Discussions about Water Resources Allocation

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Abstract: Based on the reasons of water resources allocation, the current domestic water resources distribution profile is analyzed, which can provide a theoretical basis for the future development of water resources allocation in various regions. Water resources allocation is one of the effective means to solve the uneven distribution of water resources in China. This paper reviews its development process, summarizes the development process of water resources allocation model, and forecasts the future development trend of water resources allocation research.

1. Introduction
Water resources is an invaluable resource, a material basis for human survival and economic and social development, and an irreplaceable important natural resource[1]. It plays an important role in the construction of human society. At present, water resources mainly have problems such as the spatial and temporal distribution of water resources and the layout of productivity, the competition for water use between regions and water sectors, and the competition between production, living and ecological water. In order to meet the people's longing for the beautiful life of green mountains under the current severe water resources situation, it is necessary to solve the problems of water resources safety and water environment pollution, so water conservation and water resources protection are an important part of promoting ecological civilization construction[2].

Water resources are basic natural resources and strategic economic resources, which means that water resources are both an important factor in the construction of ecological environment and an integral part of comprehensive national strength[3]. The three major water problems of “more water, less water and dirty water” are still the problems that are currently faced with and urgently needed to be solved. The uneven distribution of water resources in time and space and the frequent occurrence of extreme weather in recent years have led to frequent floods in some parts of the country during the flood season. Drought often occurs in some areas. Besides crop yield reduction, domestic water use in some areas is also difficult to guarantee. Irregular and random discharge of production and domestic water is the main reason for further deterioration of water quality. With the rapid development of society and the continuous increase of population, it will inevitably lead to the continuous increase of water demand. How to make better sustainable use and development under the existing water resources conditions in order to achieve the purpose of efficient water use and water saving, it need to rationally optimize the allocation of water resources in the region.

2. Concept
At present, there are different opinions on the concept of water resources allocation at home and abroad. I have extracted the concept of higher social recognition from the National Technical Outline of
Comprehensive Water Resources Planning: in the basin or in a specific region, with fairness, effectiveness and sustainability is the principle, combined with various engineering and non-engineering measures, in accordance with market economic laws and resource allocation guidelines, adopting means and measures such as reasonable suppression of demand, guarantee of effective supply, maintenance and improvement of ecological environment quality, and inter-regional and water use. Inter-departmental allocation of multiple sustainable water sources. The core concept of water resources allocation is to maintain the balance between regional economic development and environmental protection through rational allocation, and finally achieve the coordination of resources, environment and ecological comprehensive carrying capacity and economic and social development[4-6].

The fairness in the concept refers to the strictness and fairness of water resources allocation, the balanced consideration of the interests of different users, and the fair and reasonable distribution of water resources; the principle of effectiveness means not only ensuring the efficiency of water resources utilization. It is also necessary to pay attention to the economic benefits of water resources and to maximize the benefits of rational allocation of water resources. The principle of sustainable development means that the rights of future generations to the normal use of water resources should not be due to the unreasonable use of them by contemporary people. It is destroyed, that is, to maintain the sustainable use of water resources. The engineering measures are to build some water conservancy projects such as reservoirs, levees and culverts to control the amount of water; non-engineering measures are measures to reduce flood damage through legal and administrative means and other means directly using flood control works. The optimal allocation of water resources must first meet the basic principles of fairness, effectiveness and sustainability. On the basis of principles, effective combination of engineering measures and non-engineering measures to rationally regulate the available water resources and achieve the maximum use of water resources. To provide an effective solution to alleviate water shortages in the region and a series of water conflicts[7-8].

3. Cause and Discussion

3.1 Reasons for Water Resources Allocation

(1) Water shortage. According to the data, China's total fresh water is 2,800 billion cubic meters, ranking fourth in the world, but the per capita water resources are only 2,300 cubic meters, only 1/4 of the world average. The relatively famous Yellow River was cut off in history. During the 25 years from 1972 to 1996, there was a total of 19 years of interruption, with an average of 3 interruptions in 4 years.

(2) Unequal distribution of water resources in time and space. China's vast territory, its geographical location determines the spatial and temporal distribution of water resources, mainly in summer and autumn, less winter and spring; southeast coastal areas are rich in water, and the northwest inland areas are short of water.

