OPTIMAL RISK ALLOCATION IN PUBLIC-PRIVATE-PARTNERSHIP (PPP) PROJECTS IN INDIA

Prof M Kakati
Professor, and Former Dean, Department of Business Administration, Gauhati University, Guwahati, India
Mr Pallav Baruah
Former Manager(Technical), National Highway Authority of India, Executive Engineer, IIIT, Guwahati, India

Abstract

The risks involved in PPP projects are significant and need to be thoroughly analysed, researched and managed. The contractual misallocation of risks is the leading causes of disputes during construction and operation phases which in turn are leading to sub- optimal value-for-money in PPP projects. Hence, proper risk identification and allocation is a key to successful PPP project implementation and is important for the public client & the private bidders to assess all the potential risk through the whole project life. This paper analyses thirty PPP projects in India and identifies a plethora of risks faced by these projects, their frequency of occurrence during the development, construction and operation phases.

The paper also presents and discusses the perceptions/views of 62 experts (who have long experience in handling PPP projects) regarding (i) optimal risk allocation amongst the partners (private sponsors/promoter, government, lender, consultants etc) (ii) misallocation of risks and their consequences (iii) preferred risk mitigation strategies (iv) deficiencies in PPP project management (v) factors leading to success and factors hindering the performance of PPP projects (vi)changes of risks criticality over the whole project life(vii) preferred government supports and (viii) expected risk allocation framework. The perceptions of 62 experts were captured through three rounds of interviews.

These research findings will enable public sector clients to establish more efficient risk allocation frameworks in the early stage of project development and also private bidders (both local and foreign) to assess all the potential risks through the whole project life before bidding for the same; which in turn will minimise disputes & economic costs and maximize the value-for-money in PPP projects.

Key words: Risk allocation, PPP projects, risk criticality, risk severity, performance matrix, success factor, value-for-money

Introduction

India offers today the world's largest market for PPP projects and is largest recipient of fund from abroad. The volume PPP projects completed & under implementation in India is 2563 with an investment of US $ 179.7 billion as on March 31, 2013. A number of initiatives taken during the tenth and eleventh five year plan had resulted in the award of a large number of PPP projects especially in sectors such as highways, urban infrastructure, airports, sea-ports, railways and power both in Central and State level. The twelfth five year plan (2012-2017) of India has envisaged US$ 819.8 billion investment in infrastructure projects of which the share of PPP projects is estimated at 48% i.e. US$ 393.5 billion. Information on a large number of projects in pipeline suggests huge opportunities for foreign and domestic investors to invest in PPP projects in various sectors across the country. PPP projects offer good return on investment especially to the sponsors (private party). However it is not sure whether good return is sufficient to compensate the high risk assumed by the sponsors.

The risks involved in PPP projects are significant and need to be thoroughly analysed, researched and managed to minimize disputes & costs and maximize value-for–money. The objective of this paper is to identify a plethora of risks faced by PPP projects in India, their frequency of occurrence during the development, construction and operational phases and also to discuss the perceptions/views of experts regarding (i) optimal risk allocation amongst the partners (private sponsors/promoter, government, lender, consultants etc) (ii) misallocation of risks and their consequences (iii) preferred risk mitigation strategies (iv) deficiencies in PPP project management (v) factors leading to success and factors hindering the performance of PPP projects (vi)changes of risks criticality over the whole project life (vii) preferred government supports and (viii) expected risk allocation framework.

Issues requiring further research works

The studies related to PPP projects focuses on seven areas– risk management, integration research, governance issues, investment environment, procurement, economic viability and financial packages (Ezeldin *et. al.*, 2013). Amongst them, the risks associated with PPP along with their management techniques occupy a considerable percentage and is still considered an area of concern in PPP project management.

The following deficiencies/issues has been indentified where there is need to do further research works -

- Many literatures have concentrated on identification of critical risks or risk criticality. However, none of the researches has focussed on how risk criticality changes over the different phases of project life (development , construction, and operation & maintenance phase)
- Most of the literatures have examined who are the best party (public or private agencies) to management the risk; but hardly examine the misallocation of risk for different categories of risk and how to share risk amongst the consortium of private partners
- The current literature has hardly attempted to establish the relationship between risk criticality of PPP projects and their influence on the success of PPP projects in reality.
- The success of PPP projects must be judged over a long period using different criteria. The existing literature is less focused on the criteria to be used.

This study is trying to address of the some issues highlighted above.

Methodology

A mixed approach of on-site- observation, interviews, and questionnaire survey (among Government representatives, promoters/sponsor/developer, lenders, consultants) and case studies were used for achieving the goals/above objectives of this research The design of the survey questionnaire followed the methodology adopted by by Thomas A. V. (*2002*), Ho Y. and Wang H. (*2008*), Maniar H. (*2010*).

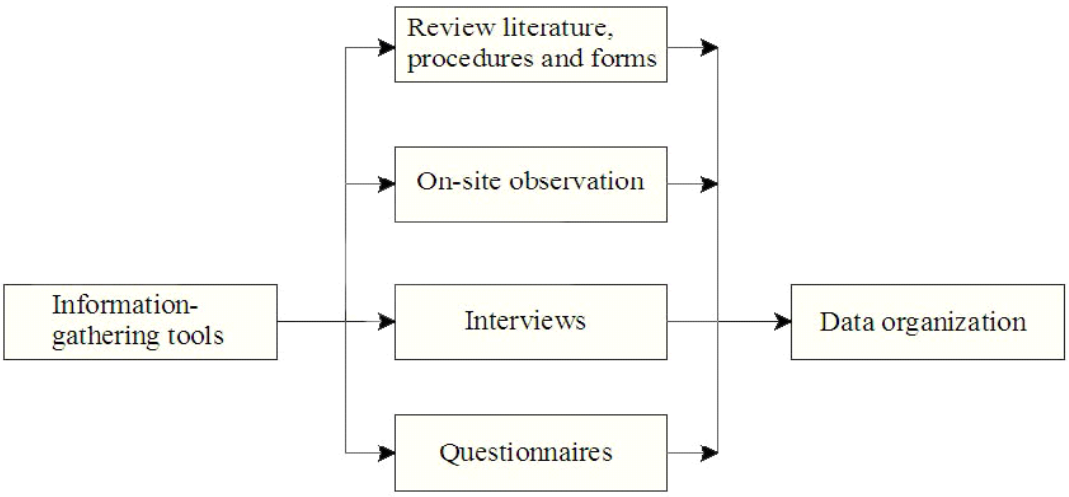

Figure 1: Details of information gathering techniques used

The prepared questionnaires have been further subjected to test of reliability and validation with the help of standard statistical tools like Cronbach's alpha. Cronbach's alpha value for each group of respondents was found to be more than 0.60 indicating that data collected through the set of questionnaires/interview were fairly consistent.

Table 1: Cronbach's Alpha for different category of respondent

Category of respondent	Cronbach's Alpha
Promoter	0.65
Govt.	0.73
Lender	0.66
Consultant	0.60
Other	0.57

5-point Likert- scale is used to get responses on degree of importance (5=Most Important to 1=Not Important), degree of criticality (5=Most Critical to 1=Not Critical), degree of agreement (5=Strongly agree/Absolutely agree to 1=Not at all/disagree), degree of adequacy (5=Highly adequate to 1=Not adequate).

All India questionnaire surveys (in three stages) were conducted among four major stake holders/participants (Government representatives, promoters/developers, lenders and consultants) of Indian PPP projects. A detailed case study analysis of 30 infrastructure projects was also carried out and survey findings have been validated through the case study comparison. The category wise details of respondents of survey are presented in Table 2.

Table 2: Category wise details of respondents

Category of Respondent	No. of Respondents				
	Declared experience in PPP infrastructure projects				Total Number and %
	Very High >10 projects	High 5-10 projects	Moderate 2-4 projects	Low < 2 projects	
Promoters	2	8	11	4	25 (40.3%)
Govt.		5	2	3	10 (16.1%)
Consultants	1	4	6	1	12 (19.5%)
Lenders	1	6	1		8 (12.9%)
Others	1		1	5	7 (11.2%)
Total and %	5 (8.1%)	23 (37.1%)	21 (33.9%)	13 (20.9%)	62 (100%)

Spearman's rank Correlation has also been estimated for the different category of respondent to check if any large scale variations exist in their degree of agreement with the risk criticality issues (table-3). The high positive correlation between the group's members implies that there is a convergence of opinion amongst the groups.

