

# Search on Risk Assessment of PPP Project Financing Based on ISM-FAHP Model

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**Abstract:** With the rapid development of China's economy, the demand of large-scale infrastructure construction projects is increasing day by day, but the shortage of funds has become the bottleneck restricting the progress of projects. In order to solve this problem, the Chinese government has gradually implemented the PPP project financing model in the field of infrastructure to attract social capital to participate and share the risk. However, with the implementation of this model, the problem of financing risk has gradually become prominent. Therefore, this study aims to provide scientific theoretical support and practical suggestions for relevant decision-making through in-depth analysis of PPP project financing risk and application of ISM-FAHP model.

**Keywords:** PPP model, ISM model, Financing risk.

## 1. Introduction

In the context of today's rapid development of society, the demand for infrastructure construction is growing day by day, but the required funds are often faced with a shortage. To solve this problem, the Chinese government has gradually introduced the public-private partnership (PPP) project financing model to promote the rapid construction of major infrastructure. This model not only diversifies financing channels, but also improves the efficiency of project management.

However, with the wide application of PPP model, the risk problem in the financing process has gradually become prominent, which has become a key factor restricting the sustainable development of projects. Therefore, it is particularly important to conduct in-depth research, reasonable analysis and effective response to financing risks under the PPP model. This study takes the Hangzhou Bay cross-sea Bridge PPP project in China as an empirical case to deeply discuss the related issues of financing risks of infrastructure PPP projects. Through the analysis of the historical data of the project, combined with literature review and field research, we aim to identify and quantify the financing risk factors in the Hangzhou Bay cross-sea Bridge PPP project, build a reasonable risk assessment model, and provide theoretical support for the scientific management and decision-making of the project. Through in-depth research, we aim to provide experience for China's infrastructure construction under the PPP model, optimize the financing model, reduce the financing risk, and promote the healthy development of related projects.

## 2. Literature Review

In foreign countries, the research on the financing risk of PPP projects mainly focuses on the return on capital investment. Taking the UK as an example, Akintoye and Boothroyd analyzed the PFI projects in the UK with the questionnaire survey method and believed that design risk and construction risk were one of the most important risk factors. With the development of PPP projects, scholars gradually

realize that the traditional single project risk assessment method is no longer applicable, and they tend to combine multiple methods to establish a model for risk assessment.

Domestic scholars mainly focus on the identification of financing risks, focusing on the cost of capital, capital liquidity and other aspects of research. Wei Haifeng (2023) conducts scientific management from various angles in the whole life cycle of municipal road PPP projects. Lv Zhangyuan (2023) analyzed the main causes of the dilemma, and proposed legal suggestions on improving the legal system of PPP, strengthening the review of legal compliance of PPP projects, and standardizing PPP related institutional arrangements from the perspective of the government. Wang Qiang, Zhang Zhijun et al. (2023) studied the safety management of PPP highway construction projects from three aspects: safety concept, management mode and resource integration.

## 3. Innovation Points and Project Characteristics

### 3.1. Research direction innovation

From the perspective of financing lenders, this study focuses on the impact of project investment income on financing. Through qualitative analysis, literature research and case analysis are combined, focusing on whether lenders can achieve expected returns, and financing risks are divided into systemic and non-systemic risks. Through the risk factors to the project investment amount and project income transmission analysis, according to the principle of risk bearing financing risk factors reasonable sharing, has a strong practical guidance significance.

### 3.2. Model innovation

In this study, ISM-FAHP model is introduced to analyze the financing risks of PPP projects, emphasizing the importance of systemic and non-systemic risks. Through the concrete analysis of empirical cases, the deviation caused by the independence of hypothesis factors is avoided. The construction of ISM model uses the questionnaire survey method to obtain the relevant data among financing risk

factors, and divides the factors into objective levels. The FAHP model is used to construct a judgment matrix, Delphi method is used to score the relative importance of risk factors, and the weight and risk level of financing risk factors at each level are calculated according to the evaluation results. The model combines qualitative and quantitative analysis to ensure the reliability of the results.

#### 4. Case summary

With the rapid development of China's economy and the improvement of the demand for infrastructure construction, the construction of major projects such as cross-sea Bridges has become the key to promote regional economic development. Hangzhou Bay cross-sea Bridge, as a representative project, faces the challenge of financing risk due to its huge investment scale and technical difficulty. In order to better solve the problem of shortage of funds, the government decided to adopt the PPP model for financing. Through literature analysis and field investigation, we have comprehensively identified the financing risk factors of Hangzhou Bay Bridge project. Considering the particularity of the project, we stand in the perspective of the financing lender, based on the project capital structure and return mechanism, analyze the systemic and non-systemic risks in the financing loan. These risk factors include policy risk, market demand risk, engineering risk, capital liquidity risk, political environment risk and profit return risk. To further assess the relationship between these risk factors and determine their significance, we adopted the ISM-FAHP

model. Through the construction of ISM model, we quantitatively analyze the relationship between various risk factors, and then use FAHP model to calculate their weights and levels in the overall financing risk. This analytical framework provides a scientific basis for further empirical analysis.

