Construction risk analysis of water environment treatment project based on WBS-RBS and AHP in flood period --Take the EPC project of comprehensive treatment of water environment in the east of a city as an example

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Abstract. Basic environment construction is a livelihood project, especially water environment management is a hot topic in current engineering construction. There are more or fewer risks in the water environment treatment construction process, especially the black and smelly water treatment during the flood season. Hidden dangers, especially this year is the resumption of work and production after the epidemic, which coincides with the flood season. This article takes the EPC project of comprehensive water environment management in the east of a city as an example, and combines the WBS-RBS method and AHP analysis to analyze the risks of the water environment management project during the flood period. Analysis enables the project risk to be predicted in advance, and the risk is quantified, so that the risk coefficient is minimized and the project construction can proceed smoothly.

1 Introduction

As the economy continues to develop, Chinese government departments pay great attention to the environment. As leaders propose to protect and improve people's livelihood during development, it is necessary to establish and firmly believe that clear water and green mountains are the golden mountains and silver mountains. [1] Black and smelly water treatment projects are under construction in our country. The treatment of black and smelly water bodies is generally divided into four aspects: internal source treatment, pollution interception engineering, ecological restoration engineering, and living water engineering. During the construction of black and odorous water bodies, there are many uncertain factors, so that there are many risks in the construction of black and odorous water bodies. In order to better achieve project goals, risk identification, assessment, response, and monitoring are indispensable parts of project management. There are many risk factors during the construction of black and odorous water bodies during the flood season.

At present, the methods of risk management mainly include Saman Aminbakhsh, Murat Gunduz, Rifat Sonmez, etc., based on the security cost theory, and proposed a security risk assessment framework (COS) model and analytic hierarchy process (AHP) [2]. Huu-Tho N et al. proposed an integrated multi-criteria decision model based on fuzzy analytic hierarchy process (AHP) and fuzzy additive ratio evaluation (ARAS) for the evaluation and selection of conveyors [3].

Liu Yongqiang, Zhang Hongrui, Qian Bijun and others constructed a water conservancy project cost risk evaluation model based on triangular fuzzy numbers. It has been confirmed by practical application that the application of this model can improve the level of refined management of project cost of water conservancy construction enterprises, and has practical effects on cost management [4].

At the end of 2019, the COVID-19 epidemic occurred, everyone was closed behind to fight the epidemic. During this period, our engineering projects were temporarily suspended accordingly. Construction was gradually recovered in May. After the restoration of the construction process, it coincided with the rainy season, therefore, the construction encountered a series of problems such as excessive water level and obstructed excavation. In order to avoid unnecessary losses during construction, taking the water environment treatment EPC project in the east part of a city as an example, the risk analysis and research related to construction during the flood period was launched under the epidemic prevention and control.

2 Project Overview

This project is located in an industrial park in the east of a city. The industrial park is adjacent to the tributary of the Yangtze River. The local area is the Dongting Lake alluvial plain, which belongs to quicksand geology and is rich in groundwater. The depth of the water level is 0.5-0.2 meters. —5000 tons/day; located in the

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subtropical transitional monsoon climate zone, the four seasons are distinct; the rainfall is uneven. The main construction content of this project includes four main channels and related tributaries in the park. Among them, the sewage interception project and the ecological restoration project are the first phase of the project, and the internal source treatment and the running water project are the second phase of the project.

3 Risk identification of the project using WBS-RBS method

WBS (work Breakdown Structure) decomposition

Figure 1.WBS decomposition structure of water environment comprehensive treatment EPC project in the east of a city during flood period construction

On the basis of the WBS structure in the above figure, we construct the RBS risk breakdown structure from the

perspective of the construction process during the flood season, as shown in Figure 2:

Figure 2. RBS breakdown structure during flood season construction of EPC project of comprehensive water environment management in the east of a city

According to the above structural decomposition diagram, the risks in the project can be judged. Combined with the actual situation of the project, the risk analysis is as follows:

3.1. Natural environment risk

The construction area belongs to the flood plain of Dongting Lake, where there are unfavorable geological conditions such as quicksand and underground rivers, and the water level is relatively high, which is not conducive to excavation and construction. In addition, during the flood season, the water level of the outer river is higher than that of the inland river, and the groundwater level rises. Improper response will cause geological disasters such as landslides and soil erosion during construction. In the process of comprehensive treatment of the water environment, the removal of silt in the water, the removal of water weeds, and the removal of weeds and trees on the shore are very important. In the removal process, it is necessary to clean up and

prevent soil erosion and post-cleaning treatment. Silt stacking Improper cleaning and improper stacking will have environmental impact and form secondary pollution.

3.2. Construction technology risk

Any project will have uncertainty in the construction process. Therefore, when it comes to extreme hydrological conditions and engineering geological conditions during the unforeseen flood season, adjustments should be made according to the actual situation. The risk performance is mainly reflected in the following aspects: measurement error, equipment use, concealed engineering, foundation pit support, traffic Risk items such as transportation and lifting.