Correlation among category of respondents for risk issues

Category	Promoter	Govt	Consultant	Lender	Others
Promoter	1				
Govt	0.821**	1			
Consultant	0.826**	0.843**	1		
Lender	0.866**	0.895**	0.921**	1	
Others	0.489*	0.688**	0.623**	0.640**	1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Risk can be classified on basis of allocation or mitigation strategy in an infrastructure project. Thus there are:

- *Transferrable* risks, i.e., risks fully transferrable to the private sector.
- *Retained* risks, i.e., risks for which the government bears the costs, e.g., the risk of delay in gaining project approvals.
- *Shared* risks, i.e., risks that are shared based on a combination of the above two allocations due to the nature of the risk.

Unlike many studies, this research focuses more on assessment of risk criticality rather than just identifying risks factors and their primary allocation. Risk criticality is defined as the combined effect of the probability of occurrence and the impact of a risk event or a risk factor.

The index developed by Wang *et. al. (2000)* was used for measuring risk criticality.

$$\text{Criticality index} = \frac{5n_1+4n_2+3n_3+2n_4+n_5}{5(n_1+n_2+n_3+n_4+n_5)}$$

Where n_1 = number of respondents who answered "Most Critical": n_2 = number of respondents who answered "Very Critical": n_3 = number of respondent who answered "Critical": n_4 = number of respondents who answered "Some What Critical": and n_5 = number of respondents who answered "Not Critical".

Table 4: Risk Criticality Classification

Risk Criticality	Criteria
Not Critical	Criticality index ≤ 0.50
Critical	Criticality index > 0.5 to ≤ 0.7
Very Critical	Criticality index > 0.7 to ≤ 0.9
Most Critical	Criticality index > 0.9

Procurement process in Indian PPP projects

The bidding process for item rate contracts (i.e. EPC / traditional procurement process) and for PPP projects (both toll and annuity) in India is typically divided into two stages. In the first stage (generally referred to as Request For Qualification-RFQ)), eligible and prospective bidders are shortlisted based on technical and financial capability of the bidders(criteria used –(i) construction works undertaken (ii) revenues of BOT/BOLT/BOO from PPP projects already implemented by bidders and (iii) net worth of minimum 25% of the estimated project costs). In the second stage, which is generally referred to as the Request For Proposal(RFP) or invitation of final bids, shortlisted bidders are encouraged to submit their respective bids after visiting the project site and ascertaining for themselves the site conditions, traffic/demand, location, surroundings, climate, availability of power, water, and other utilities for construction, access to site, handling & storage of materials, weather data, applicable laws and regulations and any other matters considered relevant by them. The Government authority/agency acknowledges that the assumptions, assessment, statements and information contained in the bidding documents, especially Feasibility Report (supplied to bidders) may not be complete, accurate, adequate or correct. Each bidder should therefore conduct its own investigations and analysis, and should check the accuracy, adequacy, correctness, reliability and completeness of the assumptions, assessments, and information contained in RFP and obtained independent advices from the appropriate sources. The project is awarded to the highest bidders offering highest premium to the authority; and in the event that no bidder offers a premium, then project is awarded to the bidders seeking the lowest VGF (viability Gap Funding)/grants from the Government authority/agency.

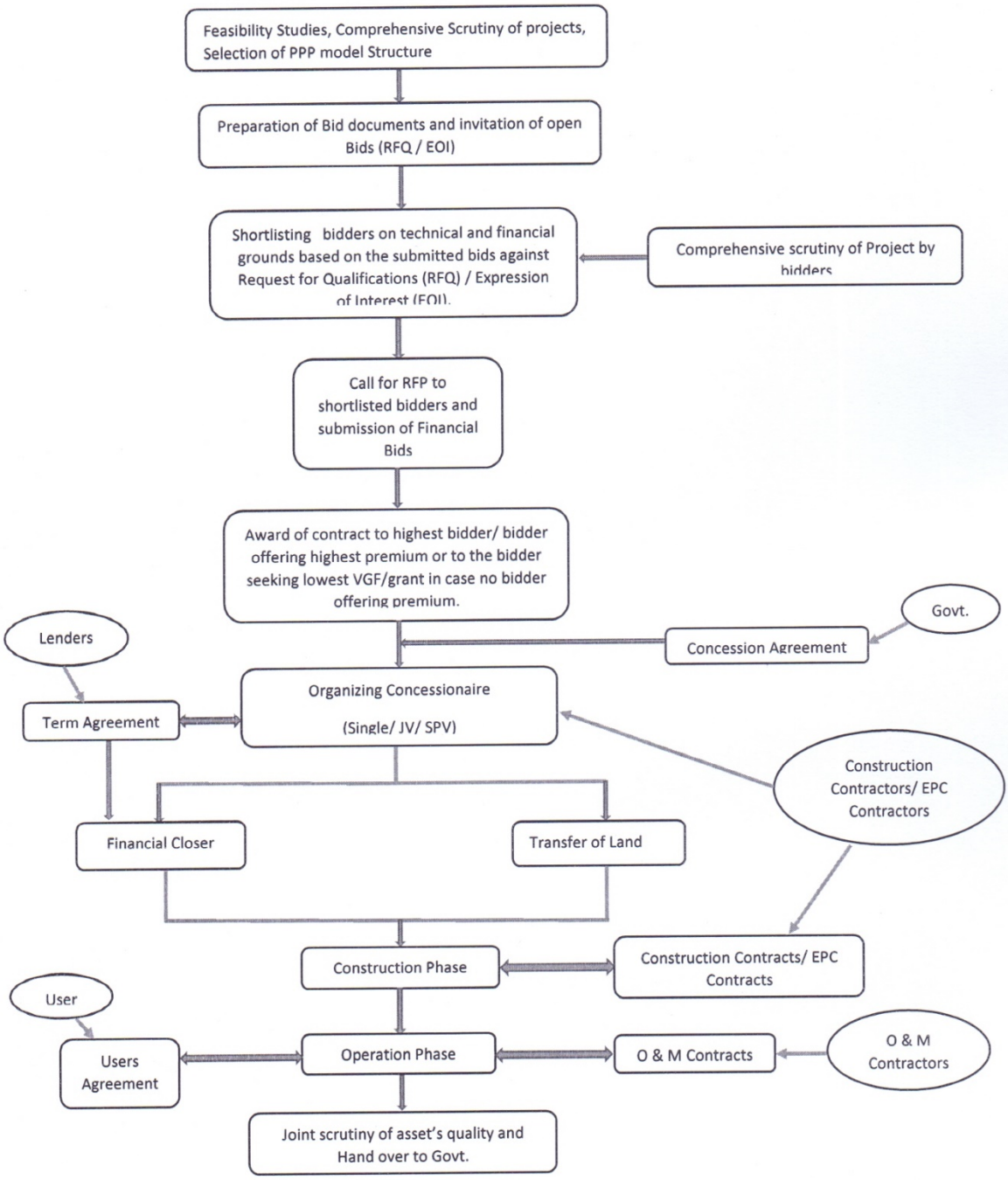

Exhibit 1 : Procurement process in Indian PPP projects

Number of final bidders should be optimal (neither very high nor very low) for ensuring real competition in bidding. A large number of shortlisted bidders is viewed as a factor that dampen participation by serious bidders, thus diluting competition, because credible investors are normally less inclined to spend the time & money necessary for making a competitive PPP bid if zone of consideration is unduly large. Restricting the list to best available bidders improve the chances of a successful PPP operation. It is also an international best practices to shortlist about three to four bidders for the final stage of bidding process. Considering all the factors, the Planning Commission of India suggested short listing of about six to seven bidders with a view to securing high quality and competitive financial bid.

Table-5 provides some of statistics related to bid for procurement process in public goods & services under different delivery modes (the statistic is based on limited amount information provided by NHAI).

