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Research Article

Collaborative Innovation Mechanism of Water Pollution Control Industry Chain Based on Complex Scientific Management

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In the process of collaborative innovation of water pollution control industry chain, there are some problems, such as chain break and lack of chain, which lead to poor effect of water pollution collaborative governance and low economic benefits. Therefore, this paper proposes a research method of collaborative innovation mechanism of water pollution treatment industry chain based on complex scientific management. In view of the problems existing in the current industrial chain of water pollution control, the collaborative economic model and matter-element extension model of the industrial chain of water pollution treatment are constructed to improve the synergy effect of each link in the industrial chain and solve the contradictions of each link in the coordination process, so as to provide guarantee for the collaborative innovation of the industrial chain of water pollution control. The experimental results show that the proposed method can bring high economic benefits in the stage of source emission reduction, process interruption, and end treatment, and the water pollution treatment effect is good, which fully verifies the practical application effect of the method. After using the design method to purify, the maximum purification rate reaches more than 80%, and the purification effect reaches class *v*. The effect is remarkable, which has practical application value.

1. Introduction

At present, the development of water pollution control industry chain is not stable, problems such as chain break and lack of chain, make the development of water pollution treatment industry unbalanced. When the relevant enterprises in the upstream of the industrial chain lack investment in technology research and development, it directly leads to the problems of low added value of relevant equipment, backward governance technology, and low governance efficiency. In addition, the infrastructure of water pollution treatment enterprises needs to be improved, the service level of franchised enterprises is low, and a perfect and standardized public service platform for water pollution treatment industry has not been built, resulting in the relatively backward development of service industry, and the whole industrial chain shows a weak pattern at both ends and strong in the middle [1, 2]. In addition, based on the analysis of the overall industrial chain structure, the water pollution control industry chain is seriously broken and the chain becomes short. At present, there is still a lack of fixed source, mobile source treatment, pollutant detection technology research, and development and related equipment manufacturing enterprises, which make the whole industry chain broken [3, 4].

At present, a large number of scholars have studied the industrial chain of water environment treatment. The organization for economic cooperation and development (OECD) defines the industrial chain of water pollution as "terminal control and end treatment," which refers to the industry that provides services, information technology, and high-tech equipment for environmental protection such as environmental treatment, water pollution control, energy conservation and emission reduction, and wastewater treatment. The industrial structure of water pollution control had been specifically analyzed, including: water pollution environmental protection treatment equipment production industry (such as water environmental protection pharmaceutical manufacturing industry, water environmental pollution treatment equipment and environmental monitoring, and analysis instrument industry), water environmental protection service-oriented industry (such as water pollution engineering design and construction unit, water pollution consulting service industry, and water pollution treatment facilities operation service industry), and waste water pollution control equipment production industry water comprehensive utilization industry. When defining the concept of water pollution control industry chain, one must clearly understand the characteristics of industrial chain [5, 6]. Relevant domestic scholars have not formed a unified understanding of the definition of the industrial chain. There is a broad intermediate zone between hierarchical enterprise organizations and perfectly competitive market organizations, and economic organizations in this zone are called intermediate organizations. Different periods and different scholars gave different definitions of the industrial chain from different perspectives, which fully reflected people's awareness of the industrial chain at that time, and also truly reflected the level of industrial chain theoretical research [7–10]. The emergy analysis method of ecological economics is introduced into the quantitative study of water pollution ecological compensation standard, which overcomes the shortcomings of traditional methods, and the ecological economic value of pollutant dilution water is determined as the ecological compensation standard of water pollution. In this process, the key pollutants in the river are determined through water quality evaluation, and then the water dilution model is established according to the purification of key pollutants. To determine the diluted water volume when the pollutant concentration reaches the water quality section standard [11, 12], this paper aims to overcome the defects of the traditional seabed optical sensor network water pollution monitoring method. Based on secondary clustering, a new monitoring method is proposed. Firstly, based on the relative entropy, the dimension of network data is obtained, and the time window entropy corresponding to the dimension of network data source IP address is given. Then, the hierarchical structure of network data is obtained, and the data is clustered using effective index criteria. The fuzzy membership degree is used to determine the category of each sample, and the clustering center of each group of data is calculated to obtain the best threshold of fuzzy classification of the data set, so as to complete the monitoring [13, 14]. Although the above methods have high monitoring accuracy, it lays a foundation for improving the quality of environmental monitoring, but the above methods do not have high economic benefits in the stages of source emission reduction, process interruption, and end treatment, and the effect of water pollution control is poor.

