INTELLIGENT MANAGEMENT METHODS OF WATER ENVIRONMENT RESOURCES IN THE CONTEXT OF GREAT ECONOMY

Xiaoyun Ma

- Jiyang College of Zhejiang A&F University, Shaoxing, Zhejiang, 311800, China
- zhuyan10086@126.com

Yan Zhu*

- Ecology and Environmental Science Research & Design Institute of Zhejiang Province, Hangzhou, Zhejiang, 310007, China

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ABSTRACT

In this paper, under the background of big economy, firstly, we integrate the life community of mountains, water, forests, fields, lakes and grasses, combined with the construction of wastewater treatment and the supporting pipeline network, and complete the architecture of the overall governance framework of the management system. Secondly, based on information resources and infrastructure, design the application functions and application system architecture of the intelligent management system to realize the integrated management of the whole life cycle of water environment resources. It also describes the attribute values of cloud computing service processing capability, sets the feature item labels between sensing, and lays the foundation for the clustering distribution of management function modules. Finally, scientific and technological innovation is proposed as an important means to improve the utilization efficiency of water environmental resources, to realize the mutual promotion of high-quality economic development and total water consumption control, industrial structure transformation and upgrading. The results show that the overall situation of water environment resource intelligent development is very good, with good satisfaction accounting for 84% of the overall, and the highest system evaluation of 4.93 points, which proves the effectiveness of this paper's water environment resource intelligent management system.

KEYWORDS

Big economic background; intelligent management; system architecture; cloud computing; cluster distribution

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1. INTRODUCTION

Intelligent management of water environment resources is an important content to promote the modernization of water environment governance system and governance capacity, and a major change to promote the construction of ecological civilization, modernization of governance system and modernization of governance capacity [1-2]. With the rapid development of social and economic development and industrialization, people are increasingly aware of the importance of promoting green development, strengthening the construction of water environment infrastructure and improving the quality of water environment [3]. And it is of great significance to design intelligent management methods for water environmental resources to reasonably determine the scale of the project, improve regional water resources planning and rational allocation, establish a strict water resources management system, and improve the efficiency of water resources utilization [4-5]. At present, the research on water environment management mainly focuses on the research and development of water environment management related technologies, while the research on water environment resource management ideas and their applications based on intelligent management is less [6]. Therefore, it is necessary to comprehensively sort out the engineering construction of water environment resource management, search for the optimal management path, provide conditions for comprehensively and efficiently implementing the intelligent management of water environment resources, and design the intelligent management system of water environment resources in the context of the large economy in order to effectively achieve the management objectives [7].

Influenced by climate change, human activities and socio-economic development, water resources management in river basins is facing more and more uncertainty and complexity. On this basis, Wang, Y et al. proposed a GIS-based water resources visualization knowledge map to visualize and quantify the knowledge base, domains and structures of water resources management by applying bibliometrics and knowledge mapping to safeguard the health and integrity of the ecosystems from the perspectives of sustainable and adaptive development, and by applying bibliometrics and knowledge mapping methods. The results of the study show that the research on water resources management in watersheds is on the rise [8]. With the acceleration of economic and industrialization processes, more and more chemical substances are emitted into the environment, and these chemical pollutants are potentially harmful to human health, especially prolonged exposure to the atmosphere can cause lipid metabolism disorders. Therefore, Zheng, S et al. found a positive correlation between NAFLD and long-term exposure to pollutants by analyzing the results of population and toxicological studies, and the study will help to better understand the mechanism of liver damage caused by pollutants in the water environment [9]. Acciarri, M. F et al. proposed a set of integrated solutions of water resources management and renewable energy development for ecologically fragile areas based on the summary of the existing research results. Renewable energy development in ecologically fragile areas. Firstly, the main research content of the project is presented, then the main research content of the project is introduced and the feasibility study of the project is conducted. Finally, in each alternative, water homogenization cost and water

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homogenization emission were calculated separately [10]. Soil moisture information is an important basis for understanding global climate change, and the validity of soil moisture information is very limited by the limitation of field observation means, especially in the mountains. Osenga, E et al. took the Southern Rocky Mountains of Colorado, USA as the research object, and by constructing a set of new set of interactive roaring bifurcation observation network based on multi-disciplines, such as climate, soil, and ecology, etc., the preliminary study was carried out. Through the implementation of the project, it can provide new ideas for mountain ecological meteorological research, and it can provide a reference for long-term monitoring work [11]. Literature [12] adopts a scientific and efficient way to enable everyone and anyone in the organization to participate in personnel management. Big data analytics and information technology (IT) are used to explore how IT can be utilized to solve the current problems faced by companies. Through the application of data mining theory, human resource management theory, the process of data mining and analysis methods, and its intrinsic connection is deeply analyzed, and the problems are discussed in depth, so as to provide a reference for improving the management level of human resource managers. With the management of water resources and environment, the reliability of medium- and long-term hydrological prediction has been put forward higher requirements. Bogner, K et al. Based on the previous work, they carry out the research on hydrological prediction method of watersheds based on numerical simulation and apply it to the monthly meteorological observation data to analyze the value of its application in hydrological prediction. Taking four catchments with real measurement data as an example, post-processing techniques were used to eliminate bias and diffuse errors, and they were validated and evaluated [13]. The problem of water scarcity has become a prominent issue in economic and social development, in order to ensure the supply of water resources, on the basis of the survey results, LI, W et al. planned six emergency water sources, and discussed the amount of water withdrawn from each source and the corresponding management countermeasures. In the long term, the utilization of aquifers as reservoirs and the joint utilization of surface water and groundwater are of great significance in ensuring water security and sustainable management of water resources [14].