Table 5: Statistics of mode of delivery of public goods and services in India

	Traditional item rate contract (EPC)	PPP / BOT (Annuity)	PPP/BOT(Toll)
Risk transfer	Risks are retained by public sector/government agency	Some risks transferred to private party; demand/revenue risk retained by public sector	Most of the risks including demand risk transferred to private party
Risk to private party	Low	Medium	High
Average number of bids received	54.4	22.5	16.9
Average number of bidders shortlisted in RFQ i.e first stage	32	19.8	15.3
Average number of bids received in second/final stage i.e. RFP	8.3	10.2	4.5
Average time overrun in months	23.04	8.94	6.84
Average cost overrun	30.4%	-	-
Litigation before arbitration tribunal (as % of the total projects	28.2%	10.2	1.3%
Litigation before Court (as % of the total projects	16.2%	4%	0

Critical risk factors in PPP projects in India

Out of the 61 risk factors considered in the study, 10 factors (table-6) have emerged as most critical and another 13 factors (table-7)emerged as very critical factors based on critical index (table-4)

Table 6 : Identified Most Critical Risk Factors

Most Critical Risk Factors	**Evaluated Criticality Index**
Revenue Generation	0.990
Demand Risk	0.980
Financial Risk	0.975
Delay in Land Acquisition	0.970
Debt Servicing Repayment	0.970
Delay in Financial Clouser	0.950
Geographical /location risk	0.940
O& M Risk	0.940
Resettlement & Rehabilitation	0.910
Completion Risk	0.900

Table 7: Identified Very Critical Risk Factors

Identified Very Critical Risk Factors	**Evaluated Criticality Index**
☐ Direct Political Risk	0.890
☐ Other pre-constructional activities risk	0.890
☐ Legal Risk	0.870

☐	Environmental Risk	0.870
☐	Cost overrun	0.860
☐	Indirect political risk	0.830
☐	Technological risk	0.820
☐	Partnering and Joint venture risk	0.790
☐	Design and latent defect risk	0.790
☐	Regulatory risk	0.770
☐	Physical risk	0.760
☐	Pre investment risk	0.760
☐	Non political force majeure risk	0.750

The perception level towards a particular risk by all the respondent categories are not same, even though overall perceptions does not differ in a significant way. One of the reason behind this difference in perceptions is that each category of respondent have got his own set of interest in a PPP project (being a stack holder) and looks into an issue through his own interest.

The natures of some of the identified critical risks are explained below:
Demand/Revenue generation risk: The demand risk is defined as fluctuation of number of users associated with introduction of toll, market changes and the level of service provided. Before linearization, public services were offered either free of cost or at very low price. Even after 25 years of liberation, people at large expect public services at low cost or for free. Still there is public resistance to price hike or toll collection. Hence, commercial justification is a critical issue in PPP projects. For many projects, commercial justification needs people participation from the beginning. Nagpur water project and Latur water project's success is due to people participation through the mechanism of public hearing in fixing the rate, consumer redressal cell, awareness and education for optimum use of water (thereby reducing the bills amount) . User must be convinced that they are now getting much better services compared to service previously provided by the public agencies at lesser cost. Some projects are difficult to justify commercially because of problem of hiking user rate, low demand and public resistance. In order to encourage such projects, GOI came up with VGF for financing such projects facing shortfall of required revenues.

Financial Risks: In Indian context, most of the promoters are not in a position to mobilize money from their current balance sheets and are primarily relying on project financing. Since the revenue from projects is in local currency, it is not sustainable to repay foreign investment (debt or equity) from domestic revenue for a long run. Secondly, the Indian promoter are more dependent on the commercial bank rather than to borrow from institutional financier. As a result there is always a chance of asset liability miss-match in case of long term projects like PPP. In India, projects like Cochin International Airport, Delhi Noida Toll Bridge, Vododara Halol Toll Road etc. suffered severely from Financial Risk at different stage of the project operation.

Delay in Land Acquisition and Resettlement and Rehabilitation Risks: Delay in survey, notification and acquisition process, politically motivated public resistance, non-availability of alternate land at reasonable cost, political patronage for encroaches, resettlement and rehabilitation problems, litigations and court proceedings can often lead to long delay in land acquisition (*Srinivasan, 2000; Ramesh, 1999, Thomas, 2002*). The primary reason for certain segments of the GQ phase of the NHDP exceeding the project completion deadline had been due to problems in land acquisition (*Gupta A.K., 2013*).

Debt Servicing Risk: The cash flow inadequacy for repayment of debt component could be a serious problem for PPP projects during the operation phase of the project lifecycle. Though provision for moratorium on principal repayment is available in many projects, the high interest rate coupled with low realization of revenue generation during the initial operation phase may increase the chances of debt servicing risk. Both promoters and lenders are therefore remains concerned with this risk. Vododara Halol Toll Road suffered from Debt Servicing risk severely.

Delay in Financial Closure: This refers to inability for timely (before the appointed date) arranging of necessary debt and equity finance for the PPP project. Generally, PPP projects require huge capital investment

upfront and the major portion of the resources are to be arranged through non-recourse type of project financing. Promoters of Indian projects are frequently medium sized contracting companies, which themselves are not well capitalized. Availability of long-term financing for infrastructure projects is very limited in India. The Indian capital market is also not matured for this type of financing *(Harris C., 2008*). The Cochin International Airport project got stuck up in its initial phase due to delay in financial closure.

Geographical and Location Risk: This risk refers to the problem arising out of Geographical location of the project. Not all locations in India are equally conducive for project development. The socio political cultures of many states differ in themselves and do not provide the same type of environment for a PPP project development. Thus, a project development environment in western India is not same with the eastern side of the country. Moreover, there are practical difficulties like availability of needful resources as well as generation of demands. The regional distributions of PPP projects in India are presented earlier by Priya M. S. and Jesintha P. (*2011*). Due to this geographical disparity Govt. of India had to adopt policies like SARDP-NE for project developments in remote North Eastern area.

Operation and Maintenance Risks: Unexpected maintenance of the infrastructure facility, poor experience, user's problems, accidents, overloading, public agitation, failure of associated infrastructure and parallel developments are some of the reasons for the subject risk. Feedback from promoters revealed that in many national highway projects, the state support agreement signed between central, state and the promoter for smooth operation of toll road is not proving adequate with frequent violations. Coimbatore Bypass project got jeopardised in absence of a proper state support.

It is also reported that PPP projects present a different risk profile than conventional projects. Many of the risks in a PPP project come from the complexity of the arrangement itself in terms of documentation, financing, taxation, technical details, sub agreements, and market conditions (*Gupta A. K. et. al., 2013*). The DMRC Airport line (Third phase of DMRC) project, Modern Bus Terminus at Amritsar also entangled with problems in the operational phase.

Resettlement and Rehabilitation Risk: Traditionally resettlement and rehabilitation was done by Govt./ the public agencies. However, in PPP project environment rehabilitation of displaced habitations are undertaken by promoter in the interest of early settlements. Due to public resentment over rehabilitation measures, risk may crop up and even jeopardise the whole project purpose. Some of the projects where huge resettlement and rehabilitation issues had cropped up were Coimbatore Bypass, Cochin International Airport, East-West Corridor of Kolkata Metro.

Completion Risk: These are the risks in which the project may not be completed on time & may also exceed its sanctioned cost. The reasons behind, may be design and latent defect, and technology failure, procurement and execution problems, and financial issues. This risk is also influenced by other risks such as delay in land acquisition and delay in financial closure etc. These come under Construction phase risks of a project and are well documented in the literature (*Baldwin, 1971, Erikson, 1979; Perry and Hayes, 1985; Al-Bahar, 1989; Smith and Bohn, 1999, Akintoye, 2001, Thomas 2002, Gupta 2013*). Integrated SWM project of Guwahati, Ahmedabad Vododora Expressway, Delhi Metro Airport line were few example of adverse effect of project delays.

Direct and Indirect Political Risks: Since investments in PPP infrastructure are long-term, irreversible and domestic market dependent, changes in the government policies adversely affect the profitability. They affect all aspects of a project, from site selection and construction through completion, operations and marketing. They are difficult to evaluate. Wherever possible, these risks are assumed by sponsors. Where this is not possible, lenders sometimes assume such risks. The ultimate political risk is expatriation. It is often difficult to distinct this risk from country risk. (*Manir H.,2011*) Coimbatore Bypass and Delhi Noida Bridge project finances got affected due to political risk.

Other Pre-constructional activities: In India, prior to the start of construction of a PPP project, be it road or in any other sector, multi-level permits (central, state and local) and approvals are to be obtained from various authorities. Though, government facilitates in obtaining such permits/approvals, there have been reported inordinate delays. Secondly, utility shifting, which are not generally part of the host department, takes lot of time due to lack of co-operation and co-ordination between Government agencies. Permit/approval delay is one of the prime causes for time overrun of projects in India. A report by the Times group highlighted that government projects worth `7 Lakh crores were stuck up due to government red tapes and at least 37 projects in Power sector

had been delayed due to want of environmental clearances (*Sidhartha, Mar,2013*). People are therefore advocating 'Single Window' clearances for project developments.