Compared with the definition put forward by domestic scholars, this paper defines the scientific definition of industrial chain as: enterprises in the same or different industries take products as the object, input generation as the link, value-added as the orientation, aiming to meet the needs of users, and form a dynamic chain industrial organization according to the specific spatial and temporal layout and logical relationship. Complex scientific management is based on the assumption that an organization is a brain that can think systematically. That is to say, the organization has an intelligent structure, which includes three levels: knowledge structure—the organization has basic knowledge; ability structure—the organization can apply knowledge to solve problems; intelligent structure—organizations can apply systematic thinking mode to integrate internal and external functions of the organization to solve problems. It has both theoretical and practical significance to apply complex scientific management ideas and methods to the research of collaborative innovation of water pollution control industry chain. The effective integration of complex scientific management theory and water pollution control industry chain is an important breakthrough. It is not only the expansion of CSM theory itself, but also provides new ideas and methods for the innovation research of water pollution control industry chain, which has theoretical and practical significance.

2. Problems Existing in the Industrial Chain of Water Pollution Control

2.1. Slow Development of Upstream Industry Chain Enterprises. The upstream of water pollution control industry chain is the continuous extension of supplier enterprises according to the development of water pollution treatment industry. The production technology of the water pollution treatment industry is obtained by the suppliers, but they do not have the R&D ability, lack of scientific and innovative technology, and it is difficult to jointly research and develop with the water pollution treatment industry [15–17]. In order to ensure the sustainable development of its own interests, the water pollution treatment industry usually suppresses the suppliers, which leads to the suppliers having to reduce the price and profits, thus unable to guarantee the R&D funds.

2.2. The Production Enterprises in the Middle Reaches of the Industrial Chain Are Lack of Core Technology. At present, there are some problems in the water pollution treatment industry, such as weak support capacity and low technical level. Although the water pollution control technology has been improved, it is still in a passive development situation, which only meets the local or national emission control requirements, but it is difficult to effectively support the future higher water environment indicators, and the technical strength is insufficient. Due to the lack of relevant technology and talents in the water pollution treatment industry chain, and the narrow scope of information exchange and cooperation, the development of related industries is slow, and the operation efficiency of water pollution treatment industry is low due to various factors.

2.3. The Internationalization Characteristics of Industrial Chain Construction Are Not Clear. At present, with the rapid development of world economy, especially in India, the rapid development of water pollution treatment technology and equipment also presents diversified development needs. Water pollution treatment enterprises must seize the opportunity to further expand their own business and market. However, the current technological development of water pollution treatment industry can only passively meet local emission requirements, but cannot face the water environmental protection requirements of the international market, especially the strict emission standards, and cannot support environmental protection goals, and the technical strength is relatively weak [18, 19].

3. Collaborative Innovation Mechanism of Water Pollution Control Industry Chain Based on Complex Scientific Management

According to the existing problems in the current water pollution control industry chain, it is necessary to use scientific means to improve it. Therefore, a complex scientific management innovation theory is proposed. Based on the innovation theory of complex scientific management (CSM) and the logic of organizational evolution, a collaborative economic model of water pollution control industrial chain is constructed. Based on the market-oriented vertical cooperation behavior of water pollution control industry chain, an extension model of matter-element is established.

3.1. Complex Scientific Management (CSM) Innovation Theory. The theoretical basis of complex scientific management (CSM) innovation mainly includes four aspects: CSM theory, strategic management theory, system science theory, and industrial economics theory [20, 21]. CSM theory is the most important pillar theory in this paper, which provides a unique research perspective, a complete theoretical system, and a series of practical theoretical tools for this study [22, 23].