In the context of large economy, intelligent management of water environment resources is particularly important. In order to improve the utilization efficiency of water environmental resources, the key elements such as the overall governance framework, the intelligent service application system, the value of cloud computing service attributes and the utilization efficiency of water environmental resources are fully considered. A framework that organically integrates the resources and strengths of all parties is established to ensure the full implementation of the intelligent management system. This includes the participation of the government, enterprises, research institutions and other parties to form a cooperative and win-win governance model. Second, the design of the intelligent service application system is the core of improving management effectiveness. Combining advanced technologies such as the Internet of Things and big data, a real-time monitoring, prediction and scheduling system for water environment resources is established to realize data sharing and

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intelligent processing of information, and to enhance the scientific and precise nature of decision-making. The intrinsic relationship between data is deeply excavated, and the utilization efficiency assessment model of water environment resources is established to realize the scientific, efficient and sustainable development of intelligent management of water environment resources in the context of big economy.

2. INTELLIGENT MANAGEMENT SYSTEM DESIGN FOR WATER ENVIRONMENT RESOURCES

2.1. OVERALL GOVERNANCE FRAMEWORK

Follow the governance policy of prioritizing protection, integrating water and land, adapting to local conditions, focusing on practicality, overall planning, step-by-step implementation, rational design, organic integration, clear responsibility, division of labor, broadening channels, and multiple inputs, and integrating the intelligent management of the community of life of mountains, water, forests, fields, lakes, and grasses [15]. Through the construction of sewage treatment and supporting pipeline network, rainwater and sewage diversion renovation, urban point and surface source pollution management, comprehensive improvement of rivers and building water ecosystems and other measures, to effectively cut down the river pollution in the watershed. To build a smart watershed, comprehensively improve the water environment monitoring and early warning and risk prevention capabilities, and provide scientific auxiliary decision-making for scientific water transfer, response to environmental emergencies and comprehensive environmental remediation in the watershed [16-17]. The overall governance framework is shown in Figure 1, and the overall governance of intelligent management of water environment resources mainly contains interception and pollution control project, landscape enhancement project, water ecology project and intelligent watershed management system.

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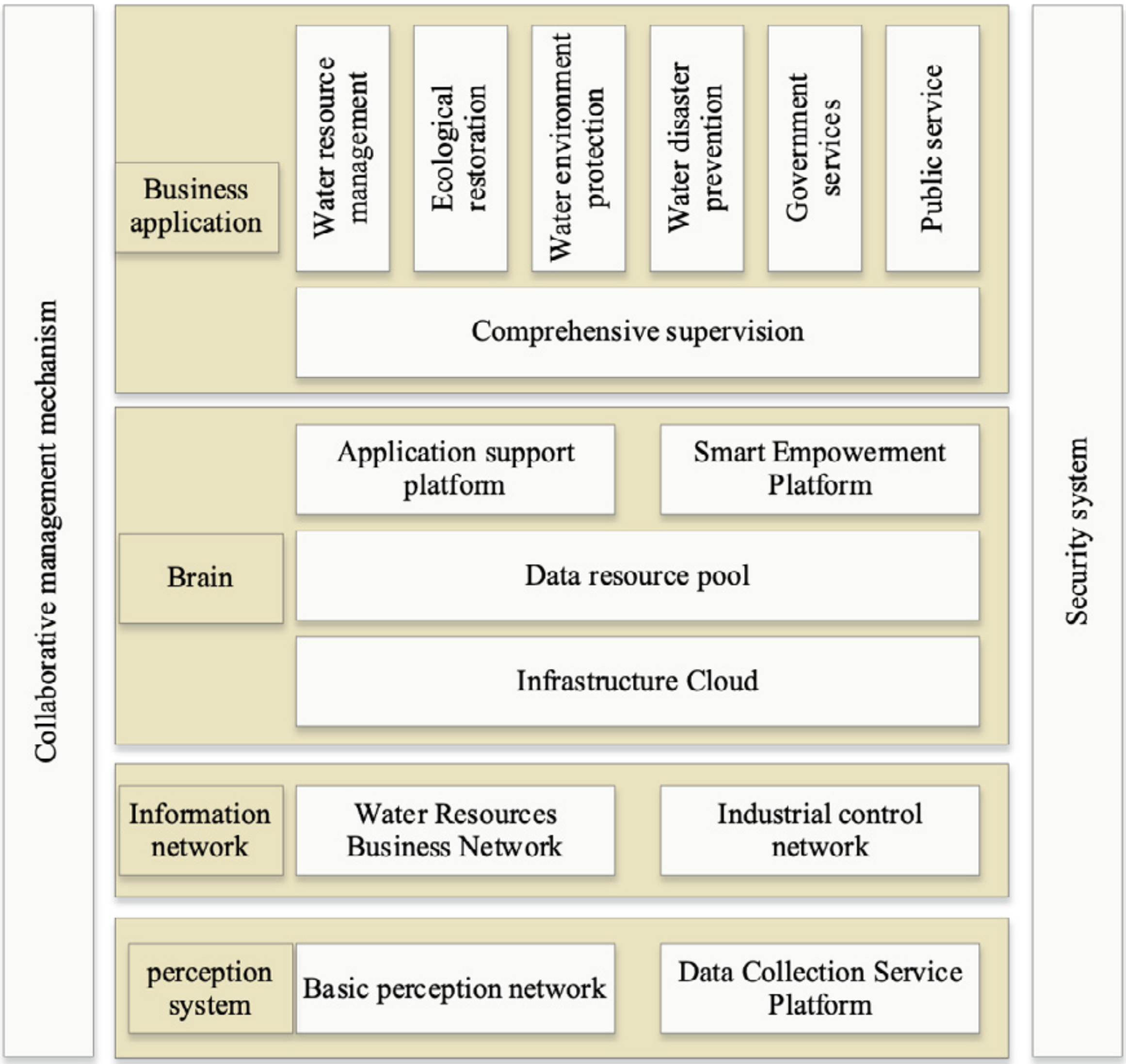

