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Risk Management in Offshore Engineering Platform Construction

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Abstract: The ocean engineering construction cost is large, technology and safety requirements are high. Therefore, the actual operation and management of Marine engineering construction projects is very complex, which requires comprehensive and high-level project management. This paper mainly studies the risk management of ocean engineering construction. Firstly, this paper focuses on the analysis of several typical risk management methods and processes, and builds the risk assessment model of Marine engineering construction, and calculates the risk weight index by using the analytic hierarchy process. The research results of this paper can provide reference materials for project construction risk management for China's Marine engineering construction industry, and help Marine engineering construction enterprises improve their risk management and control ability.

1. Introduction

As is known to all, ocean engineering construction is a very complicated project construction, project risk management is also very trouble, so the project risk management is in the process of project construction management is very important and necessary, in general, ocean engineering construction units will be built according to the construction stage of ocean engineering can be built according to the production preparation and production implementation stage, According to the risk, it can be summarized into five categories: economic risk, construction capacity risk, technical design risk, equipment acceptance risk and health environment risk [1-2]. Project risk management must first grasp the good design that source, ocean engineering design is according to the owner's demand and function of vision, integration design meet the requirements of large products, need according to the requirements of the classification rules in the design process and technical requirements, but there are many unforeseen functional devices design uncertainty of

unpredictability [3-4]. In the past design process, under the guidance of professional theories, designers usually choose design parameters according to personal experience and data, such a semi-theoretical and semi-empirical design method. Therefore, there are inevitably many defects and risks in the design [5]. The risk management of this paper takes the case as the research object, tries to find out the problems existing in the risk management of ocean engineering projects, analyzes the causes of the problems, and puts forward the countermeasures to solve the problems. At the same time, it provides a reference for other Marine engineering manufacturing enterprises to solve similar problems.

From the perspective of time development, foreign academic circles began to study risk management very early, and project risk management has made certain development and achievements, and risk management methods are also very mature, forming a series of research results for our reference [6]. In the 1950s, the economic crisis originated in the United States and affected the whole capitalist world broke out. A large number of American enterprises and companies were affected by the economic crisis and suffered huge economic losses. In view of this, in order to seek higher economic benefits or social benefits, risk managers began to realize the importance of risk management, cultivate more talents to participate in it, and continue to improve and develop in the later practical application research [7-8]. In the 1960s, the research on project risk management at the social level developed slowly, and some academic research institutions in many countries and regions around the world began to discuss the application of this theory in specific projects in combination with practice [9]. At first, the development of risk management research was mainly applied to finance and insurance industries and achieved certain achievements in those industries. However, due to the limitations of people's cognition, other industries did not receive much attention. With the continuous update of global technological revolution, the risks faced by enterprises, such as policy, cost, time and safety, increasingly affect the development and foothold of enterprises. However, the existing management theories and methods mainly aimed at the financial and insurance industry can not be directly applied in project or engineering project management. Only through continuous optimization and innovation can specific ways and methods meet the needs of enterprises be formed [10-11].

The risk management system for Marine engineering projects has been further improved, so that Marine engineering projects are more standardized, various risk prevention measures are more complete, and the projects are progressing smoothly. To provide reference for Marine engineering peers, in order to improve the risk management level of Marine engineering, better play the value of Marine engineering.

2. Risk Structure of Ocean Engineering Projects

2.1. Project risk Management

There are many specific and applicable methods in each link of project risk management. The following is a review of the more commonly used and practical methods in three stages: risk identification, risk assessment and risk response.

(1) Risk identification

Risk identification refers to finding out the main reasons, secondary reasons and deep-rooted reasons that may lead to risk accidents before the occurrence of risk accidents, and sorting them into different categories. There are many risk identification methods, different enterprises, different risks, its applicable identification methods are not the same, no one identification method can be universally applicable, specific implementation, according to the actual enterprise, the environment, project progress, overall planning of past accidents and current risk hidden trouble, predict the future trend. No matter which method is adopted, as long as the risk is completely identified, simple

may be useful [12-13].

In risk identification, expert survey method, also known as expert consultation method, expert opinion method and empirical analysis method, is mainly used to identify potential risks by pooling the experience, intuition and wisdom of experts [14]. When using this method, it should reflect the collective wisdom and wisdom. Experts from all fields and industries should be involved, and the quantity and quality should be guaranteed. According to the characteristics and complexity of the project, the number of experts should be generally controlled at 10 ~ 20. Expert survey methods mainly include brainstorming method, Delphi method, risk expert survey enumeration method and so on.

(2) Risk assessment

Risk assessment is an activity that determines the level of risks and prioritizes the risks according to the identified risks and assumes the consequences that will result from their realization [15].

