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The 5th International Conference of Euro Asia Civil Engineering Forum (EACEF-5)

## Best practice for financial models of PPP projects

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### Abstract

Public-private partnership (PPP) project's arrangement involves many participants with complex transactions and diverse interests at 5 different project stages. Especially in the project financing perspective, this arrangement creates the entire project evaluation process prone to take an extensive period before reaching financial closure. The importance of utilizing financial model as a tool for project evaluation and negotiation is highlighted in this study. 26 input assumptions and 16 output variables have been identified through comparison study of three PPP financial models, and their significances were verified based on pilot studies in India and the UK and expert opinion solicited worldwide through a structured questionnaire survey. SPSS program was used to evaluate the survey responses. The best practice PPP financial model was identified quantitatively by the agreement of four groups of stakeholders (i.e. sponsors, authorities, lenders, and consultants) upon the most preferred financial input and output indicators.

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*Keywords:* Public-Private Partnershi; Stakeholders; Financial Model.

### 1. Introduction

Public-private partnership (PPP) project's arrangement involves many participants with complex transactions and diverse interests at 5 different project stages. It is critical that the project evaluation and negotiations between the public sector authority and the other stakeholders to be carried out in a timely manner. In PPP projects, sponsor(s) generally organize a special purpose vehicle (SPV) or a concessionaire company to deal with contractor, lenders, investors, insurance providers, and other parties especially government authority. Typically, a successful PPP project

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has mutual agreement and balance of risk sharing between government authority and sponsor(s) prior to financial close. Therefore, financial models are not only used as tools to win bids but also to assist in the risk sharing negotiation between government authority and sponsor(s) [1]. This paper begins with an introduction of financial model and continues to explore best practice of financial model. The stakeholders who utilize financial models in PPP projects and their preference on financial indicators of PPP financial models are then presented. This paper highlights and discusses the most important ones.

## 2. Financial Model

The financial decision making model (also known as ‘financial model’) is a tool for evaluating a new project and facilitating negotiations among lenders, sponsor(s) and a government authority. In PPP projects, sponsor(s) generally organize a special purpose vehicle (SPV) or a concessionaire company to deal with lenders, investors, insurance providers, contractor and other parties especially government authority. Generally, a successful PPP project has mutual agreement and balance of risk sharing between government authority and sponsor(s) prior to financial close.

The sponsor(s) should have developed fairly sophisticated and accurate models that portray the economic and financial feasibility of a project under a variety of scenarios and assumptions. For the economic feasibility, the best perspective is viewed from host government that seeks ‘value for money’ in relation to government expenditure. While for the financial feasibility, the developers will focus on the level of projected distributions, their pace and timing, and the acceptability of the project’s resulting internal rate of return (IRR). However, the lenders are concerned more on: (a) Projected revenues, operating expenses, Cash Available for Debt Service (CADS) and distributions are consistent with project agreements; (b) Realistic estimates of future project revenues are sufficient to cover operating expenses and repay project debt with an acceptable margin of safety.

Table 1. Key issues in the project economic feasibility [2]

Major participants	Key issues	Remarks
Public sector	Financing costs	Balance between Return on Equity (ROE) & shorter debt tenor may result in a higher tariff for the users.
	Development costs	Legal fees, development fees and costs of conducting due diligence.
	Insurance	Costly insurance policies to mitigate construction, operation and certain specialised risks.
	Taxes	In many countries, the public sector does not pay taxes, or pays at a lower rate than the private sector does.
	Construction costs	The public sector rarely uses turnkey construction contracts in some cases and specifications.
	Operating & Management (O&M)	The private sector relies on very strict O&M practices.
Sponsor(s) and Lenders	Tariff or tolls of the infrastructure facility	Tariffs should be reviewed as reasonable over the longer term by the consumer serviced by the facility, given the foreseeable effects of future deregulation, sector reorganisation, competition, new technology and other similar factors.

