Finance-Related Critical Success Factors for the Briefing of PPP Projects in Construction

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ABSTRACT

Public private partnership (PPP) is widely used in the world. Many researchers claimed that PPP can contribute to sustainability in nature as it promotes long-term productive use of resources. The briefing stage is important to a PPP project because it is the stage when private sector funds are injected to projects. In considering this, the paper aims at identifying the finance-related critical factors that could lead to the success of the project in the briefing stage. Six finance-related factors were identified based on a comprehensive review of literature followed by personal interviews. The importance of these factors was rated using a questionnaire survey in Hong Kong and Australia. Because some background variables should be taken into account when rating these factors, a custom-made weighted ranking method was developed, which enabled an estimation of the weighted importance of finance-related factors. A comparative study of the results between Hong Kong and Australia was conducted. Discussion is provided to describe how these factors can help improve the briefing stage of PPP projects.

INTRODUCTION

The idea of bringing in private firms to finance public sector infrastructure is the early format of PPP introduced by the World Bank (IFC 1992). Projects that require private companies involved in 'design, financing, construction, ownership and/or operation of a public sector utility or service' are called Public-Private Partnership (PPP) projects (Akintoye et al. 2003).

As noted by Gray and Larson (2009), decisions made in early stages have a far-reaching influence to the rest of a project life-cycle. The briefing stage is used in Hong Kong and the UK to represent one of these early stages that can greatly influence a project. It can be considered of being synonymous with the terms 'architectural programming' and 'program' that are mainly used in the United States (Yu 2006). According to Kelly and Duerk (2002) *'briefing is the process of*

gathering, analyzing, and synthesizing information needed in the building process in order to inform decision-making and decision implementation'.

The briefing stage is important to a PPP project because it helps to clarify the client requirements in the procurement process that is one of the most important elements in PPP (Yu 2006). A good briefing can help stakeholders to make good relations and valuable decisions for a project. On the contrary, a poor briefing will not help to exchange information and clarify requirements. This will result in wasting time and delaying the whole project process.

Arising from the very nature of PPP projects, affordability issues and financial matters should be considered in the briefing stage of PPP projects. Confidential financial information contained within a PPP project would be disclosed in the early stage which emphasizes the importance of financial aspects in the briefing stage (Tang and Shen 2013a).

Since the briefing stage in PPP projects has often been overlooked in terms of its importance (Kelly 2003), this paper aims at exploring the critical factors that could lead to the success of the briefing stage for a PPP project. Specifically, this study aimed to identify and examine the finance-related critical success factors that affect the success of briefing in PPP projects. At the outset, the results were expected to provide measures to both the public and private sectors to improve briefing.

BRIEFING AND FINANCE-RELATED FACTORS

Normally, the briefing session in PPPs is set for approximately halfway through the bid preparation period. This allows the potential transaction advisors hired by the government for seeking a financial bid to consider which elements of the project they need clarification about before completing their bids. According to Kelly et al. (1992), in a comprehensive review of briefing studies for construction, the major weakness of the current briefing guide is that real assistance to clients and designers is too general and implicit. Contrasting to the briefing stage in traditional construction projects (e.g., projects where design and build processes are executed by two different groups of parties, projects which are only funded by governments), there are very few studies focusing on the briefing stage in PPP projects (Tang et al. 2010).

Using a questionnaire survey, Norwood and Mansfield (1999) found that financial sources continued to be scarce, despite a pressing need by contractors.. As they argued, some developing countries were gradually more able to provide a higher grade of local technical expertise at competitive prices. This would result in a greater chance for local contractors to compete in overseas markets, which is increasingly the case in Asia. Thus, this presents difficulties to contractors to participate in overseas PPP projects if they are not properly financed. Schaufelberger and Wipadapisut (2003) found that the availability of finance greatly influences selection of a favourable financing strategy which can support participation from the private sector.

