Risk Factors of Public-Private Partnership Projects in China: Comparison between the Water, Power, and Transportation Sectors

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Abstract: With the growing economic development experienced in China, there is an urge for more and better public infrastructure. Public-private partnership (PPP) is an innovative method for delivering these facilities and services. However, along with this method there are certain risk factors that exist or are more severe when compared to the traditional delivery method. This paper considers three types of common public projects in China that are often delivered by the PPP method, including water and wastewater, power and energy, and transportation. For each type of project, experienced practitioners in China were asked to rank the severity of 20 risk factors sought from a comprehensive literature review. The top five most severe risk factors for each type of project were considered. Government intervention and public credit were ranked severe for all three types of projects. The findings indicate that the most severe risks are government-related. It appears that the stakeholders have low confidence in the government. These findings have highlighted the severity of risk factors for common types of PPP projects in China. With this information, both public and private parties can be more aware of which risk factors would be the most severe for certain projects. As a result, appropriate precautions can be made to avoid or minimize the likelihood and consequences of these risks. By doing so, PPP projects can be carried out more successfully, and their further use can be encouraged in China. PPP stakeholders from other countries can also use the findings presented in this paper to prevent the occurrence of potential risks. Furthermore, the methodology adopted in this paper can easily be adopted for other countries. **DOI: 10.1061/(ASCE)UP.1943-5444.0000086.**

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Introduction

Public-private partnership (PPP) has been used internationally in more than 85 countries as a procurement method for delivering public infrastructure (Regan et al. 2009). Its main characteristics include a competitive bidding process, appropriate balance of project risks, private sector innovation and expertise, and improved public services and facilities. In China, PPP projects were introduced in the late 1970s as an attempt to encourage the country's reform (Adams 2006). With increasing demand for more and better infrastructure, the Chinese government started to apply PPP schemes at a large scale in the 1990s by introducing more foreign investment, especially for water, power, and road projects (Sachs et al. 2007). Although the PPP model may appear attractive for use in the large amount of infrastructure development currently being conducted in China, there is a need to structure the existing practices of PPP adopted in other countries to suit the local economic, financial, legal, and regulatory environment. In doing so, there are many challenges that are foreseeable (Chen and Doloi 2008).

China has already had some experience with PPP projects. Some of the more successful cases include Line 4 of the Beijing Metro, the Beijing National Stadium (also referred to as the Bird's Nest), the Olympic Water Park project, the first sewage treatment plant of Shanghai Zhuyuan, the Hangzhou Bay Bridge, Line 4 of the Shenzhen Metro, the sewage treatment projects in Canton Xilang, and the 10 water plants in Beijing. These cases have demonstrated that the PPP model is easier for financing in a shorter amount of time, reducing the financial burden on the local government, providing investment diversification and a reasonable amount of risk-sharing (Qu and Li 2009). Consequently, PPP is seen as beneficial to ease the financial pressure on the Chinese government. In addition, with these projects normally being on a large scale, the profits are particularly attractive to the private sector. This win-win idea means that both the public and private parties are supportive of adopting the PPP arrangement for projects in China.

The Chinese government believes that PPP is an effective way to ease their financial burden (Liu and Yamamoto 2009). Furthermore, they also believe that it is more efficient than the traditional model of financing. Other benefits achievable include flexible management mechanisms, expertise, and cost-awareness. However, the implementation of PPP in China requires certain conditions. For example, the investment system should be improved to facilitate further partnerships, and the policy and legal environment should

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be more mature. There are underlying risks for all stakeholders involved with PPP projects. This paper identifies the risk factors that occur in the three most common types of large scale public projects in China: water and wastewater, power and energy, and transportation. By highlighting and comparing the severity of different types of risks that occur in these projects, they can be better avoided. The findings presented in this paper are useful for PPP professionals in China and other countries for preventing risks.

