A SURVEY ON THE RISK MANAGEMENT IN PPP PROJECTS

Sanjay Tiwari[1]; Amit Ashish[2]
[1,2]*Department of Civil Engineering*
MITS Gwalior-474005
sanjaymits2@gmail.com, amitashish777@gmail.com

Abstract: **The study includes the survey of previous works done on risk management. This paper refers to the brief knowledge of different methods and techniques suggested and proposed by different authors for identification, evaluation and mitigation of risks related to PPP (public private partnership) projects.**

Keywords: **Risk Management, PPP (public private partnership) projects.**

I. INTRODUCTION

Risk is the potential that a chosen activity or action will lead to a loss or an undesirable outcome. Risk has been defined in number of ways in English literature, among which are the following:

- "A situation where there exists no knowledge of its outcome".
- "The variation in possible outcomes that exist in nature in a given situation".
- "The possibility of loss, injury or other adverse or unwelcome circumstance; a chance or situation involving such a possibility".
- "Lack of predictability about structure, outcome or consequences in decision or planning situations".
- "Effect of uncertainty on objectives".

Risk can be practically defined as the product of the probability of an event occurring and the consequences if the event does occur. Depending on the amount of information available, risk can be measured qualitatively or quantitatively. To fully define a risk it is necessary to understand its two component elements:

- The likelihood of a particular risk actually happening; and
- The impact or consequences if it happens.

Some researchers restrict the risk definition to events with negative consequences whereas others define it with both negative and positive consequences. Most of the above definition refers to the uncertainty and adverseness of the event. Al-bahar (1989) combined the essence of both risk and uncertainty and defined risk in the context of project management "the exposure to the chance of occurrence of events adversely or favorably affecting project objectives as a consequence of uncertainty". He also characterized risk with three components risk event, the uncertainty of the event and the potential loss or gain. Martin and Heaulme (1998) have added another component "time of occurrence" to characterize risk in addition to event, probability and impact. Survey research conducted by Akintoye and Macleod (1997) among contractors and project management practices of UK construction industry has revealed that the average perception with respect to project risk is "the likelihood of unforeseen factors occurring which would adversely affect the successful completion of the project in terms of cost, time and quality.

There are various types of risks which are faced by any infrastructure project due to the complexity of the arrangement in terms of documentation, financing, taxation, technical details, sub agreements etc. At least nine risks are faced by any infrastructure project:

1. Technical risk due to engineering and design failures.
2. Construction risks because of faulty construction techniques and cost escalation and delays in construction.
3. Operating risk due to higher operating cost and maintenance costs.
4. Revenue risk, e.g. due to traffic shortfall or failure to extract resources.
5. Financial risks arising from inadequate hedging of revenue streams and financing costs.
6. Force majeure risk, involving war and other calamities and acts of god.
7. Regulatory/ political risk, due to legal changes and unsupportive government policies.
8. Environmental risk, because of adverse environmental impacts and hazards.
9. Project default, due to failure of the project from a combination of any of the above.

II. RISK MANAGEMENT

Risk management is the process of identifying, analyzing and addressing significant risks on an ongoing basis. It is a process that can help avoid negative outcomes, and help recognize emerging opportunities. It consists of following steps performed in the following order:

1. Establishing the context;
2. Identifying the risks;
3. Analyzing the risks;
4. Evaluating the risks;
5. Developing the risk mitigation strategy;
6. Monitoring the risk mitigation strategy;
7. Quantifying the risks if possible;

8. Consulting and communicating the risk management issues to key stakeholders.

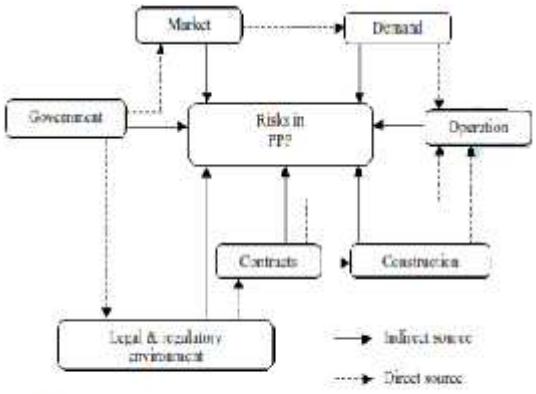
III. RISKS IN PPP PROJECTS

Much of the risk of a PPP project comes from the complexity of the arrangement itself in terms of documentation, financing, taxation, technical details, sub agreements etc. involved in a major infrastructure venture. Investors in BOT projects have to deal with many risk issues right from the development stage of the project. The three phases in a BOT project with different risk profiles are developmental phase, construction phase and operation phase. The process of project development is quite complex, time consuming and expensive business.

