

Preferred risk allocation in China's public–private partnership (PPP) projects

Yongjian Ke^{a,*}, ShouQing Wang^a, Albert P.C. Chan^b, Patrick T.I. Lam^b

^a *Department of Construction Management, Tsinghua University, Beijing 100084, China*

^b *Department of Building and Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong Special Administrative Region, China*

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Abstract

As part of a comprehensive research into PPP implementation, a two-round Delphi survey was conducted with experienced practitioners to identify the preference of risk allocation in China's PPP projects. The results show that the public sector would take sole responsibility for the risk "Expropriation and nationalization", and take the majority of responsibility for 12 other risks related to government or government officials and their actions. Fourteen risks which neither the public nor private sector may be able to deal with them alone are preferred to be shared equally. The private sector would take the majority of responsibility for 10 risks that are at the project level. Interestingly, no risk fell into the category that should be solely allocated to the private sector. Further analysis of the reasons behind these allocation preferences was then conducted. Recommendations on commercial principles and contract terms between the public authorities and private consortia are also made.

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1. Introduction

The Public–private partnership (PPP) form of procurement is recognized as an effective way of delivering value-for-money public infrastructure or services. It seeks to combine the advantages of competitive tendering and flexible negotiation, and to allocate risk on an agreed basis between the public sector and the private sector (Li et al., 2005). Since a transparent procurement process is regarded as critical to the success of PPP projects (Jefferies et al., 2002), it is important that risk allocation is clearly communicated and understood between the parties. It is thus essential for public clients and private bidders to evaluate all of the potential risks throughout the whole project life. Public and private sector bodies must place particular attention on

the procurement process while negotiating contracts for PPP to ensure a fair risk allocation between them. In recent years there have been an increasing market of PPP for the development and operation of infrastructure projects in China. With the fast pace of market-oriented transformation in the planned economy of China, a delicate balance has to be sought among private sector capacity, government regulatory function, and public satisfaction. This paper attempts to develop an equitable risk allocation scheme for the delivery of PPP projects in China. The research findings will contribute to both the practice and research in risk management for China's PPP projects and also provide valuable information for those international companies intending to invest in infrastructure construction in China.

2. Related previous research

Risk is inherent and difficult to deal with, and requires a proper management framework both theoretically and practically. Therefore, particular attention in the research field

* Corresponding author.

E-mail addresses: kyj05@mails.tsinghua.edu.cn (Y. Ke), sqwang@tsinghua.edu.cn (S. Wang), bsachan@polyu.edu.hk (A.P.C. Chan), bsplam@polyu.edu.hk (P.T.I. Lam).

has been drawn on risk allocation of PPP projects. Governments procuring a PPP project would state its preference as to how the project risks should be shared; private investors would assess their capability of taking these risks, and then propose a bidding price. The contract negotiation would probably focus on the risk-sharing scheme. A general principle is that each risk should be allocated to the party best able to manage it and at the least cost (Cooper et al., 2005). In other words, an optimal risk allocation is not to pass all risks to the private sector, but to seek a solution minimizing both the total management costs of the public and private sectors.

Unfortunately, this criterion, although very sensible, often causes contrasting results in the risk allocation context. Sometimes, the partner from which the risk emanates and thus who is best able to control it, may not be able to control the risk in the most efficient way and at the lowest cost (Medda, 2007).

Questionnaire survey is the most common research technique used to obtain a risk-sharing scheme. For instances, Li et al. (2005) developed a preferred risk allocation scheme for PPP projects in the United Kingdom based on an opinion survey with 53 suitable responses; Roumboutsos and Anagnostopoulos (2008) conducted a similar survey using the same questionnaire in Greece and compared the findings to those in the UK; Jin and Doloi (2008) gathered data from an industry-wide survey to test the theoretical framework for understanding risk allocation practice in PPP projects. Case study is another useful technique to explore a suitable risk allocation scheme for PPP projects. For examples, Abednego and Ogunlana (2006) carried out a case study research on a toll way project in Indonesia for the purpose of demonstrating an approach to achieve proper risk allocation in PPP tollway projects; Similarly, Ng and Loosemore (2007) studied the allocation via a case study of a railway project in Sydney. Recent researchers have been adopting more complicated and vigorous methods in the risk allocation arena, such as game theory (Medda, 2007), etc., instead of qualitative analyses that were used in earlier research work.

However, to the best of the authors' knowledge, only a little effort has been committed to the systematical identification and management of risks in China's PPP projects, as reported by international construction management journals in recent years. Capitalizing on the Chinese government's increased PPP experience in the last decade, they have made a lot of efforts to improve the investment environment, including moving towards the adoption of international contractual practices and working out an equitable risk-sharing scheme (Wang and Ke, 2008; Chen and Doloi, 2008). This paper aims to conduct research on risk allocation and management with regard to PPP projects in China.