Analytic hierarchy process (AHP) is a combination of qualitative and quantitative multi-criteria decision analysis method. When using this method, one is to decompose the risk factors layer by layer; Second, based on expert opinions, the importance degree of pairwise comparison factors at the same level is assigned to obtain the judgment matrix, and then the weight of each risk factor at the level and the risk probability distribution at the upper level are calculated until the probability distribution of the total target is calculated [16].

(3) Risk decision-making

Risk decision is based on risk identification, qualitative and quantitative analysis, combined with risk ranking, acceptable level and risk characteristics, to select mitigation, prevention, transfer and other risk response measures to reduce the probability of accidents and reduce the degree of loss. Risk decision making mainly refers to the four aspects of acceptable, mitigable, transferable and evasive factors [17]. Risk decision-making methods can be classified into qualitative and quantitative methods. The commonly used qualitative methods include experience judgment method, expert consultation method and crisis decision method, while the quantitative methods include expected profit and loss, utility expectation method and linear programming method.

Under the condition of risk, individual motivation behavior and criterion are to obtain the maximum utility value rather than the maximum expected value. Its application steps are as follows: first, establish effect function; The second is to calculate the expected utility loss value of each scheme. Third, choose the scheme with the minimum expected utility loss value [18].

2.2. Risk Assessment Model Construction

After reading a large number of literatures and consulting experts, this paper firstly identifies general risk factors from three dimensions: risk in decision making period, risk in pre-construction period and risk in construction period.

(1) Risk in the decision-making period

Decision period risk refers to the process of whole life cycle of the whole project, due to the influence of the external social environment of adverse factors, project progress and quality cannot be guaranteed, makes the expected return damage risk factors, such as shown in table 1, mainly includes the shortage of professional personnel risks, risks of delay of examination and approval, industry standard system is imperfect risk, policy risk.

The benefits of microgrid construction projects are largely influenced by energy-related policies such as financial subsidies, preferential land use policies and tax incentives. However, at present, there are no clear policies and regulations to support microgrid, especially to guarantee cash flow of assets and owners of microgrid. In addition, the construction cycle of island microgrid is long, and the change of relevant policies in the process is unpredictable, while investors tend to support the

market with the most favorable policies. Policy risks mainly consider local financial subsidies, tax incentives and other aspects, are determined by local support policies and government attitudes, and are expressed by levels.

Table 1. Risk evaluation index system in decision period

	Index layer	Index code	Index type
Risk in decision period (C1)	Talent shortage	C11	Qualitative
	Examination and approval delay	C12	Qualitative
	Imperfect system	C13	Qualitative
	Policy risk	C14	Qualitative

(2) Pre-construction risk

The pre-construction period refers to the risk factors that lead to the decline of the expected revenue of the project due to investment, cost and other reasons during the construction and operation of the project. Economic feasibility is the fundamental factor to measure the success or failure of a project. As shown in Table 2, it mainly includes initial cost, operation and maintenance cost, environmental governance cost and financing difficulty.

Table 2. Pre-construction risk

	Index layer	Index code	Index type
Pre-construction risk (C2)	Investment risk	C21	Quantitative
	Environmental governance	C22	Quantitative
	Profit risk	C23	Quantitative
	Financing risk	C24	Qualitative

Environmental governance cost refers to the emissions of C02, S02 and NO when the system works with diesel generator as power source. The effective compensation cost for the public and public assets can be calculated by formula (1). For investors, the fundamental purpose is to maximize the economic benefits of investment decisions. Therefore, it is necessary to effectively control the environmental governance costs in the construction and operation process of target investment projects, so as to reduce the total cost, increase profits, and promote environmentally friendly and sustainable development with maximum economic benefits.

$$C_{ge} = \sum_{n=0}^{N} \alpha_n \beta_n \tag{1}$$

Where, Cge is the environmental governance cost within a specific period, N includes C02, S02 and NOx generated by fuel consumed by equipment; Alpha n. Is the unit governance cost of gas N; βn is the total emission of gas n period.

(3) Risks during construction period

Technical feasibility determines whether a microgrid project can be established. Good technical level is an important prerequisite for realizing project benefits, while potential technical risks will not only increase project costs, reduce expected benefits, but even threaten the safe operation of the project. As shown in Table 3, the technical risks of island microgrid projects involving seawater desalination system mainly consider the risks of power supply capacity, planning and design, operation and maintenance, and water intake engineering.

