

Risks behind the Variables of Financial Model for Public-Private Partnership Project

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Abstract

Large infrastructure projects encounter numerous risks in several aspects. Since the existence of risk cannot be eliminated, alternatively the anticipated risks can be mitigated by managing them. However, all of those risks in Public Private Partnership (PPP) projects could affect the financial viability of the project. Therefore, the project evaluation from the perspective of financial implications is a very important subject to study. The main challenge is to find out the best strategy on how the stakeholders manage the risks by using PPP financial models. This paper aims to explore the project risks attributed to the identification financial risk variables. A literature review has been undertaken to identify the financial risk variables. A pilot study was conducted in India through a series of semi-structured interviews for shaping and validating the preliminary findings. Then, a structured questionnaire survey of international expert opinions was carried out to validate the financial risk variables within PPP financial models to produce the information needed for decision making, such as the most important financial risk variables, mitigation measures and its alternatives.

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1. Introduction

The complexity of project finance arrangement and the uncertainty over long term concession period have generated more risks not only to the government but also to the private parties [1], [2], [3], [4]. Thus, PPP projects require adequate allocation of the risks, associated with the complex financial, legal, organisational and socio-political structure, between the public sector authority and the private parties.

Studies on identification of various risks in general PPP projects have been undertaken by many researchers e.g. [5], [6], [7], [8], [9], [10]. However, there is still a gap of research that specifically reviews financial indicators of PPP financial model which are associated with the risks especially for PPP seaport projects. This article aims to explore the project risks attributed to the identification financial risk variables. The exploration of the risks is attributed to the identification financial risk variables from PPP financial models. By considering this approach, the risk sharing mechanism among the stakeholders can be determined comprehensively in any stage of financial negotiation. In this study, the definition of stakeholders is also limited to the actors (e.g. sponsor(s), lenders, government authority, consultant companies, insurance company, contractor, operator, etc.) who are using financial models as a tool for project evaluation, contract negotiation, appraisal report, tariff adjustment, and project performance monitoring. The next part of this article discusses financial risk variables on PPP financial model.

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2. Financial Risk Variables

Although advanced standardised PPP contracts have been introduced by the government in the UK in order to reduce bid costs and negotiations [11], the conditions in the contract can be renegotiated from time to time, though renegotiations can be costly and lengthy [12]. Therefore, when PPP financial models are used as tools for evaluating PPP projects (e.g. cash flow estimation) and negotiating PPP contract and financial terms (e.g. concession period and tariff rate), it is imperative to identify the expected risks from the most important financial indicators or financial risk variables. This section identifies the potential risks attributed to financial risk variables (critical financial indicators).

The risk identification is limited to the risks related to the financial risk variables. Liu and Yue [13] explored several methods and tools which have collective functions of risk description, analysis and calculation in the engineering field such as: active network or program evaluation and review technique (PERT), fault tree analysis (FTA), influence diagram, etc. Further, among the risk analysis tools, they argued that influence diagram in the perfect analysis tool for dynamic risk management because it represents the combination and transfer of risk elements from the two aspects of time and logic, and is good at analyzing the sensitivity and control value of risk elements. Ashley and Bonner [14] also stated that the influence diagram method provides an very useful picture of a project and its inherent risks. Influence diagram is a convenient communication tool between experts, managers and owners as well, to make the decision of risk management more timely and accurate. Hence, the links between the financial risk variables and the related risks are identified by the Influence diagram method. The next section discusses the influence diagram of the financial risk variables.

3. Discussion

3.1. Risks Related To Input Assumptions And Output Indicators

Since the identification of financial risk and consequence variables is derived from the financial risk variables, this section attends to the connection between financial risk variables and financial risks, including the decision rules to avoid the risks. It is worth recalling that financial risk variables are divided into two categories (input assumptions and financial model output). Any calculation of new outputs is based on one or a range of input data variations. Furthermore, the information to be provided in the input worksheet is raw numbers (of assumptions) instead of calculations. The output worksheet of the financial model is an overall summary of pro forma financial statements and key ratios that help the reader to understand the financial viability of the project. Therefore, financial risk variables are divided into two categories. Tabel 1 shows the financial risk variables of PPP financial model taken from literature review and survey findings.