3. Research methodology

3.1. Identification of the risk factors

A desktop literature review and telephone interviews were carried out to collect actual data from 16 PPP projects

in China. As a result, 13 principal risks causing the failures of these cases were identified. The analysis showed that these risks were mainly political risks, i.e. legislative changes, project approval and permit, political opposition, reliability and creditworthiness of Chinese entities, etc. (as shown in Table 1).

Another study involving an empirical questionnaire survey concerning PPP features and risk management in both mainland China and the Hong Kong Special Administrative Region was carried out by the authors from October 2007 to December 2007. In this study, analysis was conducted to compare variations in the perception of risks for different groups of respondents. The results of derived from academics were compared to those from industrial practitioners, and mainland Chinese were compared to Hong Kong respondents. The results showed that for some of the risks, the different groups of respondents did share varied views regarding their relative importance. These risks included project approval and permit, government's intervention, inflation, poor political decision-making, public/political opposition, etc. These risks are believed to be of particular interest; hence they have been included in this study for further analysis.

In addition, a comparative analysis of the different allocation schemes in Lam et al. (2007), Ng and Loosemore (2007), Li et al. (2005), Arndt (1998), Wang and Tiong (2000), Victorian Department of Treasury and Finance (2001) and National Treasury of South Africa (2004) was conducted as presented in Table 2. Although this analysis may not be very meaningful due to the different definitions of each risk and different risk list of each literature, an observation which could be made is that the equitable risk allocation is highly related to the unique social, economic, legal situation of the country. The conclusion reinforces again the objectives of this paper. Risk factors which were allocated to different sectors according to Table 2 have also been listed in this study.

Taking into account the desktop literature review, telephone surveys, and previous works of the authors, a list of 34 potential risks were identified as shown in Table 3. This risk list includes three parts: (1) principal risks in past projects; (2) the risks for which different groups of respondents (academics vs. industrial practitioners, mainland Chinese vs. Hong Kong respondents) share varied views regarding their relative importance and preferred allocations in the previous relative survey; and (3) the risks which have different allocations in those existing foreign risk allocation schemes. This list has been used to explore the perceptions of PPP participants towards risk allocation for construction projects in China. The findings are presented in this paper.

3.2. Application of the Delphi survey

A two-round Delphi survey was conducted in mainland China from December 2008 to February 2009 to analyze the risks and their allocations for PPP projects in China.

Table 1
Principal risks encountered in past PPP projects of China.

Case No. Risk	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Change in law	✓		✓											✓		
Approval and permit				✓												
Poor political decision-making				✓			✓				✓					
Public/political opposition				✓												
Government's reliability	✓	✓			✓	✓	✓		✓	✓	✓				✓	
Force majeure	✓				✓											
Financial risk					✓											
Insufficient income						✓		✓				✓				✓
Competition (exclusive right)								✓	✓			✓				✓
Supporting utilities risk									✓				✓			✓
Market demand change								✓	✓	✓		✓	✓			✓
Tariff change										✓						
Corruption															✓	
Case 1	Jiangsu **** Sewage Treatment Plant															
Case 2	Changchun Huijin Sewage Treatment Plant															
Case 3	Shanghai Dachang Water Plant															
Case 4	Beijing No. 10 Water Plant															
Case 5	Hunan **** Power Plant															
Case 6	Tianjin Shuanggang Waste-to-Energy Plant															
Case 7	Qingdao Veolia Sewage Treatment Plant															
Case 8	Hangzhou Bay Bridge															
Case 9	Fujian Xinyuan Minjiang No. 4 Bridge															
Case 10	Shandong Zhonghua Power Plant															
Case 11	Guangdong Lianjiang Sino-French Water Plant															
Case 12	Fujian Quanzhou Citong Bridge															
Case 13	Wuhan Tangshunhu Sewage Treatment Plant															
Case 14	Shanghai Yan'an Road.(E) Tunnel															
Case 15	Shenyang No. 9 Water Plant															
Case 16	Beijing Jingtong Expressway															

As the information solicited requires in-depth knowledge and sound experience about risks in PPP projects, a purposive approach was adopted to select this group of experts who should satisfy at least one of the following criteria (Chan et al., 2001):

- Criterion 1: Having extensive working experience in PPP projects in China.
- Criterion 2: Having current/recent and direct involvement in risk management of PPP projects in China.
- Criterion 3: Having a sound knowledge and understanding of the concepts of PPP risks.

A total of 203 practitioners/academics were identified and invited to participate in this study. The first round of the Delphi questionnaire was accompanied by an invitation letter and sent to the selected experts. The letter explained the purpose of the research, and the experts were informed that there would be two rounds of questionnaires. The definition of each risk as presented in Table 3 was also provided at the beginning of the questionnaire, in order to ensure that experts have the same understanding of these risks. These respondents were requested to allocate the described risk to either the private or the public sector, or describe it as preferably 'shared' between the public and private sector according to a five-point Likert scale (1 – Government takes sole responsibility, 2 – Government

takes the majority of responsibility, 3 – Both parties take equal responsibility, 4 – Private sector takes the majority of responsibility, and 5 – Private sector takes sole responsibility). A total of 47 completed questionnaires were returned in the first round of the Delphi exercise, representing a response rate of 23%. According to the respondents' comments, a further three risk factors were included in the second round survey, namely "Private investor change", "Subjective evaluation", and "Insufficient financial audit", as additions to the original list.

