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Enhancing Strategic CSR in Chinese Leading Enterprises: The Role of Government Compensation and a Multi-Phase Portfolio Model

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Abstract: Water environment governance of large rivers is an essential measurement of ecological protection in China. The effectiveness of governance depends highly on the fulfillment of strategic CSR (corporate social responsibility) of Chinese leading enterprises. However, the fulfillment of strategic CSR often brings economic burden to the leading enterprises and needs government compensation support. Therefore, this paper explores the impact of government compensation on the fulfillment of strategic CSR of Chinese leading enterprises by constructing a multi-stage portfolio model. The main results show that (1) the prerequisite for leading enterprises to fulfill strategic CSR is sufficient profits; (2) the increase in government compensation can significantly affect the proportion of strategic CSR fulfillment of leading enterprises; (3) only when the portfolio considers both strategic CSR and project benefits, can the leading enterprises obtain the highest economic returns and better fulfill strategic CSR. The results can provide policy reference for the government to stimulate the fulfillment of leading enterprises' strategic CSR and also give suggestions for the leading enterprises to alleviate the economic pressure brought by fulfilling strategic CSR.

Keywords: the government compensation; strategic CSR; water environment governance; multi-phase portfolio

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1. Introduction

Water environment governance of large rivers has become increasingly significant in China's water pollution control. Under the major strategy of "Carbon Peaking and Carbon Neutrality Goals" [1] and its subsidiary policies, China has made many achievements. However, the overall water pollution control situation is still unsatisfactory. It indicates that besides discussing this topic from the national strategic perspective, it is also important to study the role of Corporate Social Responsibility (CSR) for water environment governance from the enterprise level.

Due to leading enterprises' characteristics of stability, large scale, and strength for implementation, water environment governance projects are always undertaken by them. They are also expected to undertake more CSR than general enterprises, that is, strategic CSR. Strategic CSR refers to the additional political and social obligations of enterprises to the nation, the government, and the public; in the water environmental governance field, it mainly includes completing the water governance projects in quality and quantity, resolutely implementing the national policies and plans on water ecology protection, and maintaining the stability of water ecology, etc. [2,3]. Based on the view of the three-bottom-line proposed by John Elkington, strategic CSR should combine economic, environmental, and social responsibilities with business strategies and operations. From the economic dimension, the most basic economic responsibility is to make profits, and the pursuit of maximizing profits is the fundamental strategy of all production and business activities of an enterprise [4,5]. From the environmental dimension, with the increasingly strict

environmental regulatory policies in China, enterprises have to consider environmental protection when formulating enterprise strategies to avoid environmental penalties and to obtain environmental subsidies [6]. From the social dimension, enterprises should develop strategies that relate to stakeholders' benefits, in order to gain long-term prestige and assets [7]. However, due to the complexity of water environment governance projects, and more expectations from the nation and the public, the leading enterprises often bear a lot of economic pressure in fulfilling the strategic CSR and need government compensation support. Therefore, how to alleviate the economic pressure brought by fulfilling strategic CSR, and how the impact mechanism of government compensation on helping leading enterprises fulfill strategic CSR have become urgent problems to be solved.

To fill the above research gap, this paper constructed a multi-phrase portfolio model based on a strategic period and also conducted a case study to explore the impact mechanism of government compensation on promoting strategic CSR fulfillment of leading enterprises. The main contributions of this paper are as follows: (1) a multi-phase portfolio model for the strategic period under the strategic CSR has been constructed, which can make up for the inadequacy of the traditional portfolio model in the water environment governance of large rivers; (2) this paper links strategic CSR and economic responsibility together, and provides leading enterprises with a portfolio program that can help them fulfill strategic CSR; (3) this paper also explores the impact of government compensation on strategic CSR of leading enterprises, which can promote leading enterprises to undertake strategic CSR; and (4) the results can provide not only suggestions for the government to optimize and formulate related policies but also appropriate portfolio programs for leading enterprises.

2. Literature Review

2.1. Water Environment Governance Projects

Existing literature mainly discusses water environment governance projects from natural, social, economic, and management attributes. (1) Natural attributes. The water environment governance projects for large rivers usually have natural attributes, including systematicity, complexity, continuity, and high investment [8–10]. For example, water environment governance projects usually involve a number of watersheds with extensive areas, larger investments, and a complex management process, any slight carelessness can cause water pollution again [9,10]. (2) Social attributes. Water environment governance projects of large rivers have more significant social attributes than general projects, including transboundary, positive externality, non-competitiveness, non-exclusivity, and public welfare [1,7,11,12]. For example, the water environment governance projects of large rivers have a wide distribution usually involving multiple regions, such as cities and provinces. They mainly provide services to society, which can ensure the maximization of social welfare [12]. (3) Economic attributes. The economic attributes of water environment governance projects of large rivers are high input, continuous creativity, operability, etc. [10,13,14]. For example, high input means the high investments of various resources (human, material, and finance) in the water environment governance projects [10]. Operability means that water governance projects should meet the requirements of market-oriented operation, and can attract social capital to participate in the construction of governance projects [13,14]. (4) Management attributes. They include legislation, diversity, and comprehensive coordination [10,13]. Legislation means that the results of water environment governance need relevant laws and regulations to support [10]. Diversity is reflected in the multiple participating subjects, including the government, the market, and the public. Comprehensive coordination is reflected in the mutual coordination and benign interactions among different types of governance subjects [13].