Figure 1. Overall governance framework for smart management

It makes full use of existing intelligent technologies such as Internet of Things, big data, cloud computing, artificial intelligence, etc., and combines basic information resources and scientific and technological means to realize visual management, simulation, prediction and analysis of daily water environment resource management work in the watershed. Based on B/S+MI/S architecture and integrated GIS development technology, it realizes the interconnection of mobile terminal and web terminal, and consists of four horizontal and two vertical structural layouts of business application, basin brain, information network, perception system, security system and cooperative management mechanism. Among them, the main function of the business application is to realize the basin water resources management, water ecological restoration, water environmental protection, water disaster prevention and control, government services and public services in the river basin brain to provide strong data support and computing power, the above business information and data to carry out comprehensive supervision, forming the water environment resources intelligent service application system.

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Intelligent water treatment is an important part of the construction of intelligent management of water environment resources. Compared with the traditional water treatment method relying on chemicals and physical filtration, which has high cost and the effect is difficult to guarantee, the adoption of information technology and intelligent equipments can realize automatic monitoring and automatic regulation of water quality, so as to accurately control the effect of water quality treatment, avoid the over-standard of water quality and the wastage of resources as well as to reduce the treatment cost. Intelligent equipment can automatically record water quality data and upload it to the cloud to realize the sharing and interaction of water quality data. Through the analysis of water quality data, we can understand the trend and law of water quality changes, optimize the water treatment process, and improve the effectiveness and stability of water quality treatment. Intelligent water treatment has four obvious features: intelligent management, cost saving, high-efficiency water treatment and data analysis.

2.2. INTELLECTUALIZED SERVICE APPLICATION SYSTEM

The intelligent service application system is based on information resources and infrastructure, and according to the business requirements of water conservancy functional departments, the application functions and application system architecture of intelligent management are designed to realize intelligent perception, intelligent simulation, intelligent diagnosis, intelligent early warning, intelligent scheduling, intelligent disposal, intelligent control and intelligent service of intelligent management of water environment resources, so as to serve the water-related businesses such as flood control, drought mitigation and water resources management, water ecology management, and water environment management. Management of water environment management and other water-related businesses.

The functional architecture of the intelligent service application system for water and environmental resources is shown in Figure 2. Through the construction of the intelligent service application system, it realizes the integrated management of intelligent perception intelligent simulation, intelligent diagnosis, intelligent early warning, intelligent scheduling intelligent disposal intelligent control and intelligent service for the whole life cycle of water services. It provides technical support for the protection of water resources security, water environment security, water ecological security and engineering security, serves the four major business areas of flood control management, water resources management, water environment management and water ecological management, provides different feedbacks for the situation of daily status and emergency status, and comprehensively supports the management business.

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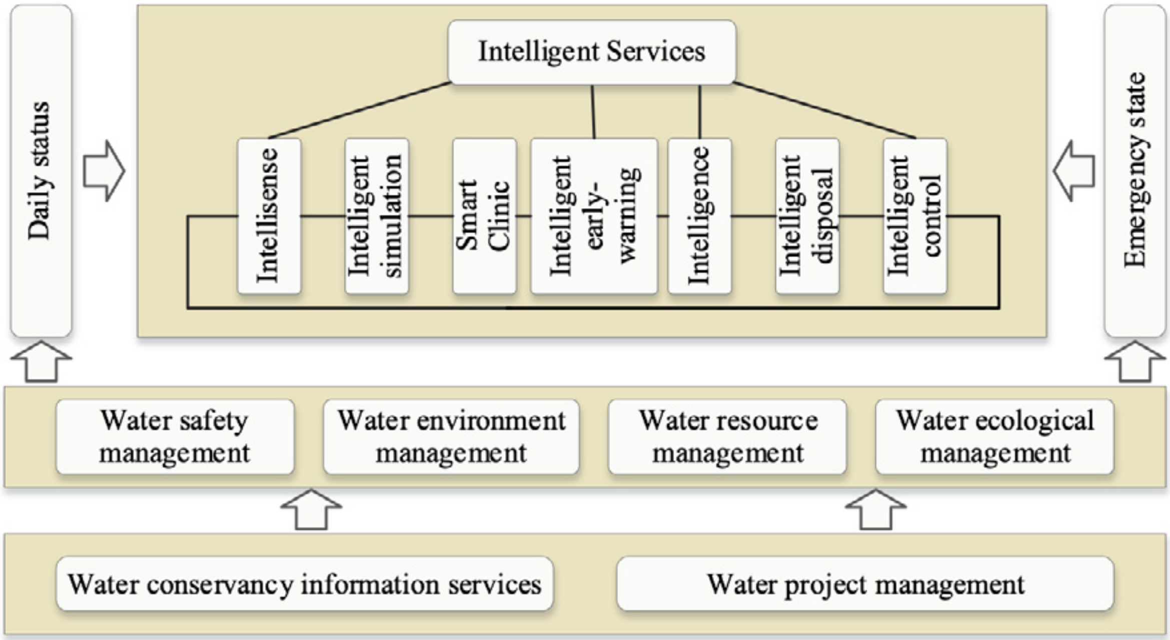

