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Risk perception analysis of BOT road project participants in India

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Despite massive investment opportunities and the establishment of a framework for private sector participation in highway infrastructure development programmes in India, private investment (including foreign direct investment) in this sector is not up to the expected level. A high degree of risk exposure, disagreement on many risk issues among major stakeholders, and the absence of adequate government guarantees have been identified as some of the major reasons for this lukewarm response. This paper discusses the outcome of a risk perception analysis carried out to evaluate the risk criticality, risk management capability, risk allocation/sharing preference, and factors influencing risk acceptance of major stakeholders. A survey was conducted among senior project participants such as government officials, promoters, lenders and consultants of Indian BOT road projects. Eight types of risks have been identified as very critical in the Indian road sector under BOT set up with traffic revenue risk being the most critical. Though there is fair agreement among survey respondents with respect to the risk management capabilities of stakeholders, their preferences of allocations are divergent. The significant factors influencing the risk acceptance of each stakeholder are identified through regression analysis. The study reveals that the factors and their relative influence on the risk acceptance of stakeholders are considerably different.

Keywords: Highway infrastructure, BOT projects, risk perception, risk criticality, risk allocation, risk acceptance, regression, traffic revenue risk, India

Introduction

Many Asian economies are growing rapidly, leading to a massive demand for investment in power, roads, telecommunications and other infrastructure. The scale and structure of huge infrastructure requirement, shortage of public sector financing, growing debt crisis and reduction of their external borrowing capacity have compelled many developing countries to shift their focus towards private sector participation (PSP) in infrastructure. Recognizing the inadequacies of the Indian road transport system as a serious constraint on economic and social development, governments at the central and state levels in India have drawn up massive road development plans. Investments needed over the next six years, for the development of the National and State Highways, are estimated to be US$33.4 billion (Investment Opportunities, 2001). Despite the massive investment opportunities in the Indian road sector and the establishment of a framework for private sector participation in highway development programmes, the government expectations of investments have not been realized. Expected foreign direct investment (FDI) has not flowed into this sector and also the response of domestic private investors to road development has been far from encouraging (*The Hindu Business Line*, 2000). In a recently published rating on India, based on a survey of 1800 investors from all over the world, risk has been identified as the most deterring factor for poor FDI flow to the Indian infrastructure sector (FDI Confidence Audit: India, 2001).

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By the year 2001, the performance data of the initial phases of BOT road projects already under operation had started coming in and many of them have serious revenue realization problems which have added to the apprehension of investors.

In India, most of the privately financed highway projects that have been awarded so far (total investment of about US$210 million) are small to medium in size. Investment in these projects ranges from US$3.2 million to US$26 million (Economic Survey, 2000). While promoters have been requiring government guarantees for many uncertainties, lenders are more worried about the non-recourse type project financing in a volatile political, legal and regulatory environment characterized by a high degree of demand and traffic revenue risks. Some of the main reasons identified for poor private investor response in Indian road projects are inordinate delays in project finalization, inadequate regulatory policy framework, lack of long-term finance products, limited availability of risk hedging products, inefficient dispute resolution mechanisms, high commercial risk, and poor risk, allocation and sharing possibilities among major stakeholders (*Indian Infrastructure*, 1999).

The last decade saw a rapid expansion of private investment in the road sector with many forms of PSP models like the build–operate–transfer (BOT), build–own–operate (BOO) and build–own–operate–transfer (BOOT) type of concessions. Though the BOT contract framework has been widely used for procurement of privately financed infrastructure projects like roads, the complexity of the arrangements has led to increased risk exposure for all the parties involved (Woodward, 1995). BOT projects, in general, have a complex risk profile due to several factors including the duration of the loan, susceptibility to political and economic risk, low market value of the security package and limitations on enforcing security.

Throughout the world, there is a shortage of private equity investment in transportation projects as compared to other infrastructure sectors, because of uncertainty in the revenue stream. Investors are nervous about the projects that cater directly to the general public – anything that involves interaction with the public (Raghuram *et al.*, 1999). Many of the privately financed transport projects undertaken during the boom period of the 1990s have started showing signs of failure around 1997, and the condition of many emerging economies worsened during 1998 and 1999. Many projects have failed due to over-optimistic traffic forecasts, excessive debt and inability to refinance bridge loans. As available finance dried up, many projects went bankrupt, had to be renegotiated, or were takeover by the Government (Estache and Strong, 2000). A recent research study carried out by the World Bank shows that the road sector in Asia is exposed to highest market risk (Alexander *et al.*, 2000).