A consultant firm can be appointed as a financial advisor by both or either, the government authority and/or the SPV Company for developing and utilizing financial models. In developing a financial model, a financial advisor depends on other parties to specify all relevant data needed for the model. Since the core aim of financial modelling is to forecast the performance of a project under uncertainty, economic and financial assumptions are made to predict the project performance. The government authority might provide policy initiatives data such as fiscal incentives scheme, retained responsibilities for the delivery of core services, governmental loan guarantee, royalty, tariff cap, etc. [2-6]. The key issues that need to be concerned by three major parties in the economic feasibility of the project are described in Table 1.

The SPV Company supplies initial cost of the project and its management cost. The Engineering, Procurement and Construction (EPC) Contractor gives construction cost and also Life Cycle Cost (LCC) on a monthly basis. Operation and maintenance costs data is provided by the operator company or facilities management contractor. The lenders will provide financial information related to the project financing. These inputs are adjusted in coordination and negotiation with the parties who provide the data. The financial advisor assembles all project costs estimation, and feeds them into model together with adjustments to the forecasted traffic volume and variable rates to correspond with the SPV target [7]. Therefore, financial models are not only used as tools to win bids but also to assist in the risk sharing negotiation between government authority and sponsor(s).

### *2.1. Developing the best practice of PPP financial models*

The complexity of project financing transactions and the diversity of stakeholders' interests are the major reasons that make financial models hard to understand and error prone. Hence, it is essential to learn the best practice of PPP financial models and audit the model for error possibilities. In the context of general financial model, Panko stated that 88% of 113 financial model spreadsheet audited since 1995 contains errors due to formula inconsistency [8].

There are two methods of developing a financial model such as: bottom-up and top-down approaches. Siersted argued that input identification of financial model can help to find out where the variables can change the calculation process [9]. The input identification can be done by mapping those variables and putting them into specific areas, so that most people can figure them out easily. This identification is a basic for formula consistency. Furthermore, transparency of the calculation formula can help the auditor and lender or other parties to keep the calculation flow and links on the right track. The majority of financial modelers adopt this strategy as a bottom-up approach, whereby the input identification of the raw data along with basic calculations is a priority. Meanwhile, Swan suggested that a good financial model is started by designing the output first, and then identifying the output rather than input [10]. This approach is called a top-down approach. The purpose or objective of the financial model first is initially identified, followed by a consideration of the usage of the financial model. Without a clear plan or set of objectives, it is often quite complicated for the stakeholders to understand the model. In the absence of the model builder, it is difficult to have full confidence that the model is really doing what it is supposed to do, and because the users or sponsors have not been involved in the development process, the results themselves may be unsatisfactory.

In order to learn how to develop a comprehensive financial model, it is important to understand the use of financial model at different stages, and to know who the parties (stakeholders) involved in using financial model are. There are five stages when the model is used with different purposes; they are pre-proposal stage, contract negotiation stage, finance-raising stage, construction stage, and operation stage. Table 2 shows the use of financial model with the stakeholders in PPP Projects.

The stakeholders mostly concern about the ability of the project to generate enough cash flow over the concession period, which is to attract or to comfort the investors towards their capital investment [11]. Meanwhile, the PPP scheme projects, which are believed to deliver better value for money, have been criticized by many as the highest level of political patronage or corporate political power [12-15]. Therefore, the reconciliation of their expectations is anticipated to control the achievement of value for money in PPP projects by utilizing PPP financial models. Since the reconciliation process needs identification of stakeholders' preferences in utilizing financial variables of PPP financial model, the financial variables are described in the next section.

### *2.2. Financial Variables of PPP Financial Model*

Chang and Chen stated that a complete financial model helps the government authority map out the best scheme for the best of public while developing policies and negotiating with the sponsor(s) [2]. The core aim of financial model contains economic and financial assumptions to predict project performance. Typically, a financial model is arranged in a spreadsheet with different worksheets. The architecture of a typical financial modelling of a project is illustrated in Fig. 1, showing the standard parts (or worksheets) of a financial model. The standard worksheets comprise three categories such as: (1) Input Worksheet, (2) Calculation Worksheet, and (3) Output Worksheet.