Risk Factors of Public Private Partnership Projects

Projects procured by PPP tend to be subjected to more risks compared to those projects that are procured traditionally because of the complexity of PPP projects. The study by Ke et al. (2009) confirmed that risk management (including risk identification, risk evaluation, risk allocation, risk management, financial risk, political risk, and market risk) has continued to be one of the main research interests for PPP in recent years. Furthermore, Khasnabis et al. (2010) emphasized the importance for future PPP studies of considering risk and uncertainties. Consequently, this section explores some of the studies that have been conducted by previous researchers in the area of PPP risks.

Unkovski and Pienaar (2009) considered the management and analysis of PPP risks. Their results showed that, although there are many risks associated with PPP projects, the method is still considered to be advantageous in South Africa because it is lower in cost and more manageable when compared to using the traditional method where the government finances and delivers the project themselves. Three major types of risks were categorized in their study: technical, financial, and legal risks.

Cheng and Shi (2009) identified similar risks for PPP projects but also provided a different perspective on how they should be considered. They defined PPP risks according to two main groups: systematic risks and nonsystematic risks. Systematic risks refer to those that are caused externally and cannot be controlled by the concessionaire. They include political risk, legal risk, financial risk and contingent risk. Nonsystematic risks are those risks that are related to the project construction and operation. These can include completion risk, operation risk, and market risk.

The Efficiency Unit (2008) of the Hong Kong Special Administrative Region in China classified in their guideline for conducting PPP projects the key types of risks. These include: demand risk; design and construction risks; operation and maintenance risks; technology/obsolescence risk; finance risk; legislative risk; approval risk; and hazard risk. Again, similar risks were identified by different researchers irrespective of geographical location.

Chen and Doloi (2008) conducted a comprehensive literature review looking at the factors holding back PPP projects in China and elsewhere. They found that those factors specific to China include: opaque and weak legal systems; complex approval systems; regulatory constraints on market entry; low market prices for infrastructure products and services; creditworthiness of local utilities; no direct interests to local government and its subordinates; and foreign currency administration difficulty. What makes these PPP risks that were identified for China unique is that they are all related to or affected by the local government in one way or another. Previous research indicates that the government should take more responsibility for providing a suitable environment to engage PPP projects.

Li and Zou (2011) derived slightly different findings from their study. They presented a fuzzy analytical hierarchy process as a risk assessment technique for a PPP expressway project in China. The results showed that planning deficiency, low project residual value at the end of the concession period, lack of qualified bidders, design deficiency, and long project approval time were assessed as the top five risks for the project.

Furthermore, Li and Liu (2009) suggested that to implement PPP projects in China, the risks of the project need to be considered from different angles, including curiosity, long-term risks, complexity, various levels within the project, and different goals of stakeholders. They firmly believe that the severity of the risks would differ depending on whether it is a traditional or PPP project being considered.

The effective handling of risks is often related to the appropriate risk allocation between the public and private sectors. The study of Ke et al. (2010) aimed to identify the preferred risk allocation of PPP risks in mainland China, Hong Kong, the United Kingdom, and Greece. The results of their study indicated that political, legal, and social risks should be handled by the public sector in mainland China and Hong Kong. Other researchers have also demonstrated different techniques to handle risk allocation. For example, Jin (2011) found that neuro-fuzzy models could be used to forecast efficient risk allocation strategies for PPP projects at a highly accurate level, which would be impossible by using multiple linear regression models and fuzzy inference systems. The same researcher conducted a previous study (Jin 2010) that considered the features related to risk allocation in PPP projects, including partners' risk management routine, partners' risk management mechanism, partners' cooperation history, risk management environmental uncertainty, and partners' risk management commitment. These features were used as determinants in the decision-making process of efficient risk allocation.

Duffield (2001) took another step forward to propose a risk evaluation technique to assess the severity of risks for different PPP projects. The likelihood and consequence of the risk would be represented by a risk index. Furthermore, the risk index would be defined according to four categories of severity that would suggest the approach for handling the risk. These categories include: (1) relying on procedures and contract administration to manage risk; (2) line management awareness and control; (3) director awareness; and (4) ministerial awareness. Similarly, Pantelias and Zhang (2010) proposed a methodological framework to evaluate the financial risk of transportation infrastructure projects delivered by PPP. They claim that the approach is simple to use and effective for considering investment options through scenario and sensitivity analyses.