'Risk management involves deciding what an acceptable risk is, how the level of the risk can be brought down to a level that is acceptable and monitoring the reduction in risk after exposure control actions have been taken' (Last, 2001). Closely related to the fields of risk assessment and management are the concepts of risk perception and risk communication. Risk perception refers to the way in which individuals intuitively see and judge the level of risk associated with a particular exposure or hazard. In general, risk perception is influenced by many factors like level of experience, the stake or profit expected from the project, geographical region and values and the level of risk communication transmitted through the news media or other sources of information related to a particular exposure or hazard.

Improper allocation/sharing of risks among stakeholders (if not based on their capability of management) may lead to sub-optimality and result in higher than necessary prices for risk transfer (ADB, 2000). The success of a project is very much dependent on the extent to which the risks involved can be measured, understood, reported, communicated and allocated to the appropriate parties (Tah and Carr, 1999; Walker and Smith, 1995). The basis of risk transfer/allocation in a BOT project should be risk criticality, stakeholder support, financial feasibility, monitoring framework and knowledge of the state of operating assets and their current performance. The criticality of risk is often perceived differently by the project participants based on their involvement, capability of management and level of investment and return from a project. When risk criticality and capability of risk management of project participants are perceived differently, the risk allocation becomes a difficult task.

The common perception, prevalent in many countries until recently, that privatization involves transfer of all risks to the private sector has been found to have major limitations. Most of the governments now recognize that privatization is a partnership in which the State must retain some risk, whether in the form of financial subsidies or the assumption of contractual responsibilities or contingent liabilities (Webster, 1996).

The rationality of risk sharing in BOT road projects is based on the principle that the party best capable of managing the risk should assume it. This principle is often not followed or accepted in many Indian BOT road projects because of the difference in risk perception among project participants. The attitude and motivation of key participants with respect to risk issues play a vital role in making the BOT concept of infrastructure procurement successful. In this context, the authors have carried out an all-India research survey to evaluate the risk perceptions of major BOT road project participants. The main objectives of this paper are (1) to evaluate risk criticality and risk management capabilities as perceived by various participants of BOT road projects, (2) to

analyse the risk allocation and sharing preferences of major participants of BOT road projects and (3) to identify the significant factors influencing risk acceptance and to establish the relationship between these factors and risk acceptance for government, promoters and lenders of BOT road projects.

This paper discusses the outcomes of the above-mentioned study. From the 22 types of risks short listed, eight risks were identified as 'very critical' in the Indian road sector under BOT set up with traffic revenue risk being the most critical one. There is a fair agreement among survey respondents (government, promoter, lender and consultant) with respect to their risk criticality rating and ranking. Though there is fair agreement among survey respondents with respect to the risk management capabilities of stakeholders, their preferences of allocations are divergent. The significant factors influencing the risk acceptance of each stakeholder have been identified through regression analysis. The important factors, which influence the risk acceptance level of government, project promoters and lenders of Indian BOT road projects were also identified and discussed.

Methodology

The methodology adopted for this research study is (1) literature review to identify major factors influencing risk acceptance of project participants of BOT road projects in India; (2) unstructured interviews and discussions with BOT road project participants to validate the factors short listed in the first step; and (3) all-India survey among four major stakeholders/participants of Indian BOT road projects viz., government representatives, promoters/developers, lenders and consultants. The consultants were included as respondents, because they play a vital role at both the pre-bidding stage and the implementation stage of a BOT road project.

Questionnaire survey for risk perception analysis

Due to the non-availability of organized information related to the occurrence of risks and their management in Indian BOT road projects, a mail questionnaire survey was used in this research. This approach is well-recognized and widely used in social science, general management and project management research (ASCE Construction Survey, 1979; Akintoye and Macleod, 1997; Bing *et al.*, 1999; Shen *et al.*, 2001). A combined questionnaire was designed for two specific purposes: (a) to identify the most critical risks in Indian BOT road projects, (b) to evaluate the risk allocation and management perceptions of BOT road project participants in India. In the questionnaire simple and straightforward questions were used to minimize ambiguity. The preliminary questionnaire was circulated among locally available experts in the field and their suggestions with respect to the contents, structure, format and sequencing of the questions were incorporated in the final questionnaire.