Legal Risks: This risk arises out of the complexity in the legal front under which the projects are being executed. For example, in India, there are about thirty-five laws that have a direct or indirect bearing on private road projects only. Tolls Act (1851), The National Highway Act (1956), National Highway Authority of India Act (1988), Land Acquisition Act (1894) and Arbitration and Conciliation Act (1940) are some of the important acts referred in road projects and have been amended to facilitate private investment in the sector. Due to tedious and lengthy process of legal dispute settlements, these risks generally crop up. Gurgaon Delhi Expressway, Delhi Metro Airport line (DMRC Third Ph), Coimbatore Bypass etc. were some of the projects entangled by legal hurdles.

Environmental risk: Fault in conducting Environmental Impact study (EIA), not adequately consulting the affected parties may result in cropping up of public resentment against a project. There have been lot of examples particularly in Energy and Power sector infrastructure projects. Lower Shobonsiri Project in North East India is a golden example though it is not in PPP mode. Similarly, delay in getting environmental clearance and pollution issues may impact performance of the project. There should be an effective R&R policy for social and environmental impact assessment and findings of such assessments should be discussed with affected stakeholders. Integrated SWM Guwahati is a classical example, still facing environmental hurdles.

Cost Overrun: Over exceeding of budgetary amount causes this risk. This may be because of unexpected additional works, repetition of work due to faults, other causes of delay in completion leading to cost escalations, faulty financial structure of the project, malpractices etc. Delhi Noida Bridge project requiring financial restructuring was a classic example of cost overrun.

Partnering & JV Risk: Most of the PPP road projects are undertaken on a consortium approach. Thus, team spirit and mutual trust among the partners are essential characteristics of a consortium. Organizational structure with well-defined areas of functioning is necessary to avoid conflict among various groups. Project risk may be aggravated by the inadequate performance of individuals and organizations contributing to the project. It has been reported that international joint ventures are subject to very high rate of failure due to cultural and operational difficulties at both national and organizational level (*Shridharan, 1997; Thomas, 2002*). Dispute in Gurgaon Delhi Expressway is an example for partnering and JV issue.

Regulatory Risks: Generally regulators are ought to be nonbiased bodies formed with representatives of all sides and highly experienced people in the field. These bodies are entrusted with legal powers and rules & provisions to deal with most of the kind of criticalities and eventualities in that particular field. Thus, they can take swift decisions on tariff changes to dispute among stack holders. Overall, they control the project rules and regulations on that particular field. In India, so far all sectors do not have uniform regulators and in some ministries the organizational head has been entrusted to function as a regulator. In those type of cases, a nonbiased decision as needed in a private participating environment cannot be guaranteed. The need for regulators is strongly highlighted by researcher like Gupta A. K. (*2013*). Absence of regulators had hindered interest of otherwise successful projects like Delhi Gurgaon Expressway, DMRC Airport Line etc.

Technological /Design & latent defect risk: These may result in repetition of work, suspension of work or just even price escalation due to change in specifications. Thereby, it may cause delay in completion or simply cost escalations without delay too. Nellore Bypass is such an example, wherein design clearance of one Railway-Over-Bridge & 17 new culverts escalated the cost in a multiple way.

Physical Risk: These are arising out of physical condition of the project and its surroundings. These differ from the locational/ geographical risk in terms of the exact physical status of the project area. For instance, within a same city/ village some physical assets / infrastructures may exist which are more valuable than few others; at the same time some physical assets may be more densely existed than the others. In such cases, valuation of both the project location may differ owing to the physical status of the project and one will have to shoulder higher risk than the other in terms of Land acquisition / rehabilitation etc. Moreover important monumental structure, temples in alignment of roads give rise to physical risk. In many NHDP projects in India physical risk had cropped up.

Pre-investment Risk: These are the risks involves at the project formulation stage. These may involve getting rid of apprehensions of various agencies for project viability, thereby facilitating of easy lending facilitates. It

may also involve obtaining state support, actual physical activities of permit/approval to utility shifting etc. The stack holders must be convinced that for the particular project, in that particular location/ state that there is no pre investment apprehension from any quarters. Otherwise, these small apprehensions may jeopardize the project interest at a later state.

Non political Force majeure risk: Non political force majeure is generally termed as "act of God", such as earthquake, flood, cyclone, fire etc. So, in Indian context, for projects in states like Assam may have to be extra safeguarded for flood and earthquake i.e. their insurance value may differ from another project in say Western India. Similarly, in coastal area somebody may prefer to get extra insurance for 'cyclone'.

Optimal risk

In traditional EPC, the private parties execute the works but risks are retained by the public sectors/Government agency; risks do not disappear. They are just passed on to customers and /or taxpayers when they are not mitigated. In PPP, majority of risks are transferred to private party; some are retained and some are shared by both public and private party. The risk allocation is the key component in PPP concession agreement and optimal allocation means that risks are allocated in such a way that maximizes value-for-money. It is worth transferring the risk to private sector in PPP project only if the risk transfer lead to (i) reduction of total project risk through better risk management skills, capability and resources (ii) low cost involved in risk minimization (iii) better hedging (iv) better diversification of risk by private party and (v) risk assigned to the point of origin (i.e- repairing risk should not be assigned to O&M operator if it is due to design defects; rather be assigned to design consultant)

Risk transferring mechanism

There are three mechanisms for assigning/transferring risk to the contractual parties (i) entrenchment of right (ii) Material Adverse Effect (MAE) and (iii) renegotiation at the time of risk realization. The entrenchment of rights approach allocates risks and obligation to the party at the time of bidding. In MAE , as and when risk arises (mainly poor debt serving) , the same is dealt with by (i) Toll charges adjustment or (ii) varying the concession or (iii) direct financial contribution and (iv) reallocation to parties. In renegotiation approach, the risk is renegotiated at later stage at the time of risk realization.

Our survey reveals that the entrenchment of rights is the most preferred method of risk management by almost all the respondents from government, consultants and lenders. Sponsors, on the other hands are divided over the risk management approach. 50% think that entrenchment of right is better approach and 50% think renegotiation at the time of risk realization is the best approached. Renegotiation is preferred by many private parties probably because of the facts that it involves bargaining between the sponsor and the government in a non-competitive environment. Since there are substantial differences in skills, capability, and information, the private party tends to gain considerably from renegotiation. It also encourages corruption and political influence. Hence, the government, consultants and lenders and even some private parties preferred the entrenchment of rights where risk is clearly assigned to the parties at the time of biddings. Initial competitions at the time of biddings are considerably high (average 15.4 in RFQ stage and 4.47 at RFP stage in Road projects in India) reflecting the bidder's knowledge of its own capabilities and awareness of internal and external project risk. Competition in fact compels bidders to thoroughly analyse risk before bidding.

MAE as mechanism of risk transfer /management is the least preferred by all parties.

Amongst the mechanism available under MAE, 'varying the concession' is the most preferred followed by 'Toll charges adjustments'.

Allocation of Risk in reality

One of the primary features of PPP project is risk sharing and its allocation to the party best suited to manage the same. Therefore, it was also intended by the authors to assess the best party for managing the risk and what is the situation in reality. The finding reveals the followings:

- 23 critical risk factors were identified by the respondents who had reasonable years of experiences in managing risk and dealing with PPP projects. Out of these 11 risks were correctly allocated to the party best capable of managing it. In case of 12 risk categories, there has been mismatch and risks are not correctly allocated (Table-8).
- In 15 risk categories, Govt. is the one of the most capable parties, but their participation mostly seen in only 6 categories, least or non-participation in 9 categories of risk.
- Promoters appear to be best party to manage risk, followed by Govt. The role of lenders are expected in certain categories like Financial Closure, Debt Servicing Risk, Financial Risk, Cost Overrun etc., but in practice lenders have hardly taken any role in managing risk. Similar is the case for insurers.

The basic reasons for allocating most of the primary allocation to the promoter/private parties is that unlike in a conventional or 'EPC' project, where government or the host department principally controls and

manage the funds for the project and remains concerned for the same, in case of PPP the fund management principally rests with the promoter and eventually he become more concerned on return of his investments. So, at all times his/her primary goal is to get into a fast track project development route even if by sharing little more responsibility to get back his assured return at the appropriate time. The other stack holders just facilitate in easy discharge of his/her (promoter's) responsibilities.

