



Risk Management in PPP Projects: A Review

Joel Macwan¹, Dr. Jayeshkumar Pitroda^{2*}

¹Student of M. Tech Construction Engineering and Management, Birla Vishwakarma Mahavidhyalaya, Anand, Gujarat, India

²Associate Professor, Civil Engineering Department, PG Coordinator Construction Engineering and Management, Birla Vishwakarma Mahavidhyalaya, VallabhVidyanagar, Anand, Gujarat, India

***Corresponding Author:** Dr. Jayeshkumar Pitroda, Associate Professor, Civil Engineering Department, PG Coordinator Construction Engineering and Management, Birla Vishwakarma Mahavidhyalaya, VallabhVidyanagar, Anand, Gujarat, India

Abstract: The term 'public-private partnership' was first instigated in the U.S., originally concerning to joint funding for educational programmes by public and private sectors, and then in the 50s to denote to analogous funding for utilities, but used in wide context in the 60s to denote to public and private sector joint ventures for urban renewal works. However, the subject of this study is called 'project-based' or 'contract based' PPPs, a more fresh development. PPPs can be in general be defined as a long-term contract between private and public sectors for providing public infrastructure and public facilities to the people. Risk in any project refers to the unplanned activity which results in an unexpected outcome. These outcomes may have detrimental effects on the performance of the project (e.g. slow progress), completion of the project (e.g. delay in completion) or on the stake holders involved in the project (e.g. loss in revenue). Due to such adverse effects risks in every project is considered very crucial and needs to be managed properly to avoid detrimental effects of risk. In order to manage the risk identification and allocation of the risk is very important. This study is conducted to identify various risk parameters involved in a PPP project and manage them for better. In this study a critical review has been done on the risk identification and allocation practices.

Keywords: Public-Private-Partnership, Risk, Risk Management, Critical Risk Factors, Identification, Allocation, Classical, Computational

1. PUBLIC PRIVATE PARTNERSHIP (PPP)

The term 'public-private partnership' seems to have instigated in the U.S, originally concerning to public and private sector's combined funding for educational programmes, but used in broader sense in the 60s to refer to joint ventures of public and private sectors for urban renewals. The term PPP is now generally used for any long-term public and private sector contract to provide public infrastructures and facilities.

However, the emphasis of this study is 'project-based' or 'contract based' PPPs, a current development. PPPs generally have the following Characteristics:

- A long-term contract between a public and a private sector;
- For designing, constructing, financing, and operating public infrastructure or service by the private sector;
- With payments made to the private sector for the use of the facility either by public sector or public itself;
- With leaving the facility in public-sector ownership, or giving back the ownership to public-sector at the end of the PPP contract.

Over the past decade, private sector financing through public-private partnerships (PPPs) is becoming very wide spread as a mean of procuring and upholding public infrastructure, in various sectors.

2. RISK

Risk can be defined as an unplanned activity which results in adverse outcomes, in a PPP it relates to ambiguous consequences which have a direct influence either on the providing of the services or the

financial feasibility of the project. In any way the consequence is a loss in revenue or increased cost which has to be tolerated by somebody and one of the core elements of PPP structuring is to determine where this loss in revenue or increased cost will lie.

And so identifying and mitigating risks in any PPP project is very crucial. And so, we adopt risk management to deal with risks involved in any project.

This study tries to identify the various risk attributes in PPP projects and various methods to manage that risk.

3. CRITICAL RISK FACTORS IN PPP PROJECTS

Risk can be demarcated as any unexpected motion. Success or failure of any project is largely at the mercy of on how well the risk has been managed. And so, risk management plays a vital role in any project.

Risk can broadly be classified in many categories such as Political risk, economic risk, performance risk, etc. but these could not be said as exhaustive list of risk that a project may face. And so many researchers have worked to identify the common risk factors.