Akintoye et al. (2003) reviewed the literature and used qualitative analysis to examine factors that could continue to deter the achievement of best value. They found that among other factors, the high cost of the PFI procurement process is a main burden on PPP projects, and leads to the unwillingness of the private sector to participate.

Other studies show that financing plays an important role in PPP. Those that focused on model development addressed different financing issues when researchers have attempted to study the financial viability of PPP projects. For example, Ho and Liu (2002) used an option pricing-based model to evaluate the financial viability of a privatized infrastructure project. To estimate when the project is at risk of non-completion through lack of funds, their quantitative model takes into account the views of both the project promoter and the government. Wibowo (2004) formulated a cash-flow model to calculate operating revenues generated by a PPP project. The financial impact of guarantees was studied from the perspectives of both the government and the project sponsor.

Researchers also studied the return and value of PPP projects. For example, Bakatjan et al. (2003) used a simplified model to determine the optimum equity level for decision-makers at the evaluation stage of a BOT project. This model combines a financial model and a linear programming model to maximize the return of a project from the equity holder's point of view. Zhang (2004a; 2004b) argued that there is a need for establishing the best-value objective dimensions for innovative project delivery models. These models could offer the best value to the public sector and support the partnership of public and private sectors by continuously enhancing the best value through long-term contractual arrangements. Then, a methodology was developed for capital structure optimization and financial viability analysis that reflected the characteristics of project financing, incorporated simulation and financial engineering techniques, and aimed for win-win results for both public and private sectors (Zhang 2005a; Zhang 2005b).

Other research, about rescue plans and capacity choice, was also conducted. For example, Ho (2006) developed a game-theory based model, which determines when and how the government would rescue a distressed project and what impacts the government's rescue behaviour on project procurement and management. Through an effective rescue model, the government would be able to map out a blueprint for the public, develop policies, and negotiate with the concessionaire (Chang and Chan 2001). Subprasom and Chen (2007) provided modelling and analysis of highway pricing and capacity choice of a BOT scheme. It was found that the combination of toll charge and roadway capacity regulation performed best in terms of a social welfare increment. Yet, in PPP highway projects, the regulation may cause financial pressure on private investors in operating a project. The government, therefore, may need to subsidize private investors in order to make their participation financially viable.

From above literature, six finance-related factors have been identified (see Table 1) and three interviews with construction practitioners were conducted to examine their views about each.

RESEARCH METHOD

Data Collection. This study was using a questionnaire survey to collect data on these factors. The questionnaire consists of two sections. In the first section, background information, mainly the type of the PPP project, the nature of the PPP project, the role in the PPP project and the experience in the PPP project, was elicited.

In the second section, the procurement-related factors which might affect the success of briefing in PPP projects were rated with a Likertscale of 1-5, where 1 represents 'strongly disagree' and 5 represents 'strongly agree'. Respondents answered the questionnaire based on a particular PPP project in which they had participated in Hong Kong or Australia.

Table 1. Finance-Related Factors of the Briefing Process in PPP Projects.

Finance-Related factors	Remarks
Practical budget and programme	Practical budget and programme of the project is needed.
Preparing bids for funding through the RAE process	Bidding for funds from the government should be prepared via the policy bureau through the resource allocation exercise process.
Conducting socio-economic studies	Socio-economic studies regarding the project need to be conducted.
Demonstration of how PPP can achieve the best value for money	Whether and how PPP can achieve the best value-for-money results should be indicated.
Proposed commercial arrangement	Proposed commercial arrangement including contract duration, payment mechanisms, and other partnership/financial arrangements should be formulated in the brief.
Good financial standing of the private partner	Good financial standing of the private partner needs to be considered in briefing.