Table 8 : Allocation of Risk to party capable of managing the risks and their mismatch

Sl. No.	Project Risk	Parties suitable for management of the risk	Risk primarily allocated to the party	Mismatch if any with primary allocation & Parties suitable for managing the risk
A	Pre investment risk	GOV, PRO	GOV, PRO	No
B	Delay in financial closure risk	GOV, PRO, LEN	PRO	Yes
C	Resettlement & rehabilitation	GOV, PRO	GOV, PRO	No
D	Delay in land acquisition	GOV, PRO	GOV	Yes
E	Other Pre-constructional activities risk (Permit/approval/utility shifting)	GOV, PRO	PRO	Yes
F	Technological risk	PRO	PRO	No
G	Design & latent defect risk	GOV, PRO	PRO	Yes
H	Cost overrun risk	GOV, PRO, LEN, INSU	PRO	Yes
I	Completion risk (time overrun)	PRO	PRO	No
J	Demand risk	GOV, PRO, USER	PRO	Yes
K	Revenue generation risk	GOV, PRO	PRO	Yes
L	Operational & maintenance risk	PRO	PRO	No
M	Direct political risk	GOV, PRO	GOV, PRO	No
N	Indirect political risk	PRO	PRO	No
O	Regulatory risk	PRO, GOV	PRO,GOV	No
P	Legal risk	GOV, PRO, INSU	PRO	Yes
Q	Debt servicing risk	GOV, PRO, LEN, INSU	PRO	Yes
R	Financial risks	GOV, PRO, LEN, INSU	PRO	Yes
S	Non political force majeure risk	PRO	PRO	No
T	Partnering (joint venture) risk	PRO	PRO	No
U	Environmental risk	GOV, PRO	PRO	Yes
V	Physical risk	PRO	PRO	No
W	Geographical / Locational risk	GOV, PRO	GOV, PRO	No
X	Others if any:			

GOV: Government/public sector; PRO: Promoter/private party ; LEN: Lender ; INSU: Insurer

Reasons for misallocation of risks

Four prominent reasons for misallocation of risks have been cited by the 62 experts we interviewed- (i) PPP participants use bargaining power to pass as many risks as possible to other parties rather than retaining the risks which they can manage (ii) During bidding , the information and time available is insufficient to fully analyze the costs and risks (iii) The tender for large PPP projects are often launched before fully analyzing the risks and their optimal allocation parameters (iv) Many risks arise during operation phase which is difficult to predict at the time of bidding. These four factors are leading to higher risks and responsible for transferring of more risks to private players and also leading to delay in financial closure

Changes of risk criticality over different phases of project life cycle

Except environmental risk and force majeure risk, the risk criticality of all categories of risk had gone up when the projects pass through from development phases to operation phase (Exhibit 2). Phase wise classification of risk is meaningless as most of the risks prevailing throughout the whole life cycle of the project. The pattern of risk changes indicate that the highest risk occurs not in construction state but rather in operational stage

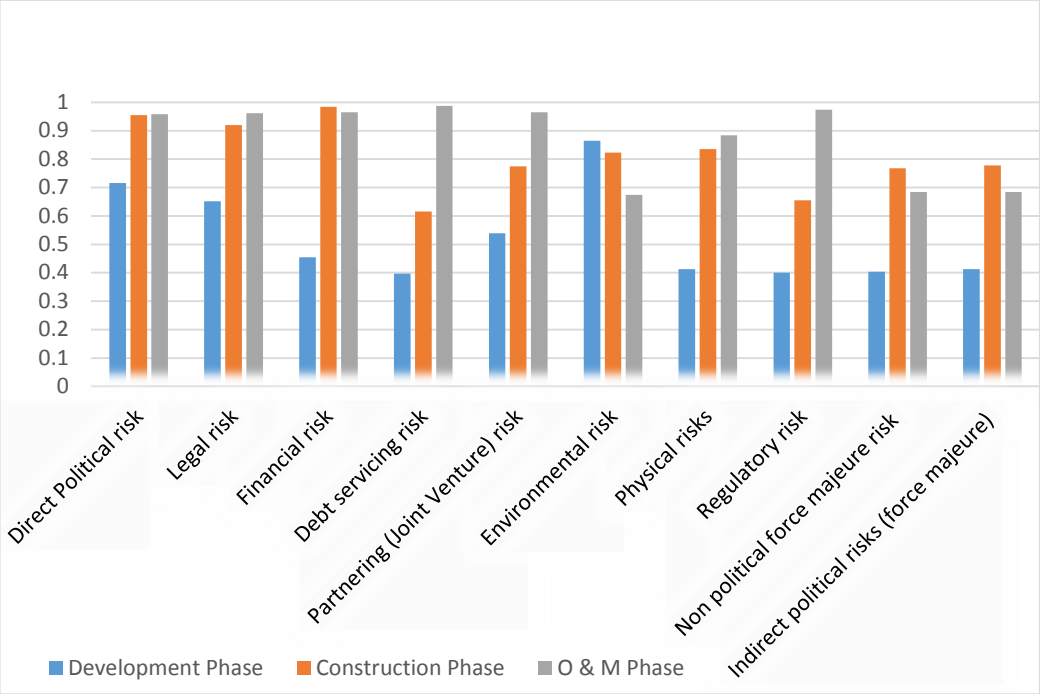

Exhibit 2 : Risk Criticality in different phases of PPP projects

Comparison of risk factors across countries

Our findings were compared with the findings of the studies in China (Xu Y. et. al., 2010), Singapore (Zhu L. et. al., 2009; Ezeldin A. S. et. al., 2013), UK (Akintoye A. et. al., 2001), Greece (Roumboutsos A. Et al, 2010) and Egypt (Ezeldin A. S. et. al., 2013). The comparative analysis (table-9) indicates that Indian PPP projects are facing the highest amount of critical risks. Out of 61 risk factors considered in the study, 29 risk factors has been identified as critical risk in India; whereas the figures for Egypt, China, Singapore and UK stand at 19, 16, 15 and 8 respectively. India is close to other countries in respect of demand risk, revenue generation risk, financial risk, direct political risk, indirect political risk, regulatory risk, and legal risks. These factors were found to be critical in all countries under consideration. It defers significantly with other countries in respect of resource capability risk, engineering survey, delay in land acquisition, rehabilitation and resettlement risk. They are found to be critical only in India. In the case of other categories of risk, no valid conclusions can be drawn. Overall, the risk criticality appears to differ significantly across countries, across sectors and even across projects. Hence a generalized model may not be able to explain optimal risk allocation behavior in reality. "One-size –fits-all" approach may not work.

Table 9: Risk allocation across counties and their compassion with PPP projects in India

Sl. No.	Risk Factor	India	China	Singapore	UK	Egypt

I	Superficial Consideration of host govt.	***	*	***	**	*
II	Government intervention	*	***	**	*	***
III	Lack of Commitment from Stack holders	**	*	***	**	***
IV	Apprehensions about technical & financial feasibility	**	*	*	**	*
V	Fault in method Cost Benefit Analysis	*	***	*	*	*
VI	Non Clarity of Concession Proposal	*	***	*	*	**
VII	Poor financial Market	**	**	*	***	***
VIII	Delay in financial closure risk	***	*	**	*	**
IX	Other Pre-constructional activities risk (Permit/approval/utility shifting)	***	*	***	*”	*
X	Government corruptions	***	***	***	*	***
XI	Resettlement & rehabilitation	***	*	*	**	*
XII	Fault in Bidding Process	*	**	*	*	*
XIII	Delay in land acquisition	***	*	*	**	*
XIV	Organizational & Co-ordination Risk for utility shifting etc.	**	**	*	*	*
XV	Technological risk	***	*	*	*	**
XVI	Technical and Financial soundness of the agencies	***	*	*	*	*
XVII	Risk for applying innovative technique / design	**	*	*	*	*
XVIII	Design & latent defect risk	***	*	*	**	**
XIX	Lack of detailed Engineering Survey	***	*	*	*	*
XX	Changes in work Scope	**	**	*	**	*
XXI	Risk for using substandard materials	**	*	*	*	*
XXII	Risk for Poor workmanship	**	*	**	*	*
XXIII	Non adherence to HSE regulations	***	*	**	*	*
XXIV	Completion risk (time overrun)	***	**	***	**	**
XXV	Wrong Preparation of Construction schedule	***	*	*	*	**
XXVI	Cost overrun risk	***	**	***	**	***
XXVII	Non Smooth cash flow for the project	***	***	**	**	*