The level of negotiations is extensive and the opportunity costs are very high. Since the finance available during the initial project phase is limited to equity, the financial risk is also high during developmental phase.

The construction phase of a PPP project is also risky due to high financing costs, time spillovers and cost overruns. The financial success of a PPP project is highly susceptible to the delay in completion.

The operation phase is considered to be with low risk. PPP project can be described as a high risk construction project followed by a low risk utility project. Pre completion risks are often greater than post completion risks in PPP projects.



outcomes.

Risk Sources in PPP (source – Thomas A V, K N Satyanarayana and K. Ananthanarayanan Identification of risk factors and risk management strategies for BOT Road projects in India)

IV. LITERATURE REVIEW

Xu, Chan and Yeung (2010) developed a fuzzy synthetic evaluation model for determining an equitable risk allocation between the government and the private sector. The model transforms imprecise linguistic risk allocation principles and experiential expert knowledge into a useful quantitative analysis.

Iyer and Sagheer (2010) suggested the use of interpretative structural modeling (ISM) for preparing hierarchical structuring of PPP risks. The study identified 17 risks during the development phase of PPP projects in India and found that 14 risks were weak drivers and weak dependents.

Jin (2011) developed a neuro-fuzzy model which can serve the purpose of forecasting efficient risk allocation strategies for privately financed public infrastructure projects with high accuracy in an ever-changing business environment.

Hastak and Shaked (2000) developed an international construction risk assessment model (ICRAM-1) which is helpful to the user in evaluating the potential risk involved in expanding operations in an international market. Another possible use is in analyzing different countries with respect to a specific project and in comparing different types of projects in a specific country.

Imbeah and Guikema (2009) developed an advanced programmatic risk analysis and management model (APRAM) for managing schedule, cost and quality risks effectively in the construction industry. It was originally developed for the aerospace industry. It is an appropriate tool for optimal allocation of resources.

Jannadi and Almishari (2003) developed a risk assessor model (RAM) to determine the risk associated with a particular activity as well as the justification factor for a proposed remedy. It is a computer model written with the help of visual basic (VB) in such a way that the user doesn't have to remember the steps or formulas. The system is menu-driven and user friendly.

Chan, Yeung, Yu, Wang and Ke (2011) evaluated that the top three risk factors are government intervention, government corruption and poor public decision making process. In order to do this an questionnaire survey was designed to examine as to how important a particular risk factor is and to analyze the allocation of risk factors to different parties.

Li and Zou (2011) proposed a fuzzy analytical hierarchy process (AHP) as risk assessment technique to simulate the vagueness of human judgement and to improve the accuracy in assessment. The study showed that it is suitable to use fuzzy AHP to assess and rank the risk factors of PPP projects.

Allan and Yin (2011) proposed the strategic risk register system (SRRS) as a practical methodology to identify the most potent risks in a system by enabling the connectivity of risks to be evaluated.

Fidan, Dikmen, Tanyer and Birgonul (2011) presented ontology for relating risk-related concepts to cost overrun. It is used to develop a database system that represents risk event histories of international construction projects with the help of which a model for estimation of cost overrun is constructed.

Hashemi, Mousavi and Mojtahedi (2011) proposed a nonparametric resampling technique and interval computations for risk analysis. The approach allowed risks to be ranked through a hybrid bootstrap and introduced an

applicable hybrid approach to deal with bridge construction projects.

Zou, Chen and Chan (2010) developed a web-based RM3 (risk management maturity model). It contains five attributes namely management, culture, risk identification, risk analysis and systematic risk management. The study showed that the proposed RM3is suitable for construction organizations to assess their risk management maturity levels and find ways for improvements.