Akintola Akintoye et al. (1998) in his study surveyed 41 people from construction industry to know about their perception on the risk allocation. The respondents tended to rank most highly those risk factors that are paramount to their own business objectives. In General, the 10 significant risk factors were identified as related with design, construction cost, performance, construction delay, cost overrun, commissioning, operation and maintenance, payment and tendering cost. The consistently least important risk factors identified were land purchase risk, debt risk, bankers' risks, development risk, changes legislation, project life risk and change of government. [1]

Nur Alkaf AbdKarim et al. (2012) tried to investigate risk factors from the contractors' perspective involved in construction projects within Batu Pahat and Muar districts. The significant risk-contributing factors found were lack of material, delayed material deliveries, lack of equipment, poor quality of workmanship, and cash flow problems. These noteworthy factors can be classified as two major categories namely construction and finance. [2]

Yongjian Ke et al. (2011) in his paper studied the risks involved in China's PPP projects. 46 responses were collected and analysed by the Kendall's concordance analysis, and the Spearman rank correlation test. The Kendall's concordance analysis revealed consistent rankings of risk factors. The Spearman rank correlation test reflected no significant difference on the rankings of the probability and consequence of risks identified amid respondents with and without PPP experience. The top ten risks according to their risk significance index score were: (1) government's interference; (2) meagre political decision making; (3) financial risk; (4) government's reliability; (5) market demand change; (6) corruption; (7) subjective evaluation; (8) interest rate; (9) immature juristic system; and (10) inflation. [4]

Many other researches also tried to find the critical risk parameters but the results are always based on the respondents and what they constitute as risk.

From this much it can be said that risk has inherent site-specific nature and risk factors cannot be generalized for projects. And so, the approach for risk management adopted is that risk associated with any project is first identified and then it is allocated.

4. RISK IDENTIFICATION AND ALLOCATION

As said in previous section risk cannot be generalized for every project and so risk has to be identified and properly allocated for every project, failing in doing so can cause failure of the project. Every company identifies and allocates the risk based on their expertise, there is no general methodology that is adopted for risk identification and allocation.

The most common way to manage the risk is to allocate risk to the competent party. If the party who is evaluating the risk can take the risk it retains that risk otherwise it tries to transfer that risk to the other involved stakeholders. All the risk identification and allocation methods can be classified in to two categories such as classical approach and computational approach.

5. CLASSICAL APPROACH TO RISK MANAGEMENT

Classical approach relies on the expertise of the personnel assessing the risk for the project. Risk can be analysed in classical approach by following certain worksheet or risk evaluation matrices.

Yadav Ashwini Ashok et al. (2015) provided a simpler framework to adopt for BOT infrastructure projects. Which involved these steps(1) List all associated risk with the proposed project in order of importance. (2) For each, list corresponding mitigation measures, and then examine the availability of mitigating measures based on their effectiveness. (3) For each risk and its mitigating measures, negotiate with government and related entities to incorporate the risk mitigation measures, and fine tune the concession agreement.(4) Allocate risks to related parties so that risk is borne by the party most capable of controlling it. (5) Implement the risk allocation and security structure and enter into financing process for the project.[5]

Hemantadoloi et al (2012) tried to quantify risks associated with cost, time and operational performance in PPP projects and to develop an understanding on the crossovers in the complex project networks. And said that risks in PPP projects are interrelated and these risks also propagate to the development phase and performance phase of the project. The success in modelling an efficient PPP framework relies on the integration of the underlying risk and efficient management over entire project life. It was found that the design complexity, financial structure and government policy impacts are the three main factors affecting risks across time, cost and operational performance in PPP projects. This further emphasizes the criticality of the finance and tendering phase of the PPP project life cycle. The criticality of the different risk factors and variables across project cost, time and operational project performance are equally similar. Suffice to say, if a particular risk has a high degree of influence in cost and time performance in the construction phase, there is a potential chance that the same risk will affect the operational performance in the post construction phase as well. Risk affecting cost is generally higher than time and operational performance.[9]

