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Research on Risk Countermeasures of Transportation Infrastructure PPP Project

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Abstract: The public-private-partnership (PPP) model has become an important way to implement transportation infrastructure projects, but with the rapid growth of the scale of transportation infrastructure PPP projects, the risk problem of PPP projects has become increasingly prominent, and many projects have suffered losses or even project failures due to improper risk management. This paper identifies and classifies the risks arising from transportation infrastructure PPP projects, distributes the risk factors among different participants, and finally proposes risk countermeasures for PPP projects.

1. Introduction

PPP projects of transportation infrastructure (hereinafter referred to as "PPP projects") are more complicated than general construction projects, which are mainly reflected in huge investment, long contract period (concession period is generally 20-30 years), complex financing, different purposes of stakeholders and so on. Therefore, the premise and guarantee of planning and formulating a fair and reasonable risk sharing scheme is to clearly identify the risks of PPP projects. In the construction of transportation infrastructure, private enterprises and private capital cooperate with the government, because the individual nature and level of the partners are quite different in each stage of project planning, decision-making, construction and operation, and the whole project has a long cycle and many links, so various risks may appear in the project. In order to prevent this risk event from adversely affecting the project, project managers should be targeted to strengthen the identification of various risks in PPP projects, and put forward targeted methods to reduce or eliminate risks to ensure investment returns.

2. Identification and Classification of PPP Project Risks

With the time and field of research concern, the list of risk factors of PPP projects is constantly changing. From the late 1990s to the early 21st century, PPP projects were only applicable to a limited number of areas. In this pilot stage, the risk research on PPP projects is exploratory, and typical case studies are used as the main method. For example, Wahdan[1]identified eight types of

risks through the Prince Edward Island Bridge project in Canada. Zhang and Wang [2]discussed 12 risks of Yan 'an East Road tunnel project, the second cross-river tunnel in China and Shanghai. Later, as PPP projects became more and more common in the world, the risk list of PPP projects continued to develop, becoming longer and more diversified. Li and Akintoye [3] reviewed a large number of PPP projects and risk management literature, and put forward a total of 46 risk factors related to PPP projects in the UK. Ke and Wang [4] compared China's risk distribution preference based on the risk list made by Li. Ameyaw and Chan [5] refer to various literatures and cases to identify 40 risk factors that affect China's traffic PPP project. Alkaf and Karim [6] screened the previous studies on the risks of PPP projects and put forward 81 risk factors. Che et al., identified 22 risk indicators for transport PPP projects from the macro and micro levels [7].Using the method of questionnaire and literature analysis, 20 risks of urban rail PPP project were identified [8]. Zhu et al., built the risk transmission path of transportation infrastructure PPP project and form the risk transmission network relationship [9].

The existing literature proves that the risk factors of PPP projects are different in different administrative jurisdictions and industries. After sorting out and analyzing, the key risks of PPP can be classified into financial and commercial risks (including 8 risk factors), legal and socio-political risks (including 7 risk factors), technological and natural risks (including 8 risk factors) and cooperative relationship risks (including 9 risk factors).

(1) Financial and commercial risks

Financial and commercial feasibility is the basis of implementing PPP projects. When investors finance projects, they often face many challenges, such as difficulty in obtaining credit from local banks, inability of local institutions to provide long-term financing or equity financing, lack of financing support and guarantee from the host government, and high financing costs. The project will also be affected by the macroeconomic environment, including the instability of the financial system, macroeconomic adjustment, the weak capacity of domestic banking institutions, influential economic events, capital market and interest rate fluctuations.

Income risk is also a key factor affecting the success or failure of the project, and the income depends on the demand, price and relevant subsidy measures of the government.

The contract guarantees the cooperative relationship, and the PPP project mainly participates in the rights and obligations, income distribution and risk sharing agreed by both parties through the contract. The matters discussed by both parties should be implemented in the specific terms of the contract. Excessive changes in the contract during the cooperation period will cause risks to the project. In addition, the agreement on performance appraisal standards by both parties and the specific matters related to income and performance appraisal should be clearly defined in the contract.