For the second round survey, the experts were provided with feedback of the results obtained in the first round. The average of the scores of each risk item, the frequency of each option in the five-point scale, and the respondent's own score in the first round were shown. The respondents were asked to re-assess their scores in the light of the average values, and requested to make further explanations to risk factors that they held significantly different opinions to the other experts. A total of 46 completed questionnaires were received in the second round, representing a highly favorable successive rate of 98% with respect to the first round survey. The respondents' information is given in Table 4.

3.3. Tools for data analysis

The data collected from the current questionnaire survey was analyzed using the mean score method, within different

Table 2
Comparative analysis of risk allocation preferences from different literature.

Risk factor		Lam et al. (2007)	Ng and Loosemore (2007)	Li et al. (2005)	Arndt (1998)	Wang and Tiong (2000)	NTSA (2004)	VDTF (2001)	Same
Political	Termination of concession by Government		Public			Public	Public		✓
	Expropriation and nationalization		Private	Public		Public	Public		×
	Political opposition			Public			Public		✓
	Change in law	Share	Private	Share	Share	Share	Share	Public	×
	Unstable government	Public		Public					✓
	Project approval and permit	Private	Share		Share			Private	×
	Influential economic events			Private				Private	✓
	Changes in industrial code of practices			Private	Share		Share	Private	×
Construction	Availability of finance			Private	Private			Private	✓
	Improper design	Private	Private	Private	Private	Private	Private	Private	✓
	Insolvency of subcontractors	Private		Private	Private	Private	Private		✓
	Quality risk	Private	Private	Private	Private	Private	Private	Private	✓
	Site safety	Private			Private				✓
	Availability of labor/materials	Private		Private		Public			×
	Ground conditions	Public	Private	Private				Private	×
	Site availability	Public	Private	Public	Share			Private	×
	Construction/design changes	Private	Public				Public	Public	×
	Labor disputes and strikes	Private				Private		Private	✓
	Land use		Public	Public			Public		✓
	Waste of materials		Private	Private	Private				✓
	Construction cost overrun		Private	Private	Private	Private	Private	Private	✓
	Construction completion		Private	Private	Private	Private	Private	Private	✓
	Supporting utilities risk		Public		Share	Share			×
	High financial cost			Private	Private	Private			✓
	Unproven engineering techniques			Private	Private	Private	Private	Private	✓
	Protection of geological and historical objects					Private		Private	✓
Operation	Operation cost overrun		Private	Private	Private		Private		✓
	Operator default		Private		Private	Private		Private	✓
	Quality of operation		Private		Private	Private	Private	Private	✓
	High maintenance cost			Private	Private		Private	Private	✓
	Frequency of maintenance			Private	Private		Private	Private	✓
	Low operating productivity			Private	Private	Private	Private		✓
	Residual assets risk				Private		Private	Public	×
	Condition of facility					Private		Private	✓
Legal	Contractual risk	Public				Share			×
	Third party tort liability	Public		Private					×
	Ownership assets		Private			Share	Private	Share	×
	Insolvency of Concession company					Private	Private		✓
Market	insufficient income			Private	Private	Private			✓
	Fluctuation of material cost (by government)		Public			Public	Public	Public	✓
	Fluctuation of material cost (by private sector)		Private			Private	Private	Private	✓
	Tariff change		Private	Private		Private	Private	Private	✓
	Market demand change		Private	Private	Share	Private	Share		×
	Exclusivity					Share		Private	×
Economic	Inflation risk	Share	Share	Private		Share	Share	Share	×
	Interest rate		Share	Private		Share	Private		×
	Foreign currency exchange					Public	Private		×
Other	Force majeure		Share	Share	Share		Share	Share	✓
	Residual risk		Public	Private					×
	Weather	Share		Private	Public		Public		×

groups as categorized according to the primary roles of the respondents. The five-point Likert scale described previously was used to calculate the mean score for each risk,

which was then used to determine their allocation. These results made it possible to cross-compare the allocation preferences of the risks to the respondents with and

Table 3
Checklist of PPP project risk factors.