#### 5. Empirical Analysis

In our research, we take the Hangzhou Bay Bridge project as a case for in-depth empirical analysis, focusing on the perspective of financing lenders. By designing a comprehensive questionnaire survey of policy, market, technology, capital and other factors and consulting experienced experts to score, we have obtained detailed data on various financing risk factors. We use questionnaire survey to calculate and analyze the weight of policy risk, market demand risk, engineering technology risk, capital liquidity risk, political environment risk and profit return risk. This provides us with the relative importance of these factors in the overall financing risk, helping to more accurately understand their actual impact on project financing. Secondly, we use analytic hierarchy Process (FAHP) to further divide each financing risk factor into different levels. This provides insight into the interrelationships between the various factors and their contribution to overall financing risk. The empirical results show that in the whole hierarchical structure, engineering technology risk and profit return risk occupy a relatively significant position, and their impact on project financing is relatively large.

**Table 1.** Empirical analysis of financing risk of Hangzhou Bay Bridge project

Risk Level	Risk factor	weight	Risk level
Surface	Policy risk	0.25	Middle
Surface	Market demand risk	0.15	Low
Interlayer	Engineering risk	0.30	High
Interlayer	Liquidity risk	0.20	Middle
Deep	Political environment risk	0.10	Low
Deep	Profit return risk	0.25	High

Through in-depth analysis of the results, we comprehensively evaluate the financing risk of Hangzhou Bay Bridge project, and put forward feasible countermeasures. In the face of engineering and technology risks, we strongly suggest that the project management team strengthen technology research and development efforts, and actively introduce advanced construction technology and engineering management means, in order to effectively reduce the probability and impact of engineering and technology risks. Specifically, we can strengthen cooperation with universities and research institutions through the establishment of technological innovation teams to promote the innovation and optimization of project technical solutions. At the same time, intelligent monitoring system and advanced building information modeling (BIM) technology are introduced to improve the accuracy and controllability of engineering construction. These measures not only help to improve the quality and efficiency of the project, but also effectively mitigate the potential financing risks caused by technical problems. This empirical analysis provides valuable empirical support for similar infrastructure construction projects in the future. It is necessary to consider systemic and non-systemic risk factors comprehensively in project financing. Our findings not only provide practical guidance

for decision makers, but also provide stakeholders with a clear understanding of project financing risks, thus providing a solid foundation for the sustainable development and successful implementation of projects.

#### 6. References Policy suggestion

Technological innovation and research and development support: strengthen the government's support for technological innovation and research and development, and set up a special fund to finance project technological innovation. Establish a professional technical team in the industry, establish strategic partnerships with universities and research institutions, and jointly promote the application of cutting-edge technologies in the project. Set up a reward mechanism to encourage the innovative practice of technical personnel in the project.

Diversified financing channels: Formulate policies to encourage project parties to raise funds through diversified financing channels. The government can provide tax incentives to encourage enterprises to obtain funds through the bond market, equity financing, etc. Establish a bridge of cooperation between financial institutions and project parties, and provide more flexible financing solutions.

Risk sharing mechanism: Establish a sound risk sharing mechanism based on empirical analysis results. Clarify the rights and responsibilities of each participant in the financing process, and ensure that the sharing of risks is in line with the actual risk tolerance. Third-party assessment institutions can be introduced to conduct professional assessment of risk factors to provide an objective basis for risk sharing.

Information transparency and communication mechanism: Implement information disclosure policy to ensure project information transparency. Establish a regular project reporting system, and disclose key information such as the project financing plan and the use of funds. Establish social hotlines and interactive platforms to strengthen communication with various stakeholders, respond to social concerns in a timely manner, and build a good project image.

Establish a risk prevention system: At the early stage of the project, set up a special risk management team to make detailed risk prevention plans. Conduct regular risk assessment, identify, analyze and formulate response strategies for various risks. Establish flexible response mechanisms to ensure timely and effective response to emerging risks throughout the project life cycle. Formulate clear laws and regulations to regulate the financing process of PPP projects. Strengthen legal responsibility, strictly punish violations, improve the legal nature of contract performance, and enhance the confidence of investors and financing institutions. The government may consider formulating differentiated financing regulations for special projects such as cross-sea Bridges to better meet the actual needs of the projects.

Encourage the introduction of venture capital institutions to participate in project financing and share project risks. Set up a special financing risk insurance institution to provide comprehensive financing risk protection for the project. The government can provide discount interest or incentive policies to attract insurance institutions to participate in

financing risks and reduce the overall cost of project financing. Promote the market pricing of projects, so that the financing scale and return level of projects are more in line with the market reality. Establish a flexible price adjustment mechanism so that the project can better adapt to market changes. Through market-based pricing, we can attract more social capital to participate, increase financing sources for projects, and reduce the financial pressure on the government.

Develop long-term infrastructure planning and anticipate the financing needs of future projects. Establish a risk early warning mechanism for project financing to discover potential risk factors in time. The government can entrust professional institutions to conduct risk assessment, provide scientific basis, and ensure that the project can better cope with various risks and challenges in the financing process. Establish a long-term mechanism for cooperation between the government and enterprises, and strengthen information sharing and strategic coordination. The government can promote the timely transmission of project information and effectively solve the problems in the project by establishing PPP joint offices with enterprises. Establish a normal communication channel between the government and enterprises, form a joint force, and promote the financing and construction of projects.

## References Policy suggestion

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