2.2. Strategic CSR

2.2.1. Strategic CSR of Leading Enterprises

The role of strategic CSR of leading enterprises in water environment governance has become a research focus in this field. Scholars discussed strategic CSR most from economic, environmental, and social perspectives. Xu et al. [15] explored that the strategic CSR of leading enterprises originated from the strategic requirements under the socialist market economic system, it included shaping the spirit of the country, upgrading and transforming the industrial structure, and sustainable development of the environment and resources. Xu et al. [16] believed that strategic CSR of leading enterprises included realizing the national fiscal revenue, reservation of national assets, sustainable development of the environment, and the construction of public infrastructure. Xu et al. [17] discussed the consistency between enterprise strategy and national policies from economic responsibility, social responsibility, and environmental responsibility. Xu et al. [18] believed that the special function of China's state-owned economy determines the leading enterprises' strategic CSR, including maintaining economic security, promoting the optimization and upgrading of the industrial structure, and improving environmental protection and sustainable development.

2.2.2. Strategic CSR of Leading Enterprises in Water Environment Governance

Strategic CSR is closely related to the national water environment governance strategy [2]. Scholars have explored the strategic CSR that leading enterprises should fulfill in water environment governance, mainly including the following four responsibilities. (1) Responsibility for water quality and water ecology protection [13]. It includes water quality protection, watershed water quantity control, eutrophication prevention, the prevention of tributary water bodies deterioration, and so on [19–21]. (2) Responsibility for ecological scheduling. While taking into account the social and economic benefits of flood control, power generation, water supply, navigation, and irrigation, leading enterprises also should consider the needs of the river ecosystem, and value the reservoir's own regulatory performance as well as the river's ability to lose and transfer water, so as to scientifically utilize the ecological scheduling function [22]. (3) Responsibility for ensuring navigation. Dams and other water-blocking structures break natural navigation channels, for which ship-crossing facilities such as locks and vertical lifts need to be constructed. The modification costs of the ship-crossing facilities are generally borne by the leading enterprises, and the relevant costs are generally not charged after construction [23]. (4) Responsibility for dam maintenance and repair. Leading enterprises have responsibilities in economic expenditures in the areas of dam maintenance and repair [24].

2.3. Government Compensation

In the case of water environment governance projects, government compensation can give leading enterprises support to fulfill the requirements of national strategy, therefore, it has aroused discussion in the academy. Current research is mostly from a gaming perspective to analyze the importance of government compensation. An et al. (2018) explored the compensation method of PPP projects for urban water environment treatment in China from an incentive perspective by using the game method to find the incentive coefficient and establish an effective compensation mechanism [25]. Gao et al. (2019) constructed a three-party game model of enterprises, government, and local government, and by introducing the Cobb–Douglas production function refined the regulatory level of the government into regulatory attitude and regulatory skill. The results proved that the higher the ecological compensation, the lower the possibility of local government cooperation [14]. Zhu et al. (2022) constructed an evolutionary game model and analyzed the interaction between upstream and downstream governments with the government in the basin by considering the change of the government compensation behavior [26].

2.4. Portfolio under Strategic Objectives

A portfolio refers to projects, project sets, and other related work, which are grouped together to achieve strategic goals and facilitate effective management [27]. As the correlation between portfolio and strategy is becoming increasingly tight, portfolios under the strategic perspective have attracted widespread attention. Bai et al. (2021) proposed a method based on complex network theory to select robust portfolios under strategic objectives and demonstrated the application of the portfolio selection method through numerical examples [28]. Samoryadov et al. (2017) constructed a strategic decision model with a portfolio approach and fuzzy logic, by optimizing objectives of profitability and risk for the entire portfolio, to value and compare strategic portfolios [29]. Hutchison et al. (2015) used the "strategic bucket" theory to make effective decisions on optimal resource allocation for projects [30]. Lu et al. (2021) investigated the multi-project portfolio scheduling problems about the evolution of human resource skills and constructed a mixed integer planning model with the strategic objective of minimizing the number of projects and the total cost of inputs [31]. Bai et al. (2017) studied the coupling influence of portfolio configuration component weights on strategic attributes from the strategic perspective and designed a coupling-based model for portfolio configuration strategic closeness [32].