Research Methodology

Data for this research study were primarily collected through interviews conducted with experienced practitioners in China. The respondents were asked to rank the importance of risk factors for the three types of projects: water and wastewater, power and energy, and transportation. Ranking and prioritization of risks in PPP projects is an important part of risk management so that risks can be effectively allocated to the most appropriate party (Iyer and Sagheer 2010). This section describes the design of the interview template and the background of the interview respondents. Furthermore, the analytical techniques adopted are explained. These include: mean score ranking, Cronbach's alpha, and Kendall's concordance analysis.

Design of Interview Template

To analyze the risk ranking and allocation for different types of PPP projects in China, an interview template was designed and conducted with PPP experts. Respondents were asked to provide some

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simple background information related to their experience. They were also presented with a list of 20 PPP risk factors and asked to rate them according to their severity on a Likert scale from one to five, with one representing the least severe and five representing the most severe. The list of risk factors was derived on the basis of a comprehensive literature review and also from findings of a previous questionnaire survey conducted by the writers and their research team (Xu et al. 2010). To prevent misinterpretation, the interview respondents were provided with the definition for each of the 20 PPP risk factors, as shown in Table 1.

Background of Interview Respondents

A total of 38 interviews were conducted in major cities around China, including Beijing, Shanghai, Nanjing, and Dalian. These cities were selected based on their rapid development in infrastructure, their activeness in PPP projects, and also the available contact points of the researchers. General information regarding the respondents' backgrounds was recorded including the number of years they have been involved with PPP projects, the number of PPP projects they have participated in, the type of sector they were working for, and also the types of projects that they have been involved with. All respondents who participated in the interviews have hands-on experience with PPP projects. Most (63%) have 5 years or less working experience. Approximately 30% of the respondents had 6–10 years of working experience, and the remaining had more years. This experience profile is considered acceptable given that PPP projects have only become more popular in China in recent years. All respondents interviewed were experienced with running PPP projects. All respondents had executed at least one PPP project. Sixty-six percent of the respondents had executed one to three projects, a few had executed four to five projects, and approximately 10% had executed six or more projects. A large proportion of the respondents (43%) represented the private sector, 34% represented other organizations, and fewer respondents represented the public sector.

Seven types of projects that the respondents have been involved with were identified. In order of highest involvement, these included 15 in water and wastewater, eight in power and energy, seven in transportation, four in other types of projects, two in housing and offices, and one each in hospitals and medical services and cultural and sport facilities, respectively. These projects represented proportions of 39, 21, 18, 11, 5, 3, and 3%, respectively. Considering that the first three types of projects were dominant in participation level, they were selected for comparison purposes in this study based on their severity of risk factor.

Analysis Techniques

Mean Score Ranking

The mean is the most widely used and reported measure of central tendency (Lind et al. 2002). The mean score ranking technique is also a common technique used to analyze the results obtained by questionnaire surveys (Chan et al. 2009; Chan et al. 2010). In this study, the respondents were asked to assess the risks according to a Likert scale from one to five, where one is the least important and five is the most important. The mean score for each risk was, therefore, calculated by the summation of the respective scores given by each respondent according to the Likert scale, divided by the number of respondents that assessed the risk. The formula can be represented as follows:

$$M = \frac{\sum s}{n} \tag{1}$$

where M = mean score for each risk factor; s = score given by respondents according to a Likert scale from one to five; and n = number of respondents that assessed the risk factor.