Yun-li Gao et al (2008) concluded that the project participants related to risk loss and have risk carrying capacity should undertake risks, and the risk loss the participant undertakes has straight relation to its risk carrying capacity. This kind of risk allocation method encourages the project participants to think much of risk management and control and to interconnect and exchange risk information with each other, thus the optimal risk management can be guaranteed. This kind of risk allocation method can clear the risk responsibilities of the project participants, and improve the effectiveness of risk management. By means of this method, two kinds of problem should be noticed, one is that all project participants should come to an agreement to allocate risks, second is the risk assessing expert group should be sanctioned by all project participants and the assessing result of the expert group should be accepted. [10]

Awad S. Hanna et al. (2013) in his paper stated that risk is mostly misallocated. As result, parties with the minimum amount of control and influence over many of the risk-producing factors and decisions often carry the majority of the construction risk burden. To standardize risk allocation process, the Construction Industry Institute (CII) formed Research Team 210. Team described the model resulting from the study, which helps contracting parties in determining how each risk in a construction contract can best be identified, assessed, and allocated. It is clear that optimum risk allocation is highly dependent on project specific circumstances and participants. Recognizing these industry needs, the single-party and two party risk assessment worksheet was developed to allow the participants to perform internal as well as external risk alignment before contracting. Together, these worksheets provide the risk allocation model. A similar approach can be used on a weekly, monthly, or quarterly basis. The risk allocation model is accompanied with numerous supportive tools such as flowcharts, risk matrices, contract language tables, risk allocation principles, and legal research. [11]

Emlynwitt et al. (2011) said questions the VfM of PPP projects and attribute any gains due to such scheme to better risk allocation between private and public parties. For that he formulated four hypothesis and tested them on the basis of historical data two of them were proved and provided an empirical model for risk allocation. Hypothesis 1 greater risk transfer from the client to the contractor is associated with greater project delivery efficiency. Hypothesis 2 more integrated procurement routes are associated with more risk transfer to the contractor. [12]

6. COMPUTATIONAL APPROACH TO RISK MANAGEMENT

With more and more complex projects and risk factors involved risk profile of a project is so complex nowadays. Identification and allocation through classical methods proves to be difficult for such projects, but with the advancement in computer science and the computing power available now computational models can be generated for risk identification and allocation for any project. And these computational methods give better approximation of risk than classical methods.

Oleg Kaplinski. Et al (2013) found that the classic approach is not enough. The decision maker's attitude towards risk taking needs to be incorporated in the approach. The classic approach does not take it into account, particularly in the context of utility maximization. And so, he carried out some tests to reveal the importance of decision maker's attitude in risk making. The test suggested that attitude towards risk affect operational startergy. He also says that individual traits of the decision maker should be accounted for. Concurrently, learning attitudes towards risk fetches interesting lookouts on the problem of operational strategy. It explains the mechanism of decision-making, connecting economic and psychological aspects. The criterion of maximization was used to identify the attitudes towards risk. [13]

Edmundas Kazimieras Zavadskas et al. (2010) said that for decision-making several methods should be applied and the best alternative according to aggregated results is to be selected in his model he considered multiple alternative possible loss and various alternative attributes and based on it created decision matrix. This allows making of decision by examining multiple variables when initial data values are given at intervals. [16]

Athena Roumboutsos et al. (2008) conducted a survey in Greece registering the risk assessment and preferences of prime stakeholders. Stakeholder groups allocated 31 risks to either public or private sector, while the contracting parties shared five risks. However, there was no agreement on eight risks. These involved inflation and interest rate volatility, geotechnical conditions, weather, land acquisition, availability of finance, residual risks and delays in project sanctions and permits. [18]

Nan Li Et al. (2015) in his paper investigated that risk in every project is subjective and so put forth a cognitive psychology approach to analyse the risk of a project. For the alleged attributes of risks. He estimated probability distributions and the criticality under changing conditions. Probability distributions and criticality indices of the attributes of risks can be estimated based on the expert assessments, via Monte Carlo simulation and Kolmogorov-Smirnov test. [20]