2.5. Strategic Phases

The water environment governance of large rivers needs to consider each strategic phase's goal of the strategic period. Ansari, R. et al. (2015) described strategy as an overall and long-term development plan for an enterprise. The strategic decomposition and execution are the foundation for implementing high-level strategic decisions and achieving enterprises' strategic goals [33]. Ghannad P et al. (2020) proposed that decision-makers need to develop a long-term portfolio program that organically links the phases of the strategy period through the relevant decisions made at the point in time of the phases [34]. Li (2020) divided the phases of the strategic period and introduced the concept of the strategic period for comprehensive water environment management [35]. Kumar et al. (2017) argued that in formulating a strategy, enterprises need to divide the strategic period into phases or time periods in accordance with the time dimension and adopt a top-down form of business decomposition defined as a temporal decomposition of strategic objectives [36].

In summary, although existing literature has extensively discussed this field from different perspectives, there are still some aspects worth further exploration. Firstly, there lack of consideration of leading enterprises' strategic CSR in the portfolio design of water environment governance of large rivers. Due to the particularity of strategic CSR, whether putting it in the portfolio may affect the effectiveness of water environment governance, but fewer studies have discussed its key role in this process. Secondly, as the economic return of the portfolio may not cover the cost which leading enterprises fulfill strategic CSR generated, it is necessary for the government to give compensation support to ensure leading enterprises fulfilling strategic CSR. However, seldom research has studied the impact mechanism of government compensation on strategic CSR. Thirdly, given the complexity and continuity attributes of the water environment governance of large rivers, different phases have different strategic goals and tasks, but less research has taken the multi-phase strategic period into account in the water environment governance of large rivers.

3. Methodology

3.1. Data Sources

The data used in this paper is sourced from Yangtze Ecology and Environment Co., Ltd. (Wuhan, Hubei province, China), a subsidiary of the Three Gorges Group. The first-hand data mainly comes from on-site visits to the enterprise, employee interviews, and questionnaire surveys. The second-hand data mainly comes from the internal information of the enterprise, including the annual report of the enterprise, the official website, the WeChat official account, and media coverage.

3.2. Model Construction

Given the expectations of the country and the people towards leading enterprise, as well as their competitive advantages, when facing problems such as insufficient shipping capacity of large rivers, water quality deterioration, water environment deterioration, etc., they should sacrifice their economic interests to maintain the water ecological environment, public interests, and social stability. That is the direct embodiment of the leading enterprises' strategic CSR [37]. However, it will bring negative effects on leading enterprises' economic benefit, therefore, it is necessary for the government to compensate leading enterprises' losses and ensure strategic CSR fulfillment. Many studies have shown that the fulfillment of CSR has a positive effect on economic returns [38,39], based on this view, this paper aims to explore the impact mechanism of government compensation on fulfilling strategic CSR and find a solution to fulfilling both economic responsibility and strategic CSR of leading enterprises. The research framework has been constructed in Figure 1.

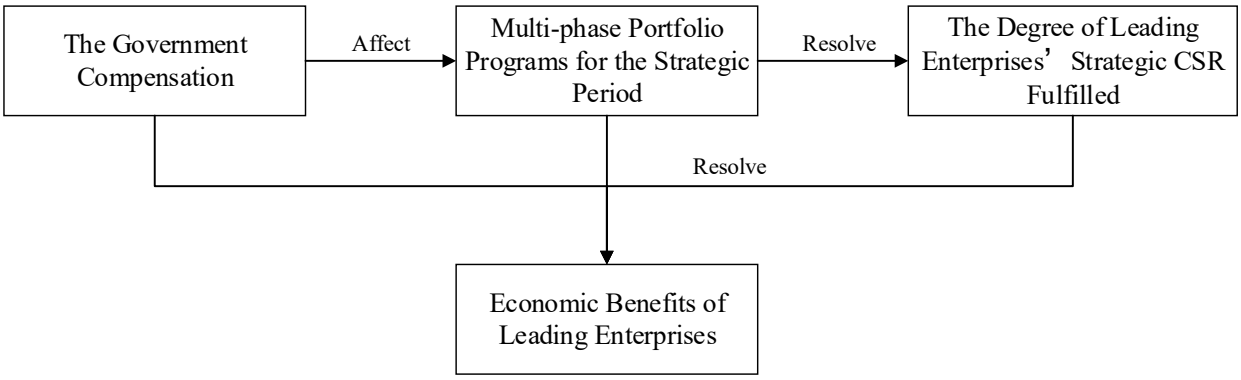

Figure 1. Research Framework.