Table 1. Definition of PPP Risk Factors

Risk no.	Risk	Definition
1	Government intervention	Public sector interferes unreasonably in the facilities/services
2	Public credit	The reliability and creditworthiness of the government to fulfill obligations
3	Financing risk	Financial difficulties experienced by the consortium as a result of poor financial market or lack of financial income
4	Poor public decision-making process	Government makes wrong or poor decisions owing to lack of knowledge or interest
5	Subjective project evaluation method	Subjective evaluation at the beginning of a public project to decide the procurement method
6	Completion risk	Project takes longer than the predicted time to complete
7	Government corruption	Bribery of bureaucrats resulting in inappropriate privileges and benefits being offered to the private sector
8	Price change	Improper tariff design or inflexible adjustment framework leading to insufficient income
9	Operation cost overrun	Operation cost overrun resulting from overpriced operation and slow operation
10	Imperfect law and supervision system	Lack of specific laws for PPP projects
11	Project/operation changes	The likelihood of unexpected changes and errors occurring during the project operation
12	Inability of concessionaire	The consortium not being able to perform its obligations as agreed
13	Inflation	Unanticipated changes to inflation rate
14	Conflicting or imperfect contract	Improper arrangements in the contract such as inappropriate risk allocation among stakeholders
15	Interest rate fluctuation	Unanticipated fluctuations in interest rate
16	Insufficient project finance supervision	The financial status and expenditures are not monitored and controlled
17	Delay in project approvals and permits	Delay or refusal of project approval or permit by government
18	Inadequate competition for tender	Lack of transparency and structure during tender, lack of opportunities for tenderers, few tenderers
19	Foreign exchange fluctuation	Fluctuation in currency exchange rate and/or conversion difficulties
20	Change in market demand (noncompetition factor caused)	Demand change, the need for the services and facilities have changed, maybe not needed or less needed than before

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Cronbach's Alpha

Cronbach's alpha was used to measure the reliability of the survey respondents. The value can range from negative infinity to 1, where a score closer to 1 would indicate a higher degree of reliability (Cronbach 1951). The statistic can be defined as (DeVellis 2010)

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right) \quad (2)$$

where α = Cronbach's alpha; K = number of risk factors; σ_X^2= variance of the total scores for the respondents; and $\sigma_{Y_i}^2$= variance of component i for the respondents.

Kendall's Concordance Analysis

The projects were considered as one group. Kendall's concordance analysis was conducted to measure the agreement of different respondents on their rankings of risk factors based on mean values within this group. If the Kendall's coefficient of concordance (W) was statistically significant at a predefined significance level of 0.05, for example, a reasonable degree of agreement among the respondents within the group on the rankings of risk factors was indicated. The W for the risk factors was calculated by the following formula (Siegel and Castellan 1988):

$$W = 12\frac{\sum_{i=1}^{n}(R_i - R)^2}{p^2(n^3 - n) - pT} \quad (3)$$

where W = Kendall's coefficient of concordance; n = number of risk factors being ranked; R_i = ranks assigned to the ith risk factor; R = mean value of the R_i values; p = number of respondents; and T = correction factor for the tied ranks.

According to Siegel and Castellan (1988), W is only suitable when the number of attributes is ≤ 7. If the number of attributes is >7, chi-square is used as a near approximation instead. The critical value of chi-square is further achieved by referring to the table of critical values of the chi-square distribution, which can also be found in Siegel and Castellan (1988).

Results and Discussion

Reliability of Survey Results

The value of Cronbach's alpha was calculated to be 0.822, indicating that a high level of uniformity among the survey responses was received (Norusis 2008).

Agreement of Respondents

The Kendall's coefficient of concordance (W) for the ranking of risk factors was 0.406. The computed w was statistically significant with significance level at 0.000.

As the number of attributes considered were above seven, as mentioned previously the chi-square value would be referred to rather than the W value. According to the degrees of freedom, the critical value of chi-square was 30.144. The computed chi-square value was found to be above this value at 115.852. Therefore, the assessment by the survey respondents on their rankings of risk factors is proven to be consistent. This finding ensures that the completed survey questionnaires are valid for analysis.

Ranking of Risk Factors

The 20 risk factors were rated by interviewees according to their severity of threat toward different types of PPP projects (Table 2). The results were ranked and studied for water and wastewater, power and energy, and transportation projects.