Several influence diagrams that were developed in this research can be considered as representing financial risk analysis for PPP projects. One of these influence diagrams can be seen in Fig. 1. Although the developed influence diagrams are relatively wide-ranging in structure, they should encompass critical factors and their influences. When these influence diagrams are used continuously from the pre-proposal stage to operation stage, it would invariably lead to enhancements and refinements of the decision making process.

The importance of financial risk variables were identified from the literature review and then consolidated into five most important indicators of each input and output of PPP financial model (based on each stakeholder's point of view). These indicators were further analysed by conducting another literature review to identify the related risks as shown in Table 1 and Table 2.

Table 1. Financial risk variables of financial viability module

| Financial risk variables | Yun, et al. [15] | Zhang and AbouRizk [16] | Zhang [10] | Survey findings |
|--------------------------------|---|---|---|-----------------|
| Project costs | Total project cost | Project development cost | Construction cost, construction cost escalation rate | √ |
| Volume / Demand (traffic) | Traffic demands | Market demand | Market demand | √ |
| Revenue forecast | Annual revenue | Sale price | Price | √ |
| Operating and Maintenance cost | Operation and maintenance cost | Project O&M costs | O&M Cost | √ |
| Loan repayment schedule | – | – | Loan repayment period | √ |
| Financing cost | – | – | – | √ |
| Project timelines | Concession period and construction duration | Construction period | Construction duration | √ |
| Capital structure | – | – | Required minimum ratio of equity at project risks | √ |
| Interest and fees | Escalation rate, interest rate of the loan, discount rate | Discount rate (combining interest rate and inflation rate). | Base debt interest rate, currency exchange rate, and inflation rate | √ |
| IRR | √ | – | √ | √ |
| Net cash flow | – | √ | – | √ |
| EBITDA | – | – | – | √ |
| CADS | – | – | – | √ |
| LLCR | – | – | √ | √ |
| Interest covering ratio | – | – | – | √ |
| Repayment period | – | – | Loan repayment period | √ |
| Revenue | √ | √ | √ | √ |
| NPV | √ | Project development cost NPV | √ | √ |
| Operating cost | √ | √ | √ | √ |
| ROE (Equity IRR) | – | – | √ | √ |
| DSCR | √ | – | √ | √ |