According to the characteristics of water environment governance projects and portfolios of large rivers, and the content and attributes of strategic CSR of leading enterprises, this study proposed project restrictive conditions, such as quantity constraints, non-renewable resource constraints, and financial constraints considering strategic CSR. Then, this study constructed a multi-stage portfolio model for water environment governance of large rivers based on strategic periods.

3.2.1. Model Assumptions

(1) There is no logical relationship among water environmental governance projects [40];
(2) There is no interactive relationship among water environmental governance projects [41];
(3) Considering only non-renewable resource constraints in the process of water environment governance portfolio [42].

3.2.2. Description of Variables and Symbols

The related variables and parameters are as follows:

(1) Decision variables

x_{it}: Whether project i is selected in time period t (1 or 0);
z_i: Whether project i is selected for the full strategy period (1 or 0) (Decision variables);

(2) Other variables and parameters

η: Economic benefits for water environment management project enterprises;
n: Number of optional projects during the full strategic period;
N: Maximum number of optional projects during the full strategy period;
A: Maximum number of available projects that can be selected in time period t;
p_i: Percentage of the degree of fulfilling strategic CSR for project i;

p_t: Minimum percentage of the degree of fulfilling strategic CSR in phase t of the strategy period;

p: Minimum percentage of the degree of fulfilling strategic CSR;

b_i: Benefits can be obtained for completion of project i;

c_i: Production readiness costs to be invested in project i;

R_q: Total amount of non-renewable resources in category q available for the full strategic period;

R_{qt}: Total amount of non-renewable resources in category q available during strategic period t;

e_{iq}: Quantity demanded for resources q for project i;

F_t: Funds available at the beginning of time period t;

G: External funding available to the leading enterprises before the start of the strategic period;

k_i: Investments required in the implementation of project i;

r: Market interest rate;

C_{bc}: Amount of compensation paid by the government and relevant departments to the leading enterprises for fulfilling strategic CSR.

3.2.3. Objective Function

Based on the consideration of the survival as well as the long-term benefits of water environment governance enterprises, the maximization of the enterprises' economic return is taken as the optimizing objective of the multi-phase portfolio model for the strategic period of water environment governance of large rivers under the consideration of fulfilling strategic CSR of the leading enterprises. The economic return consists of four parts, i.e., project revenue, project preparation cost, project required investment, and compensation amount for fulfilling strategic CSR. The objective function is constructed in Model (1):

$$\text{Max } \eta = \sum_{t=1}^{T}\sum_{i=1}^{n} b_i x_{it}(1+r)^{-t} - \sum_{t=1}^{T}\sum_{i=1}^{n} c_i x_{it}(1+r)^{-t+1} - \sum_{t=1}^{T}\sum_{i=1}^{n} k_i x_{it}(1+r)^{-t+1} + C_{bc}\sum_{i=1}^{n} p_i z_i (1+r)^{-T} \quad (1)$$

3.2.4. Restrictive Condition

(1) Number of projects constraints

Due to various limitations in the capabilities, talents, resources, and funds of the leading enterprise, the number of projects that the leading enterprises can implement during the entire strategic period and each stage of the strategic period is limited. Therefore, it is necessary to constrain the number of projects that can be implemented. The constrained number of projects is expressed in Models (2) and (3):

a. Total constraints for the strategy period

$$\sum_{i=1}^{n} z_i \leq N \quad (2)$$

b. Quantitative constraints by phase

$$\sum_{i=1}^{n} x_{it} \leq A, t = 1, 2, \ldots, T \quad (3)$$

(2) Funding constraints

When implementing a portfolio, the leading enterprises need to satisfy a constraint of greater than or equal to zero in terms of funding within each phase of the strategic period in order to sustain the project implementation and the normal operation. The funding constraints are expressed in Models (4) and (5):

a. Funding constraints for the first phase of the strategic period. Funds F_1 available at the beginning of the first phase of the strategic period need to be used to finance the costs

of the project and the investment required for project implementation during that phase, the funding constraint is:

$$G + F_1 - \sum_{i=1}^{n} c_i x_{i1} - \sum_{i=1}^{n} k_i x_{i1} \geq 0 \tag{4}$$

b. Strategy period funding constraints. Funds available at the beginning of each phase of the complete strategic period need to provide the cost and investment of the selected implementation project in that time period, according to the method of Li (2016) [43], the funding constraint is:

$$\begin{gathered} G + \sum_{t=1}^{\tau+1} F_t (1+r)^{-t+1} + \sum_{t=1}^{\tau} \sum_{i=1}^{n} b_i x_{it} (1+r)^{-t} - \sum_{t=1}^{\tau+1} \sum_{i=1}^{n} c_i x_{it} (1+r)^{-t+1} - \\ \sum_{t=1}^{\tau+1} \sum_{i=1}^{n} k_i x_{it} (1+r)^{-t+1} \geq 0, \tau = 1, 2, \ldots, T-1 \end{gathered} \tag{5}$$