The survey questionnaire was mailed to senior level officials (government representatives, promoters/developers, lenders and consultants) who have experience in BOT road projects in India. Only 'top level officers who have powers/role for strategic decision making in their respective organisations with respect to BOT road projects' were included in the sample. The survey covered most of the known strategic decision makers in the Indian BOT road sector. Out of 124 questionnaires sent, 62 responses were received. The response rate of 50% is considered very good for this kind of a mail survey. Though the total number of respondents in each category is limited, the reliability of survey results is expected to be high because all the respondents are top-level experienced management officials in their organisations. The summary of the survey responses are given in Table 1. Based on the level of experience, respondents were classified and presented in four sub-groups: very high, high, medium and low. The number of responses with respect to the category and the level of experience are evenly distributed in the sample.

Risk identification in privately financed infrastructure projects – review

In this section the literature related to identification of risks and risk factors in privately financed infrastructure projects is briefly discussed. UNIDO (1996) have developed a risk checklist under two major categories (general/country risks and specific project risks) with three sub categories under each. Political risks, commercial risks and legal risks are classified in the first category, whereas developmental risks, construction/completion risks and operating risks under the second category. Akintoye *et al.* (1998) have done risk assessment/prioritization in private finance initiative (PFI) projects in UK. The 10 most important risk factors identified (based on survey among clients, contractors, and financial institution) are design risk, construction cost risk, performance risk, risk of delay, cost overrun, commissioning risk, volume risk, operating/maintenance risk, payment risks and tendering cost risks. The land acquisition, debt risk, bankers' risk, and political risks are found to be the least important. Salzmann and Mohammed (1999) have presented risk identification framework for international BOOT projects based on four super factor groupings: host country, investors, projects and project organization. They also reviewed the published risk and success

Table 1 Summary of the survey responses

Category	No. of respondents				
	Experience in BOT road projects				Total no. (%)
	Very high > 8 projects	High 5–8 Projects	Medium 2–4 Projects	Low < 2 Projects	
Government	4	3	2	6	15 (24 %)
Promoters	6	6	4	2	18 (29 %)
Lenders	4	5	4	3	16 (26 %)
Consultants	4	4	3	2	13 (21 %)
Total no. (%)	18 (29 %)	18 (29 %)	13 (21 %)	13 (21 %)	62 (100 %)

Table 2 Classification of risks in Indian BOT road projects

Project phase	Risk category
Developmental phase	Pre-investment risk, Resettlement and rehabilitation risk, Delay in land acquisition, Permit/ Approval risk, Delay in financial closure
Construction phase	Technology risk, Design and latent defect risk, Completion risk, and Cost overrun risk.
Operation phase	Traffic revenue risk, Operation risk, Demand risk, Debt servicing risk
Project life cycle	Legal risk, Political risk (direct & indirect), Partnering risk, Regulatory risk, Financial risk, Environmental risk, Physical risk, and Non-political force majeure risk

factors. Arndt and Maguire (1999a) have carried out research in risk identification and allocation of private sector toll road projects (BOOT projects) in Australia, operating under public sector road network. Wang *et al*. (2000) have studied in detail the risk criticality for various political risks in China's BOT projects. The critical risks identified are creditworthiness and reliability of Chinese parties, change in law, force majeure, delay in approval, expropriation, and corruption. The Asian Development Bank (2000) has reported a list of PSP risks in expressways. The various risk categories covered are design, construction, traffic and revenue, operational and maintenance and finance. But developmental risk issues such as project identification, bidding cost, land acquisition, arrangement of finance in time, etc. are not adequately covered. In India, literature pertaining to risk management in private infrastructure projects including road projects has mostly dealt with the professional experience of the concerned authors. Ramakrishnan (1995, 1996) has presented important risk factors affecting the privatization of roads in India. A few case studies related to risk issues associated with implementation of BOT road projects in India have also been reported (Sharma and Taunk, 1998; Ramesh, 1999; Raghuram *et al*., 1999).