Integrity is an important concept in complex scientific management. Integrity is one of the essential attributes of the system. In the research of system science, it has become the most important part of system science. Holistic thinking is the core content of systematic thinking, which determines the contents and principles of systematic thinking.It is impossible to reveal the true nature of things without grasping the development laws of things from a holistic perspective. The holistic view of CSM is the basic perspective of the CSM research system. The holistic view first considers the most important and core features of the system as a whole when guiding and thinking about problems. Applying this theory to the collaborative innovation of the water pollution treatment industry chain, the water pollution treatment industry chain can be identified as the coordination between enterprises, markets, and intermediate organizations. Among them, the enterprise is equivalent to the water environment management enterprise, the market is equivalent to the wastewater recycling link, and intermediate organizations are equivalent to industries that provide services for water pollution and environmental protection [12, 23]. It is generally believed that the social economy has two basic economic organizations: enterprise and market. In fact, many researchers in the theoretical and business circles believe that there is an intermediate organization between the enterprise and the market, such as multinational companies, virtual organizations, and network organizations. The evolution logic of the three kinds of organizations in the water pollution control industry chain is: after the market organization is produced, the intermediate organization is produced, and then the enterprise organization is produced, or the opposite evolution logic. However, in the evolutionary history of organizations, intermediate organizations are the last to emerge. Therefore, this intermediate organization should be the third type of organization. Network organization is not an intermediate organization but a third type of organization [24–27]. The growth of corporate network organizations is an important growth method for companies in the complex global business environment. The network organization absorbs the advantages of the market and the enterprise, and is an organization that sublates the two. The resulting logic is shown in Figure 1.

3.2. Establishment of a Collaborative Economic Model for the Water Pollution Control Industry Chain. Based on the complex scientific management (CSM) innovation theory and organizational evolution logic, the collaborative economic model of water pollution treatment industry chain is constructed. The basic premise of establishing the collaborative economic model of water pollution treatment industry chain is to determine the environmental quality change of water pollution treatment industry [28, 29]. Based on the utility equation of water pollution treatment enterprises, the following formulas are constructed:

$$
\begin{aligned}
A_i(t) &= \frac{P_i(t) - Q_i(t)}{M_i(t)},\\
D_j(t) &= \frac{\left|I_j(t) - \Delta H_j(t)\right|}{N_j(t)},\\
F_{i,j}(t) &= \exp\left[l\left[A_i(t) - D_j(t)\right]^2\right],
\end{aligned}
\tag{1}
$$

where $A_i(t)$ is the utility function of the water pollution treatment enterprise, i represents the commodity vector set consumed by the water pollution treatment enterprise in the treatment process, t represents the water pollution degree; $D_j(t)$ is determined by the quality of pollutants discharged when the water pollution treatment industry produces goods, $D_j(t) > 0$; I represents the industrial production function of the water pollution control industry; H represents the input of production factors of the water pollution control enterprise, that is, labor input and capital input; F represents the degree of environmental pollution caused by the production of water pollution control enterprises; l represents the amount of environmental pollutants discharged when the water pollution control industry produces

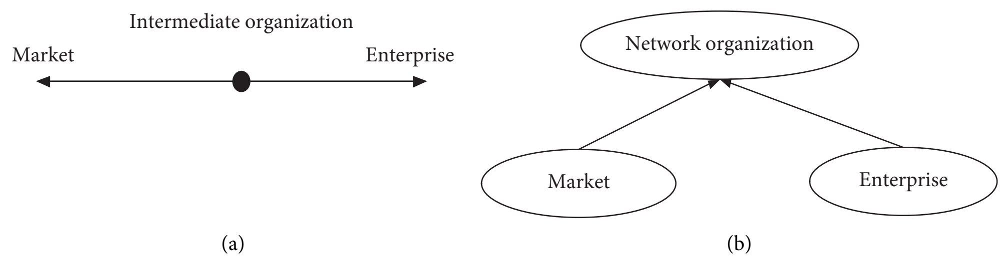

Figure 1: Three types of organizational evolution. (a) Linear evolution of three kinds of organizations. (b) Nonlinear evolution of three kinds of organizations.

goods; and M represents the pollution damage function of the water pollution treatment industry. The direct function of this parameter is to transform the environmental pollution problem that the water pollution treatment company cannot control into the environmental damage problem in real life, so as to facilitate data collection and analysis.