Figure 2. Functional architecture of intelligent service application system

The intelligent service application system is designed based on the software-as-a-service of cloud computing, and the intelligent management business of water environmental resources is constructed through each different service module, and each module builds a business application that meets its own needs according to the characteristics of the business requirements, and the design of the application module is shown in Figure 3. The construction mode can effectively avoid repetitive construction of the system, easy system upgrade and transformation, and realize the openness and dynamic sustainable development of the system. In the process of system upgrade and transformation, only the functional modules need to be upgraded, and a unified upgrade can be carried out for the common modules. Software as a service can easily access a variety of application components, and ultimately exposed to the user in the form of interfaces to call, and at the same time, through a unified portal single sign-on, unified authentication and other technical means, to achieve a single portal, a variety of services, and future access to the system is also the same through the registration of the service to achieve, rapid deployment of applications. Application of cloud computing to take a modular construction model that is the water information service module, water business management function module, water decision support function module and water emergency management function module.

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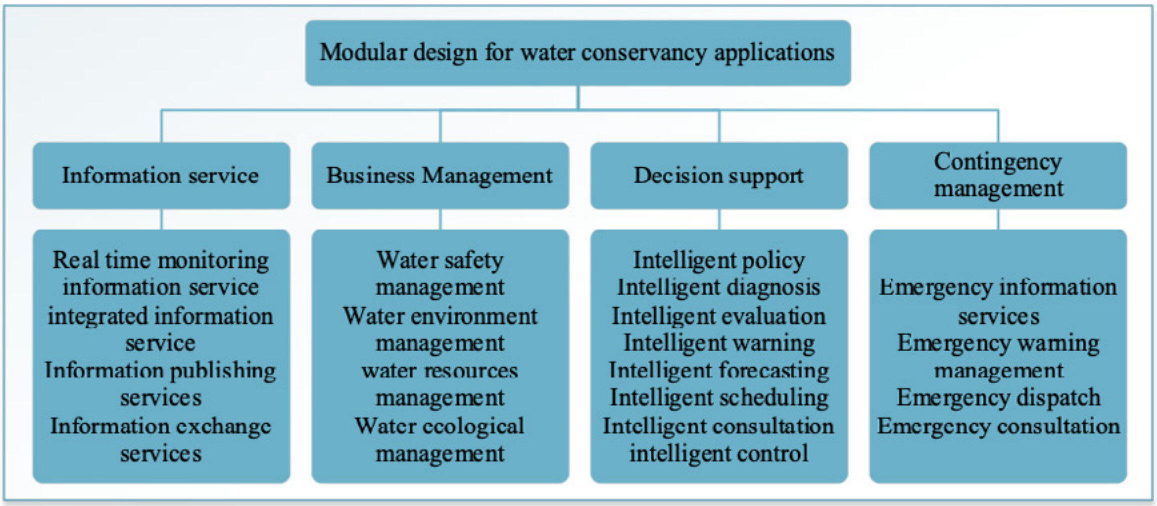

Figure 3. Application module design of intelligent service application system

2.3. CLOUD COMPUTING SERVICE ATTRIBUTE VALUES

Cloud service S in the cloud computing operating model is denoted as:

$$S = \{S_1, S_2, \cdots, S_i, \cdots, S_n\} \tag{1}$$

where n is the number of sensing services on the cloud platform and S_i is the ird cloud service. Attribute S which reflects the service level and processing capability in the cloud service is denoted as:

$$S = \{S_F, S_N\} = \{S_1, S_2, \cdots, S_k, \cdots, S_m\}, k \in [1, m] \tag{2}$$

where m is the attribute dimension of the cloud service,S_F is the functional attribute that reflects the sensing level of the service, S_N is the non-functional attribute of the cloud service, and S_k is the kth dimensional attribute of the sensing cloud service. As a result, the ith sensing cloud service S_i can be expressed as:

$$S_i = \{x_i^F, x_i^N\} = \{x_{i,1}, x_{i,2}, \cdots, x_{i,k}, \cdots, x_{i,m}\}, k \in [1, m] \tag{3}$$

Where x_i^F is the value of the functional attribute of the ind cloud service S_i, x_i^N is the value of the non-functional attribute, and $x_{i,k}$ is the value of the attribute of the ith sensing cloud service S_i on the kth dimensional attribute S_k.