Identification of critical risks in Indian BOT road projects

A list of 22 risks associated with BOT road projects in general and unique to Indian project environment was prepared based on desk based literature review, reported case study analysis and informal discussions with Indian BOT road project participants (Table 2). In the study, four project phases are used for classifying risks: (1) developmental phase, (2) construction phase, (3) operation phase, and (4) project life cycle phase. Risks occurring in more than one of the phases are included in the project lifecycle phase. The survey respondents were asked to rate the criticality of these identified risks based on their perception and experience with Indian BOT road projects. A five-point scale from 'Not Critical' to 'Most Critical' was used for measuring risk criticality. Criticality is assumed to be the combined effect of probability of occurrence and the impact of occurrence of the risk. Based on the criticality rating of each category of respondents, the mean, standard deviation, and criticality index was evaluated for each risk. The index developed by Wang *et al*. (2000) was used for measuring risk criticality.

$$\text{Criticality Index} = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)} \quad (1)$$

Where n_1, n_2, n_3, n_4 and n_5 are the number of respondents who answered 'most critical', 'very critical', 'critical', 'somewhat critical' and 'not critical' respectively.

Based on the above analysis, eight risks were identified as 'very critical' in Indian BOT road projects. In the decreasing order of criticality they are: traffic revenue risk, delay in land acquisition, demand risk, delay in financial closure, completion risk, cost overrun risk, debt servicing risk and direct political risk. ANOVA test shows that the there is high degree of agreement on criticality rating among government officials, promoters, lenders and consultants at 0.05 significance level. The high degree of agreement on risk criticality rating and ranking shows that the respondents have a common

understanding of the risks in Indian BOT roads and the reliability of their ratings are likely to be high.

Risk management capability and risk preference

The rationality of risk sharing in projects is based on the principle that the party best capable of managing the risk should assume it. Often this principle is not followed or accepted in many Indian BOT road projects. In the survey research, questions were asked to the respondents regarding their opinion about the party best capable of managing various risks in Indian BOT projects. The respondents were also asked to indicate their preference of risk allocation/sharing of these risks. The direct and indirect stakeholders considered in this research are government, promoter, contractor/operator, lender, insurer and road user. Although investigations were carried out for all the risks in BOT road projects, in this paper the discussion is restricted to 'very critical' risks. Survey responses on risk management capability and risk allocation/sharing for these risks are given in Table 3. The last column shows the preference of particular category of respondents on a possible risk sharing arrangement. A particular group is included for allocation only if more than 30% of the respondents in the corresponding category prefer to allocate/agree to share. Table 4 shows a consolidated (combined opinion of all the category of respondents) perception of respondents on the capability of risk management and allocation in Indian BOT road projects. In the case of traffic revenue risk, demand risk, completion risk and cost overrun risk, there is no full agreement on risk management capability rating. The perception of various category of respondents on risk management capability and risk allocation preference with respect to most critical risks are discussed below.

Traffic revenue risk

Though the majority of the government representatives perceive the promoter as best capable of handling this risk, promoters, lenders and consultants are equally divided in their rating favouring both promoter and government. About 15% of the respondents from government, consultants and lenders are of the opinion that road users are best capable of absorbing traffic revenue risk. Probably they feel that the distribution of traffic risk to a wider base is possible if road users share this risk. However, none of the promoters think so.

Allocation/sharing preference for traffic revenue risk is highly divergent among various categories of respondents. Government representatives prefer to allocate it between promoter and lender whereas, promoters want to share it among government, promoter and road users. Government representatives feel that promoters and lenders are the commercial stakeholders and they should share it. Probably promoters feel that traffic revenue risk is mainly dependent on government support actions and macroeconomic developments in the area for which traffic guarantee from government is essential. The lender's preference is for a wider risk sharing among all major participants with the highest preference for promoter and road user. Risk should be allocated to road users when it goes beyond government's capacity. Very few government officials favoured transferring the traffic revenue risk to road users.

Traffic revenue risk is the most critical risk in Indian BOT road projects and also most difficult to negotiate for allocation. About 50% of the total survey respondents indicated that negotiation and allocation of this risk is the most difficult. The reason for the unacceptability of this risk to stakeholders can be attributed to its high criticality in the Indian environment. None of the BOT road projects currently in operation have achieved the projected traffic. Major factors contributing to this risk are public resistance to pay toll, toll enforceability problems due to inadequate state support, modification in the toll structure/system by government (under public pressure), inadequacy in the toll tariff and its subsequent increase. The highly complex and unpredictable growth rate in the country is also making traffic projections difficult.