Delmon (2000) suggested that the impact of risks in carrying out a PPP project is noticeable which arises from different sources such as capital budget, construction time, construction cost, operation cost, market conditions etc.

Grimsey and Lewis (2002) suggested that most of the risks in PPP projects is caused due to the complex nature of the arrangement in terms of financing, documentation, taxation, technical details etc.

Wang et al. (2004) recognized and evaluated the multifaceted risks and their effective mitigation measures. He proposed a risk model named Alien Eye's Risk Model to show the hierarchical behavior of risks at different levels and the relationship between different risks in a risk influence matrix. To provide detailed risk management strategies and procedures a qualitative risk mitigation framework was also developed.

Zhang (2005) examined the critical success factors for PPP projects in the development of infrastructure. In ensuring PPP success, number of rank agreement factor (RAF) were found to be essential such as (1) concession agreement, (2) loan agreement, (3) guarantees/support/comfort letters, (4) supply agreement, (5) operation agreement, (6) off-take agreement, (7) design and construct contract, (8) shareholder agreement, and (9) insurance agreement.

Li et al. (2005) developed a process of negotiation for allocation of risks. The process is formed by the combination of a systematic risk-management approach for construction projects proposed by Al Bahar and Crandall (1990) with the principle of risk sharing in PPP/PFI procurement supported by Grant (1996) and HM Treasury (2000).

Sachs et al. (2007) provided the knowledge about the opportunities and impact of political risks in China and 14 Asian countries.

Sachs and Tiong (2009) proposed a method which is able to quantify qualitative information on risks (QQIR) as well as shortens the gap between qualitative and quantitative risk assessment methods.

Jin and Doloi (2008) performed a study to interpret the risk allocation mechanism in a transaction cost economic perspective. They also used multiple linear regression to develop models for determining the appropriate relationship between explanatory and response variables of an operation based theoretical framework.

Solino and Vassalo (2009) discovered that nonintegrated PPP contracts have important advantages for urban rail PPP. In terms of encouraging economies of scale and density, boosting competition, and reducing the financial costs these advantages have notable uses.

Yuan et al. (2010) suggested 15 performance attributes which are based on the perspectives of different stakeholders for implementing complete and effective performance management in PPP projects.

Chan et al. (2010) studied and found that the top three obstacles rated by the Hong Kong respondents were (1) long delays due to political debate, (2) long delays due to negotiation, and (3) number of schemes that reached the contract stage, are very few as they are aborted before contract.

Merna and Smith (1996) classified risks in PPP projects into two categories of global and elemental. The global risks are those which are generally outside the control of the project parties which includes political, legal, commercial, and environmental factors, and the elemental risks are those which includes project risks such as construction, design, technology, operation, finance, and revenue risks.

Songer et al. (1997) showed a methodology for privatized infrastructure projects which is known as Monte Carlo risk assessment methodology. The method yields problem refinement techniques and flexible decision-making tools for assessing feasibilities and encouraging risk modification and mitigation.

Akintoye et al.(1998) noted the transfer of risk to the private sector in the U.K.'s PFI (Private Finance Initiative) and surveyed the relative importance of 26 risk factors, such as design risk, construction cost risk, environmental risk, and legal risk. Different risks are ranked based on their importance by the different groups surveyed such as contractors, clients, and lenders.

Tam and Leung (1999) studied and found that the political risks were difficult to handle as compared to financial risks. They found that the technical risks were easiest to handle, even on projects where innovative technologies are incorporated in Southeast Asia.

Lam (1999) reviewed risks associated with major infrastructure projects as number of projects are cancelled, delayed and cost overruns due to daunting risks.

Charoenpornpattana and Minato (1999) presented a detailed description of risks induced by private sector in transportation projects in Thailand. They grouped risks into five different categories, political, economic, legal, transaction, and operation.

Salzmann and Mohamed (1999) identified risks containing factors and sub-factors which are in need to be addressed in Built-Own-Operate-Transfer (BOOT) projects. These risks are presented corresponding to the development phase and the operations phase in two different frameworks. Their study is totally based on the detailed survey of available literature.