XXVIII	Non effective escalation clauses	**	**	*	*	**
XXIX	Non political force majeure risk	**	**	*	**	***
XXX	Geographical / Locational risk	***	**	*	*	**
XXXI	Geo-technical Risk	***	***	*	*	*
XXXII	Non availability of power and water supply	*	*	*	*	*
XXXIII	Non proper accessibility to site	**	*	*	*	**
XXXIV	Political Force majeure Risk	**	**	*	***	***
XXXV	Poor Project Management	**	**	*	*	*
XXXVI	Patent infringement	*	*	*	**	**
XXXVII	Adequacy of insurance (CAR)	*	*	**	*	***
XXXVIII	Sub-Contractor's insolvency	**	*	*	**	*
IXL	Demand risk	***	***	***	***	**
XL	Influential economic market	***	***	***	**	***
XLI	Revenue generation risk	***	***	***	**	**
XLII	Financial risks	***	***	***	***	***
XLIII	Currency fluctuation	**	**	*	*	***
XLIV	Inflation of Cost	**	***	***	*	***
XLV	Policy changes/ changes in tax regime	***	***	**	**	***
XLVI	Performance Risk	**	**	*	*	*
XLVII	Fault in revenue estimation	***	**	**	*	*
XLVIII	Improper toll levying	***	**	*	*	*
XLIX	Parallel Project Development	**	*	*	*	**
L	Partnering (joint venture) risk	***	*	*	**	*
LI	Defaulting Stakeholders	***	*	*	**	**
LII	Direct political risk	***	***	***	***	***
LIII	Indirect political risk	**	***	**	***	***
LIV	Regulatory risk	**	***	***	**	***
LV	Legal risk	**	***	***	***	***
LVII	Debt servicing risk	***	**	**	**	***

LVIII	Environmental risk	***	*	**	**	**
LIX	Termination Risk	*	*	*	*	**
LX	Third party liability	*	*	**	**	*
LXI	Under performance by utilities	*	**	**	*	***
LXII	Constraint on foreign investors in their own country	**	*	***	***	**

Government supports

In India, Government provides support to PPP projects in seven different ways - (i) guarantee (ii) Cash subsidy (iii) Equity participation/grant (iv) sub-ordinate debt (v) complementary investments (feeder roads/other development rights) (vi) Tax relief and (vii) land purchase and clearness. Our study reveals that surprisingly, cash subsidy is the least preferred by both sponsors and lenders, rather all are interested in Tax relief. There are two plausible reasons (i) some of the PPP projects are bringing very high return to sponsors/contractors; tax relief would lead to reduction of tax burden heavily (ii) Tax relief /exemption would facilitate the sponsor to borrow at the cost of public agency which is much lower. Since the PPP projects are highly geared, the return on equity holder would be substantial.

Risk factors influencing success of a PPP project

The success of a PPP project depends on how the private party manage risks and keep their impact and occurrence at 'tolerance level'. This paper also tries to establish a relationship between success of a PPP project and its influencing risk factors. We ask the respondents having experience in a particular projects or set of projects to rate the performance of the projects and level of risk they are experiencing in respective projects.

Profit/return on investment is not considered as success parameters as most of projects are in the first stage of their operation phase. We have discussion with some of the respondents and selected seven criteria for measuring project performance /initial success- (i) Demand Revenue Generation(ii) Debt Service Repayment (iii) time overrun management (iv) cost overrun management (v) service conditions (vi) HSE(health Safety and environment) issues and (vii) efficacy in handling critical issues. Respondents feel that these criteria will strengthen the project's prospect which in turn helps meeting the short and long term obligations to its stakeholder. Based on their responses ratings a 'Success Factor Index (SFI)' has been worked out in line with the Criticality Index developed by Wang *et. al.*, (*2000*). Thus,

$$\text{Success Factor index (SFI)}=\frac{5n_1+4n_2+3n_3+2n_4+n_5}{5(n_1+n_2+n_3+n_4+n_5)}$$

Where n_1 = number of respondents who answered "Highly Success": n_2 = number of respondents who answered "Success": n_3 = number of respondent who answered "Some What Success": n_4 = number of respondents who answered "Poor performance": and n_5 = number of respondents who answered "Failed".

By the above criteria 10 projects out of 30 projects are considered to be most successful projects based on overall SFI. Another 13 projects have rated as good performers; 7 projects are moderate performers and 3 projects are rated to be poor performer at the time of interview. All the thirty PPP projects are doing well so far HSE performance is concerned possibly due to strict environment regulations and public concern. Service conditions appear to be kept at desirable level because of better enforcement of the output specifications. However, some of the surveyed Projects could not carry out well in respect of debt service repayment, management of time overrun and efficacy in handling of critical risk issues. (for details, refer to annexure-I &II)

SFI is regressed against twelve independent risk factors. The results of the regression are shown in table-10. The independent variables considered in the regression are the most critical risk factors which is a function of risk probability and risk impact. Case wise analysis shows that baring three projects, risk occurrence is low in most of the projects plausible due to effective risk treatment by the private parties from the beginning of the project. Risks in the surveyed projects have been mitigated in such a way that risk is reduced to a 'tolerance level'. This clearly shows that if the critical risks are well treated, their occurrence and impact on the project can be minimized to a great extent.

Amongst all the risk factors O&M risk has emerged as most influencing factor. The project with low O&M risks has come out to be most successful projects. Land acquisition risk, though considered as the most critical risk has the least contribution to the success of the projects. While a debt service risk has great influence on success, the same is not true with financial risks. Financial risk appears to have little impact on the success of the projects. Though technical, legal, and political risks are still very prominently present in O&M phase, they have the least impact on the success of the PPP projects. Cost overrun risk, resettlement &rehabilitation risk,

demand risk and political risk can still distinguished between successful projects from non-successful projects, but their impact is not as significant as others.

Table 10: Summary of Regression analysis of success factors and risk parameters

Risk Factors	R	R^2	BETA	T(sig)	F(sig)
	0.920[a]	0.846			7.774(0.000)
Demand Revenue Risk			0.197	1.358(0.192)	
Financial Risk			-0.034	-0.189(0.853)	
Land Acquisition Risk			0.059	0.345(0.734)	
Debt Service Risk			0.236	1.39(0.183)	
O&M Risk			0.414	2.353(0.031)	
Resettlement & Rehabilitation Risk			0.194	1.171(0.258)	
Time overrun risk			0.195	0.824(0.421)	
Cost overrun risk			0.235	1.519(0.147)	
Legal Risk			0.033	0.169(0.868)	
Regulatory risk			0.171	1.487(0.155)	
Technological risk			0.044	0.366(0.719)	
Political risk			-0.17	-1.243(0.231)	
Constant	0.369				

Dependent variable: Success factor index of a Project.

Perceived deficiencies in PPP project Development Efforts in India

The respondents had highlighted nine major deficiencies which are presented below in order of ranking

1. Absence of efficient Project Management for dealing with critical issues. The concept of PPP is new and India is yet to achieve next level of sophistication and maturity. Further a large number of technocrats are on deputation and have developed little expertise in project management
2. Corruptions/Malpractices-The Government has to amend the Prevention of Corruption Act, 1988 which does not distinguish between genuine errors in decision-making and acts of corruption. Measures may be taken immediately to make only malafide action by public servants punishable, and not errors, and to guard against government officers and bureaucrats for decisions taken with bonafide intention. The government may speed up amendment of the Prevention of Corruption Act, Vigilance and Conduct rules applicable to government officers
3. Selection of right type of agencies- Though PPP projects have received good responses, there are many instances where the bidding process is not transparent with information asymmetries, unfair and unequal treatment of potential bidders in the procurement process . Often evaluation of technical, managerial and financial capability of the consortium are not done properly both by the public agencies and banks leading to selection of agencies with lesser resource capability.
4. Lack of strict enforcement measures- Due to ill motive and corruption, there is no sincere effort by public agencies to enforce the private party to achieve the output specifications in the bid documents
5. Non availability of Regulatory authority in each & every sector (discuss details in the last section)
6. Frequent changes in political establishments- several layers of political setup in a particular location and coalition form of governments in many States as well as centre is also affecting the output of the project delivery and delaying the implementation of many measures required for success of the projects
7. Volatility of Indian market especially during recession period leading to weak equity base of SPV and as a result the PPP projects are highly geared.
8. Joint Venture issues- PPP is a consortium of large number of private parties with diverse interests. This often leads to infighting amongst the partners.