The questionnaire survey in Hong Kong was carried out from March to May 2009 to collect opinions from the public sector. Those who had PPP experience in the HKSAR government departments were chosen as participants in this study. Overall, 500 questionnaires were sent out and 122 effective responses were collected, yielding a response rate of 24.4%, an acceptable level in construction research (Akitoye 2000; Zhang 2004b). Questionnaires were received from the respondents who worked in the Architectural Services Department, the Buildings Department, the Drainage Services Department, the Efficiency Unit, the Environmental Protection Department, the Highways Department, and the Transport Department.

The questionnaire survey in Australia was carried out from August to October 2010 to collect opinions from the public sector on the Queensland Government in Australia. Questionnaires were distributed to professionals in governmental departments, including the Department of Education and Training, the Department of Infrastructure and Planning, the Department of Transport and Main Roads, and the Department of Treasury. These departments all have had PPP work experience such as the Southbank Institute, the North-South By-pass Tunnel, and the Airport Link project. Consequently 78 effectively completed questionnaires were collected, giving a response rate of 26.4% which was in the acceptable range in construction research (Akintoye 2000; Zhang 2004b).

Preliminary findings.   The sample data collected in Hong Kong covered a wide range of PPP projects: about one third of the respondents have worked on road

projects (33.6%), followed by drainage projects (29.5%), waste transfer stations (13.1%), theme parks (9%), tunnels (6.6%), schools (4.9%) and rail projects (3.3%). Of the four different natures of PPP projects, slightly more than half of the projects involved refurbishment (52.5%), followed by new build (33.6%) and schemes comprising both new build and refurbishment (13.9%). In terms of roles played in PPP projects, 51 respondents were engineers (41.8%), followed by client representatives (22.95%), administrators (9.84%), contract managers (8.20%), surveyors (7.38%), financial managers (4.92%), architects (2.46%), and contractors/suppliers (2.46%). It should be noted that most of the respondents (77%) were not directly involved in briefing, leaving 23% of respondents directly involved in briefing. Despite this, their active involvement in projects should provide useful data for this survey. Especially when briefing is perceived to be part of the inception stage of a project, professionals who work at other stages should be able to provide opinions on how to improve the briefing process.

In the sample data collected in Australia, more than half of the respondents (56.4%) worked in infrastructure projects (including rails, tunnels, roads etc.), while 43.6% took part in PPP building projects such as hospitals and schools. For the nature of PPP projects, most of the projects were new build (98.7%) and only one respondent worked in refurbishment projects (including renovation, extension etc.). In terms of roles in PPP projects, 20 respondents (25.6%) were from professional groups including contractor/suppliers, engineers, and surveyors. The remaining 74.4% of respondents (n=58) are at management level such as administrators, client representatives, contract managers, financial managers, and legislative councillors. For the briefing experience in PPP projects, 47 respondents were directly involved and 31 respondents did not directly join the briefing process.

DATA ANALYSIS AND DISCUSSION

Homogeneity tests.   Before calculating values for factor ranking, comparisons based different background variables were made to test the homogeneity of the data. Table 2 provides the mean scores collected in Australia for each of the finance-related factors for the buildings and infrastructure projects together with the 2-tailed t-test p-values. This indicates significantly different ($p < 0.05$) mean scores for 3 factors. Table 3 provides the mean scores collected in Australia for each of the finance-related factors for contractors and clients together with the 2-tailed t-test p-values. It also indicates significantly different ($p < 0.05$) mean scores for 3 factors. In general, therefore, it seems that the results are not homogeneous across project types and roles in PPPs, with the finance-related factors having a higher influence on building projects than infrastructure projects and a higher influence on contractors than clients.

Similar results were also obtained from data collected in Hong Kong.