For non-functional attributes such as sensing time and sensing speed, the sensing services on the cloud platform need to be divided into batch number ranges in advance when clustering, and set up different grades, and the service provider needs to give the sensing time and speed of the sensing services of this class for different batch grades [18-20]. The triangular fuzzy number is used for description, and its mathematical expression is:

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$$x_{i,k} = \left[x_{i,k}^{NL}, x_{i,k}^{NM}, x_{i,k}^{NU}\right], 0 < x_{i,k}^{NL} \leq x_{i,k}^{NM} \leq x_{i,k}^{NU} \quad (4)$$

Where $x_{i,k}^{NU}$ and $x_{i,k}^{NL}$ are the upper and lower bounds on the values of the non-functional attributes, i.e., the maximum and minimum values of sensing time, or the slowest and fastest values of service speed, required by the service provider to complete the service at the corresponding batch level. $x_{i,k}^{NM}$ is the most likely value of the non-functional attribute, i.e., the sensing time and the sensing speed that the service provider most often employs to provide this type of service at the corresponding batch level. By describing the values of the cloud computing service processing capability attributes and setting the labels of the feature items between sensing, a foundation can be laid for managing the clustering distribution of the functional modules.

2.4. WATER ENVIRONMENT RESOURCE UTILIZATION EFFICIENCY

As an important means to improve the utilization efficiency of water environment resources, the mechanism of science and technology innovation in the context of big economy can be expressed as the mechanism of influence on the utilization efficiency of water environment resources, which can be expressed as the science and technology innovation in the context of big economy accelerates the promotion and application of water-saving technology, effectively controls the total amount of water consumption and reduces the total consumption of water environment resources. Science and technology innovation optimizes the water consumption structure by promoting the innovation of the development mode of traditional industries, accelerating the transformation of the production mode, and promoting the transformation and upgrading of the industrial structure. Science and technology innovation in the context of the big economy promotes the high-quality development of the economy, realizes the mutual promotion of high-quality development of the economy and the control of the total amount of water consumption, the transformation and upgrading of the industrial structure, and ultimately improves the efficiency of the utilization of water environment resources, and the influence mechanism is shown in Figure 4. Due to the differences in the level of regional science and technology innovation, the application scope of water-saving technologies and key industries are different, and the degree of transformation and upgrading of industrial structure is different, so the effect of the level of innovation on the utilization efficiency of water environment resources in the context of the big economy is not the same. The level of science and technology innovation in the context of large economy significantly improves the utilization efficiency of water environment resources, and there are significant spatial differences in the effect of the level of innovation on the utilization efficiency of water environment resources in the context of large economy.

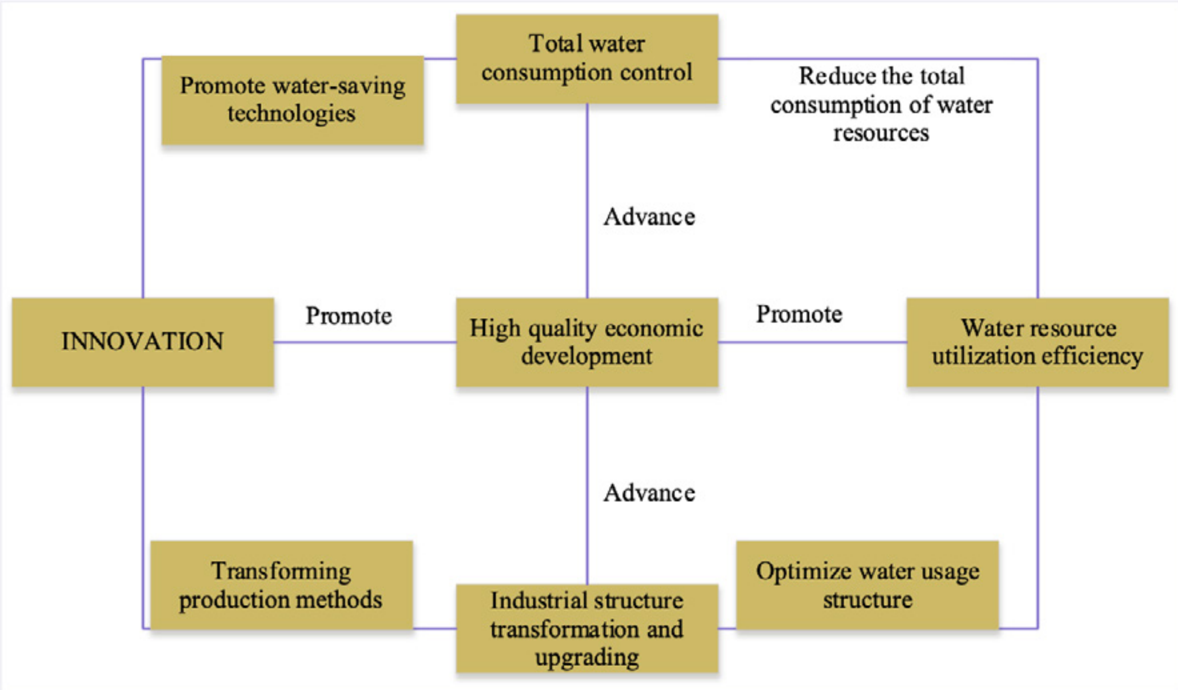

Figure 4. Mechanisms affecting resource utilization efficiency in the water environment

3. MODELING OF WATER ENVIRONMENT RESOURCE UTILIZATION EFFICIENCY

Spatial econometric modeling is used to construct a model of the effect of the level of innovation on the efficiency of water environment resource use in the context of the large economy [21-22]. The formula is expressed as:

$$W_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 U_{it} + \beta_3 R_{it} + \varepsilon_{it} \quad (5)$$

Where U_{it} denotes the degree of industrial upgrading in region i in year t, R_{it} denotes the intensity of water environment regulation in region i in year t, β_0 denotes the constant term, β_1、β_2、β_3 denotes the elasticity coefficient of I_{it}, U_{it}, R_{it} respectively, and ε is the random error term.