(3) Resource constraints

In the process of implementation, the portfolio of water environment governance of large rivers will be constrained by various non-renewable resources. Before the implementation of this type of portfolio, the relevant departments and the leading enterprises will allocate and plan for the amounts of available resources for the complete strategic period and the various stages of the strategic period [44]. Therefore, it is necessary to set up resource constraints for the complete strategic period and the various stages of the strategic period, respectively. The resource constraints are expressed in Models (6) and (7):

a. Total resource constraints

$$\sum_{i=1}^{n} e_{iq} z_i \leq R_q, q = 1, 2, \ldots, Q \tag{6}$$

b. Resource constraints by phase

$$\sum_{i}^{n} e_{iq} x_{it} \leq R_{qt}, q = 1, 2, \ldots, Q, t = 1, 2, \ldots, T \tag{7}$$

(4) strategic CSR fulfillment constraints

In the actual implementation process of water environment governance of large rivers, as strategic CSR is mandatory, the leading enterprises need to fulfill a certain strategic CSR to obtain compensation from the government, and further to achieve the economic benefits. The constraints on the fulfillment of the strategic CSR of the leading enterprises are expressed in Models (8) and (9):

a. General constraints on the fulfillment of strategic CSR

$$\sum_{i=1}^{n} p_i z_i \geq P \tag{8}$$

b. Stages of strategic CSR fulfillment constraints

$$\sum_{i=1}^{n} p_i x_{it} \geq P_t, t = 1, 2, \ldots, T \tag{9}$$

(5) Variable constraints

Variables are constrained according to their different types, with 0–1 variable constraints shown in Models (10) and (11):

$$x_{it} \in \{0, 1\} \tag{10}$$

$$z_i \in \{0, 1\} \tag{11}$$

3.3. Case Study

3.3.1. Case Subject

Yangtze Ecology and Environment Co., Ltd. (Beijing, China), as a subsidiary of the Three Gorges Group, undertake a number of tasks such as investment, construction, and

management of comprehensive water environment management projects. The Project of JS Center City Water Environment System Governance Phase I is a portfolio that is invested in and constructed by the Group in response to the strategy of the Great Protection of the Yangtze River, including the Bai Shui Lake Regional Wastewater Treatment and Management Phase I Project, the JS Center City Yangtze River Outfall Sewage Treatment Project, Two-River Basin Comprehensive Improvement Project, and other engineering branches. The Group proposes to select the portfolio among 12 water environment treatment projects (labeled as A–L), and the 12 projects are not logically related, i.e., there is no process logical relationship or organization logical relationship between the projects. In addition, the strategic period is divided into five stages. The basic data of each project of A–L are shown in Table 1. The total amount of initial funds, available resources, and the degree of strategic CSR fulfillment to the Group in each stage of the strategic period are shown in Table 2.

Table 1. Basic data of the project's costs, benefits, required investment, and resource consumption.

Project No.	c_i (Ten Million Dollars)	b_i (Ten Million Dollars)	k_i (Ten Million Dollars)	e_{iq}	p_i
A	1.50	105.8	72.25	7.0	0.18
B	1.68	139.1	80.75	6.5	0.15
C	1.94	149.6	93.5	7.9	0.12
D	1.50	104.1	72.25	8.6	0.25
E	5.05	225.4	156	9.6	0.03
F	3.22	190.8	155	9.7	0.09
G	4.99	215.4	150	10.6	0.11
H	3.22	261.6	157	11.8	0.10
I	5.46	290.7	213	14.3	0.07
J	3.63	254.5	175	14.0	0.17
K	3.51	232.5	169	13.6	0.08
L	4.46	267.9	218	15.8	0.05

Table 2. Initial funding, available resources, and the degree of strategic CSR fulfillment.

t	1	2	3	4	5
F_t (10 Million Yuan)	37	42	46	52	50
R_t	10	14	16	11	9
P_t	0.09	0.10	0.08	0.09	0.12

3.3.2. Case Model Construction

Based on the above tables, according to the practical situation of the Project of JS Center City Water Environment System Governance Phase I, the corresponding constant variables of each constraint are set. The maximum number of projects that can be selected during the strategic period is five, and the maximum number of projects that can be selected during each phase of the strategy period is one; the external capital possessed by the Group before the start of the strategic period is 1 billion yuan, the total amount of non-renewable resources available is 50 units, and only one kind of non-renewable resources is considered in the case study; the minimum fulfillment ratio of the strategic CSR is 60%; and the market interest rate is 5%.