Shen et al. (2001) studied the chineese construction industry which is developing at a fast pace and has attracted many foreign companies through the formation of Sino-foreign joint venture. Joint ventures have become an important sector as it is the reason behind China's

development but there is some difficulty in the functioning of joint venture due to the difference in management systems, technological practice, and cultural background among the partners. Risks of significant degree are involved in joint venture investments due to which foreign firms are intended to study proper strategies for managing risks.

Miller and Lessard (2001) proposed a process to deal with different risks such as (1) market-related: demand, financial and supply; (2) completion: technical, construction and operational; (3) institutional: regulatory, social acceptability and sovereign.

Cano and Cruz (2002) developed a project risk management process particularly for construction projects, from the opinion of the owner and the consultant. The process can be helpful to other project participants and organizations with complex projects and with high-level of risk management maturity.

Ghosh and Jintanapakanont (2004) identified important risk variables associated with infrastructure projects. They conducted a survey based on the study of these risk variables to determine the critical risk factors for a mass rapid-transit underground rail project in Thailand.

Bing et al. (2005) organized a questionnaire survey for exploring the tasks which are to be given more preference and which are to be given less preference. They concluded that macro and micro level risks should be kept within the public sector or shared with the private sector.

Ng and Loosemore (2007) analyzed the reason behind decisions taken for distribution of risks between public and private sectors and their outcomes. They also assessed the degree of complexity of risks which are faced by infrastructure projects and the level of difficulty which is faced while distributing these risks.

Zeng and Smith (2007) presented a risk assessment methodology to counter the risks in complex construction situations. To handle the uncertainties and subjectivities in the construction process they applied fuzzy reasoning techniques.

Zou, Zhang, Wang (2007) prioritized risks on the basis of their significance and objectives in terms of cost, time, quality, safety and environmental sustainability. They suggested that clients, designers and government bodies should cooperate with each other starting from the feasibility phase onwards in order to address potential risks in time. The contractors and subcontractors with skill and knowledge must be employed to maintain the standard and quality of construction and carry out the construction activities efficiently and safely as well as to minimize construction risks.

V. CONCLUSION

Risk management includes identification of risks- as to which risk will affect the project most, risk quantification- evaluation of risks to determine the possible impact, risk mitigation and control- techniques or processes and measures by which we can reduce the effect of incoming risks. In PPP projects risk management is essential for successful completion of a project. By employing the techniques of risk management we can save a particular project from failing.

REFERENCES

Osama Ahmed Jannadi and Salman Almishari (2003) . " Risk assessment in construction" J. Constr. Eng. Manage., ASCE, 2003.129:492-500.

Jamal F. Al-Bahar and Keith C. Crandall, member, ASCE (2012). " Systematic risk management approach for construction projects" J. Constr. Eng. Manage., ASCE, 1990.116:533-546.

Makarand Hastak and Aury Shaked (2000). "ICRAM-1: Model for international construction risk management" J. Manage. Eng., ASCE, 2000.16:59-69.

William Imbeah, A.M.ASCE; and Seth Guikema (2009). "Managing Construction Projects Using the Advanced Programmatic Risk Analysis and Management Model" J. Constr. Eng. Manage., ASCE, 2009.135:772-781.

Lisa Turnbaugh, P.E. (2005). "Risk Management on Large Capital Projects" J. Prof. Issues Eng. Educ. Pract. 2005.131:275-280.

K. C. Iyer and Mohammed Sagheer (2010). "Hierarchical Structuring of PPP Risks Using Interpretative Structural Modeling" J. Constr. Eng. Manage. 2010.136:151-159.

Xiao-Hua Jin (2011). "Model for Efficient Risk Allocation in Privately Financed Public Infrastructure Projects Using Neuro-Fuzzy Techniques" J. Constr. Eng. Manage. 2011.137:1003-1014.

Yelin Xu; Albert P. C. Chan; and John F. Y. Yeung (2010). "Developing a Fuzzy Risk Allocation Model for PPP Projects in China" J. Constr. Eng. Manage. 2010.136:894-903.