Construct the generalized production function model, which can be expressed as:

$$W_{it} = A I_{it}^{\beta_1} U_{it}^{\beta_2} R_{it}^{\beta_3} e^{u_{it}} \quad (6)$$

where A denotes the environmental constant and u_{it} denotes the random error term. Taking logarithms for both sides of Eq. (6) yields:

$$\ln W_{it} = \ln A + \beta_1 \ln I_{it} + \beta_2 \ln U_{it} + \beta_3 \ln R_{it} / R_{it} \quad (7)$$

According to Equation (7), the elasticity coefficients of the variables in the model are estimated using Equation (5) to find the difference, which can be presented in the form of growth rate of the function model:

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$$\Delta W_{it}/W_{it} = \beta_1 \Delta I_{it}/I_{it} + \beta_2 \Delta U_{it}/U_{it} + \beta_3 \Delta R_{it}/R_{it} \tag{8}$$

According to Equation (8), divide both sides by $\Delta W_{it}/W_{it}$ at the same time and multiply by 100% to get:

$$100\% = \beta_1 \frac{\Delta I_{it}/I_{it}}{\Delta W_{it}/W_{it}} \times 100\% + \beta_2 \frac{\Delta U_{it}/U_{it}}{\Delta W_{it}/W_{it}} \times 100\% + \beta_3 \frac{\Delta R_{it}/R_{it}}{\Delta W_{it}/W_{it}} \times 100\% \tag{9}$$

Then Equation (9) represents the contribution of the level of science and technology innovation, the degree of industrial upgrading, and the intensity of water environment regulation to the efficiency of water environment resource utilization in Region i in Year t in the context of large economy.

4. INTELLIGENT MANAGEMENT SYSTEM SIMULATION ANALYSIS

4.1. QUESTIONNAIRE DESIGN

This paper adopts a combination of questionnaire survey method and interview method to conduct an in-depth investigation and research on the development of intelligent management of water environment resources in the context of J Group's large economy. In order to ensure that the information obtained from the interview is more comprehensive and objective, the interview adopts in-depth interview, according to the outline of the interview content and the interviewee one by one, the outline of the interview content adopts open-ended questions in order to obtain more in-depth details of the problem. In the interview process, in order to seek the effectiveness of the results of the interview, and the interviewees to clarify the meaning of each question, and basically control the content of the interview and the guidance of the interview questions. The main content of the interview includes how to feel about the use of the intelligent management of water environment resources in the context of the use of the big economy, what are the satisfactory and unsatisfactory aspects of the Group's intelligent management of water environment resources, and what optimization suggestions are put forward in the light of their own use. In order to ensure the effectiveness of the interview results, the interview subjects were selected from employees and managers related to the intelligent management of the company's water environment resources, and relevant scholars who understand the operation of the intelligent management system, and sampling was carried out according to different classifications, and a total of 10 people were selected to conduct open-ended question interviews. After the interviews with the 10 selected subjects, the contents of the interviews were organized and summarized.

Details of the questionnaire survey design are shown in Table 1, and the questionnaire content contains two parts, a total of 29 questions. The first part is about the basic situation of employees and managers of J Group, with a total of 5 questions, and the second part is a survey on the development of intelligent management of the group's water and environmental resources, including the overall situation of the group's intelligent development of water and environmental resources, intelligent management, operation and maintenance, intelligent planning and management, intelligent talent system, intelligent protection, with a total of 24 questions. The survey questionnaire was issued in 1 month, during which 200 questionnaires were issued and 187 valid questionnaires were retrieved, with a recovery rate of 93.5%, the questionnaire validity is good, and the data is relatively perfect.

Table 1. Basic information about Group J's survey sample

Category	Characteristics	Frequency	Percentage
Age	20-30	31	16.6
	31-40	103	55.1
	41-50	30	16
	Above 50 (not including 50)	23	12.3
Academic qualifications	Below Bachelor's Degree	18	9.6
	Undergraduate	131	70.1
	Postgraduate (Masters)	26	13.9
	Graduate student (PhD)	12	6.4
Monthly income	Below 5000	89	47.6
	5000-7000	53	28.3
	7001-10000	34	18.2
	10000 above	11	5.9
Length of service	Less than 5 years	61	32.6
	5 to 10 years	63	33.7
	11-20 years	43	23
	More than 20 years (excluding 20)	20	10.7
Department	Group Headquarters	12	6.4
	Water Supply	31	16.6
	Drainage	51	27.3
	Engineering department	26	13.9
	Water sales department	14	7.5
	Dispatch Center	31	16.6
	Others	20	10.7

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From the samples of this questionnaire survey, most of them are in the age of 31-40 years old, with bachelor's degree and 5 to 10 years of working experience. This indicates that the main users of the intelligent management system of water environment resources are mainly technicians who have certain working experience as well as cultural level.