(2) legal and social and political risks

Legal and socio-political risks are macro-level risks, which will have a serious impact on the project once they occur. Law is very important for PPP projects, because it provides a regulatory and institutional framework and takes into account the interests, obligations and rights of all parties [10]. There are considerable risks for foreign investors to implement PPP projects in countries with imperfect legal framework, which may lead to corrupt political and business environment and unreasonable administrative behavior. Changes in laws will also bring unpredictable risks to PPP projects. For example, in 1990s, many foreign investors participated in BOT projects in China and obtained the fixed rate of return promised by local governments, thus reducing operational risks and ensuring the economic interests of PPP investors.

Because most PPP projects involve infrastructure projects related to people's livelihood and are sensitive to investors, there may be risks such as technical requirements of the government for equipment and supporting equipment, restrictions on social capital and construction and operation.

In addition, the government's support for the project is very important. The government plays the role of both supervisor and participant in PPP projects. Especially for social capital, the position of the government is relatively strong. Once a project lacks government support and recognition, it will face great failure risks.

(3) Technical and natural risks

The development of infrastructure projects cannot be separated from the support of technology, especially large-scale infrastructure projects have higher requirements for engineering technology, which is also an important consideration for the government to choose social capital. Technology is used to ensure project quality, control project cost and make the project meet local requirements. Technology not only refers to the technology of project construction, but also includes the technology of project management and operation in the whole project cycle. Any technical error in any link will cause the risk of project failure. Technical risks also include lack of innovation in design, lack of reliability in technology and outdated technology. The natural environment also has an important influence on the smooth construction and operation of the project. In addition, force majeure is also a risk factor worthy of attention. Although the probability of occurrence is small, once it happens, it will have a serious impact on the project.

(4) Risk of cooperative relationship

The essence of PPP mode is a cooperative relationship between the government and social capital. In addition to the two, it also involves many other stakeholders, such as local residents of the project, employees involved in the project, other contractors or cooperative enterprises. Good cooperation between different stakeholders is very important for the realization of project objectives. Due to the complexity of stakeholders in PPP projects, the risk of partnership is also an important challenge.

Good partnership is very important for the smooth development of the project. The unfair distribution of partners' responsibilities, risks or powers, the differences in working methods, technical levels and management strategies among partners, and the failure of any partner to fulfil their commitments are all potential risks of cooperation. In addition, in the cooperation between all parties, due to the lack of cooperation foundation, mutual trust is low, and stakeholders need time to run in and build trust. Due to differences, competition and conflicting interests among participants, the lack of coordination between government and social capital usually leads to contradictions and the loss of value for money (VFM).

In the relatively long cooperation period of PPP projects, the long-term management and operation have high requirements on the ability and cooperation effect of all parties. Fair cooperative status is the basis of a cooperative relationship. Both parties also need to agree and clarify various affairs in the contract in advance, and determine a consistent dispute solution.

3. Risk Allocation of PPP Projects

(1) PPP project risk sharing stakeholders

The main participants of PPP project are government, social capital, raw material suppliers and financiers.

(2) PPP project allocation principles

Risk management is an important aspect of PPP project management, and PPP mode emphasizes the risk sharing and benefit sharing of all parties involved, so a reasonable risk allocation scheme has become an important part of PPP project risk management. Reasonable distribution scheme should follow certain principles. Based on the comprehensive theoretical research and case study, the risk allocation principles it follows mainly include the following points:

Optimal distribution principle. The principle of optimal allocation means that each specific risk

should be allocated to the party who can bear it at the lowest cost and has the most control over the corresponding risk, and gives the risk-bearing party the right to choose how to deal with and minimize the risk. This ensures a low-risk cost and a strong risk management level, and also encourages all parties involved to make efforts to control risks to a certain extent.