Table 3. Construction period risk

	Index layer	Index code	Index type
Construction period risk (C3)	Power supply capacity risk	C31	Quantitative
	Planning and design risk	C32	Qualitative
	Operation and maintenance risk	C33	Qualitative
	Water intake project risk	C34	Qualitative

In this paper, power shortage rate (LPSP) is selected as an index to evaluate the risk of power supply capacity of the system, which can effectively reflect the ability of the system to provide continuous, stable and reliable power. If at time t, the microgrid system cannot provide enough electric energy, energy loss will occur. Then, the ratio of power shortage to total load demand is called power shortage rate, and the specific expression is shown in Equation (2).

$$LPSP = \sum_{t=1}^{T} LSP(t) / \sum_{t=1}^{T} E_t(t) \tag{2}$$

Where LSP(t) is the system energy loss at t, Et(t) is the total system load demand at t.

3. Algorithm Simulation Experiment

In this paper, relevant experts are invited to compare all risk factors pairwise with each other based on their rich professional experience, and grade them according to their importance degree. Aij is the comparison of the importance of risk factors Ai and Aj, the scale assignment given by the scale scale, and the judgment matrix is constructed based on the comparison results of pairwise risk factors. The root method was used to calculate the weight value Wi of each risk factor (I =1, 2, 3, 4, 5, 6). Firstly, the judgment matrix of the first-level index is determined.

Calculate the weight value of risk factors: use the root method to calculate the geometric mean value of each component in the matrix, and get the dimension vector Wi. The analytic hierarchy process (AHP) was used to calculate the results, and the weight values of all risk factor evaluation indexes of the project were summarized.

4. Analysis of Experimental Results

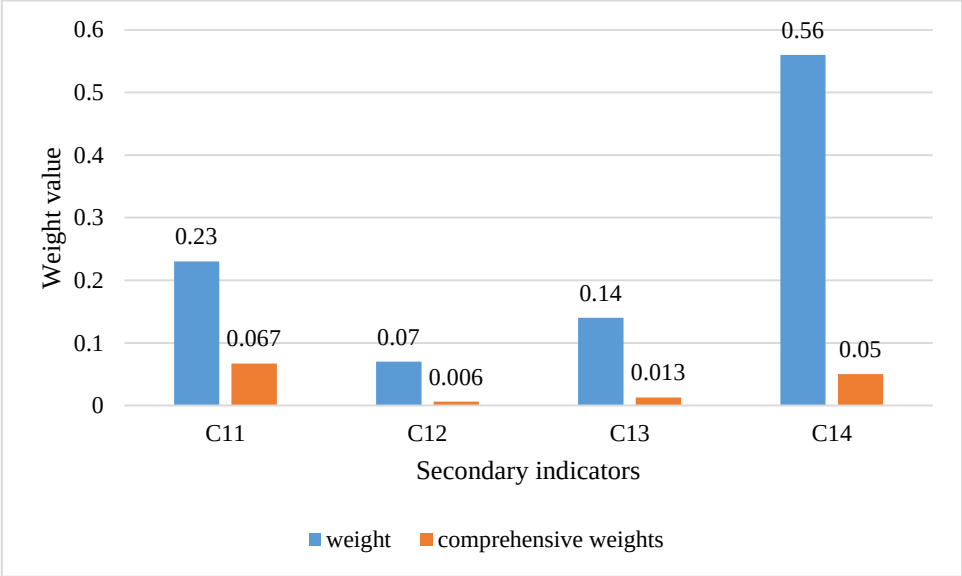

Figure 1. Risk factor weights for the decision period

As shown in Figure 1, is the index weight of risk factors in the decision-making period, and the first-level index of risk factors in the decision-making period is 0.09.