By introducing various constant variables and constructing a water environment governance portfolio model for this case, it can be concluded that under the strategic CSR, the multi-stage strategic period based on the water environment governance portfolio model for large rivers is:

$$\text{Max } \eta = \sum_{t=1}^{T}\sum_{i=1}^{n} b_i x_{it}(1+5\%)^{-t} - \sum_{t=1}^{T}\sum_{i=1}^{n} c_i x_{it}(1+5\%)^{-t+1} - \sum_{t=1}^{T}\sum_{i=1}^{n} k_i x_{it}(1+5\%)^{-t+1} + C_{bc}\sum_{i=1}^{n} p_i z_i (1+5\%)^{-T}$$

$$s.t.\begin{cases} \sum_{i=1}^{n} z_i \le 5 \\ \sum_{i=1}^{n} x_{it} \le 1, t = 1,2,\ldots,5 \\ G + F_1 - \sum_{i=1}^{n} c_i x_{i1} - \sum_{i=1}^{n} k_i x_{i1} \ge 0 \\ G + \sum_{t=1}^{\tau+1} F_t (1+5\%)^{-t+1} + \sum_{t=1}^{\tau} \sum_{i=1}^{n} b_i x_{it} (1+5\%)^{-t} - \sum_{t=1}^{\tau+1} \sum_{i=1}^{n} c_i x_{it} (1+5\%)^{-t+1} - \\ \sum_{t=1}^{\tau+1} \sum_{i=1}^{n} k_i x_{it} (1+5\%)^{-t+1} \ge 0, \tau = 1,2,\ldots,4 \\ \sum_{i=1}^{n} e_{iq} z_i \le 50 \\ \sum_{i}^{n} e_{iq} x_{it} \le R_t, t = 1,2,\ldots,5 \\ \sum_{i=1}^{n} p_i z_i \ge 60\% \\ \sum_{i=1}^{n} p_i x_{it} \ge P_t, t = 1,2,\ldots,5 \\ x_{it} \in \{0,1\} \\ z_i \in \{0,1\} \end{cases}$$

3.3.3. Model Solution

The economic compensation is provided by the government to the leading enterprises for fulfilling strategic CSR. The compensation amount may have a certain impact on the selection of portfolio programs. Therefore, this study sets the amount of government compensation for the fulfillment of strategic CSR as 5, 10, 20, 50, 80, and 100 billion yuan, to solve the water environment governance portfolio model of large rivers based on a multi-phase strategic period under strategic CSR. The total percentage of the degree of strategic CSR fulfilled is obtained by summing the percentage of the degree of fulfilling strategic CSR of each selected project.

(1) The compensation amount C_{bc} is 5 billion yuan. Based on the multi-stage portfolio model, the JS Phase I portfolio is carried out. It makes the top five portfolio programs with the highest economic returns, the results are shown in Table 3.

Table 3. Portfolio Results for C_{bc} = 5 billion yuan.

No.	Portfolio Program	η	Total Percentage of the Degree of Strategic CSR Fulfilled ($\sum_{i=1}^{n} p_i z_i$)
1	B, H, J, G, A	260.887	0.71
2	B, J, H, G, A	259.745	0.71
3	B, H, J, C, A	258.234	0.72
4	C, H, J, B, A	257.824	0.72
5	B, H, J, A, C	257.41	0.72

(2) The compensation amount C_{bc} is 10 billion yuan. It makes the top five portfolio programs with the highest economic returns, the results are shown in Table 4. Based on the results of the model solution, the top five portfolio programs that make the highest economic returns are shown in Table 4:

Table 4. Portfolio Results for C_{bc} = 10 billion yuan.

No.	Portfolio Program	η	Total Percentage of the Degree of Strategic CSR Fulfilled ($\sum_{i=1}^{n} p_i z_i$)
1	B, H, J, G, A	263.668	0.71
2	B, J, H, G, A	262.527	0.71
3	B, H, J, C, A	261.054	0.72
4	C, H, J, B, A	260.645	0.72
5	B, H, J, C, D	260.271	0.79

(3) The compensation amount C_{bc} is 20 billion yuan. It makes the top five portfolio programs with the highest economic returns, the results are shown in Table 5.

Table 5. Portfolio Results for C_{bc} = 20 billion yuan.

No.	Portfolio Program	η	Total Percentage of the Degree of Strategic CSR Fulfilled ($\sum_{i=1}^{n} p_i z_i$)
1	B, H, J, G, A	269.231	0.71
2	B, J, H, G, A	268.090	0.71
3	B, H, J, C, A	266.696	0.72
4	B, H, J, C, D	266.461	0.79
5	C, H, J, B, A	266.286	0.72

(4) The compensation amount C_{bc} is 50 billion yuan. It makes the top five portfolio programs with the highest economic returns, the results are shown in Table 6.

Table 6. Portfolio Results for C_{bc} = 50 billion yuan.