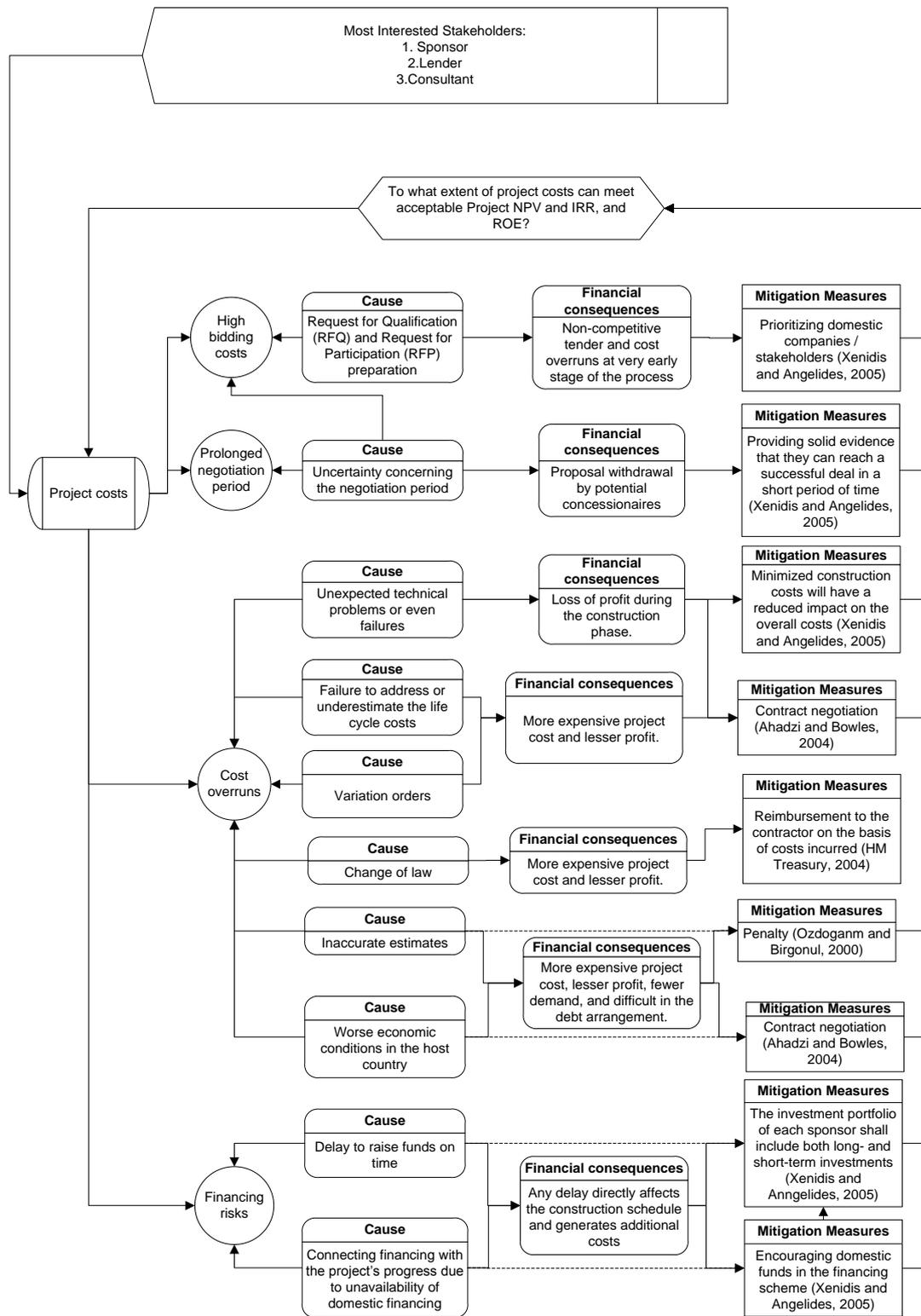


Fig.1. Influence diagram of project costs, risks, and mitigation measures

Table 1. Input assumptions and financial risks

| Input Assumptions | Decision Rules | Financial risk |
|---------------------------|---|--|
| Project costs | PFI should not be used for individually procured projects under £20m [17]. | High bidding costs, prolonged negotiation period, cost overruns, and financing risks [8]. |
| Volume / Demand (traffic) | Traffic forecast should serve several purposes A background for estimating future traffic levels in the design and appraisal of infrastructure improvement schemes, and of traffic policies and initiatives aimed at changing the use of the network. A basis for predicting many of the environmental impacts of the traffic both at the national and local levels; An indicator for informing regarding how much the traffic can be expected to grow under present policies An indicator of the effect of measures that they might propose to influence the growth. | Competitive risk [28]; project approval risk [29]; revenue risk [18], [19]; [20]; [30]; [21]; and [22]. |
| Revenue forecast | "If there is no off-take agreement, and the revenue forecast is subject to price, demand, business cycle, inflation, currency parity and other operating risks" [23]. | Bidding risk [24]; traffic risk [25], [26], [27]; competitive risk [28]; project approval risk [24]; revenue risk [18], [19], [20], [15], [21], and [22]; and funding risk [31], and [32]. |
| Operating cost | A general estimate of operating costs should include estimates of the services required to operate the completed facility and will alter in line with the nature of the project, such as: (1) human resource costs, staffing, pension liabilities, redundancy costs etc; (2) consumables; (3) repairs, maintenance and cleaning; (4) administrative overheads; (5) insurance costs; (6) in-house management costs [34]. | Market risk [25], [33], [21]; and cost overruns [8]. |
| Loan repayment schedule | Loan repayment profile must be tailored to the project for which it was set up (i.e. Greenfield or Brownfield project in developed or developing country, etc.) [28]. | Construction risk [10],[35]; revenue risk [18], [19], [20], [15], [21], [22]; and funding risk [31], [32]. |
| Financing cost | Higher transaction and financing costs should be off-set through efficiency gains (e.g. low financial service charges, fixed and low interest rate financing, long-term loan financing and low costs from fluctuations of currency and exchange rates) [36], [30]. | Financial risk [37], [38], [39]; agency cost risk [40]; legislative & government risk [21]; and construction risks [35]. |
| Project time lines | The length of the concession period should be determined based on project conditions, whole life cycle cost, likely term of senior debt, and financial analyses [18]. | Time overrun [25], [42], [8]; market risk [10], [6], [23]; prolonged negotiation period, and cost overrun [8]. |
| Capital structure | The Korean government regulates that the level of equity ratio should not be less than 20% [15]. | Revenue risk [18], [19], [20], [15], [21], [22] and funding risk [31], [32]. |