The ranking of the top five most severe risk factors for each type of project were identified and analyzed. In total, nine risk factors

Table 2. Comparison of Risk Ranking among Different Project Sectors

		Types of project					
		Water and wastewater		Power and energy		Transportation	
Risk no.	Name of risk factor	Ranking	Mean	Ranking	Mean	Ranking	Mean
1	Government intervention	4.14	4	3.98	1	4.00	1
2	Public credit	4.00	5	3.70	5	3.91	2
3	Financing risk	4.71	1	3.16	9	3.12	8
4	Poor public decision-making process	4.00	6	3.33	7	3.49	5
5	Subjective project evaluation method	4.33	3	3.87	3	3.24	7
6	Completion risk	4.43	2	2.59	14	2.85	16
7	Government corruption	3.17	12	3.87	2	2.98	10
8	Price change	3.25	9	3.06	10	3.81	3
9	Operation cost overrun	3.29	8	3.64	6	3.05	9
10	Imperfect law and supervision system	3.00	13	3.31	8	3.61	4
11	Project/operation changes	2.83	14	2.12	18	3.35	6
12	Inability of concessionaire	2.60	16	3.81	4	2.96	11
13	Inflation	3.33	7	2.50	15	2.53	20
14	Conflicting or imperfect contract	3.20	10	2.36	16	2.87	14
15	Interest rate fluctuation	3.20	11	2.61	11	2.69	18
16	Insufficient project finance supervision	2.75	15	2.60	13	2.88	12
17	Delay in project approvals and permits	2.57	= 17	2.10	19	2.85	15
18	Inadequate competition for tender	2.57	= 17	1.82	20	2.80	17
19	Foreign exchange fluctuation	2.57	= 17	2.33	17	2.66	19
20	Change in market demand (noncompetition factor caused)	1.88	20	2.61	12	2.88	13

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were studied. The following discussion aims to provide some reasons why these risk factors are believed to be the most severe. In addition, the risk factors of the three types of projects were compared to draw similarities and differences.

Government Intervention

The risk factor, government intervention, was ranked in the top five among the 20 risk factors for all three types of projects. For power and energy and transportation projects, this risk was ranked the most severe. For water and wastewater projects, this risk was ranked slightly lower, at the fourth position. Qi et al. (2009) conducted an analysis of 16 PPP projects in China. These projects included those from the water and wastewater, power and energy, and transportation sectors. From their analyses, government intervention was a primary cause of failure recorded. Government intervention would only be appropriate under circumstances where the general public would be substantially affected. For example, if unacceptably high toll fees or service fees are charged to the general public, the government would probably consider stepping in to restrict the consortia. Obviously, government intervention would only be feasible if it is also contractually viable. Otherwise, unreasonable government intervention would ruin the relationship with the private sector and discourage their interest in future PPP projects. Zhong and Fu (2010) also reported that some of the early PPP projects in Guangdong failed because they were implemented solely by the local government without professional advisers, showing a high level of government intervention.

Public Credit

Public credit was ranked in the top five for all three types of projects. Transportation projects were ranked slightly higher, at the second position, whereas water and wastewater and power and energy projects were both ranked in the fifth place. The findings are in line with the discussion in Sachs et al. (2007) regarding the creditworthiness of the local governments in China. They highlighted that one of the main problems related to the application of PPP in China was the unrealistic and unreasonable guarantees made by Chinese local governments. As a result, public credit has become a concern. They further discussed that the Chinese local governments usually make promises that they are incapable of fulfilling to attract potential investors to carry out the projects. Unfortunately, contracts are breached frequently because of this common practice of the Chinese local governments. As a result, both parties lose out. The private party may lose their investment or achieve unexpectedly lower returns than anticipated and achieve no compensation. Sachs et al. (2007) concluded that the Chinese local governments have been known to pay more to resolve the damage that has been caused to the other parties or the project itself.