No.	Portfolio Program	η	Total Percentage of the Degree of Strategic CSR Fulfilled ($\sum_{i=1}^{n} p_i z_i$)
1	B, H, J, G, A	285.920	0.71
2	B, H, J, C, D	285.030	0.79
3	B, J, H, G, A	284.779	0.71
4	C, H, J, B, D	284.620	0.79
5	B, H, J, D C	284.14	0.79

(5) The compensation amount C_{bc} is 80 billion yuan. It makes the top five portfolio programs with the highest economic returns, the results are shown in Table 7.

Table 7. Portfolio Results for C_{bc} = 80 billion yuan.

No.	Portfolio Program	η	Total Percentage of the Degree of Strategic CSR Fulfilled ($\sum_{i=1}^{n} p_i z_i$)
1	B, H, J, C, D	303.600	0.79
2	C, H, J, B, D	303.190	0.79
3	B, H, J, D, C	302.710	0.79
4	B, H, J, G, A	302.610	0.71
5	B, J, H, C, D	302.458	0.79

(6) The compensation amount C_{bc} is 100 billion yuan. It makes the top five portfolio programs with the highest economic returns, the results are shown in Table 8.

Table 8. Portfolio Results for C_{bc} = 100 billion yuan.

No.	Portfolio Program	η	Total Percentage of the Degree of Strategic CSR Fulfilled ($\sum_{i=1}^{n} p_i z_i$)
1	B, H, J, C, D	315.980	0.79
2	C, H, J, B, D	315.570	0.79
3	B, H, J, D, C	315.090	0.79
4	B, J, H, C, D	314.838	0.79
5	C, H, J, D, B	314.556	0.79

4. Result Discussions

The results in this study support and expand the views of Kraft and Hage (1990) that the fulfillment of strategic CSR is closely related to the enterprises' profitability [7]; and government support can have a positive impact on the fulfillment of strategic CSR, which is in line with Xu and Liu (2010), and Xu (2011) [15,16]. Unlike the previous views, this study has other new findings: (1) the order of implementation of the optional project has an impact on the portfolio returns; (2) when the compensation is small, the proportion of strategic CSR fulfillment of projects has less impact on the portfolio results; the total proportion of strategic CSR fulfillment is lower; (3) while when the compensation is increased, the

impact of the proportion of strategic CSR fulfillment on portfolio results is correspondingly increased, the proportion of strategic CSR fulfillment is increased; (4) the strategic CSR and project benefits can reach a trade-off. The detailed results analyses are as follows:

(1) The order of implementation of the optional project will have an impact on the portfolio returns. In Table 3, the results show that the highest economic returns portfolio programs are B, H, J, G, and A, and the highest economic return is 2608.87 million. Although portfolio programs 1 and 2, and portfolio programs 3–5 choose five identical projects, respectively, due to the time value of money, the different orders of project implementation lead to different economic returns.

(2) When the amount of compensation for strategic CSR fulfillment is small, the portfolio results are more preferred project benefits. Therefore, the optimal combination that maximizes the economic return of the portfolio tends to choose projects with higher project returns, such as projects H, J, G, etc. Comparatively speaking, the proportion of strategic CSR fulfillment of projects has less impact on the portfolio results. Thus, in the case of a smaller compensation amount (C_{bc} = 5 million, C_{bc} = 10 billion), according to Tables 3 and 4, the optimal portfolio scheme is basically the same, and its corresponding total proportion of strategic CSR fulfillment is lower.

(3) When the compensation amount of strategic CSR fulfillment is gradually increased, the degree of influence of the total proportion of strategic CSR fulfillment on the results of the portfolio is also gradually increased. From Table 4, only Program 5 among the five portfolio programs at C_{bc} = 10 billion yuan is different from that at C_{bc} = 5 billion yuan, and the total proportion of strategic CSR fulfillment in Program 5 (B, H, J, C, and D) is significantly improved compared with that in Program 5 (B, H, J, A, and C) at C_{bc} = 5 billion yuan. In Table 5, the top three programs of portfolio benefits at C_{bc} = 20 billion yuan remain unchanged compared to C_{bc} = 5 billion yuan and 10 billion yuan. The benefits of Program 4 (B, H, J, C, and D) exceed those of Program 5 (C, H, J, B, and A) for the first time, while the total ratio of strategic CSR fulfillment of Program 4 is 0.79, which is higher than the rest of the portfolio programs, and it indicates that the importance of the ratio of strategic CSR fulfillment is gradually increasing.