It can be seen from equations that when the degree of water pollution changes, the profit of the water pollution control company is directly affected. In this case, it is obvious that the cost the water pollution treatment enterprises are willing to pay in order to improve the water environment quality is equal to the compensation cost when other factors damage the water environment quality of the mining area. For consumers of water pollution control, the situation is slightly complicated. If consumers of water pollution control commodities have to pay for water pollution environmental quality control fees, the cost of related commodities consumed by the water environment treatment industry will be reduced [30, 31]. Suppose V_1 and V_2 represent the degree of water pollution before and after water pollution treatment, respectively; u represents the overall cost; and Z represents the product price consumed by the water pollution treatment industry in the water pollution treatment process. If consumers of products related to the water environment treatment industry are willing to pay compensation fees for water pollution treatment, c_1 is used to represent the effectiveness of higher water pollution treatment quality. On the contrary, if consumers of products related to the water environment treatment industry are unwilling to pay compensation fees for water pollution treatment, c_2 is used to represent the effectiveness of lower water pollution control quality, so we can get

$$W_1 = F_{i,j}(t)\left[u\left(P, Z\left(V_1\right), c_1\right) - u\left(P, Z\left(V_2\right), c_1\right)\right], \tag{2}$$

$$W_2 = F_{i,j}(t)\left[u\left(P, Z\left(V_1\right), c_2\right) - u\left(P, Z\left(V_2\right), c_2\right)\right], \tag{3}$$

where W_1 represents the cost of related products consumed by the water environment treatment industry; W_2 represents the water pollution environment quality treatment cost indirectly paid by consumers of water pollution treatment products.

Under normal circumstances, in the above consumption process, the value of W_1 is greater than the value of W_2. It can also be seen from the above equations (2) and (3) that not all the environmental pollution control benefits of the water pollution control industry are determined. Since the relationship between W_1 and W_2 is uncertain in real life, the function W_1 has two possible values, which are represented by W_i and W_j, respectively; E represents the income level of water pollution control companies; and R represents the water pollution control companies. The other expected utility of the available values of W_i and W_j are

$$\begin{aligned} W_i &= E\left(W_1 - W_2\right) + R\left(W_1 + W_2\right), \\ W_j &= \frac{E\left(W_1 - W_2\right)}{R\left(W_1 + W_2\right)}. \end{aligned} \tag{4}$$

Reorganizing the above formula shows that when there are small changes in W_1 and W_2, the water pollution control income W_i of the water pollution control industry (that is, the ratio of the utility difference between the two states and the expected marginal utility of water pollution control in the water pollution control industry) will have corresponding changes [32]. The amount of environmental quality change in the water pollution treatment industry is determined, and a pollution treatment economic model for the water pollution treatment industry is established. The specific calculation formula is as follows:

$$G = \frac{\left[u\left(E, W_1\right) - u\left(E, W_2\right)\right]}{R\left(W_i - W_j\right)} \times A_i(t). \tag{5}$$

The above model only shows the decision-making behavior of water pollution control companies from the theoretical model, but in reality, the decision-making behavior of water pollution control companies is subject to more constraints. Consumers who participate in the governance behavior of water pollution control companies respond quickly to the market and can respond more efficiently. Therefore, it is necessary to analyze the vertical cooperation behavior of the water pollution control industry chain based on market orientation.

3.3. Vertical Cooperation Behavior Based on Market-Oriented Water Pollution Control Industry Chain. From the perspective of transaction cost economics, there are also a large number of transaction costs in the main transaction process of each link in the water pollution control industry chain. Therefore, the transaction cost issue is also seen as affecting the choice of vertical cooperation mode in the water pollution control industry chain. In the selection process of the specific vertical cooperation mode, the transaction characteristics, market environment, water pollution control product characteristics, and business operation characteristics faced by both parties to the transaction are different, leading to multiple forms of cooperation modes. Also, among the above factors, transaction characteristics are considered to be the most important factors [14]. Under normal circumstances, transaction characteristics include bounded rationality, opportunism, asset specificity, uncertainty, and transaction frequency. Among them, asset specificity, transaction uncertainty, and transaction frequency are considered to a greater extent in the analysis process. Under different asset specificity, transaction uncertainty, and transaction frequency, the vertical organization mode of the agricultural industry chain is also different. From the perspective of transaction costs, the vertical cooperation mode of the water pollution control industry chain is shown in Figure 2.

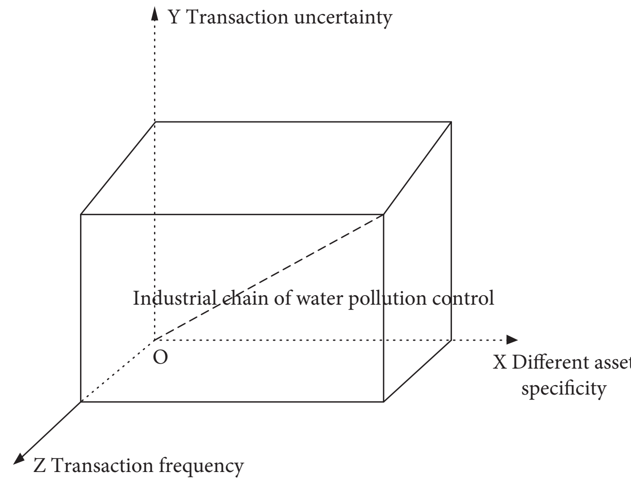

Figure 2: The vertical cooperation model of the water pollution control industry chain from the perspective of transaction costs.