Table 2. Stakeholders who are utilising financial models in PPP projects [2-3,11,16]

Stakeholder	Description	Stage
Authority	Evaluate the estimated cost of two procurements either PPP or public sector comparator (PSC).	Pre-proposal stage
	Negotiate the risk sharing mechanism with the bidders and evaluate the competitive bidders' proposal.	Bidding and contract negotiation stage
	Evaluate a new tariff	Operation stage
Sponsor	Facilitate the submission of proposal	Pre-proposal stage
	Negotiate the risk sharing mechanism and capital structure of the project with other potential sponsor(s), lenders and the government authorities.	Bidding and contract negotiation stage
	Monitor and track the performance of the project.	Construction stage and operation stage.
Lender	Negotiate a new tariff with the government authority	Operation stage
	Modify the initial model to lender base case financial model in order to test the project's financial viability.	Finance-raising stage
	Maintain the financial model and monitor the project costs	Construction stage.
Consultant	Assess the impact of any annual operations budget submitted by the project vehicle to lenders	Operation stage
	Develop and audit the financial models.	Proposal stage, contract negotiation stage, finance-raising stage, construction and operation stage.
	Assist the sponsor, the lender and the government authority in evaluating the project.	

Input worksheets. These worksheets generally comprise various assumptions (e.g. project timelines, economic assumptions, technical data, capital cost, loan commitment, tenor, grace, loan type, interest rate and fees, repayment structure, target of equity, ROE, tax information, working capital and reserves, etc.), which are derived from the project documents or from other relevant sources. These worksheets are designed to allow users to be able to change the numbers used in the model, but not the formulas. Furthermore, Swan suggested that the input worksheet should be made up of raw numbers instead of calculation [10]. However, a link formula in the inputs sheet is not considered as calculation.

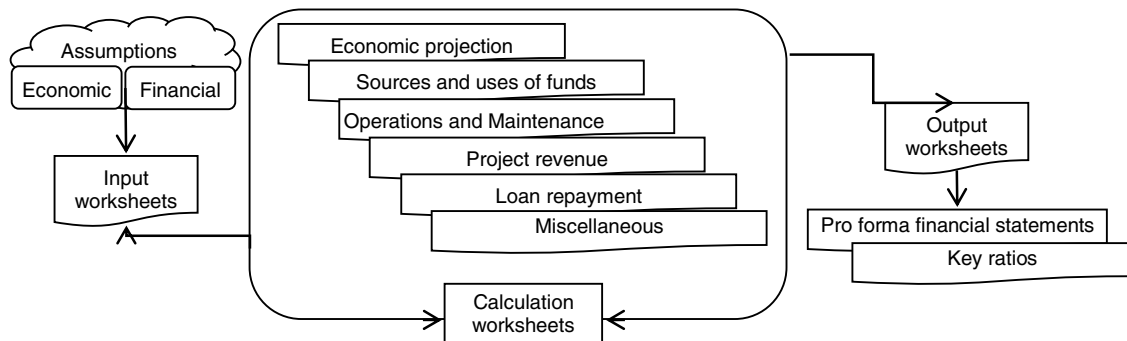


Fig. 1. Architecture of a Financial Model  
 Source: Modified from Khan and Parra (2003)

Calculation worksheets, as the most important part of a financial model, contain various calculations such as: economic projections, sources and uses of funds, operations and maintenance, project revenue, loan repayment, and miscellaneous calculations. However, these calculations are proven to be error-prone. Swan addressed that calculations on multiple sheets increase the risk of error because it can be difficult to form a mental map of the relationships between various elements on different sheets [10]. In order to reduce the error and to ease the formula audit, all the calculations should be placed on a single sheet.

Output worksheets. an overall summary is shown from this worksheet to help the reader visualize the financial viability of the project, which includes pro forma financial statements (e.g. income statement, balance sheet and cash flow statement) and key ratios such debt service coverage ratio (DSCR), loan life cover ratio (LLCR), net present value (NPV), interest rate of return (IRR) and return on equity (ROE). In addition, three types of financial model outputs such as revenues, net profit and IRR will be enough to find the most suitable strategy for setting unit prices and adjusting them periodically.