Delay in land acquisition

There is a high degree of agreement among all the major BOT road project participants regarding the risk allocation preference and the risk management capabilities of various stakeholders with respect delay in land acquisition. The majority of the participants rated government as the best capable party. About 25% of government representatives and lenders prefer that government should share the risk of land acquisition delay with promoters. Consultants and promoters prefer that government should take the entire responsibility. In most of the Indian BOT road projects, responsibility of land acquisition is with the government. However, compensation paid to the promoter in case of delay in land acquisition is very small compared to the possible project loss to the promoter arising from inordinate project delay due to non-availability of land in time.

Demand risk

This risk is related to the uncertainty in traffic realization of a toll road during its operation period due to reduction in the demand for the facility. About 60% of government representatives and lenders feel that the promoter is the best capable party to manage demand risk. About half of

Table 3 Risk management capability and risk allocation preferences

Risk	Respondents*	Best capable party* (Percentage within the category)						Risk allocation/sharing preference among stakeholders (Percentage within the category preferred to allocate/share)						Risk sharing preference#
		G	P	CO	L	I	RU	G	P	CO	L	I	RU	
Traffic revenue risk	G	20.0	66.7				13.3	20.0	93.3	20.0	33.3	13.3	20.0	P, L
	P	50.0	44.4			5.6		66.7	83.3	5.6	27.8	11.1	33.3	P, G, RU
	C	30.7	38.5	7.7		7.7	15.4	76.9	84.6	7.7	15.4	7.7	23.1	P, G
	L	43.8	31.2			6.2	18.8	43.8	81.3	18.8	43.8	6.3	50.0	P, RU, G, L
	Combined	37.1	45.1	1.7		4.9	11.2	51.6	85.5	12.9	30.6	9.7	32.3	P, G, RU, L
Delay in land acquisition	G	86.7	13.3					100.0	26.4	6.7		6.7	13.3	G
	P	94.4	5.6					100.0	11.1					G
	C	100.0						100.0	7.7					G
	L	93.8	6.2					100.0	25.0					G
	Combined	93.6	6.4					100.0	17.7	1.6		1.6	3.2	G
Demand risk	G	13.3	60.0			13.3	13.4	13.3	86.7	20.0	46.7	20.0	20.0	P, L
	P	55.6	33.3	5.6		5.5		61.1	83.3		22.2	5.6	33.3	P, G
	C	46.1	38.5	7.7			7.7	53.8	100.0		15.4	7.7	23.1	P, G
	L	25.0	62.5			6.3	6.2	43.8	93.8	18.8	43.8		31.3	P, G, L
	Combined	35.5	48.3	3.2		6.5	6.5	43.5	90.3	9.7	32.2	8.1	27.4	P, G, L
Delay in financial closure	G	13.3	66.7	6.7	13.3			20.0	93.3	26.7	13.3			P
	P	11.1	83.3		5.6			38.9	100.0	22.2	11.1			P, G
	C	7.7	69.2		23.1			23.1	100.0	15.4	7.7	7.7		P
	L	6.2	87.5		6.3			37.5	100.0	12.5	6.3			P, G
	Combined	9.6	77.4	1.7	11.3			30.6	98.4	19.4	9.7	1.6		P, G
Completion risk	G		26.7	73.3				6.7	66.7	80.0	40.0	13.3	6.7	CO, P, L
	P		16.7	77.8		5.5		16.7	77.8	94.4	11.1	11.1		CO, P
	C		30.8	69.2				23.1	69.2	86.4	23.1	7.7		CO, P
	L		12.5	87.5				6.3	81.3	87.5	25.0	6.3		CO, P
	Combined		21.0	77.4		1.6		12.9	74.2	87.1	24.2	9.7	1.6	CO, P
Cost overrun risk	G	13.3	53.3	26.7		6.7		6.7	86.7	73.3	40.0	20.0	13.3	P, CO, L
	P		33.3	61.1		5.6		11.1	77.8	83.3	16.7	16.7		CO, P
	C		38.5	61.5				15.4	84.6	76.9	15.4	15.4	7.7	P, CO
	L		50.0	50.0				12.5	81.3	75.0	18.8	6.3		P, CO
	Combined	3.2	43.6	50.0		3.2		11.3	82.3	77.4	22.6	14.5	4.8	P, CO
Debt servicing risk	G		80.0		20.0				93.3	6.7	53.3	6.7		P, L
	P	5.5	88.9		5.6			22.2	100.0		61.2	22.2	5.6	P, L
	C		61.5		30.8		7.7		92.3	30.8	76.9	7.7	7.7	P, L
	L		75.0		25.0			6.3	93.8	12.5	62.5	12.5	12.5	P, L
	Combined	1.6	77.4		19.3		1.7	8.1	95.2	11.3	62.5	12.9	6.5	P, L
Direct political risk	G	93.3	6.7					86.7	40.0	6.7	13.3	13.3	2.0	G, P
	P	94.4				5.6		94.4	44.0	5.6	5.6	16.7	16.7	G, P
	C	92.3	7.7					84.6	23.1		23.1	15.4		G
	L	93.8				6.20		87.5	37.5		12.5	12.5		G, P
	Combined	93.6	3.20			3.20		88.7	37.1	3.2	12.9	14.5	8.1	G, P