Suggested Risk Management Process in a PPP project

Many researchers have come up with useful risk management framework for risk allocation between private and public agency. They are useful for dealing with risk allocation problems during the biding process but may not be so useful for dealing with risk issues over the whole project life. This research is trying to suggest a new framework for dealing with risk management and allocation issues for the whole project life (exihibit-3). Key elements in the proposed framework are explained below.

- Risk severity have been decomposed into four pillars –(i) Pillar I-Low probability/occurrence, low Impact (ii) Pillar II-high Occurrence, low Impact (iii) Pillar III-Low Occurrence, high Impact and (iv)Pillar IV-High Occurrence, High Impact
- Different mitigation strategies are required for risk factors coming under each pillar. For risk factors coming under pillar I, private party should develop enough resource capability (financial, managerial, technical etc) to deal with risks as and when they arise (risk tolerance). For risk factors under pillar II, private party must identify the risks and develop appropriate strategy for dealing with the risks before they occur (risk treatment). For risk factors under pillar III, the private party should explore the possibility of transferring and sharing risk with other members of the consortium including lenders, insurers and users. PPP projects are in general large in size but the bidders are generally medium companies. They may not be able to generate enough financial capability to deal with high occurrence extreme event. Hence, for the risk factors coming under pillar IV, there should be ex-ante provision for risk reallocation and sharing with public and Government agency.
- Another key element of the proposed framework is the pricing of risk. Pricing should be based on residual risk and needs to take into account three components-(i) risk free return, (ii) risk premium for every risk factor retained by the private player, and (iii) illiquidity premium due to high transaction/ impact cost. Apart from rewarding private party for each risk retained by them, they should be rewarded for their money tied up for a very long time with limited scope for disinvestment unlike venture capitalists that have well-define exist route.
- The most important element of the proposed framework is the development of benchmark performance through performance matrix and strategic initiatives to be taken by private party. The focus of the bid documents and the current research efforts are on risk allocations and minimum performance standards to be adhered to by the private party. Focus is currently more on development of risk matrix. What is equally important is the development of benchmark performance through performance matrix and strategic initiatives to be taken by private party in collaboration with the public sectors over the entire project life. The performance matrix should not only concentrate on functional requirements but mainly on strategic requirements. Two projects in our case study appear to do so to some extent with a reasonable success. A well developed performance matrix may help in mitigating many potential risks the project may face in its whole life. One of the authors has developed performance matrix and strategic initiatives required for success of two PPP projects under considerations. The first project is electricity distribution project. The strategic performance matrix includes year-wise output specifications/targets for (i) improvement of recovery ratios, (ii) T&D losses reduction(iii) increase Revenue

per employees (iv) Energy audit (V) LT/HT ratio reduction (vi) load survey (vii) process improvement through TPM and six sigma (viii) demand side management (ix) billing and collection efficiency, (x)reduction of manpower, (xi)technology up gradation(xii) installation of pre-paid meter, spot billing, satellite billing, etc, In the other project i.e water supply project, strategic performance matrix includes year wise targets for water distribution loss, metering, household coverage, household connections per million rupees investment, investment per households, collection and billing efficiency, development of flexible pricing and costing system for different group of customers, manpower reduction and optimizations etc. One of the positive aspects is that many public agencies in India has gone for MOU based performance management system and the same may be extended to their PPP projects as well . Effectiveness of the proposed performance matrix will largely depend on the incentive schemes for private party for exceeding performance above MOU targets.

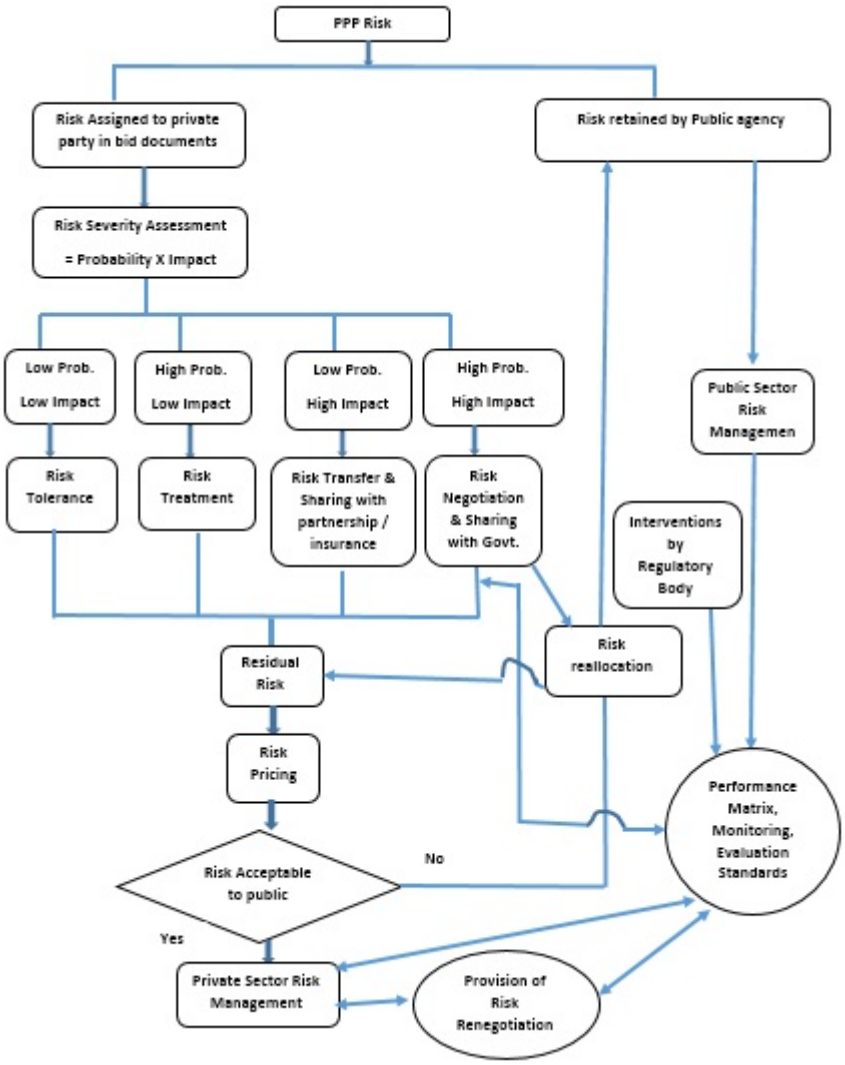

Exhibit 3: Suggested Risk Management Process in PPP project

Concluding remarks and areas of future research

Based on the analysis of the opinions of the experts and the case studies, the study has arrived at the following conclusions and recommendation thereon:

- In contrast to many studies our study found highest risk in Operation phase which span over 20-30 years and a private party often loses bargaining power related to tariffs and other matters in case there are abrupt changes in the economic or policy environment which are beyond its control. The private sector must be protected against

what have been called an "Obsolescing Bargain"-the loss of bargaining power over time by private player in PPP. Future research works should also focus on the problems of "Obsolescing Bargain" and the development of ex-ante provision and mechanism for dealing with such problem in the concession agreement.

- One of the perceived deficiencies is the non availability of independent Regulatory authority in each & every sector. Setting up of independent regulator for each and every sector both at state and central level may solves many problems encounters in the execution of PPP projects. They should be formed with a unified mandate that encompasses activities like creation of sector/sub sector-wise model concession agreement, dispute resolutions before going for arbitrations and court, tariff revision through democratic process, reallocation of risks, development of benchmark performance standards etc. In case of electricity sector, each State/Province in India has its own regulatory body.
- Since demand risk and public resistance to toll collection and hike in tariff is high in many PPP projects in India, 'willingness to pay' survey should be conducted by the private party before going for final bid.
- Veccnica, Hellowell and Gatti, (2013) has explored risk- return relationship in PPP projects of UK hospital sector and found that the expected returns are in general in excess of the WACC (weighted average cost of capital) benchmarks. Their findings highlight significant problems in current procurement practices and the methodologies by which bids are assessed. The return on PPP projects in India are above 17% and since it is highly geared; the return on equity is likely to be much higher. The future research work should also explore the risk return relationship for PPP projects.
- Future research should also focus on (i) optimal risk allocation amongst the members of consortium (current research is mainly focusing on risk allocation between private and public agency, not on optimal risk allocation amongst the members of a consortium) (ii) Development of model for Estimation of Value-for-Money (Vfm) (iii) Effectiveness of using hedging instruments (Cap, Swap, futures, options, weather derivatives, catastrophic derivatives etc.) in mitigating risks.