NedaShahrara et al. (2016) studied artificial neural network (ANN) approach. For this research, a model of neural network was adopted to develop a model that formulates the relationship between the project's important risk variables. Which were determined by conducting sensitivity analysis and Monte Carlo simulation on conventional spread sheet data. This technique was applied on data gained from six actual BOT dormitory projects in Cyprus as a case study to demonstrate the procedure. actual cash flow statements for six university dormitory construction projects were taken and considering 15, 20, 25, and 30-year concession periods for each, 24 conventional spread sheets were prepared to compute net present value (NPV) and internal rate of return (IRR) as project performance indicators for the various concession periods. With data sets drawn from Monte Carlo simulation and several important parameters on all the spread sheets, 1871 random scenarios were produced, and each scenario with a selected set of eight input variables was fed into the ANN. Thus, negotiation process can be automated with the use of ANN approach for a BOT-type contract by taking into account project risks and uncertainties along with several important parameters to build an unbiased and accurate pricing structure for BOT-type projects. [21]

A. V. Thomas1 et al. (2006) described that Private infrastructure projects under BOT arrangement have a complex risk profile due to several factors. To a considerable extent, the success of a BOT project is influenced by the degree to which various project risks are identified, assessed and allocated. A risk probability and impact assessment framework based on fuzzy-fault tree and the Delphi method was proposed. The proposed framework is based on extensive scenario modelling and systematic processing of professional judgement of experts to assess complex risk events. A flexible fault tree model with varying strengths of cause-effect relationships has also been proposed for determining probabilities of occurrence of risk events. Demonstration of the proposed risk assessment framework shows that fuzzy-fault tree-based risk assessment reduces the variability among the

experts in the probability estimation of complex risk events. The variability among the different experts' estimations is considerably low compared to direct probability encoding at the top-level of the fault tree. The Fuzzy-Delphi technique is suitable for determination of risk influences in projects, where long term forecasting is required. [22]

7. CONCLUSION

In conclusion it can be said that risk although can be classified in various categories that is not exhaustive. And risk for any particular project need to be identified and then allocated. There are two approaches for identifying and allocation (1) classical approach (2) computational approach in classical approach mainly relies on expertise of the risk management personnel involved and worksheets and risk evaluation matrices. However, these approaches fall short for the evaluation of recent complex projects and so, the more advanced and sophisticated computational methods are used for recent projects. Computational methods prove to be more accurate and effective in identifying and allocation of the risk. Risk plays a vital role in success or failure of the project and so apt consideration should be given to risk management.

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AUTHORS' BIOGRAPHY



Joel Macwan, born in Gujatat, India Joel Macwan completed his graduation in civil engineering from the Dr. Jivraj Mehta institute of technology in 2016. During his graduation he carried on research work on construction planning and scheduling. He also worked on green building analysis. Currently he is Student at Birla Vishwakarma Mahavidhyalaya pursuing M.Tech in Construction Engineering and Management. His study area is mainly construction planning and management. He is also working on knowledge based expert systems for construction planning.



Dr. Jayeshkumar Pitroda, received his Bachelor of Engineering Degree in Civil Engineering from Birla Vishwakarma Mahavidyalaya Engineering College, Sardar Patel University (Vallabh Vidyanagar, Gujarat-India) in 2000. In 2009 he received his master's degree in Construction Engineering and Management form Birla Vishwakarma Mahavidyalaya Sardar Patel University (Vallabh Vidyanagar, Gujarat-India). In 2015 he received his Doctor of Philosophy (Ph.D.) Degree in Civil Engineering from Sardar Patel University (Vallabh Vidyanagar, Gujarat-India). He has joined Birla Vishwakarma Mahavidyalaya Engineering College as a faculty in 2009, where he is lecturer of Civil Engineering Department and at present working as Associate Professor from February 2018 having total experience of 18 years in the field of Research, Designing and Education. At present holding charge of PG Coordinator Construction Engineering and Management. He is guiding M.E. / M.Tech (Construction Engineering and Management/ Construction Project Management/ Environmental Engineering) thesis work in the field of Civil / Construction Engineering/ Environmental Engineering. He has published many papers in National / International Conferences and Journals. He has published nine Research Books in the field of Civil Engineering, Rural Road Construction, National Highways Construction, Utilization of Industrial Waste, Fly Ash Bricks, Construction Engineering and Management, Eco-friendly Construction.

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