Similarly, as shown in Tables 6–8, when the compensation amount is larger, the five portfolio programs with higher economic returns appear as new combination types, such as Program 4 (C, H, J, B, and D) in Table 6, and Program 5 (B, J, H, D, and C) in Table 7, etc. The total proportion of strategic CSR fulfillment of the newly appeared project combinations is all higher. Taking the portfolio of C, H, J, B, and D as an example, when the compensation amount is 50 billion yuan, the program enters into the top five economic benefits for the first time. As the compensation amount rises to 80 billion and 100 billion, the ranking of the economic benefits of this portfolio rises to No. 2. Comparing Tables 5–8, it shows that the total proportion of the five optimal results of the portfolio's strategic CSR fulfillment shows a rising trend in general. Taking the portfolio of B, H, J, C, and D as an example, its rank rises gradually with the increase in the compensation amount, and when C_{bc} = 80 billion yuan and 100 billion yuan, this portfolio program is the optimal program. The above analyses show that the impact of strategic CSR fulfillment proportion on the portfolio results will significantly increase with the increase in compensation amount.

(4) Based on the special characteristics of the large river water environment governance project and the special attributes of leading enterprises' strategic CSR, the portfolio mostly selects projects with high returns and a higher proportion of strategic CSR fulfillment. According to Tables 3–8, the projects with higher frequency in the results of portfolio solving include B, J, C, etc., and they can obtain high returns and have a high proportion of strategic CSR fulfillment. For example, although the benefit of Project J is not the highest, it has a high proportion of strategic CSR fulfillment, and thus it is selected more frequently. Therefore, in the process of carrying out the portfolio of large river water environment governance, the enterprises have reached a certain degree of trade-offs between project revenue and strategic CSR. Only when both are taken into account at the same time, can

the enterprises obtain the highest economic returns, realize their economic goals, and thus fulfill better their economic responsibility and strategic CSR.

However, the model in this study has been simplified to some extent for the consideration of calculation, and may have some limitations, including: (1) the expenditure for fulfilling strategic CSR is linear expenditure, and there is a linear relationship with b_i (benefits can be obtained for completion of project i), future research can study the relationship between strategic CSR and government compensation from a dynamic perspective; (2) this study only considers the proportion of fulfilling strategic CSR, and there may exist other factors which may have the impact on the results, future research can further explore the possible influence factors in this process; (3) due to the generally weak constraint of renewable resources in water environment governance projects, this study only considers the constraint of non-renewable resources. This may cause bias in the results, future research should pay attention to this aspect.

5. Conclusions, Implications and Limitations

5.1. Conclusions

This paper explores how to enhance strategic CSR in Chinese leading enterprises in water environment governance under the role of government compensation and multi-phase portfolio. The main conclusions are as follows: (1) the prerequisite for leading enterprises to fulfill strategic CSR is sufficient profits; (2) the increase in government compensation can significantly affect the proportion of strategic CSR fulfillment of leading enterprises; (3) only when the portfolio considers both strategic CSR and project benefits at the same time, can the leading enterprises obtain the highest economic returns, and better fulfill strategic CSR.

5.2. Implications

(1) Government perspective

Firstly, the government could establish a reasonable compensation system, to motivate the enthusiasm of leading enterprises to fulfill strategic CSR. For example, the government could directly provide financial subsidies or introduce tax policy of reductions and exemptions. Secondly, optimize the strategies of water environment governance and build a periodic assessment system. The government should consider the actual implementation of leading enterprises when formulating a water governance strategy. For example, the government could separate strategy into phased strategic goals, and conduct an assessment in each stage. It can enable leading enterprises to combine their phased strategic goals with national strategies, help leading enterprises arrange the resource allocation of fulfilling strategic CSR more reasonably, and further improve the efficiency of water environment governance. Thirdly, the government could encourage and support leading enterprises to adopt multi-portfolio plans, by establishing a well-connected relationship network, which can help leading enterprises obtain easy access to obtain various resources that a multi-portfolio may use, ultimately benefiting the realization of strategic CSR.

(2) Enterprise perspective

Firstly, leading enterprises should actively play the role of the main body of the construction of China's CSR system and give full consideration to the fulfillment of strategic CSR in the water environment governance portfolio of the large rivers. Secondly, leading enterprises should transform the conception that fulfilling strategic CSR will reduce economic benefits. Actually, there exists the balance that the fulfillment of strategic CSR and economic benefits can be achieved simultaneously. Thirdly, the leading enterprises should make full use of government compensation, and also actively adopt appropriate portfolio plans to fulfill strategic CSR, the fulfillment of strategic CSR can help them gain prestige and resources. From a strategic perspective, it can be beneficial for the long-term survival and development of leading enterprises.

5.3. Limitations and Outlooks

Although this study has discussed the role of strategic CSR in the water environment governance portfolio, it still lacks a discussion of the specific mechanism of strategic CSR in the governance process. In addition, this paper lacks a discussion of the impacts of process logic relationship and organizational logic relationship in water environment governance projects of large rivers on the portfolio results. Further research could conduct in-depth explorations in these directions.

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