Jie Li and Patrick X. W. Zou (2011). "Fuzzy AHP-Based Risk Assessment Methodology for PPP Projects" J. Constr. Eng. Manage. 2011.137:1205-1209.

Patrick X. W. Zou; Ying Chen; and Tsz-Ying Chan (2010). "Understanding and Improving Your Risk Management Capability: Assessment Model for Construction Organizations" J. Constr. Eng. Manage. 2010.136:854-863.

Hassan Hashemi; S. Meysam Mousavi; and S. Mohammad H. Mojtahedi (2011). "Bootstrap Technique for Risk Analysis with Interval Numbers in Bridge Construction Projects" J. Constr. Eng. Manage. 2011.137:600-608.

Gulsah Fidan; Irem Dikmen; A. Murat Tanyer; and M. Talat Birgonul (2011). "Ontology for Relating Risk and Vulnerability to Cost Overrun in International Projects" J. Comput. Civ. Eng. 2011.25:302-315.

Neil Allan and Yun Yin (2011). "Development of a Methodology for Understanding the Potency of Risk Connectivity" J. Manage. Eng. 2011.27:75-79.

Akintoye, A., Taylor, C., and Fitzgerald, E. (1998). "Risk analysis and management of private finance initiative projects." J. Eng., Construct. Archit. Manage., 5(1), 9-21

Delmon, J. (2000). "BOO/BOT projects: a commercial and contractual guide", Sweet & Maxwell Limited, London.

Grimsey, D. and Lewis, M.K. (2002), "Evaluating the risks of public private partnerships for infrastructure projects", International Journal of Project Management, 20, 107-118.

Zhang, X. (2005), "Critical success factors for public-private partnerships in infrastructure development", Journal of Construction Engineering and Management, ASCE, 131(6), 631-644.

Shen et al (2004), "Awarding construction contracts on multi-criteria basis in China", Journal of Construction Engineering and management, ASCE, 127 (1), 76-81.

Songer, A.D., Diekmann, J., & Pecsok, R.S. (1997), "Risk analysis for revenue dependent infrastructure projects." J. Construct. Manage. Econom., 15(4), 377-382.

Lam, P.T.I. (1999). "A sectoral review of risks associated with major infrastructure projects." International journal of project management, 17(2), 77-87.

Tam, C.M., and Leung, A.W.T. (1999), "Risk management of BOT projects in southeast Asian countries." Proc., Joint CIB Symposium on profitable partnering in construction procurement, E & FN Spon, London, 499-507.
Cano, A. & Cruz, M.P (2002), "Integrated methodology for project risk management", Journal of Construction Engineering & Managemnt, ASCE, 128 (6), 473-485.
Ng, A. and Loosemore, M. (2007), "Risk allocation in the private provision of public infrastructure", International Journal of Project Management, 25(1), 66-76.
Ghosh, S. and Jintanapakanont, J.(2004), "Identifying and assessing the critical risk factors in an underground rail project in Thailand: a factor analysis approach", International Journal of Project Management, 22 (8), 633-643.
Bing, L., Akintoye, A., Edwards, P.J. and Hardcastle, C.(2005), "The allocation of risk in PPP/PFI construction projects in the UK", International Journal of Project Management, 23, 25-35.
Rajeev Kansal (2007), "Identification of critical success factors (CSFs) for implementing BOT projects", Ph.D. thesis, MITS, Gwalior.
Charoenpornpattana, S., and Minato, T. (1999), "Privatization-induced risks: state- owned transportation enterprises in Thailand." Proc., JointCIB Symposium on Profitable Partnering in Construction Procurement E & FN Spon, London, 429-439.
Merna, A., and Smith, N.J. (1996). Guide to preparation and evaluation of build-own-operate-transfer (BOOT) project tenders, Asia Law and Practice, Hong Kong.
Miller, Roger and Lessard Donald (2001), "Understanding and managing risks in large engineering projects", International Journal of Project Mnagement, 19, 437-443.
Salzmann, A., and Mohamed, S. (1999), "Risk identification frameworks for international BOOT projects." Proc., Joint CIB Symposium on Profitable Partnering in Construction Procurement, E and FN Spon, London, 475-485.