Ranking analysis.   In view of the heterogeneous nature of the data, it is clear that the different background information of PPPs should be taken into consideration. To do this, samples in which background information is closer to the majority of the collected data was assigned a higher score, and vice versa. Denoting the number of respondent by N, each respondent is represented as a vector, where the dimension is

the same as the factor number. The sample is denoted as $X_i = (x_{i,1}, x_{i,2}, ..., x_{i,d}) \in R^d$, where d is the dimension number. The background information variables can be regarded as class labels (Duda et al. 2000; Bishop 2006; Hastie et al. 2008) used to distinguish the samples from the different groups. Consequently, the data from the 78 respondents are grouped into several classes with each kind of background information. For example, respondents who chose the same type of the PPP project are grouped into one class. The class label for X_i is denoted as l_i A variable k is introduced to represent the different background information types. This ranges from 1 to 4 to denote "the type of the PPP project", "the nature of the PPP project", "the role in the PPP project" and "the experience form in the PPP project" respectively.

Table 2. The Types of PPPs and Finance-Related Factors.

Factors	Sig. (2-tailed)	Average mean	Mean of infrastructure projects	Mean of building projects
Prepared bids for funds through the RAE process	.000	4.12	3.80 (0.32)	4.53 (0.41)
Conduction socio-economic studies	.000	4.60	4.30 (0.30)	5.00 (0.40)
Demonstration how PPP can achieve the best value for money	.000	4.46	4.05 (0.41)	5.00 (0.54)
Practical budget and programme	.360	-	-	-
Proposed commercial arrangement	.269	-	-	-
Good financial standing of the private partner	.652	-	-	-

Table 3. The Role in PPPs and Finance-Related Factors.

Factors	Sig. (2-tailed)	Average mean	Mean of contractors	Mean of clients
Prepared bids for funds through the RAE process	0.001	4.12	4.00 (0.12)	3.96(0.16)
Demonstration how PPP can achieve the best value for money	0.000	4.46	5.00 (0.54)	4.11 (0.35)
Good financial standing of the private partner	0.000	4.77	5.00 (0.23)	4.62 (0.15)
Practical budget and programme	0.207	-	-	-
Conduction socio-economic studies	0.061	-	-	-
Proposed commercial arrangement	0.185	-	-	-

To distinguish the data sample in each background group, the weight for each sample X_i is defined as:

$$w_{xi} = \frac{1}{4}\sum_{k=1}^{4} w_{li}^{k} = \frac{1}{4}\left(w_{l_i}^{1} + w_{l_i}^{2} + w_{l_i}^{3} + w_{l_i}^{4}\right) \tag{1}$$

Where $w_{l_i}^{k}$ is the weight for X_i with class label l_i in background type k.

For background information type k, the weight is computed as:

$$w_{l_i}^{k} = \exp\left(-\frac{1}{2}\left(\mu_{l_i}^{k} - \mu^{k}\right)^{T}\Sigma^{-1}\left(\mu_{l_i}^{k} - \mu^{k}\right)\right) = \exp\left(-\frac{1}{2}\left(\mu_{l_i}^{k} - \mu\right)^{T}\Sigma^{-1}\left(\mu_{l_i}^{k} - \mu\right)\right) \tag{2}$$

Where $\mu_{l_i}^{k}$ is the mean of class l_i in the background variable k. $\mu^{k} = \mu$ is the mean of total N data samples. Σ is the covariance matrix of data, which is:

$$\Sigma = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \mu)(x_i - \mu)^{T} \tag{3}$$

The weight score in (2) is used to reduce the influence of the outlying distributed data samples. For example, if the class mean $\mu_{l_i}^{k}$ in background class k is far away from the total data mean μ, a small weight is given to the samples X_i with class l_i. Contrarily, if the class $\mu_{l_i}^{k}$ in background class k is near to the total data mean μ, a large weight is given, since the samples in that background variable represent the majority of the collected data. The covariance matrix Σ is used to compute a better distance function instead of the Euclidean distance (Duda et al. 2000). Moreover, the weight has the property of ranging from 0 to 1.

