A Decision Model of Risk Allocation for Urban Rail Transit Projects under Public-Private-Partnership Model: A Research Framework

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Abstract. In the field of supplying urban rail transit projects, Public-Private-Partnership (PPP) model is an important implementation approach in China, but the project management performance is still not satisfactory owing to lack of reasonable and quantitative risk allocation models. At first, on the basis of literature review, this paper puts forward a logical framework of study on risk allocation model for the urban rail transit project under the PPP model. And then, it deconstructs the main research points which include collecting and analyzing the influencing factors of project risk allocation, constructing the theoretical framework of risk allocation decision, constructing and verifying the quantitative risk allocation decision model. Finally, the paper provides several methods for this research theme. The viewpoints of the paper have some methodological significance for theoretical research and practical work on the risk allocation decision of the PPP project.

Introduction

In today's China, the construction of urban rail transit project(s) (URTP) continue to maintain steady growth, Public-Private-Partnership (PPP) model has become the main implementation model due to it can take full advantage of the public sector and the private sector. In essence, the key success factors for PPP project is how to allocate the project risks reasonably. In other words, only through allocating the project risks to the appropriate body (the public sector or the private sector), the PPP project can be successful [1][2]. At present, owing to the main study paradigm of RA decision in PPP project is normative research, the RA lists of project risks is based on the theoretical (or ideal) principle rather than the actual decision situation, which leads to the ideal solution is difficult to be implemented efficiently—the contractors usually take on more project risks which causing a lot of controversies at the stage of contract implementation [3]. Therefore, the construction of decision model on risk allocation (RA) for URTP under the PPP model has important significance for the current national conditions of China.

Literature Review

Research Status and Trends of RA in Engineering Management

The empirical evidences show that allocating the project risks resonably among the participants of project can save project costs and time, which promote the theoretical research on RA decision-making in the field of engineering management. It focuses on on the following two aspects. The first one is summarizing and refining the theoretical principles of RA, and its purpose is to guide the contractual arrangements of RA [4-7], but other studies have found that there are some deviations between the theoretical principles and the practical operation of RA, or even completely opposite [3]. The second one focuses on the quantitative studies of RA decision, and its main idea is to construct quantitative models of RA decision by AHP, fuzzy mathematics, game theory and other mathematical tools [8][9]. In short, the normative research results showed increasingly out of touch with reality, and
the quantitative studies of RA decision maybe more active which reflects the development trend of RA decision in the future.

Analyzing of Influencing Factors on Project RA

The complexity of the Project RA decision determines the diversities of its influencing factors. Vega has explored earlier the influencing factors on project RA decision [10], Hartman et al. have expanded the study scope of RA decision [11], which provides a good reference for Chinese scholars to carry out the similar studies, thus more and more studies of RA decision began to advance in China. ZHAO Hua and YIN Yi-lin have provided a more systematic and complete discussion, which may be reflect the depth of the current study on this theme basically [12].

Research on RA of PPP Project and its Influencing Factors

PPP project RA is an active research topic. However, the existing research is no fixed pattern, nor does it come only viable solution [10][13]. Fraud & Shaoul found that RA of PPP projects were too subjective and did not achieve the desired performance [14]. Therefore, more and more scholars proposed PPP project RA decision should take into account situational factors [15], with respect to the generally accepted principles of RA, the reality of the RA decision was determined more by business needs, creditors demand, enterprise bargaining power and its culture or policy [3].

In summary, the RA decision is an active topic in the study field of engineering management, fine decision-making demand in the practice makes the quantitative decision model become a cutting-edge research, and some related research results has been achieved. But for the RA decision of the urban rail transit project under the PPP model, some influencing factors on RA decision of the real transaction situation were still lack of full considerations.

Methodology and Research Contents

Logical Framework of Research

According to the literature review above, it is easy to find that the existing theoretical study results on RA can be lack of guidance for the practical decision of URTP under the PPP model. In view of above, only through analyzing the real RA decision situation, exploring the influence factors of the RA decision and their influence levels in PPP project, the quantitative decision model on RA in PPP project can be constructed, which can provide decision support for the owners of the URTP under PPP model. This paper’s research logical framework is shown as Figure 1.

Research Contents

According to the research logical framework are shown as Fig. 1, to construct a quantitative RA decision model for the URTP under the PPP model is necessary to study the following three aspects.

A. Collecting and analyzing the influencing factors on RA decision for the URTP (PPP model).

Due to there are rare thematic studies on quantitative RA decision model for PPP project, and the theoretical explore disjointed the practice, the primary research step is achieve the influencing factors list which can be suitable for PPP model and the URTP.

B. Constructing the theoretical framework of RA decision for the URTP (PPP model)

Although obtaining the above influencing factors list, it does not directly guide the practical RA decision. Obviously, the different factors in the list influence the RA decision differently, some have relatively large effect, some are not obvious, and some even may be not affect. Therefore, on the basis of questionnaires and statistical analysis, to assess the importance of different factors, and to construct the theoretical framework of RA decision, is the next research step.
C. Constructing and verifying the quantitative RA decision model for the URTP (PPP model).

Based on the study aforementioned, the quantitative RA decision model for the URTP (PPP model) can be constructed, but its validity is still questionable, which means that it still needs to be studied to test. Therefore, some case studies and statistical analysis are necessary to test the quantitative RA decision model for the URTP (PPP model), which has become an essential research content naturally.

Research Methods

As shown in Fig 1, this paper presents several methods, their specific study objects and related descriptions of as shown in Table 1.
Table 1. Research Method and its description.

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<th>No.</th>
<th>Method</th>
<th>Study Object</th>
<th>Related Description</th>
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| 1   | Literature review | i. collect influencing factors of project RA  
|     |                 | ii. judge the suitability of above factors for PPP model and URTP  
|     |                 | i. review must be systematically  
|     |                 | ii. according to the topic, complete  
|     |                 | the initial screening and exclude nothing to do with the theme  
|     |                 | iii. attain primary factors list |
| 2   | Expert Survey   | same as above                 | supplement literature review                                                       |
| 3   | Questionnaire   | data collection               | i. if respondent does not agree with the survey's point of view, he or she can put forward his/her views  
|     |                 | ii. a respondent need to present evaluation value for every influencing factor’s importance |
| 4   | Statistical Analysis   | i. confirm influencing factors  
|     |                 | ii. construct decision model  
|     |                 | iii. test decision model  
|     |                 | i. sample capacity to meet the statistical requirements  
|     |                 | ii. faithful to the original data |
| 5   | Case study      | model validation & optimization | project performance as constrain                                                  |

It should be noted that this paper only presents a general descriptions of the several methods shown in Table 1, which does not means that its logical order and absolute range of applications, in fact, the literature review method should be adopted in the full course of the study.

Summary

At present, the large-scale construction of the URTP in many Chinese cities is the norm phenomenon. Correspondingly, the reform of supply in the field of urban infrastructure is increasingly deepened, which including the system of investment and financing, construction management, and so on. In current China, the PPP model has become an important choice in the supply field of the URTP, the lack of meticulous guidance for RA decision of the PPP model, has becomes one of the key issues in the supply system reform process of the URTP. This paper presents a research logical framework of RA decision in the URTP under the PPP model, analyzes its research contents and the related research approaches and methods, which has some guiding significance for the theoretical study topic. Furthermore, to a certain extent, the research approaches in this paper has been able to guide the practical operation.

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