ID	Risk factor	Definition
1	Corruption	Corrupt local government officials demand bribes or unjust rewards
2	Government's intervention	Public sector interferes unreasonably in privatized facilities/services
3	Expropriation and nationalization	Due to political, social or economic pressures, local government takes over the facility run by private firm without giving reasonable compensation
4	Government's reliability	The reliability and creditworthiness of the government to be able and willing to honor their obligations in future
5	Third party reliability	The reliability and creditworthiness of a third party to be able and willing to honor their obligations in future
6	Public/political opposition	Prejudice from public due to different local living standards, values, culture, social system, etc.
7	Immature juristic system	The lack of national PPP law leads to different ways of PPP implementation in different places in China
8	Change in law	Local government's inconsistent application of new regulations and laws
9	Interest rate	Unanticipated local interest rate due to immature local economic and banking systems
10	Foreign exchange and convertibility	Fluctuation in currency exchange rate and/or difficulty of convertibility
11	Inflation	Unanticipated local inflation rate due to immature local economic and banking systems
12	Poor political decision-making	Government officials considers more their career achievement or short-term goals or personal interests, or with little PPP experience etc., resulting in a poor political decision-making process
13	Land acquisition	The project land is unavailable, or unable to be occupied at the required time
14	Approval and permit	Delay or refusal of project approval and permit by local government
15	Improper contracts	Improper arrangements in the contracts including inappropriate risk allocation among stakeholders, commitment from public/private partners
16	Financial risk	Poor financial market or unavailability of financial instrument resulting difficulty of financing
17	Construction/operation changes	Unanticipated changes and errors in the construction/ operation resulting from the improper design or poor investigation
18	Construction completion	Longer construction time than predicted, Construction cost overrun or poor construction quality
19	Delay in supply	Subcontractors and suppliers not being able to supply labor or material on time
20	Technology risk	The technology adopted not being mature or able to meet the requirements
21	Ground/weather conditions	Poor or unexpected ground/weather conditions
22	Operation cost overrun	Operation cost overrun resulting from improper measurement, ill planned schedule or low operation efficiency
23	Competition (exclusive right)	The government does not offer the exclusive right, or does not honor to its commitment and build another competitive project
24	Market demand change	Demand change from other factors, i.e. social, economic, etc., except the exclusive right
25	Tariff change	Improper tariff design or inflexible adjustment framework leading to the insufficient income
26	Payment risk	The consumer/government not being able or willing to pay, due to social or other reasons
27	Supporting utilities risk	Supporting utilities, such as electricity, water, necessary for the construction, operation and management would not be available in a timely manner or at fair rates
28	Residual assets risk	Assets transferred to the government at the end of the concession period would not be normally running
29	Uncompetitive tender	The tendering process and documents vary from project to project and from province to province in China without transparent or standardized models
30	Consortium inability	The consortium not being able to perform its obligations as a PPP project company
31	Force majeure	The circumstances that are out of the control of both foreign and local partners, such as flood, fires, storms, epidemic diseases, war, hostilities and embargo
32	Organization and coordination risk	An increase of transaction cost or a dispute may occur because of the improper organization and coordination
33	Tax regulation changes	Central or local government's inconsistent application of the tax regulation
34	Environmental protection	Stringent regulation which will have an impact on construction firms' poor attention to environmental issues
35	Private investor change	Due to the disputes among private investors or other reasons, one or some investors exit/enter the consortium
36	Subjective evaluation	Subjective evaluation and design of the concession period, tariff structure, market demand, etc.
37	Insufficient financial audit	The government/lenders would not perform a careful audit to the financial status of the project company

without hands-on PPP experience by using the independent 2-sample *t*-test.

Kendall's concordance (W) analysis was conducted to measure the agreement of different respondents on their ratings of risk allocation based on mean values within a particular group. According to Siegel and Castellan (1988), W is only suitable when the number of attributes is less than or equal to 7. If the number of attributes is greater than 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 chi-square

distribution, which can also be found in Siegel and Castellan (1988).

The agreement between the two respondent groups (with and without hands-on PPP experience) on their ratings of risks was measured by the Spearman rank correlation coefficient (r_s). Again, if the value of r_s exceeds the critical value at a significance level of 0.05, it can be asserted that there is relationship between the two different respondent groups. The critical values of r_s are also given in the appendix tables in Siegel and Castellan (1988).

Table 4
Survey respondents' profile.

Respondent profiles	Categorization and percentages
Types of the organization	Government (13.0%) Public Enterprises (37.0%) Private Enterprises (28.3%) Academic Organizations (21.7%)
Number of years of work experience	Less than 6 years (22.2%) 6–10 years (20.0%) 11–15 years (17.8%) More than 15 years (40.0%)
Number of years of PPP experience	Never (26.7%) Less than 3 years (15.6%) 3–5 years (33.3%) More than 5 years (24.4%)
Number of PPP projects participated	None (44.4%) Less than 3 projects (28.9%) 3–5 projects (17.8%) More than 5 projects (8.9%)

4. Discussion of survey results

The presentation of results herewith constitutes statistical descriptive analysis carried out using the Statistical Package for Social Sciences (SPSS). The survey feedback concerning the preferred risk allocation is presented in Table 5.