4.2. ANALYSIS OF INTERVIEW RESULTS

The result of the research is the internal opinion of Group J on the application of intelligent management system of water environment resources, which shows that there are three representative problems in the development process of intelligent management of water environment resources in Group J. One of them is that there is no unified intelligent water underlying architecture in terms of technology, so that the intelligent management of water environment resources within the group is restricted to deal with only their own water operation data, without interoperability between the management, which also leads to valuable data can not be efficiently transmitted, stored, converted into formats, and so on. Intelligent management at all levels can not be interoperable, but also led to the imperfect function of the pipe network geographic information system, there is no unified intelligent management, resulting in the level of safety and security of intelligent management at all levels is uneven. Therefore, using the intelligent management system of water environment resources in the context of the big economy designed in this paper, the use of feelings, satisfaction and optimization suggestions are summarized, and the effectiveness of the intelligent management system of water environment resources in this paper has been verified.

Table 2 for the intelligent management system adoption rate interviews, the industry scholars relatively high requirements for the Group's intelligent management system for water environmental resources of the basic functions of higher recognition, but some aspects of the existence of a greater space for development, and that its functionality is targeted, the system structure is relatively simple and stable. At the same time, they gave optimization suggestions, thinking that it is necessary to seek cooperation with a third party, increase the scale of management, and focus on improving the technical level of the staff, so as to guarantee the stable operation of the intelligent management system. From the comprehensive analysis of the internal and external parts of the interviews, the intelligent management system of water environmental resources in the context of the big economy designed in this paper has a complete system architecture, and the interoperability between the various system operations forms a stable data source. However, with the process of intelligent development in the context of a large economy, the traditional system of talent introduction and training can not meet the needs of intelligent development of water and environmental resources, resulting in the Group for the intelligent management system for the actual use of personnel did not reach the expected level, but also indirectly affects the level of technical support to continue to develop. The development of intelligent management system of water environment resources is mainly based on its own intelligent construction, adding a collaborative management

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mechanism to achieve win-win cooperation, but still need to cooperate with third parties to strengthen the intelligent management of water environment resources. Comprehensively, the intelligent management system of water environment resources in the context of the big economy designed in this paper is very effective in the overall intelligent management benefits, but it still needs to be combined with optimization suggestions for improvement, so as to accelerate the speed of intelligent development.

Table 2. Intelligent management system adoption rate

Interview Title	Managers	Technical staff	Water Industry Scholars
Feeling of use	Save time.	The interface is perfect and neat	Data storage time is shorter.
	Operation is more complicated.	System response is rapid.	Not much different from the industry's leading edge systems.
	Data interoperability, easy to share.	Flexible functions and strong calculation ability.	Small differences, easy to operate.
Satisfaction	Replace manual work.	Saving time.	The system structure is stable.
	Relatively stable, not easy to fail.	Simple process.	High simulation degree.
	Decision construction.	Huge memory, easy to operate	Low cost.
Dissatisfaction	Less update.	Transmit the same data over and over	Shortage of talents
	Single operator interface.		Limited funds.
Optimization Suggestions	Optimize the operation interface.	Optimize interface flow	Seek cooperation with the third party.
	Timely update	Increase memory	Improve personnel skills
	Strengthen hardware construction	Add storage	

4.3. ANALYSIS OF QUESTIONNAIRE RESULTS

According to the questionnaire results statistics to get the overall situation of the development of water environment resource intelligence, the statistical results are shown in Figure 5. Most of the investigators think that the overall situation of the development of water environment resource intelligence in the context of the big economy is very good, accounting for 60%, 24% of those who think that the development is very good, 3% of those who think that the development is not good, 2% of those who think that the development is very bad, and 84% of those who have a good degree of satisfaction in the whole, which proves the validity of this paper's design of the intelligent management method.

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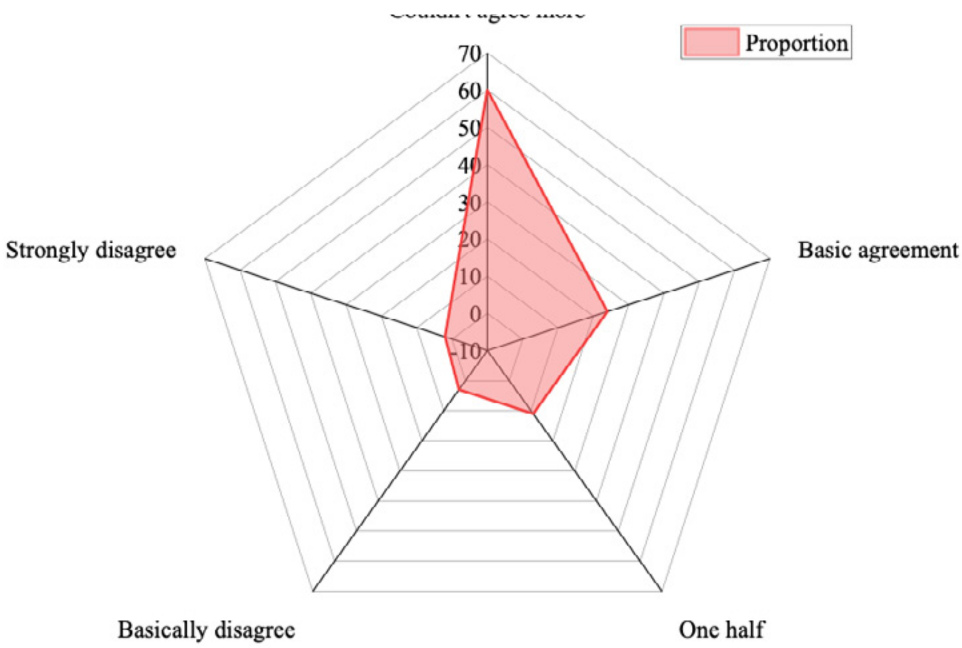