3.4. Constructing an Extension Model of Matter Element. From the perspective of transaction cost, the vertical cooperation mode of water pollution treatment industry chain shows that all links of water pollution treatment industry chain are interrelated. Therefore, in the process of water pollution control industry chain coordination, some contradictions will inevitably occur between each link, which will affect the effect of water pollution treatment. In order to solve this problem, the matter-element extension model is constructed. the matter-element extension model is constructed based on the comparison and optimization of a variety of known general decision-making. According to the needs of incompatible contradictory problems generated at various levels and stages, this model breaks through the conventional and expansionary way but adopt creative decision-making skills, grasp key strategies, maximize the main system, incompatible contradictions into compatible relations, so as to achieve the global optimal decision policy objectives [33].

The indicator layer in water pollution control is set as b, and the characteristic value is L. The two together constitute the evaluation matter-element T structure level [34], and the classic domain matrix of the classification standard is

$$O = \begin{bmatrix} N & b & L_1 & L_2 & L_3 & L_4 & L_5 \\ b_1 & (0-20) & (20-40) & (40-60) & (60-80) & (80-100) & \\ b_2 & (0-20) & (20-40) & (40-60) & (60-80) & (80-100) & \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \\ b_3 & (0-15) & (15-30) & (30-45) & (45-60) & (60-75) & \end{bmatrix}. \quad (6)$$

The node area matrix O' can be determined according to the value range of the grading standard [35]:

$$O' = \begin{bmatrix} N & b_1 & L_1 & 15 \\ b_2 & L_2 & 30 & \\ \vdots & \vdots & \vdots & \\ b_3 & L_5 & 75 & \end{bmatrix}. \quad (7)$$

The element matrix is determined to be evaluated:

$$O_r = \begin{bmatrix} N_r & b_1 & L_1 & 15 \\ b_2 & L_2 & 30 & \\ \vdots & \vdots & \vdots & \\ b_3 & L_5 & 75 & \end{bmatrix}. \quad (8)$$

After normalization, a new element matrix to be evaluated is obtained:

$$O_r' = \begin{bmatrix} N_r & b_1 & L_1 & 0.15 \\ b_2 & L_2 & 0.30 & \\ \vdots & \vdots & \vdots & \\ b_3 & L_5 & 0.75 & \end{bmatrix}. \quad (9)$$

According to the matter-element extension model, the contradiction of each link in the coordination process of water pollution treatment industry chain can be effectively solved [36], and the collaborative innovation mechanism of water pollution treatment industry chain based on complex scientific management has been completed.

4. Experimental Analysis

In order to verify whether the designed collaborative innovation mechanism of the water pollution control industry chain based on complex scientific management can realize the effective deployment of the water pollution control industry chain, and whether the application of this mechanism can give full play to the economic utility of each link in the industrial chain, experiments are conducted on the study.

4.1. Introduction to Experimental Subjects. The experimental area contains a water pollution control project, which is mainly aimed at the main flood control and drainage channel in the experimental area. The river has not been cleaned in the past 5 years, the flow rate is slow, the discharge capacity is limited, and the long-term sedimentation has reduced the river bed section. The original flood control and drainage capacity of the river are reduced, and the flood disaster is serious. To ensure water safety in the area, the water system is dredged and the urban natural ecological water system is restored. Through the upgrading and transformation of sewage treatment plants, an efficient automatic monitoring system and corresponding supporting facilities are established. The water ecosystem is protected and restored, the healthy life of the river is maintained, and a coordinated, green, and livable environment is created. Figure 3 shows the overall overview of water pollution in the experimental area.