4.1. Agreement of PPP experienced and inexperienced respondents

Noting in Table 4 that some respondents without hands-on PPP experience (but interested or wishing to invest in PPP) were included in the Delphi survey, a closer look at the differences of perspectives from these two groups was performed first. According to 36 degrees of freedom, the critical value of Chi-square was 50.998 at a significance level of 0.05. For both groups, the computed Chi-square values of the allocation (497.365 and 389.355 for 'with PPP experience' and 'without PPP experience', respectively) were both above the critical value of Chi-square. Therefore the assessment by the respondents within each group on their allocations is proved to be consistent. The correlation coefficient of the rankings on the allocation was 0.970, which is much greater than the critical value of 0.275 at a 0.05 level. This result implies that there was no significant disagreement on the ratings of the PPP experienced respondents and inexperienced respondents. These findings ensure that the completed questionnaires are valid for further analysis.

Furthermore, the independent 2-sample *t*-test was undertaken to examine if there was any significant difference in mean value responses between the two respondent groups for each of 37 risks discussed. Among the *t*-test results for the allocation of the 37 risks, no risk fell below the significance level of 0.05 (see Table 5). This yet again reinforces the previous assertion that a high extent of

agreement was found to be valid between the two sets of ratings, allowing to lump the two sets of data together for the obvious reason of having a larger sample size.

4.2. Risk allocation preferences

For all respondents, the computed Chi-square value of the allocation was 873.609, which was above the critical value of Chi-square 50.998 at 36 degrees of freedom at a significance level of 0.05. Therefore the assessment by all the respondents on their allocations is proved to be consistent for further analysis. The preferred risk allocation options are presented as mean values of participants' responses. Five risk allocation categories are identified according to the "half-adjusting" principle:

- (1) Risks (with a mean score smaller than 1.5) that should be solely allocated to the public sector;
- (2) risks (with a mean score greater than or equal to 1.5 and smaller than 2.5) that should be mostly allocated to the public sector;
- (3) risks (with a mean score greater than or equal to 2.5 and smaller than 3.5) that should be equally shared by both parties;
- (4) risks (with a mean score greater than or equal to 3.5 and smaller than 4.5) that should be mostly allocated to the private sector; and
- (5) risks (with a mean score greater than or equal to 4.5) that should be solely allocated to the private sector.

However, no risk fell into the category that should be solely allocated to the private sector as presented in Table 5. This observation reflects that respondents may still believe that private investors will encounter many problems caused by government or government officers and their actions. According to both experts and project managers in PPPs, as PPPs rely heavily on the investment environment reflecting the legal and banking systems, there are no mature project structures, models or best practices in place. On the other hand, PPP is an inter-disciplinary undertaking requiring all project participants with comprehensive knowledge, which is still lacking in China (Sachs et al., 2007). In addition, Chinese central government and local governments lack the requisite experience and there are no mature enabling laws and policies in place (Wang et al., 2000; Wang, 2002; Ho, 2006). These could cause many problems during the execution of PPP projects in China. Therefore, from the viewpoint of the respondents, the private sector may not have the capability to take sole responsibility yet. However, another potential reason for this may be due to the sample of survey respondents.

4.2.1. Risks to be solely allocated to the public sector

The risk "Expropriation and nationalization" with a mean value of 1.28 (see Table 5) is the only risk solely allocated to the public sector. This risk is obviously a coun-

Table 5
Preferred allocations of the risk factors.