Figure 5. Satisfaction statistics of the development of water environment resource intelligence

Based on the questionnaire results, Figure 6 shows a comparison between the original data and the survey results on the intelligent development of water environmental resources. The samples agree on the effectiveness of implementing the intelligent management system for water environmental resources in the context of the big economy. The system comprehensively improves the efficiency of water environmental resource operations, reduces workload, aids in decision-making, and accelerates economic development. Based on the scores of very compliant, basically compliant, general, partially non-compliant, and very non-compliant (ranging from 5 to 1), it is evident that the original management method, with the aid of management decision-making, scored a minimum of 2.71 points. It accelerated economic development by 3.13 points, achieved a comprehensive score of 3.35 points, and scored the highest in improving operational efficiency with 3.82 points. This paper evaluates the implementation of an intelligent management system for water and environmental resources in the context of a large economy. The system's intelligent development scored 4.76 points, while its impact on operational efficiency and workload reduction scored 4.89 and 4 points, respectively. The intelligent development of water and environmental resources contributed 4.62 points to decision-making management, and 4.93 points to economic development. The economic development score was 4.93. Thus, this paper demonstrates that the intelligent management system for water and environmental resources in the context of a large economy has improved overall development, operational efficiency, and management decision-making while reducing the workload of management, ultimately contributing to economic development.

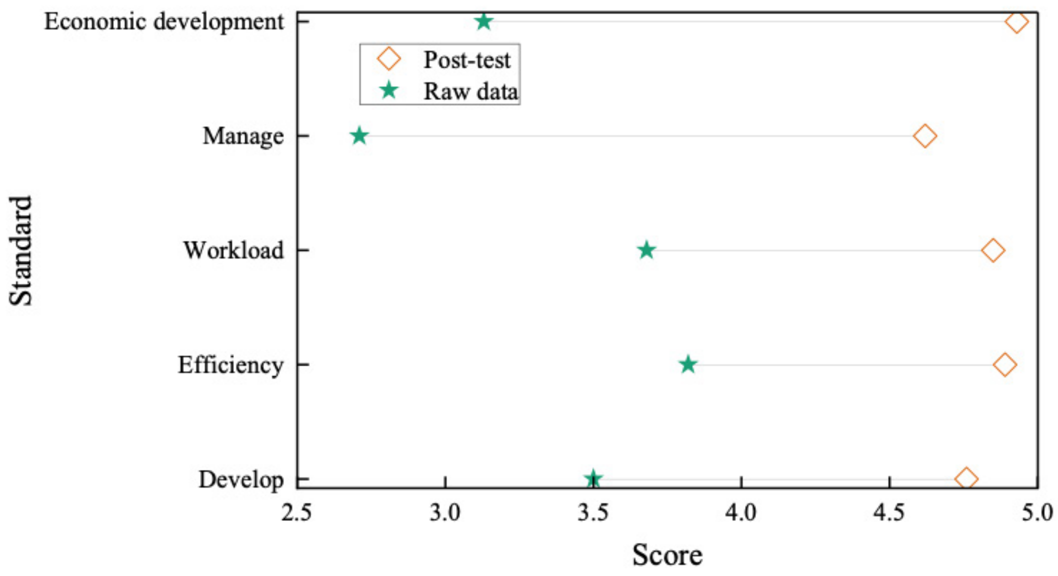

Figure 6. Comparison of the development of water environment resource intelligence

5. CONCLUSION

This paper presents the governance framework for the intelligent management system of water environmental resources. The framework is structured around information resources and infrastructure, and utilizes existing intelligent technologies such as the Internet of Things, big data, cloud computing, and artificial intelligence. By combining basic information resources and scientific and technological means, the framework enables visualization management, simulation, prediction, and analysis of water environmental resources management work. The application system for intelligent management of water environment resources is designed to lay the foundation for clustering distribution of management function modules. Finally, the questionnaire and interview methods were combined with research to simulate experimental verification. The results showed that the implementation of the system described in this paper comprehensively improved the intelligent development of water environmental resources, operational efficiency, and reduced workload. It also aided in management decision-making and accelerated economic development. The scores were 4.76, 4.89, 4.85, 4.62, and 4.93, respectively. It is evident that the original management methods scored the lowest at 2.71 points under the management decision-making score. However, there was an improvement of 1.91 points in the management system's effectiveness after the application. This proves the effectiveness of the intelligent management system for water environment resources in the context of the big economy.

ABOUT THE AUTHORS

Xiaoyun Ma was born in Shanxi, China, in 1983. From 2001 to 2008, she studied in Zhejiang University of Technology and received her bachelor's degree in 2005 and Master's degree in 2008. Currently, she works in Zhejiang A&F University. She has

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published a total of nine papers. Her research interests are included Resource and Environment Management.

Yan Zhu was born in Hangzhou, China, in 1983. From 2002 to 2009, he studied in Zhejiang University of Technology and received his bachelor's degree in 2006 and Master's degree in 2009. Currently, he works in Ecology and Environmental Science Research & Design Institute of Zhejiang Province. His research interests are included Environmental Policies and Standards.

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