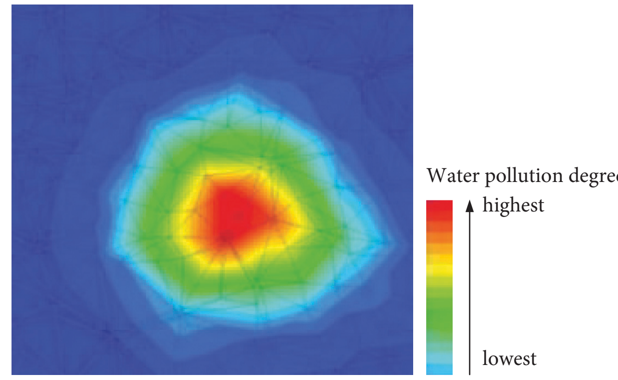

Figure 3: Overall overview of water pollution in the experimental area.

4.2. Data Collection. Relevant data and environmental data on the production activities of the plot to be investigated are collected such as production technology, raw and auxiliary materials, products, production facilities and auxiliary facilities layout, production equipment level, accident records, mark the location and purpose of nearby groundwater wells, the relationship between groundwater and surface waters, the distribution of residents, and other sensitive targets.

4.3. Monitoring Points. The layout of water pollution monitoring wells is determined based on the original production and auxiliary equipment layout of the plot to be investigated and the surrounding environment, and the locations are located in areas where environmental impacts may occur. Generally, there are 10 sites, 3 around the production area, 3 auxiliary facilities for raw and auxiliary material storage, sewage and solid waste treatment, and 4 plant boundaries. According to the groundwater flow direction of the site, at least 3 of the holes shall be installed as groundwater monitoring wells, and the depth of the groundwater monitoring well shall be 2 m below the static water level.

4.4. Construction of the Evaluation Index System of the Water Pollution Control Industry Chain

4.4.1. Definition and Selection Method of Indicators. The evaluation index standard mainly refers to the "National River Health Evaluation Index, Standard and Method" and "National Lake and Reservoir Health Evaluation Index, Standard and Method"; Combined with relevant domestic and foreign research experience on river pollution control, it is divided into 5 levels. Ineffective is grade I, invalid is grade II, generally grade III, more effective grade IV, very effective grade V. Table 1 shows the specific classification levels of water quality indicators, and Table 2 shows the specific classification levels of flow rate indicators.

4.4.2. Selection of Evaluation Indicators. According to the index selection description and the research results of urban river pollution control, combined with cases, source emission reduction, process interruption, and end treatment (end river water quality control, end river habitat restoration, and end river bank restoration) were selected as evaluation indicators.

4.5. Result Analysis

4.5.1. Source Reduction. The water pollution control industry chain collaborative innovation method based on complex scientific management was used to treat the water pollution in the experimental area, and the effect of reducing water pollution at the source of the area before and after treatment in 2019 was compared. The results are shown in Figure 4.

Analyzing Figure 4, it is can be seen that in the source emission reduction link, before applying the collaborative innovation method of the water pollution control industry chain based on complex scientific management, the purification rate of ammonia nitrogen content in water pollution is significantly lower than the purification rate after system treatment. The designed method is used. After purification, the maximum purification rate had reached over 80%, and the purification effect had reached Grade V, which is very effective. Before using the designed method, the maximum purification rate was only 30%, and the purification effect was Grade IV. It shows that through the coordination and treatment of the water pollution control industry chain, the quality of the water environment can be effectively improved, and the effect of water pollution control can be improved. It further shows that the designed method has reliable theoretical basis, strong adaptability, and remarkable engineering experiment results. It is an environmentally friendly and reductive water control system, which is particularly suitable for the treatment of different polluted water bodies, and has achieved the expected goals and effects.

4.5.2. Process Blocking. In addition to emission reduction at the source, there is also a link in the water pollution control industry chain that is responsible for process interruption. In order to verify the effect of the designed method in the process of water pollution interruption, the treatment cost of the water pollution treatment company in the process of interruption is used as an indicator. Comparing the cost of

Table 1: Water quality index classification standard.

Grade	Total phosphorus purification rate (%)	Purification rate of ammonia nitrogen content (%)
I	0–5	0–10
II	6–15	11–25
III	16–20	26–35
IV	21–40	36–45
V	41–100	46–100

Table 2: Classification standard of flow rate index.