| | | |
|-------------------|---|---|
| Interest and fees | The interest rate and fees should be tested to ensure that they are reasonably close to market for the type of project being considered [23]. | Market risk [25], [33], [48]; traffic risk [44]; and credit risk [8]. |
|-------------------|---|---|

Table 2. Output indicators and financial risks

| Financial Outputs | Decision Rules | Financial risk |
|-------------------------|--|--|
| IRR | IRR must be greater than the required rate or discount rate (Bakatjan <i>et al.</i> , 2003). The Government authority should implement a project if the expected IRR covers the market interest rate plus a risk premium which takes account of the uncertainties [57]. | Violation of flat payment profile assumption [43]; cost overrun [8], revenue risk [18], [19], [20], [21], [22]; high risk premium [21]; traffic risk (Cheng, 2010b), and market risk [24], [33], [57]. |
| Net cash flow | Positive and higher net cash flows are preferred (Schmidt, 2012). | Market risk [24], [33], [57]; cost overrun [8]; tariff risk [25], [26], [27]; and decision risk [46], [47], [48]. |
| EBITDA | Higher is better | Decision risk [46], [47], [48]. |
| CADS | Higher is better | Funding risk [31], [32]; revenue risk [18], [19], [20], [21]; and [22], cost overrun [8], and calculation risk [49]. |
| LLCR | The minimum LLCR generally should be greater than 1.2 [50] | Market and cross-currency risk [10], [6], [23]; revenue risk [18], [19], [20], [21]; and [22]; cost overrun [8], and funding risk [31], [32]. |
| Interest coverage ratio | “When a project’s interest coverage ratio is 1.5 or lower, its ability to meet interest expenses may be questionable. An interest coverage ratio below 1 indicates the project is not generating sufficient revenues to satisfy interest expenses [56]. | Funding risk [31], [32]; revenue risk [18], [19], [20], [21]; and [22]; and cost overrun [8]. |
| Repayment period | A project is acceptable if its payback is less than the maximum cost recovery time established by the analyst. The investment should proceed if the payback period exceeds a specified period. When using payback period as a ranking method between projects, the project with the shortest payback period should be selected [48]. | Liquidity risk [54], tariff risk [25], [26], [27], and decision risk [46], [47], [48]. |
| Revenue | Higher is better | Bidding risk [24]; traffic risk [44]; competitive risk [25]; project approval risk [14], revenue [18], [19], [20], [21], [22]; and funding risk [31], [32]. |
| NPV | Higher is better | Discount rate risk [51], [52]; decision risk [46], [47], [48]; unprofitable project risk [21], and high social margin cost [53]. |
| Operating cost | Lower better | Market risk [25], [33], [21]; and cost overruns [8]. |
| ROE (Equity IRR) | The project sponsor should use less borrowing than the level that maximizes the debt market value, when the project sponsor chooses to maximize the ROE [42]. | Tariff risk [25], [26], [27]; and cost overrun [8]. |
| DSCR | India prefers that the minimum ADSCR should be above 1.30 in all years of the loan period [55]. | Revenue risk [18], [19], [20], [15], [21]; and [22]; cost overrun [8]; calculation risk [49], and decision risk [46], [47], [48]. |

4. Conclusion

The most preferred financial indicators are adopted as financial risk variables. From the research findings, the user of PPP financial model will be able to identify the possible risks from the financial risk variables. The link between the financial risk variables and the related risks was identified by Influence diagram method. Hence, the aim of this paper to explore the project risks attributed to the identification financial risk variables is achieved.

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