Allocation	ID	Category	Risk factor	Total		PPP-exp.		Non-exp.		t-Test	
				Mean	Std.	Score	Std.	Score	Std.	t	Sign.
Risks to be solely allocated to the public sector	3	Country	Expropriation and nationalization	1.28	0.62	1.16	0.47	1.43	0.75	−1.138	0.264
Risks to be mostly allocated to the public sector	4	Country	Government's reliability	1.65	0.92	1.68	0.99	1.62	0.86	0.358	0.722
	2	Country	Government's intervention	1.70	0.84	1.68	0.85	1.71	0.85	−0.016	0.987
	12	Country	Poor political decision-making	1.83	0.85	1.68	0.69	2.00	1.00	−1.256	0.216
	13	Project	Land acquisition	2.00	0.70	1.88	0.60	2.14	0.79	−1.061	0.295
	1	Country	Corruption	2.11	0.95	2.20	1.08	2.00	0.77	0.862	0.394
	14	Country	Approval and permit	2.11	0.82	1.92	0.86	2.33	0.73	−1.594	0.118
	27	Project	Supporting facilities risk	2.26	0.80	2.32	0.95	2.19	0.60	0.692	0.493
	29	Country	Uncompetitive tender	2.28	0.86	2.16	0.80	2.43	0.93	−0.983	0.331
	23	Project	Competition (exclusive right)	2.30	0.96	2.16	0.99	2.48	0.93	−1.264	0.213
	8	Country	Change in law	2.33	0.84	2.32	0.80	2.33	0.91	0.016	0.987
	33	Country	Tax regulation changes	2.35	0.74	2.16	0.62	2.57	0.81	−1.902	0.064
	7	Country	Immature juristic system	2.43	0.89	2.40	0.96	2.48	0.81	−0.266	0.791
Risks to be equally shared by both parties	6	Country	Public/political opposition	2.54	0.55	2.52	0.59	2.57	0.51	−0.35	0.728
	25	Project	Tariff change	2.87	0.72	3.00	0.82	2.71	0.56	1.203	0.236
	31	Country	Force majeure	2.91	0.28	2.88	0.33	2.95	0.22	−0.757	0.453
	26	Project	Payment risk	3.00	0.82	2.92	0.86	3.10	0.77	−0.725	0.473
	34	Country	Environmental protection	3.02	0.80	2.88	0.88	3.19	0.68	−1.335	0.189
	37	Project	Insufficient financial audit	3.04	0.84	3.00	0.87	3.10	0.83	−0.201	0.841
	36	Project	Subjective evaluation	3.13	0.78	3.28	0.79	2.95	0.74	1.646	0.107
	15	Project	Improper contracts	3.15	0.47	3.20	0.50	3.10	0.44	0.645	0.523
	11	Market	Inflation	3.22	0.55	3.20	0.65	3.24	0.44	−0.364	0.718
	10	Market	Foreign exchange and convertibility	3.26	0.91	3.32	1.03	3.19	0.75	0.385	0.702
	21	Country	Ground/weather conditions	3.33	0.63	3.40	0.71	3.24	0.54	0.693	0.492
	24	Market	Market demand change	3.37	0.83	3.40	0.96	3.33	0.66	0.122	0.904
	5	Project	Third party reliability	3.39	0.61	3.36	0.57	3.43	0.68	−0.048	0.962
	9	Market	Interest rate	3.39	0.88	3.44	1.04	3.33	0.66	0.259	0.797
Risks to be mostly allocated to the private sector	17	Project	Construction/operation changes	3.52	0.69	3.64	0.76	3.38	0.59	1.032	0.308
	28	Project	Residual assets risk	3.52	0.75	3.48	0.71	3.57	0.81	−0.422	0.675
	32	Project	Organization and coordination risk	3.65	0.77	3.72	0.68	3.57	0.87	0.359	0.722
	30	Project	Consortium inability	3.78	1.09	3.96	1.06	3.57	1.12	1.13	0.265
	35	Project	Private investor change	3.85	0.73	3.80	0.71	3.90	0.77	−0.189	0.851
	19	Project	Delay in supply	3.96	0.79	4.00	0.87	3.90	0.70	0.216	0.83
	18	Project	Construction completion	4.02	0.68	4.08	0.70	3.95	0.67	0.382	0.704
	16	Project	Financial risk	4.07	0.80	4.16	0.80	3.95	0.80	0.446	0.658
	22	Project	Operation cost overrun	4.20	0.78	4.24	0.78	4.14	0.79	0.349	0.729
	20	Project	Technology risk	4.37	0.80	4.44	0.71	4.29	0.90	0.516	0.609

try level risk according to the categories in [Hastak and Shaked \(2000\)](#). A high tariff for the users, huge profits for the investor, or a wrong decision by the government on the PPP project may result in great political and social pressures. Under these situations, it is possible that the government would be forced to terminate the concession and take over the facility run by private firms without giving reasonable compensation ([Sachs et al., 2007](#)). For the private partner, they can hardly do anything to deal with the consequence caused by expropriation and nationalization. It is thus recommended that the concession agreement should provide for warranties, indemnities, liabilities and a compensation mechanism for early termination of contract ([Efficiency Unit, 2008](#)).

4.2.2. Risks to be mostly allocated to the public sector

Twelve risks to be mostly allocated to the public sector as depicted in [Table 5](#) are: “Government's reliability”, “Government's intervention”, “Poor political decision-making”, “Land acquisition”, “Approval and permit”, “Corruption”, “Supporting facilities risk”, “Uncompetitive tender”, “Competition(Exclusive right)”, “Change in law”, “Tax regulation changes”, and “Immature juristic system”. It can be seen from the above that almost all the risks have the same characteristic, i.e. they are related to government or government officers and their actions. Through a closer look at these risks, they can be divided into three subcategories, i.e. (1) risks at country level related to the legal system; (2) risks at country level related

to some specific government officers; and (3) risks at project level.

Five risks, “Uncompetitive tender”, “Change in law”, “Approval and permit”, “Tax regulation changes” and “Immature juristic system” could be counted in the country level category related to the legal system in China. So far, except for some local governments’ or ministries’ regulations relevant to PPP, e.g. the Beijing and Ministry of Housing and Urban–Rural Development’s (formerly named Ministry of Construction) regulations, there is no national PPP law in China (Ho, 2006). The tendering process of many PPP projects in China and the tendering documents vary from project to project and from province to province without transparent or standardized models (Sachs et al., 2007). It is therefore hard for private investors, especially foreign ones, to study and adapt to the various rules and regulations in the different places given the broad geographic area of China. It is hence strongly suggested for those who are planning to set steps in the infrastructure construction to hire a professional legal consultant to handle the legal affairs. Additionally, risks in this category may probably be caused by the macro control and intervention on investment and market from the central government. It is therefore essential to avoid contravening the central government’s policies, the long-term goals or public interests when negotiating with local governments (Wang et al., 2000; Wang and Ke, 2008). These risks could be covered in the concession agreement as follows: (1) if a significant change in law prevents the Project Company from fulfilling its obligations, the Project Company is entitled to receive corresponding payments irrespective of its inability to supply service then; (2) the Project Company can be restored to the same economics position if change in law results in additional costs to the Project Company over and above an agreed threshold; (3) the change in law provision applies to any change in law after Bid Submission Date and includes any changes in tax regulations, etc. (Wang et al., 1999, 2000).