The weight for background k is the same as the exponential term of a multivariate Gaussian distribution in class l_i.

$$\frac{1}{(2\pi)^{d/2}}\frac{1}{|\Sigma|^{1/2}}\exp\left(-\frac{1}{2}\left(\mu_{l_i}^{k} - \mu\right)^{T}\Sigma^{-1}\left(\mu_{l_i}^{k} - \mu\right)\right) \tag{4}$$

Which ignores the constant term. A similar weighting scheme has been widely used in non-parametric kernel methods (Schölkopf and Smola 2001), neural network based machine learning (Bishop 2006), and manifold approximation (Belkin and Niyogi 2005).

Recall that in (1), the weight means that if a data sample is close to the majority of all the four background variables, it is allocated a large weight in computing the final ranking. The final ranking score for factor j is therefore calculated as:

$$r_j = \sum_{i=1}^{N} w_{x_i} x_{i,j} = w_{x_1}x_{1,j} + w_{x_2}x_{2,j} + ... + w_{x_N}x_{N,j} \tag{5}$$

And the results are shown in the Table 4 (Hong Kong) and Table 5 (Australia).

As shown in Table 4, "practical budget and programme" ranked first (3.53), followed by "good financial standing of the private partner" (3.41). Both of these two factors give confidence to the public factors from the potential private partner. Practical budget and programme could lead to a reasonable investment from the private sector. A good financial standing could assure the public sector that a potential private partner is capable of finishing projects.

Table 4.Ranking Scores of Finance-Related Factors (Hong Kong).

Finance-related factors	Ranking score
Practical budget and programme	3.53
Proposed commercial arrangement	3.41
Good financial standing of the private partner	3.34
Conduct of socio economic studies	3.31
Demonstration how PPP can achieve the best value for money	3.27
Prepared bids for funds through the RAE process	3.11

Table 5.Finance-Related Factor Ranking Scores (Australia).

Finance-related factors	Ranking score
Practical budget and programme	3.41
Proposed commercial arrangement	3.31
Good financial standing of the private partner	3.23
Conduct of socio-economic studies	3.16
Demonstration how PPP can achieve the best value for money	3.01
Prepared bids for funds through the RAE process	2.80

"Proposed commercial arrangement" (3.27) and "conduct of socio-economic studies" (3.11) listed the last positions of ranking results. The reasons for these results might be that public sector stakeholders thought the commercial arrangements and socio-economic studies were not that necessary during the briefing process, comparing with other financial aspects.

Table 5 shows that the Australian public sector rated "practical budget and programme" (= 3.41) and "proposed commercial arrangement" (= 3.31) most highly. Relatively, the respondents rated factors of "demonstration how PPP can achieve the best value for money" (= 3.01) and "prepared bids for funds through the resource allocation exercise process" (= 2.80) low. Generally speaking, the officers of Australian state governments paid more attention to a reasonable budget and PPP procurement programme than value-for-money results during the briefing process. There might be an inherent conflict between the public sector's need to demonstrate the value-for-money results and the private sector's need for robust revenue streams to support the financing arrangement (Tang et al. 2013b). Overall, 20 government respondents who had been directly involved in the briefing process reckoned that market soundings were worth more consideration than the financial standing of the private partner in the early stage of a PPP project.

CONCLUSIONS

The Briefing stage is important for all construction projects, especially PPP-type projects which are practiced worldwide and getting more complex arising from more stakeholders, longer concession period, and increased responsibilities. Better briefing can save both time and cost in later stages of projects.

Of the finance-related factors, the factor "practical budget and programme" took the first place in both the Hong Kong list and the Australian list. The public sector from both Hong Kong and Australia paid more attention to a reasonable budget and PPP procurement process. It can be concluded that the financial ability of the potential private sector is important for the private sector. All other factors had the same ranking which means although different countries may have different policies of PPP projects, their concerns about finance during the briefing stage are the same.

The limitations of the research presented in this paper is that the data were collected from the public sector only. The research team assert that these findings and subsequent discussions, however, would still be beneficial to almost all project stakeholders in PPP projects. Thus, this paper will improve the understanding of the briefing stage in PPP projects.

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