Brief biography of author

- **Prof M Kakati** is professor and former Dean, Faculty of Management, Gauhati University. He obtained MMS degree from BITS, Pilani, and Phd in Flexible Manufacturing Systems from Gauhati University. His current research interests include Financial Engineering, Management of Computerized Technology and PPP projects. His research papers have appeared in Technovation, Human Systems Management, International Journal of Production Economics, Engineering Costs and Production Economics, International Journal of Development Banking, Vikalpa, Finance India, and ICFAI Journal of Applied Finance, Derivative Markets etc. He has consulted over 25 national and international organizations and conducted large number of EDP programs for senior managers of top public sector undertakings.

- **Mr. Baruah** is a Professional Engineer working in the field of Infrastructure development in India. He is currently Executive Engineer in the newly established IIIT Guwahati (under PPP mode) and is fully responsible for building IIIT-G's infrastructures, including its new campus near Guwahati, Assam. Earlier, Mr. Baruah was involved in shaping up the IIT Guwahati campus as part of his job assignment. He was a Manager (Technical) in NHAI, during which tenure he had dealt several important projects of East West Corridor of NHDP in India, including the new Brahmaputra Bridge near Brahmaputra. Moreover, Mr. Baruah also served in the prestigious Petrochemical project, BCPL of Assam during its commissioning phase and was instrumental in operational zing several of its infrastructures. Mr. Baruah has a Graduate Engineering back ground with post-graduation in Structural Engineering from IIT, Guwahati. Currently, he is involved in research activities related to Project Management & Infrastructure developments.

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Annexure-I
Success Factor Indices for 30 case study projects

Sl. No.	Performance parameters	PJ1->T3 of DIAL	PJ2->OA	PJ3->EWC KOL-MET	PJ4->DMRC	PJ5->DNB	PJ6->VDH	PJ7->MPEx	PJ8->COMBB P	PJ9->LWMP	PJ10->MWSS	PJ11->SWTPG	PJ12->SWTPH	PJ13->HYA	PJ14->CONTVP	PJ15->NBP	PJ16->RAJAMUN	PJ17->KANDP-CONT	PJ18->MORM-GOA	PJ19->GANDHI D-RLY	PJ20->AHM-VORD-EXP	PJ21->CDH-KoChiR	PJ22->PANGR-PALA	PJ23->PPWSP	PJ24->VGCTPCL	PJ25->NVSSP	PJ26->HASRLY	PJ27->GUR-DEL-EXP	PJ28->AIR-L-DMRC	PJ29->AMRT-BU-T	PJ30->Mhow-Pitampura
		SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI	SFI
1	Demand & Revenue generations	0.853	0.880	0.973	0.987	0.547	0.547	0.973	0.400	0.760	0.907	0.827	0.840	0.973	0.813	0.907	0.840	0.960	0.960	0.960	0.933	0.667	0.933	0.960	0.933	0.947	0.960	0.960	0.987	0.840	0.920
2	Debt Service repayment	0.653	0.840	0.653	0.987	0.440	0.440	0.960	0.429	0.747	0.773	0.773	0.813	0.987	0.707	0.973	0.720	0.960	0.747	0.947	0.973	0.893	0.867	0.973	0.947	0.933	0.693	0.613	0.720	0.907	0.907
3	Management of overall-time over run	0.973	0.587	0.587	1.000	0.867	0.907	0.960	0.947	0.907	0.907	0.693	0.907	0.973	0.907	0.973	0.933	0.893	0.813	0.813	0.933	0.933	0.867	0.947	0.880	0.893	0.693	0.667	0.693	0.947	0.947
4	Management of overall-cost over run	0.920	0.627	0.600	0.975	0.547	0.760	0.760	0.733	0.907	0.867	0.733	0.787	0.933	0.880	0.853	0.800	0.800	0.800	0.800	0.880	0.800	0.827	0.880	0.880	0.867	0.880	0.880	0.627	0.907	0.907
5	Service Conditions	0.973	0.907	0.987	1.000	0.933	0.773	0.947	0.853	0.893	0.907	0.587	0.760	0.960	0.893	0.933	0.907	0.920	0.920	0.893	0.933	0.933	0.933	0.933	0.933	0.933	0.933	0.893	0.627	0.893	0.893
6	HSE performance	0.973	0.973	0.907	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.733	0.907	0.947	0.907	0.880	0.907	0.893	0.893	0.920	0.880	0.947	0.947	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920
7	Efficay in handling of critical risk issues	0.907	0.907	0.480	0.975	0.587	0.693	0.813	0.533	0.880	0.880	0.493	0.800	0.960	0.880	0.947	0.773	0.907	0.813	0.920	0.947	0.893	0.880	0.947	0.893	0.893	0.707	0.493	0.493	0.920	0.920

Annexure-II
Case-wise expert's ratings of 12 risk factors

Projects	Overall Av. SFI Rating	Risk Factors											
		Demand Revenue Risk	Financial Risk	Land Acquisition Risk	Debt Service Risk	O&M Risk	Resettlement & Rehabilitation Risk	Time overrun risk	Cost overrun risk	Legal Risk	Regulatory risk	Technological risk	Political risk
PJ1->T3 of DIAL	0.893	L	L	M	M	M	L	L	L	L	L	L	M
PJ2->CIA	0.817	L	H	H	L	M	M	H	M	M	L	M	M
PJ3->EWC-KOL-MET	0.741	M	H	H	M	M	H	H	H	M	L	H	H
PJ4->DMRC	0.978	L	L	L	L	L	M	L	L	L	L	H	M
PJ5->DNB	0.691	H	M	L	H	M	L	L	H	M	L	L	L
PJ6->VDH	0.720	H	M	M	H	H	M	L	L	L	L	L	L
PJ7->MPEx	0.905	L	M	L	L	L	L	L	M	L	L	L	L
PJ8->COIMBBP	0.688	H	M	M	H	H	M	H	H	H	L	L	H
PJ9->LWMP	0.859	L	M	L	L	M	L	L	L	L	M	L	L
PJ10->NWSS	0.880	L	L	L	L	M	L	L	M	L	L	L	L
PJ11->SWTPG	0.691	L	H	L	H	H	L	H	H	H	L	L	M
PJ12->SWTPH	0.830	L	L	L	M	M	M	L	L	L	M	L	H
PJ13->HYIA	0.962	L	L	L	L	L	L	L	L	L	L	L	M
PJ14->CONTVP	0.855	M	M	L	L	M	L	L	L	L	L	M	M
PJ15->NBP	0.924	L	M	M	L	L	L	L	H	L	L	L	L
PJ16->RAJAMUN	0.840	L	L	M	L	L	M	L	L	L	L	L	L
PJ17->KANDP-CONT	0.860	L	M	L	H	M	L	L	M	H	L	L	L
PJ18->MORM-GOA	0.850	L	L	M	L	L	M	L	L	L	L	M	L

PJ19->GANDHID-RLY	0.893	L	M	M	L	M	L	L	L	L	L	L	L
PJ20->AHM-VORD-EXP	0.926	L	L	L	M	L	M	L	L	L	L	L	L
PJ21->COH-KoChiRf	0.867	H	M	L	M	M	L	L	L	L	L	M	L
PJ22->PANGR-PALA	0.893	L	L	M	L	L	L	L	M	L	M	L	L
PJ23->VPIWSP	0.937	L	L	M	L	L	M	L	L	L	L	L	L
PJ24->VGCTPCL	0.912	L	L	L	L	M	L	L	L	L	M	L	L
PJ25->JNISSP	0.912	L	L	L	L	L	L	L	L	L	M	L	M
PJ26->HASRLY	0.827	L	L	L	L	M	L	L	L	L	M	H	L
PJ27->GUR-DEL-EXP	0.775	L	L	H	L	H	H	L	L	H	L	L	L
PJ28->AIR-L-DMRC	0.752	L	H	H	L	H	M	H	L	H	L	H	L
PJ29->AMRT-BU-T	0.905	M	M	L	L	M	L	L	L	L	L	L	L
PJ30->Mhow-Pithampura	0.916	L	L	L	L	L	L	L	L	L	L	M	L