Grade	Specific description
I	Basically no water
II	No change in velocity of each section
III	There is no obvious change in the flow velocity of each section
IV	The flow velocity of each section is not obvious
V	More sections have different speeds

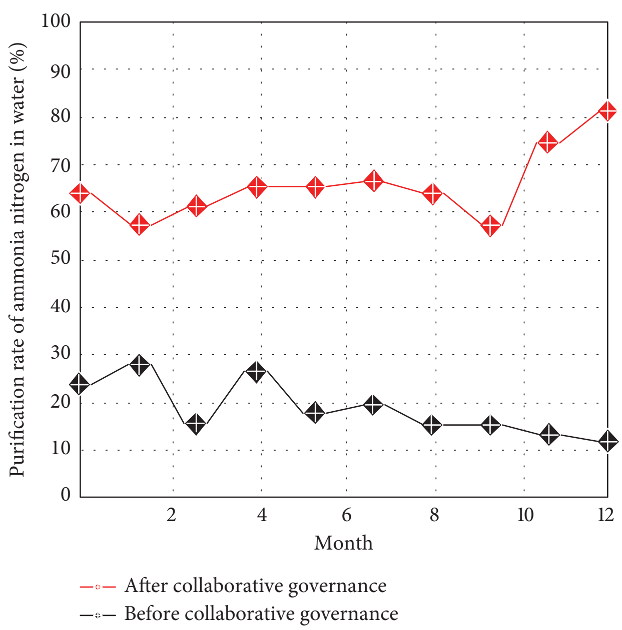

Figure 4: Comparison results of ammonia nitrogen purification rate in water pollution before and after coprocessing.

water pollution treatment before and after the design method was adopted in the region in 2019, the result is shown in Figure 5.

Analyzing Figure 5, it can be seen that before adopting the designed method for water pollution treatment, the overall cost is higher, and after using the designed method, the cost of water pollution treatment has been significantly reduced. This is because the design method is based on complex scientific management theory to regulate and control each link in the industrial chain of water pollution control, so that the cost of water pollution treatment in each link is reduced, thus reducing the overall treatment cost. It shows that the design method has obvious economic benefits and is worthy of application in the collaborative management of water pollution treatment industry chain.

4.5.3. Terminal Treatment. The industrial structure of water pollution control includes water pollution environmental protection equipment production industry (such as water environmental protection pharmaceutical manufacturing industry, water environmental pollution control equipment, and environmental monitoring and analysis instrument industry), water environmental protection service industry (such as water pollution engineering design and construction units), water pollution consulting service industry, water pollution treatment facility operation service industry, and wastewater comprehensive utilization industry. Among them, the comprehensive wastewater utilization industry belongs to the end treatment link. This link uses the wastewater that has undergone source emission reduction and process blocking treatment for secondary use. For this purpose, the wastewater utilization rate is used as an indicator to compare the effects before and after using the designed method, as shown in Figure 6.

Analyzing Figure 6 shows that in the end treatment link, before the designed method is used to coordinate the optimization of the water pollution industry chain, the waste water utilization rate is low, and the highest value still does not exceed 20%, indicating that all links in the industry chain are not paid attention to. The utilization of wastewater only takes wastewater treatment as a goal, and lacks attention to wastewater utilization. After the collaborative control of water pollution industry chain, the utilization rate of wastewater has been significantly improved, which shows that the method attaches importance to all aspects of the industrial chain of water pollution, and does not ignore the problem of wastewater utilization. Therefore, it improves the utilization of wastewater in water pollution treatment, and fully verifies the effectiveness and economic value of this method in water pollution control. This is because this method is based on the complex scientific management (CSM) innovation theory and organizational evolution logic to build a collaborative economic model of water pollution control industrial chain.

5. Discussion

The most basic characteristic of an enterprise is the pursuit of profit maximization. Whether the enterprises can form an economic chain or not depends on whether they can realize their own interests, which is the key to the construction of industrial chain. The companies in the circular economy industry chain are also same as the above. They all consider their own interests before deciding whether to cooperate with other companies. An enterprise in a high-quality circular economy industry chain should have the following two