The principle of imputation. The principle of imputation, that is, determining the attribution of responsibility, is a commonly used method in law to solve the dispute of responsibility assumption, which has certain reference significance for the risk sharing of PPP projects. There are many stakeholders in PPP projects, and the reasons leading to risk events are not single, and the contractual relationship between the parties is complicated, which makes the responsibility attribution in PPP project risks relatively complicated. Therefore, the imputation framework can be established for different types of specific risk factors, and a diversified imputation principle system can be constructed. For the risk factors that can define the fault party and the imputation object, the imputation principle can be used to analyze them; If it is impossible to accurately distinguish the faults of stakeholders, it is necessary to adjust the sharing strategy according to the actual situation and other risk sharing principles.

The principle of risk-return reciprocity. The principle of reciprocity of risk and return means that if a project participant obtains the greatest economic benefits when managing a risk, the risk should be borne by this subject. This principle not only emphasizes the participants' commitment to risk management costs and risk losses, but also respects their right to obtain benefits commensurate with the risks they bear. If the cost of risk management is greater than the corresponding income, risk transfer can't happen voluntarily, and risk allocation is valuable and meaningful only if all participants get benefits from risk sharing. This idea coincides with the asset pricing theory.

The risk has an upper limit principle. The upper limit of risk loss should be set according to the financial strength, technical ability, management ability and other factors of each participant in the project risk allocation, and no one party can bear the risk beyond its capacity alone to ensure the long-term and sustained stability of the cooperative relationship between the two parties. Otherwise, any participant may not be able to guarantee the supply efficiency of public goods or services, which will ultimately affect the enthusiasm of project participants to maintain partnership and the sustainability and stability of the project.

The principle of dynamic risk sharing. Different from the traditional financing mode, PPP mode emphasizes the integration of project life cycle, which lasts for decades. During this period, many unexpected situations may occur, while the probability of the same risk event at different stages is very different and its impact on the project is not consistent, so the probability impact of the risk event itself is changing. Therefore, from the perspective of PPP project life cycle, the unchangeable risk allocation scheme is unreasonable and unfair, and the risk allocation must be dynamic to adapt to the characteristics of different stages of the project and the changes of participants' management level.

4. PPP Project Risk Response

Decision makers will respond to risks. In most cases, there are four main risk response measures. Avoidance, elimination, transfer and retention. The best choice to deal with risks should be to avoid risks, but this is difficult to achieve in practice, because avoiding risks also means losing opportunities at the same time. Therefore, in most cases, it is more realistic to minimize risks and even eliminate the impact of risks on the project in an ideal situation. When dealing with risks that cannot be reduced or eliminated, decision makers choose to transfer or share the remaining risks, such as buying insurance and preparing emergency expenses. Thus, in the actual project management, risk response measures will affect risk management, which is reflected in the

following aspects:

First of all, the risk response measures affect the final distribution of risks. Through negotiation, signing agreements, signing memorandums, etc., the participants have basically defined their rights, responsibilities and obligations in project implementation, and they may take relevant measures to transfer risks when dealing with risks. Because different participants have different risk control capabilities and coping measures, risks may be borne by a third party other than the initial allocation scheme along the complex relationship between participants in the transfer process, or even flow back to the party that originally transferred the risks.

Secondly, the risk response measures affect the risk consequences. Different participants have different risk management levels and risk preferences. In the face of the same risk, different participants will choose different measures to deal with it. Participants with high risk management level and sufficient experience can reduce the risk, and the risk assessment level is reduced to a certain extent compared with the assessment value when allocating risks. At this time, it is necessary to re-examine the risk allocation plan.

Finally, risk response may produce new risk events. Risks are interrelated, and specific measures to deal with a risk are diverse. Appropriate countermeasures may reduce other risks and even avoid some risk events while reducing the corresponding risks. The poor response measures may produce new risk events and even affect the development and operation of the whole project.

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