Financing Risk

Financing risk has always been a major problem, especially for water and wastewater projects. For example, the Guangzhou Xilang project, which was the first PPP wastewater treatment plant project in China, was held back because of financing risk. It was initially planned in 1993 but took several years to take off because of the lack of a financing source (Zhong and Fu 2010). Another example occurred in 2004, when the Beijing government introduced five small-sized wastewater treatment plant projects. These projects aimed to improve the wastewater treatment capacity and control water pollution in Beijing. Unfortunately, the awarded consortia withdrew from the project because of financial difficulties. Chinese banks are often reluctant to provide long-term loans that are required for PPP projects or tend to restrict the credit policies to the private sector. These experiences reflect the problems in the existing financing policies of China (Zhong and Fu 2010). Consequently, financing risk was ranked the most severe among the 20 risk factors for water and wastewater projects. For the other types of projects studied, this risk was ranked of medium severity only. The financing model adopted for each project will vary in its level of financial risk. This paper focuses primarily on comparing different types of PPP projects. For further studies, it would be worthwhile for researchers to consider how financing risk is affected by the mode of PPP adopted in projects.

Poor Public Decision-Making Process

The risk factor, poor public decision-making process, was ranked similarly for the three types of projects. Transportation projects were ranked slightly higher, at the fifth position, possibly indicating that the Chinese government is more prone to making poor decisions for these types of projects. Sachs et al. (2007) reported that bad decisions made by the Chinese government were another problem holding back the implementation of PPP. This was ascribed to the lack of knowledge in running PPP projects and also to the unrealistic guarantees that would be made by the Chinese government. As a result, there have been many complaints from the general public, and key officials have stepped down (Sachs et al. 2007).

Subjective Project Evaluation Method

Subjective project evaluation method was ranked third for water and wastewater and power and energy projects but only of medium severity for transportation projects. This difference is probably attributable to the fact that, traditionally, water and wastewater and power and energy projects have been handled by the government. However, since the 1990s, the Chinese government has started to introduce private financing for these projects (Zhong et al. 2008). With private financing as the target, proper evaluation of projects has been neglected. A complete evaluation should be conducted to assess whether PPP would be the suitable method for delivering certain public projects. The evaluation criteria should focus on value for money, innovation, expertise, time, cost, and general public satisfaction . Khansnabis et al. (2010) acknowledged the importance of conducting a careful analysis before PPP projects are undertaken to assess the financial and economic implications of the project from each participant's viewpoint, with due regard to risks and uncertainties associated with such long-term investments. Unfortunately, private financing has been a priority for adopting the PPP approach for those previously government-run projects. Consequently, evaluations of the projects have not been conducted adequately. The interviewees reflected in their ranking the importance of a subjective project evaluation method.

Completion Risk

Completion risk was only ranked highly for water and wastewater projects, at the second position. Generally speaking, completion risk causes a project to go beyond the initial schedule. The consequences are a lack of cash flow to pay for the operating costs and subsequent debts, postponed length of maturity, and increased interest from the loan (Li and Liu 2009). As a result, the whole project cost will be increased, and the project will not be completed as planned. Furthermore, Pribadi and Pangeran (2007) analyzed the risks that were associated with water PPP projects. Their study found that delay in completion for water PPP projects was often caused by a lack of coordination of contractors, failure to obtain standard planning approvals, and failure to grant contractual land-use rights or rights-of-way. These causes probably explain why completion risk was ranked high for water and wastewater projects.

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Government Corruption

This risk factor was regarded as a potential threat for power and energy projects and ranked second by the interviewees, contrasting with the other types of projects, for which this risk factor was not regarded as threatening. Although there is no evidence to support the reasons for this large difference in ranking among the projects, government corruption has previously been suspected for power and energy projects. The Laibin B power project was an example of successful PPP implementation and was adopted as a role model for future similar projects (Sachs et al. 2007). In addition, it was revolutionary at the time for being awarded through international tendering and comprising 100% foreign ownership. Wang and Ke (2009) believe that, although the Chinese government had addressed the risk of government corruption through warranties in this project, there was no confidence that the private party could walk away easily if it did occur. They further explained that their beliefs are attributable to several predictions: corruption would not take place in the open; it is difficult to determine corruption by using contract language; and the enforcement of the contract terms would be doubtful.

