dan Wu was responsible for experimental design and writing the manuscript, Zhuling Pan was responsible for research collection and writing the manuscript.

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