3.3. Project management risk

Water environment treatment projects are inherently special in the flood season, especially after the impact of

payment method is slow. The time cost requirements for the initial financing funds are very strict. Especially after the suspension of work due to the epidemic, although the state has issued relevant reduction policies, The cost of financing funds is still one of the major sources of risk, especially during the flood season construction process, the construction progress is slow, the implementation of funds is small, and the risks of financial financing will still affect the overall operation.

4 The project uses WBS-RBS method risk matrix

Based on the relevant theoretical knowledge of WBS-RBS and the risk analysis of this project, the WBS-RBS matrix framework of the EPC project of comprehensive treatment of water environment in the east part of a city is constructed. Starting from the project goal, the project is gradually decomposed, and WBS is established at one time Dendrogram and risk RBS dendrogram, according to the interweaving of two tree diagrams to form WBS-RBS risk matrix for loss identification and analysis, one by one judge whether there is a risk in the risk point, and there is a risk. As shown in the following table:

This project is an EPC project. The total contract price is the basic point of lowering the total cost, and the

		Risk assessment																								
		A1				A2				A3				A4				A5								
		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A					
		1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5		
Water environm ent governan ce	B1	B11	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓		✓				✓	✓	✓	✓	
		B12					✓	✓	✓	✓					✓	✓	✓	✓	✓				✓	✓	✓	✓
		B13	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓				✓	✓	✓	✓
	B2	B21					✓	✓			✓	✓			✓	✓	✓	✓	✓				✓	✓	✓	✓
		B22	✓				✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
		B23					✓	✓			✓		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
	B3	B31	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
		B32	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
		B33	✓	✓	✓	✓			✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
		B34	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
		B35					✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
	B4	B41	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
		B42		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
		B43					✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓

Using fuzzy numbers to express preferences, we sampled data from three experts to score. They compared a series of indicators. Each indicator has a fuzzy number, which is (l_1, m_1, u_1) , (l_2, m_2, u_2) , (l_3, m_3, u_3) ;

one $\left(\frac{l_1+l_2+l_3}{3}, \frac{m_1+m_2+m_3}{3}, \frac{u_1+u_2+u_3}{3} \right)$ fuzzy numbers into

Calculate the comprehensive weight of each indicator:

(1) The comprehensive fuzzy value D_i^k (initial weight) of the K-level index i is calculated as follows:

$$D_i^k = \sum_{j=1}^n a_{ij}^k \div \left(\sum_{i=1}^n \sum_{j=1}^n a_{ij}^k \right), i = 1, 2, \dots, n$$

(2) Defuzzification. And find the final weight.

$M1(l_1, m_1, u_1)$ and $M2(l_2, m_2, u_2)$ are triangular fuzzy numbers. The probability of $M1 > M2$ is defined by the triangular ambiguity function as:

$$P(M_1 \geq M_2) = \begin{cases} 1 & m_1 \geq m_2 \\ \frac{l_2 - u_1}{(m_1 - u_1) - (m_2 - l_2)} & m_1 \leq m_2, u_1 \geq l_1 \\ 0 & \text{other} \end{cases}$$

(3) Determine the weight of each indicator at other levels

Using the same method, the next level of indicator A_i weight W_i is obtained, then the total weight of indicator A_i :

$$TW_i = W_{C_m} \times W_i (m = 1, 2, 3, 4; i = 1, 2, \dots, 5)$$

The total weight of the lower-level indicators is calculated.

The fuzzy evaluation matrix of criterion layer is obtained by calculation of this project:

$$W_{C_m} = \begin{bmatrix} 0.58 & 0.55 & 0.40 & 0.50 \\ 0.44 & 0.35 & 0.63 & 0.45 \\ 0.29 & 0.33 & 0.33 & 0.33 \\ 0.44 & 0.55 & 0.38 & 0.44 \\ 0.44 & 0.39 & 0.44 & 0.50 \end{bmatrix}$$

$$TW_i = [0.96 \quad 0.79 \quad 0.59 \quad 0.88 \quad 0.79]$$

6 Conclusion

According to the data, the target-level risk of the EPC project of the comprehensive treatment of water environment is relatively low, and it is basically low-medium risk. According to the specific situation of the project, formulate risk response measures and control plans. After analyzing the above methods, it is found that project management risk > construction technology risk > natural environment risk > safety management risk > financial financing risk. When the project is constructed in the flood season, the project management risk is relatively high. Contract management and schedule control should be strengthened to keep pace with actual construction and construction period claims in special circumstances.

Due to the special circumstances during the epidemic and the flood season, the construction period was delayed. In order to avoid losses as much as possible and quickly resume production, a series of measures such as construction period claims can be adopted to minimize management risks. When the site conditions cannot meet the construction conditions, the construction can be appropriately suspended to avoid economic losses caused by construction technical risks. Due to the impact of the epidemic this year, higher authorities have also introduced many corresponding policies to minimize the risk of financial funds this year.

7 Report

According to the above research, both the EPC project of comprehensive water environment management under the current situation and even other projects under construction have experienced a long period of suspension. The construction has gradually resumed after the epidemic is basically controlled. There are all kinds of obvious or hidden risks. Before resuming production, it is necessary to predict the project risks and formulate response plans. It is an indispensable that the risks identified in advance ensure the smooth progress of the project.

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