Imperfect Law and Supervision System

The risk factor, imperfect law and supervision system, was ranked fourth for transportation projects. For power and energy projects, it was ranked of medium severity, and for water and wastewater projects, it was ranked low. In many Chinese PPP projects, it is not uncommon to find that the financiers undertake roles on both sides of the PPP arrangement, and often they will supervise the project as well. The effectiveness of this arrangement can be doubtful. Aware of the potential problems, some projects, especially transportation-type ones, have taken action to avoid overlapping roles. In the Guangzhou No. 2 underground line project, the supervision of all aspects related to the project were purposely passed to the public procuratorial service, and the financing bank acted as a double check (Adams et al. 2006). Other measures that have been taken to improve legislation related to transportation-type projects include the establishment of specific laws such as the Highway Law (Chen and Doloi 2008). It is obvious that these actions were a result of the riskiness of the imperfect law and supervision system for transportation projects. The writers do not rule out the possibility that, in some situations, the laws are simply not enforced.

Inability of Concessionaire

This risk factor was ranked fourth for power and energy projects. For the other types of projects, this risk factor was ranked relatively low. Previous studies (Braadbaart et al. 2009; Zhong and Fu 2010) have shown that the lack of competition during the bidding process of PPP projects has meant that wrong, inappropriate, or unqualified concessionaires have been selected. It is possible that power and energy projects are technically more demanding than the other types of projects studied, hence the ability of the concessionaire would be more demanding.

Conclusions

This paper has examined some of the most severe risk factors that could occur in PPP projects. A comparison was conducted looking at the risk factors of water and wastewater, power and energy, and transportation projects in China. The results showed that government intervention, public credit, financing risk, poor public decision-making process, subjective project evaluation method, completion risk, government corruption, imperfect law and supervision system, and inability of concessionaire were the most severe risk factors for these projects, with government intervention and public credit being severe for all three groups of projects. It appears that the major risks of PPP projects in China are primarily related to the government. Some of the lessons learned and recommendations from these findings include:

- The consortium members should consist of nongovernment representatives to avoid government intervention;
- The Chinese government should make realistic promises that they intend to and are able to carry out;
- A stable income should be ensured to eliminate financing risk. Ideally, the income should result from the services and facilities, but if this is not feasible, government support should be considered. Special attention to this aspect should be given in water and wastewater projects;
- The Chinese government should understand the PPP process well and try to adopt the good practices of other countries where possible;
- Currently, there is no equivalent of the public sector comparator in China to assess whether public projects are suitable to be delivered by PPP. It is important to introduce such a process to ensure that projects are not poorly delivered by PPP;
- For the future, water and wasterwater projects, in particular, should consider implementing an early and structured plan to avoid completion risk;
- Government corruption must be avoided, especially for power and energy projects. The government should enforce prosecution to eliminate the occurrence of corruption;
- Laws must be enforced, especially for transportation projects; and
- Concessionaires for power and energy projects, in particular, should be selected carefully and appropriately to avoid underqualified members.

This paper has provided an interesting perspective on procuring PPP projects, especially for those practitioners and academics in western countries. The study has highlighted the most common types of PPP projects in China and analyzed the differences between their risks. It is hoped that the results have enabled project stakeholders from other countries to be more aware of the potential risks so as to avoid or minimize them effectively. Furthermore, opportunities for conducting PPP projects in China will, as a result, be encouraged. This study also has its limitations. The main limitations of this study are that the interviews were conducted with only 38 experts in Beijing, Shanghai, Nanjing, and Dalian. Although these experts had conducted PPP projects across China, the results would have been more representative if a larger sample of respondents from different cities across China were interviewed.

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