### 3. Research Methodology

The description of PPP financial model and its financial variables are addressed in the foregoing sections. Each financial variable has been reviewed thoroughly from the relevant published literature including textbooks, research reports, conference papers, journal articles, and internet materials. It is worth noting that the selected financial variables were derived from the main role of each stakeholder as illustrated in Table 2. Twenty six input assumptions and 16 output variables have been identified through comparison study of three PPP financial models, and their relative significances were verified based on pilot studies in India and the UK and expert opinion solicited worldwide through a structured questionnaire survey. The agreement on the important variables are measured by adopting a Likert type scale of 1–6 (with 1 being “extremely disagree,” 2 being “very disagree,” 3 being “disagree,” 4 being “agree,” 5 being “very agree,” and 6 being “extremely agree”). Each financial variable is considered “important” if it is at a significance level greater than 3.5 i.e. it is higher than neutral value. SPSS program was used to evaluate the survey responses with systematic statistical analyses. The best practice PPP financial model was identified quantitatively by the agreement of four groups of stakeholders (i.e. sponsors, authorities, lenders, and consultants) upon the most preferred financial input and output indicators.

Comparison procedures such as T-Test, One-Way Analysis on Variance (ANOVA) test and Post Hoc test are commonly used to determine whether the mean significance of each variable are equal. Post Hoc test was selected to find the significant variance of p value of each financial indicator among stakeholders who utilize PPP financial models. ANOVA test has its limitation to identify which group differs from others because it analyses only the factors that have significant variance between and within groups. While T-test only indicates a single pairwise mean comparison, Post Hoc test provides multiple pairwise comparisons. An assumption of group homogeneity is needed in Post Hoc test. When group sizes are found to be unequal, Games-Howell and Dunnett’s T3 should be selected for further variance analysis. The hypotheses for comparing the importance upon expectations and financial indicators of two of the four independent stakeholders are described below:

**Hypothesis:** Stakeholders’ preference on indicator of PPP financial model is equal.

*Ho: The mean significance of each indicator is equal between two stakeholder groups and within stakeholder groups.*

*Ha: The mean significance of each indicator is different between two stakeholder groups and within stakeholder groups.*

### 4. Results and Analysis

In total, 400 questionnaires were distributed. Seventy-three respondents from 38 countries completed the whole questionnaire giving an 18.25% rate of response. Since the topic is related to PPP financial models, some potential respondents refused to participate in this research due to confidentiality issues. Nevertheless, this response rate is still acceptable for social science research [17]. Many respondents (29 consultant companies, 12 government authorities, 12 financing institutions, 9 sponsor companies, and 11 anonymous) were from organizations that had rich experience, knowledge, and expertise in PPPs. They were also involved in using financial models for the purpose of project evaluation, contract negotiation, appraisal reporting, tariff adjustment, and project performance monitoring, as intended by this research. The most preferred financial indicators were selected according to their rankings without considering the project stages, as shown in Table 3. However, in order to gain more interesting findings, the discussion will be limited to the disagreement between stakeholders, which is indicated by the significant mean variance from statistical analysis.

Table 3. Comparison of the top rank preferred input assumptions

Stakeholder	Input Assumptions			Financial Model Outputs	
	Top 5	Mean	Rank	Top Rank	Mean
Sponsor(s)	Project costs	5	1	IRR	5
	Volume / demand	4.8889	2	Net cash flow	5
	Revenue forecast	4.7778	3	EBITDA	4.7778
	Operating cost	4.7778	3	CADS	4.6667
	Loan repayment schedule	4.7778	3	LLCR	4.6667
	Financing cost	4.7778	3	Interest covering ratio	4.6667
				Repayment period	4.6667
Authority				Revenue	4.6667
	Volume / demand	5.6667	1	IRR	5.7
	Operating cost	5.6	2	NPV	5.7
	Maintenance cost	5.6	2	Revenue	5.5
	Project timelines	5.6	2	Operating cost	5.4
	Revenue forecast	5.5	3	DSCR	5.3
Lender	Volume / demand	5.4167	1	IRR	5.5
	Project costs	5.3333	2	DSCR	5.5
	Revenue forecast	5.3333	2	CADS	5.4167
	Operating cost	5.3333	2	Net cash flow	5.25
	Interest and fees	5.3333	2	LLCR	5.25
				Revenue	5.25
Consultant				ROE	5.25
	Project costs	5.2222	1	DSCR	5.3077
	Volume / demand	5.1481	2	CADS	5.0769
	Revenue forecast	5.1481	2	LLCR	5
	Capital structure	5.1111	3	Net cash flow	4.9462
	Operating cost	5	4	IRR	4.7692
	Loan repayment schedule	5	4		

4.1. Systematic statistical analyses on stakeholder disagreement

In order to identify how stakeholders differ from each other, Post Hoc tests are used to obtain the stakeholders' preference on input assumptions and output indicators as illustrated respectively in Table 4 and Table 5 Since the

significance levels of all financial indicators are higher than neutral value (3.5), these variables are considered “important”.