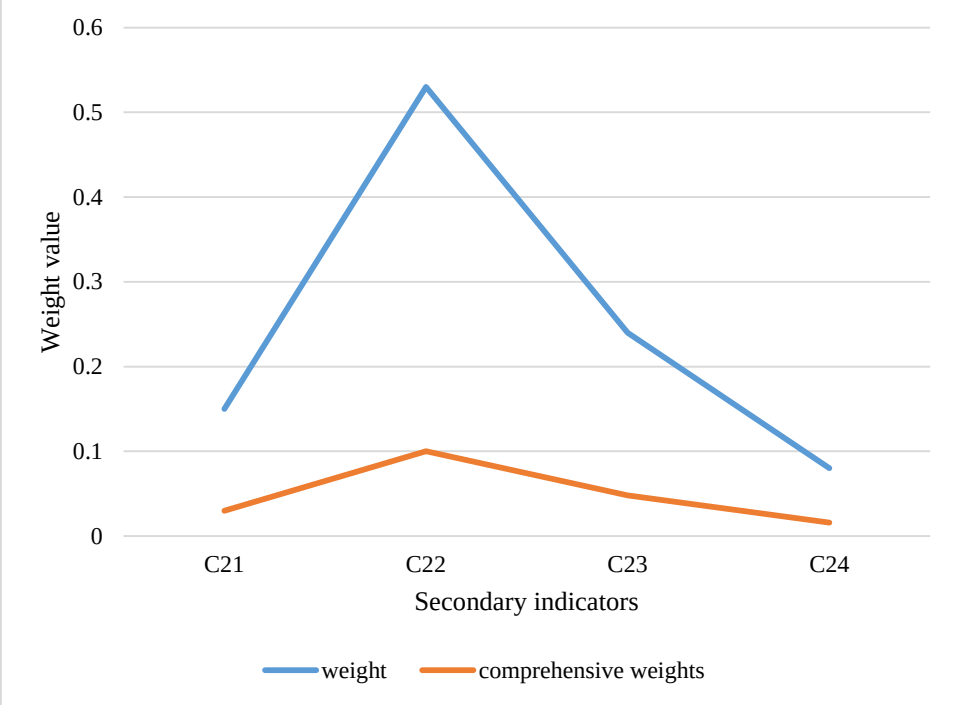

Figure 2. Pre-construction risk factors

As shown in Figure 2, is the index weight of risk factors in the early stage of construction, and the first-level index of risk factors in the early stage of construction is 0.20.

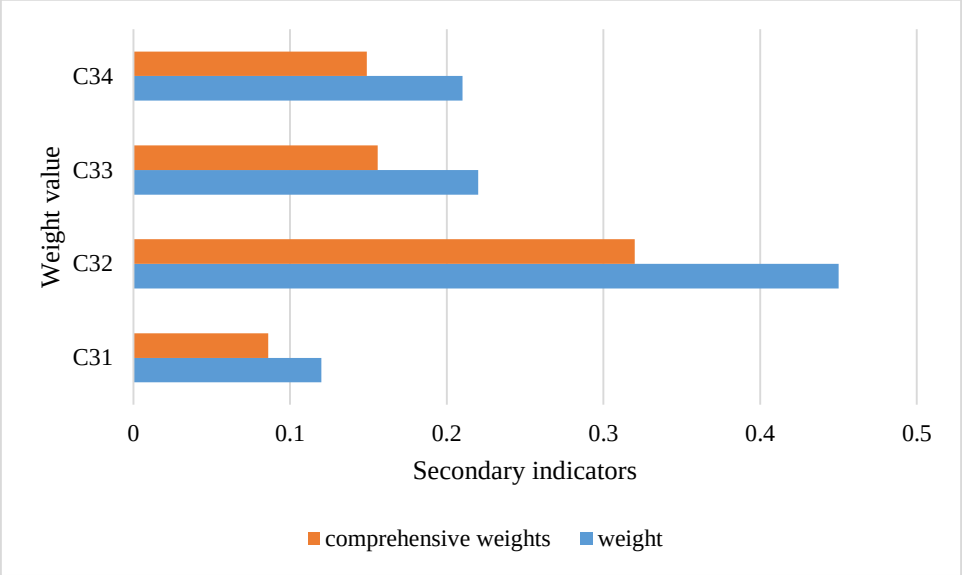

Figure 3. Risk factors during construction

As shown in Figure 3, is the index weight of risk factors in the construction period, and the first-level index of risk factors in the construction period is 0.71.

Through the above chart can be concluded that the weights of risk factors in the process of project implementation and sorting, find out the key of the project risk factors using ABC analysis of a few risk factors, and most of the secondary risk factors, by grasping the key of a few risk factors to focus on the most, to solve the problem of risk at the same time, most of the remaining minor risk factors are also cannot be ignored. Firstly, the comprehensive weight values of all risk factors of the project are accumulated in order from the largest to the smallest, and the cumulative results of the comprehensive weight values are analyzed. Generally speaking, the critical value of the risk level index is set as the cumulative weight of 0-0.65, which is called A class factor, and is A first-level (important) risk factor. Factors in the range of 0.65-0.97 are referred to as class B factors, which are secondary (secondary) risk factors; Factors in the range of 0.97 to 1.0 are known as class C factors and are level 3 (general) risk factors.

5. Conclusion

In the current downturn of the Marine engineering construction industry, owners' requirements on the quality, service and other aspects of the Marine engineering construction enterprises are also increasing. At the same time, the enterprises of Marine engineering construction units are also faced with homogenization competition, price war and other problems. In order to survive and develop, enterprises must strengthen the market development, increase the competitive advantage of products and control the risks. Through the research and analysis of this paper, in terms of risk prevention and control, according to the current situation of a large-scale Marine engineering construction, the project risk prevention and control management measures are designed. Based on the theory of risk response, the basic strategies of risk prevention and control in the construction of the same type of Marine products are designed.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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