The second category at country level relative to some government officers consists of four risks, “Poor political decision-making”, “Government’s reliability”, “Government’s intervention” and “Corruption”. Local governments in China sometimes make wrong decisions, such as providing too many guarantees to investors or lacking accurate predictions of demand for the projects, because of their limited experience and knowledge about PPP or considering their career achievement or short-term goals for personal interests (Wang et al., 2000; Wang, 2002). Unrealistic or unreasonable guarantees and supports made by Chinese local governments lead to high cost for local governments to fulfill the contracts, resulting in default of payments by local governments (especially during the change at expiration of office terms and change of key officers). The wrong decisions made by the local governments would also incur complaints from the public and may even result in the key officials stepping down (Sachs et al., 2007; Ho, 2006). Therefore, for private investors, the risk of cred-

itworthiness of local governments is of their main concern (Wang et al., 2000), and they need to assess the liability of government officials’ decisions, especially their verbal promises. Understandably, it is hence essential for the private sector to strive for the governments’ cooperation and assistance, but this may substantially increase the cost for such cooperation and assistance due to the corruption of some local government officers (Wang, 2002). In addition to money, project companies have to spend a lot of time and effort in dealing with the relationship with the government, which also has a negative influence on the efficiency of the companies’ operation and management as well as profits (Ho, 2006). A strategic management principle for this category would be to demand the strong support from the central government in order to underpin the obligations of local governments under the project (Wang et al., 1999, 2000).

The remaining risks “Competition (Exclusive right)”, “Supporting facilities risk” and “Land acquisition” are included in the third category relative to the target project. These risks would usually be taken by the public sector in terms of government incentives and support. Taking Guangxi Laibin B Power Project for instance (Wang and Ke, 2009), Guangxi Government would be responsible for the following during the construction period: (1) the delivery of the site and completion of the preliminary contract works and the access road; (2) coordinating and facilitating all dealings with the appropriate Government Authorities during the construction period; (3) obtaining, in a timely manner, and thereafter maintaining, the approvals required for construction which can only be obtained by Guangxi Government; (4) providing the Project Company with the transmission line and providing start-up electricity and steam and all fuel for testing. The risks “Land acquisition” and “Supporting facilities risk” were hence allocated to Guangxi Government through the provisions above. Government support would also be offered to ensure that no similar competitive project will be approved so that the market volume would not be undermined by the other projects.

4.2.3. Risks to be equally shared by both parties

There are 14 risks in the equally shared risk category option. Four risks that should be shared equally by both parties (“Public/Political opposition”, “Ground/weather conditions”, “Force majeure” and “Environmental protection”) belong to the country level. The nature of these four risk factors is such that public and private sectors may not be able to deal with it alone. Hence, a shared mechanism would appear to be the best option (Li et al., 2005). These risks are generally recognized as being severe, but have a low probability of occurrence. “Force majeure” risk is commonly covered by taking out insurance policies. Regarding the risk “Public/Political opposition”, it is important for the private investor to assess carefully whether the project is against the central government’s long-term goals or public interests when submitting a tender docu-

ment (Wang and Ke, 2008). If the invitation of bidding has stated the environment standards required for the project, additional measures undertaken to protect the environment by the private sector due to changes of the requirements should be rationally compensated. During construction, archaeological, geological and historical objects could be found, or other ground/weather conditions would be met such as a rainstorm or an earthquake. In such cases, all costs arising or any delaying effects on the project schedule caused by such risks should be compensated by an appropriate extension of the construction period or the concession period or both.

Four risks including “Interest rate”, “Foreign exchange and convertibility”, “Inflation” and “Market demand change” could be grouped as the market level risks, which are preferably shared by both parties equally. The reason behind this may be same as above since both partners may not handle it well alone. A useful experience to share these risks is to set up a threshold for higher or lower revenue changes caused by risk events. Taking Laibin B project for example again (Wang and Ke, 2009), the US\$ portion of the operating tariff shall be adjusted from time to time to take account of variations in the US\$ – RMB exchange rate beyond a certain threshold (5%) as provided under the Power Purchase Agreement. In this example, the Project Company bore the consequence by a risk event of foreign exchange rate below 5%, while local government took the risk when the change of foreign exchange rate is over 5%. Similar solutions could be suitable for the other three risks. For instance, there are various ways to cope with demand risk. It may be dealt with directly through guaranteeing minimum purchase of project output, or indirectly through adjusting tariff with demand, or a combination of them (Ye and Tiong, 2003). In a tariff adjustment mechanism considering demand, the price would increase in accordance with the reduction of demand beyond an agreed threshold, and vice versa for the increase of demand. However, sometimes the government would not request to reduce the price if the market volume increases in order to motivate the private partner to improve service quality.