Table 4. Post hoc tests of stakeholders' preference on input assumptions

Dependent Variable	(I) Stakeholder (J)Stakeholder	Mean Difference (I-J)	Std. Error	Sig.
Input - Initial working capital (Dunnett T3)	anonymous	-.33333	.36593	.975
	Lender	-.33333	.42351	.993
	Developer	.00000	.32577	1.000
	Authority	-1.06667*	.26773	.008
Input - Target of equity (Dunnett T3)	anonymous	-.50667	.38303	.843
	Lender	-1.00667*	.30607	.029
	Developer	-.28444	.30699	.981
	Authority	-.94000*	.30007	.046
Input - Tax Information (Dunnett T3)	anonymous	1.00000	.53541	.556
	Lender	.31667	.33071	.976
	Developer	1.06667	.33166	.059
	Consultant	.91852*	.23100	.005
Input - Exchange rate parity (Dunnett T3)	anonymous	-.77778	.46756	.652
	Lender	-.86111	.37241	.248
	Developer	-.66667	.38180	.590
	Authority	-1.14444*	.32957	.022
Input - Loan commitment (Dunnett T3)	anonymous	-.05385	.52166	1.000
	Lender	-.73718	.28228	.159
	Developer	.56838	.41548	.822
	Authority	-.75385**	.25802	.098
Input - Maintenance cost (Dunnett T3)	anonymous	-.53704	.34714	.720
	Lender	-.62037	.29760	.364
	Developer	-.03704	.33075	1.000
	Authority	-.97037*	.22963	.002

\*. The mean difference is significant at the 0.05 level.

\*\*.. The mean difference is justified to be significant at the 0.1 level.

## 5. Discussion and conclusion

In order to simplify the disagreement analysis, the following most financial indicators was selected: (1) Input assumptions (i.e. Project costs, Volume / Demand (traffic), Revenue forecast, Operating cost, Maintenance cost, Loan repayment schedule, Financing cost, Project timelines, Capital structure, and Interest and fees); and (2) output (i.e. IRR, Net cash flow, EBITDA, CADS, LLCR, Interest covering ratio, Repayment period, Revenue, NPV, Operating cost, ROE, and DSCR).

The hypothesis is proposed to test the agreement among stakeholders on financial indicators (input assumptions and output variables). The results indicate that not all stakeholders have the same preferences on input assumptions and financial model output ( $H_0$  is rejected). The stakeholders that have different preference on input assumptions



are: (1) Consultant Vs Authority (i.e. Initial working capital, Tax Information, Exchange rate parity, Loan commitment, and Maintenance cost); and (2) Lender Vs Consultant (i.e. Target of equity). And the stakeholders that have different preference on financial model output are: (1) Consultant Vs Authority (i.e. Internal Rate of Return, Net Present Value, Revenue, Operating Cost, and Principal payback); and (2) Developer Vs Authority (i.e. Net Present Value).