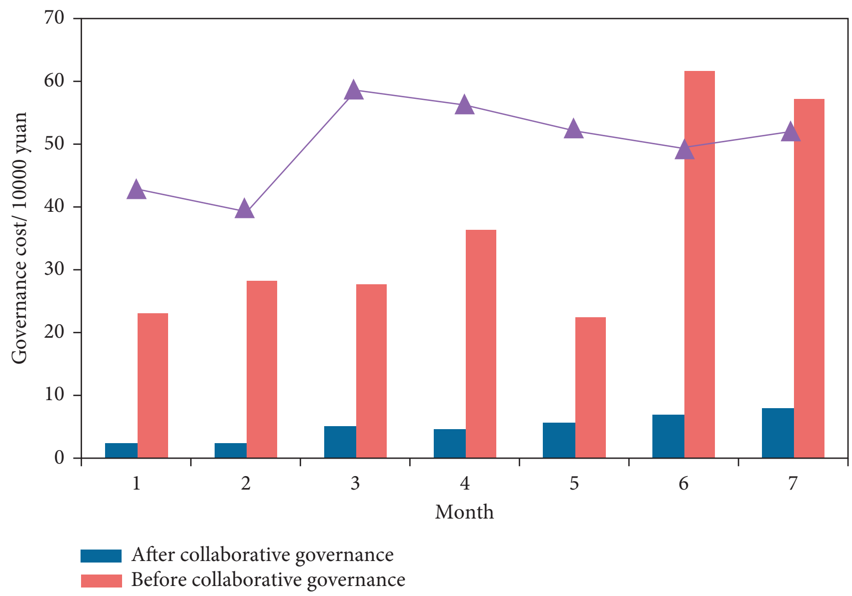

Figure 5: Comparison of water pollution control costs before and after adopting the designed method.

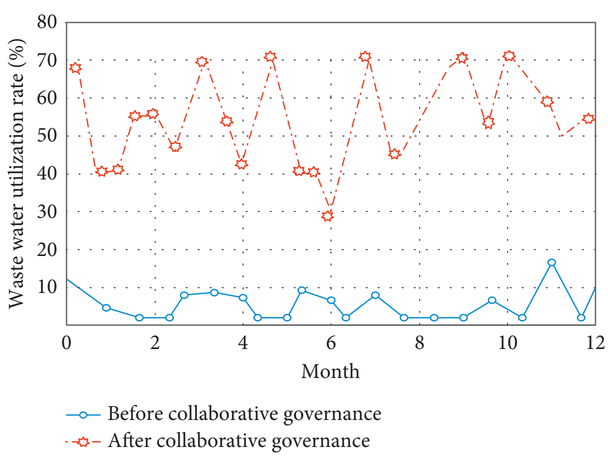

Figure 6: Comparison of wastewater utilization before and after adopting the designed method.

characteristics: one is that its own interests can be satisfied and its own value can be reflected; the other is that the enterprise can create value for other enterprises and make other enterprises' value also be reflected. In the process of operation, enterprises in circular economy industry may need to pay the economic price. However, in the absence of external factors such as the government, they need to withdraw; under the constraints of external conditions, enterprises will still follow the "instinct" of maximizing their own interests. The most basic characteristics of enterprises can maximize their own interests. Therefore, to ensure that enterprises are profitable is the most basic condition for constructing circular economy industrial chain.

Under the condition of fully considering the above factors, this paper puts forward the collaborative innovation mechanism of water pollution treatment industry chain based on complex scientific management. The theory of CSM contains unique views and views on innovation, especially the research from the perspective of time and space has important practical significance. From the perspective of time and space, CSM innovation theory can guide people to rethink the creation of innovation value in the process of practical innovation, and open up a better innovation environment. It can be said that CSM innovation theory is one of the most important theories that CSM theory plays a role in practice, and has obvious practical significance. Relying on the complex scientific management theory, the water pollution control effect has been significantly improved by coordinating all links in the industrial chain of water pollution control.

6. Conclusions

In order to solve the problem of chain break and lack of chain in the current water pollution control industry chain, the research method of collaborative innovation mechanism of water pollution treatment industry chain based on complex scientific management was proposed. Based on the analysis of the problems existing in the current industrial chain of water pollution control, the collaborative economic model of the industrial chain of water pollution treatment is established, and the vertical cooperation behavior of the industrial chain of water pollution treatment is analyzed based on the market orientation. According to the analysis results, the matter-element extension model is established to effectively solve the contradictions in each link of the water pollution control industry chain coordination process. The experimental results show that the design method can effectively restrict the industrial chain of water pollution control, the water treatment effect has been significantly improved, and the economic benefits have been improved, which show that the method can be applied in practice and has practical application value. In the future development, the introduction of more advanced science and technology and information technology has more effectively solved the contradictions in various links in the coordination process of the industrial chain of water pollution control.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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