(3) Water pollution

Water quality is mainly divided into the following categories: Drinking water class I: National nature reserve, water quality is not polluted; drinking water class II: cleaner, can be used as drinking water after filtration; drinking water class III: can be used as ordinary industrial water after filtration and cleaning; class IV: ordinary Agricultural water, irrigation water; Category V: ordinary landscape water; inferior V: useless dirty water.
Through the distribution map of total rainfall and water resources in various provincial-level administrative regions in 2017, it can clearly see the reality of uneven distribution of water resources in various regions, and there are large differences in different regions. It can be seen from Figure 2 that the rainfall varies greatly in 2017 in the provincial administrative regions of the country. The area with the most annual rainfall is Hainan Province, which is 2062.2mm; the area with the least rainfall is Inner Mongolia Autonomous Region, only 208.2mm; The difference in rainfall is nearly 10 times. Figure 3 shows the total amount of water resources in the provincial administrative regions in the country in 2017. The total amount of water resources ranks first in the country in Tibet, with a total volume of 474.99 billion m³. The region with the most water resources is the Ningxia Autonomous Region, of 1.08 billion m³; the difference is 439.8 times. In order to solve the situation of large differences in water resources distribution in different regions, China has also launched a number of projects to alleviate this problem. The South-to-North Water Transfer Project, which was officially launched in 2002, is to solve the water shortage problem in the Huanghuaihai Basin in northern China. This will promote the coordinated development of the region in the northern region; in order to alleviate the water shortage in the central Guizhou region and improve the water environment and ecology of the region, the water diversion project in the central part of the project will be officially started in 2017, which is mainly from the relatively abundant water. The transfer of water from the main stream of the Jinsha River is an important milestone in promoting the sustainable economic and social development of the Central region of Yunnan. In 2017, the water quality of 123 rivers in the country was tested. The results showed that there were 32 water quality class I-III, accounting for 26%; 67 water quality class IV-V, accounting for 54.5%; 24, accounting for 19.5%; according to the national water quality testing classification standards, nearly 80% of lake water bodies do not meet drinking water standards, and useless dirty water accounts for 1/5 of the total, which fully indicates that water quality is not up to standard. As many as it is, it is particularly important to protect water resources and use water that is reasonably treated. Figure 4 shows the statistics of water use in different water sectors in China. Agriculture is still the largest sector of water use, accounting for 62.32% of the total water use in the country; domestic water accounts for 13.87%, industrial water accounts for 21.13%, and artificial ecological environment only accounts for 2.68%; research on the allocation of water resources for agriculture with the largest water demand. How
to use less water on the premise of quality and quantity must develop water-saving agriculture and implement refined irrigation.
3.2 Research Progress on Water Resources Allocation Model

The allocation of water resources with the development of social economic and ecological environment probably has experienced the following relatively large stages\cite{9-12}:

(1) predicting the corresponding water demand based on the current national economic development;
(2) considering simultaneously the level of regional economic development;
(3) Rational allocation of ecological development concepts;
(4) Four major river basins, including the Yangtze River, Yellow River, Huaihe River and Haihe River, as the target basis for large-scale water resources allocation across multiple basins;
(5) The different needs of different users are integrated into the mass and quality of water resources.

Different stages of water allocation.

![Fig.5 Three configuration model](image)

3.3 Problems in the Water Resource Allocation Model

(1) "The constraints of the model are not comprehensive." The proposed water resource allocation model is mostly composed of objective function and constraint conditions, but there is a problem of heavy water quality and light water quality in model construction.

(2) "The model lacks practicality." Because water resources tend to involve many factors in the configuration process, it is difficult to construct an ideal configuration model using the objective function and constraints in the model construction. If the construction model is too complicated or too large, it will make the model difficult to solve or the optimization results obtained will be difficult to adapt to the actual situation.

(3) "The model has limitations." At present, the quantitative model of water resources allocation mainly aims at realizing the comprehensive benefits of water resources, and does not reflect the value of water resources itself, resulting in low water resource allocation efficiency, low utilization efficiency, and water waste.

4. Development Trend

Based on the reasons of water resources allocation, combined with the conditions of economic and social development, in the future, water resources should shift the focus of allocation to diversification, quality and ecologicalization; focus on the allocation of agricultural water resources, build agricultural water models, and reduce agricultural water consumption. Develop water-saving ecological agriculture; closely link with today’s social development status and water demand, adjust and optimize the water resources allocation model, and guide the rational allocation of water resources.

5. Conclusions

This paper analyzes the domestic water resources by taking the rainfall and water holdings in various regions of China in 2017 as an example. The results show that the water problem is still grim, and the uneven distribution of domestic water resources, water pollution and extensive water use is still everywhere. The ecological environment is the basis for the development of the national economy. It...
will rationally allocate water resources based on the protection of the ecological environment and combine the current social development to maximize the benefits of water resource utilization.

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