Table 5. Post hoc tests of stakeholders' preference on financial model output

Dependent Variable	(I) Stakeholder	(J) Stakeholder	Mean Difference (I-J)	Std. Error	Sig.
Net operating profit (Games-Howell)	Consultant	anonymous	-1.05769**	.28464	.066
		Lender	-.64103	.30291	.259
		Developer	.08120	.37680	.999
		Authority	-.90769	.34265	.120
Internal Rate of Return (IRR) (Dunnett T3)	Consultant	anonymous	-.73077	.33462	.405
		Lender	-.73077	.28578	.151
		Developer	-.23077	.33462	.998
		Authority	-.93077*	.22797	.003
Net Present Value (NPV) (Dunnett T3)	Authority	anonymous	.70000	.43589	.692
		Lender	.61667	.32563	.490
		Developer	1.25556*	.33129	.023
		Consultant	1.23846*	.20617	.000
Revenue (Dunnett T3)	Consultant	anonymous	-.42308	.46522	.970
		Lender	-.67308	.33506	.399
		Developer	-.08974	.32453	1.000
		Authority	-.92308*	.27846	.022
Operating Cost (Dunnett T3)	Consultant	anonymous	-.93077	.43697	.401
		Lender	-.48077	.45206	.955
		Developer	-.17521	.37063	1.000
		Authority	-1.13077*	.34937	.035
Principal payback (Dunnett T3)	Consultant	anonymous	-.83846	.42960	.494
		Lender	-1.03846	.38809	.124
		Developer	-.37179	.35762	.960
		Authority	-1.33846*	.36682	.017

\*. The mean difference is significant at the 0.05 level.

\*\*.. The mean difference is justified to be significant at the 0.1 level.

## References

- [1] F. Kurniawan, S. Ogunlana, I. Motawa, Stakeholders' expectations in utilising financial models for public-private partnership projects, *Built Environment Project and Asset Management*, 4 (2014) 4 – 21.
- [2] M. F. K. Khan, R. J. Parra, *Financing Large Projects: Using Project Finance Techniques and Practices*, Pearson Prentice Hall, Singapore, 2003.
- [3] L. M. Chang, P. H. Chen, BOT Financial Model: Taiwan High Speed Rail Case, *J. Const. Eng. and Mngmt*, 127 (2001) 3, pp. 214 – 222.
- [4] X. Zhang, Financial Viability Analysis and Capital Structure Optimization in Privatized Public Infrastructure Projects. *J. of Const. Eng. And Mngmt*, 131 (2005) 6, pp. 656-668.

- [5] N. Kulkarni, A. Prusty, Bidding Strategy for BOT Port Terminal Projects in India. *The J. of Structured Finance*, 12 (2007), pp. 90-106.
- [6] Government of India, Tariff setting and Bidding Parameters for PPP projects in Major Ports, Department of Shipping New Delhi, 2007.
- [7] A. Kaka, F. Al-sharif, Financial Modelling of PPP Projects, In Akintoye, A. & Beck, A. (Eds.). *Policy, Finance & Management for Public-Private Partnership Projects*. Wiley-Blackwell, Oxford, 2009.
- [8] R. R. Panko, What we know about spreadsheet errors, 2010, available from: <http://panko.shidler.hawaii.edu/SSR/Mypapers/whatknow.htm>.
- [9] M. Siersted, Time to Grow Up: Time to raise modelling standards, paper presented at Financial Modelling for PPP/PFI Conference (SMI), 3-4 March 2010, London.
- [10] Swan, J. (2008) *Practical Financial Modelling: A Guide to Current Practice*, Oxford.
- [11] F. Kurniawan, A Review: Exploring Stakeholders' Expectations from PFI Financial Modelling at Different Stages, paper presented at PMI India Conference 2010, 19-21 November 2010, Mumbai, available from: <http://www.slideshare.net/PMInstituteIndia/bie-01> (accessed 19 September 2011).
- [12] D. Heald, G. Georgiou, Consolidation principles and practices for the UK government sector, *Accounting and Business Research*, 30 (2000) 2, pp. 153-167.
- [13] A. Cranem, D. Matten, *Business ethics*, Oxford University Press, Oxford, 2004.
- [14] L.-S. Beh, Development and Distortion of Malaysian Public-Private Partnerships – Patronage, Privatised Profits and Pitfalls, *The Australian Journal of Public Administration*, 69 (2010) 1, 74-84.
- [15] M. Siemiatycki, Delivering Transportation Infrastructure Through Public-Private Partnerships: Planning Concerns". *Journal of the American Planning Association*, 76 (2010) 1, pp. 43-58.
- [16] A. Hucknall (2010) The Value of Financial Model Audit, paper presented at Financial Modelling for PPP/PFI Conference (SMI), 3-4 March 2010, London.
- [17] D. A. De Vaus, *Research Design in Social Research*, SAGE, London, 2001.