The other project level risks that should be shared are: “Third party reliability”, “Improper contracts”, “Tariff change”, “Payment risk”, “Subjective evaluation” and “Insufficient financial audit”. Third party reliability risk would normally occur at the construction or operation stage of a PPP project, which is regarded as being out of the control of both parties, after the government and the Project Company reach an agreement on risk allocation and define them in the concession contract (Li et al., 2005). The respondents hence suggest it to be shared equally between the public and private partners. It is of equal importance for the government and the private investor to make their investment decisions based on reliable feasibility studies. However, in some cases, private investors, especially foreign investors, would not be familiar with local governments and their off-take capability, as well

as the business environments in China. They would reach agreements easily with the government’s promises, especially when the government needed funding while the investors needed projects (Wang, 2002). It is not surprising that risks of “Improper contracts”, “Tariff change”, “Payment risk” and “Subjective evaluation” will happen eventually. Since the feasibility studies and contract negotiation are relative to both parties, it would be the best for the public and private sectors to share the responsibility for these risks. Although financial audit is the obligation of the public sector in supervising the project performance, the intrinsic reason for the financial problem may still belong to the private sector. It is therefore reasonable for the private partner to share the risk too.

4.2.4. Risks to be mostly allocated to the private sector

The survey results (see Table 5) indicate that 10 risks out of 37 should be mostly allocated to the private sector. These risks include: “Financial risk”, “Construction completion”, “Construction/operation changes”, “Delay in Supply”, “Technology risk”, “Operation cost overrun”, “Residual assets risk”, “Consortium inability”, “Organization and coordination risk” and “Private investor change”, which all belong to the project level risks. This result coincides with a survey of traditional contract procurement in Hong Kong in which contractors were assigned 20% of risk items (Ahmed et al., 1999), but contrasts with a survey of risk allocation preference in PPP construction projects in the UK where 32 risks out of a total of 46 (representing 70% of all the catalogued risk items) were allocated to the private sector (Li et al., 2005). This may suggest that PPP procurement for construction projects in China has not achieved the objective of risk transfer from the public sector to the private sector such as in the UK.

Risks “Consortium inability” and “Private investor change” are both relative to the private consortium, and then are suggested to be taken by the private sector. As defined in the term “PPP” by the Efficiency Unit (2008) in Hong Kong, the public and private sectors both bring their complementary skills to a PPP project for the sake of providing public services more efficiently. Therefore, a basic commercial principle for the private investors is that it is not appropriate to invest in the infrastructure development if they are relatively less efficient in the construction or operation than the public sector.

Since the shortage of government funding is one of the major driving forces for the public sector to promote PPP implementation, it is hence understandable that the private partner should be responsible for the availability of financial resources. However, in some cases such as urban railway projects, which may have a low expected fare income, government assistance, such as minimum return guarantee, shall be required so as to make it possible for the private sector to find lenders in the financial market.

According to the previous comparative analysis of different risk allocation schemes, most construction and oper-

ation risks are assigned to the private partner. The results in Table 5 again reinforce this statement. The private sector should take the majority of responsibilities for “Construction/operation changes”, “Construction completion”, “Delay in Supply”, “Technology risk”, “Operation cost overrun”, as well as “Residual assets risk”.

In accordance with the previous findings by Li et al. (2005), “Organization and coordination risk” is usually associated with the day-to-day requirements of the project. Since the construction and operation responsibilities rest with the private sector in PPP procurement, the allocation is appropriate.

5. Conclusions

This paper has studied the allocation preferences of risks in China's PPP projects. The identified risk allocation preference would help the public and private sectors achieve a balance of distribution of responsibilities and risks and thus reduce the time and cost of contract negotiation. According to the analysis, only 1 out of the 37 risks (“Expropriation and nationalization”) was solely allocated to the public sector. Twelve risks to be mostly allocated to the public sector were identified, which were all related to government or government officers and their actions. There were 14 risks in the equally shared risk category option. The nature of these risk factors makes it difficult for either the public or the private sector to deal with it alone. The private sector should take the majority of responsibilities for the remaining 10 risks, which all belong to the project level risks. Interestingly, no risk fell into the category that should be solely allocated to the private sector. Hence, another observation which can be made is that PPP procurement for construction projects in China has not achieved the objective of full risk transfer from the public sector to the private sector such as in the UK. Reasons behind these allocation preferences and recommendations on the commercial principles or contract terms between the government and private consortium are also provided in this paper.

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