*G: Government P: Promoter C: Consultant L: Lender CO: Contractor/Operator I: Insurer RU: Road User.
#Considered for allocation only if the responses are more than 30% in the respective category.

Table 4 Combined risk perception on capability of risk management and allocation

Risks	Best capable party to manage the risk*	Allocation preference*#
Traffic revenue risk	P, G	P, G, RU, L
Delay in land acquisition	G	G
Demand risk	P, G	P, G, L
Delay in financial closure	P	P, G
Completion risk	CO	CO, P
Cost overrun risk	P, CO	P, CO
Debt servicing risk	P	P, L
Political risks	G	G, P

*P: Promoter G: Government CO: Contractor Operator L: Lender I: Insurer RU: Road user.
#Included only if the combined opinion is more than 30%.

the promoters and consultants rated government as well as the promoter as the most capable party. As far as the risk sharing/allocation preference is concerned, it is similar to traffic revenue risk with the government preferring to allocate the demand risk to the promoter and the lender, whereas all the other participants want the government to share demand risk along with the promoter. In privatization of road infrastructure, though the commercial risk should have been assigned to the private sector, government is often compelled to assume it (at the expense of tax payers), which it cannot control or can control no better than the private sector (Arndt and Maguire, 1999a).

The demand for road use is also influenced by various external factors such as socioeconomic development, tariff, connectivity, linked infrastructure and parallel facility. These factors are mainly controlled by government. The concessionaire's control over demand risk is only partial and can influence the demand for the road only by providing better services, marketing or introducing concessions. If the promoter is burdened with risks over which they do not have control or the capability to manage, realization of such risks will result in either the failure of the project or an increase in the project cost. Both situations will not help the government, the promoter or the road users. The combined opinion indicates that demand risk can partly be reallocated to insurer.

Delay in financial closure

This risk refers to failure in the timely arrangement of the necessary debt and equity finance. Disagreement over clauses in concession agreement, inadequate guarantees from government, delay in debt syndication and the failure of the promoter to raise the necessary equity in time often delays the project's financial close. Survey results show that the promoter is best capable of handling this risk. The government representatives feel that it is the promoter who has bid for the project and signed the agreement and it is their responsibility to manage finance in time. Consultants also prefer to allocate this risk to the promoter. In India, government does not assume any responsibility for delay in financial closure of BOT road projects (Model Concession Agreement, 2000). The promoters and the lenders feel that this risk has to be shared by government. The promoters of Indian BOT roads are often medium to small level contracting companies, who are not well capitalized. Availability of long-term finance for infrastructure projects is very limited in India. The Indian capital market is also underdeveloped and unreliable and promoters find it difficult to arrange alternate finance from this source. In non-recourse finance, financial closure of a project depends on its bankability, which in turn is also influenced by traffic revenue stream, government support/guarantees, land acquisition and permits/clearances in time. These issues are to a great extent governed by government's policy and co-operation. Though promoters are ready to take this risk, they want it to be partly shared by the government.

Completion risk

This is the risk that the road project may not be completed or may be delayed resulting in a reduction in the effective operation period. The EPC contractor is best capable of controlling this risk. All the stakeholders, except government representatives, prefer that the contractor and the promoter should share the completion risk. About 40% of the government representatives preferred that, along with the contractor and the promoter, lenders should also share this risk. For possible cost escalation due to completion delay, lenders can incorporate provisions of standby credits in the finance agreements.

Cost overrun risk

The survey results show that the best parties capable of managing cost overrun are the contractors and promoters. Unlike completion risk, the promoter is equally capable of handling this risk along with the contractor. Since the cost involved in these types of projects is high,

contractors alone will not be able to manage the cost overrun and promoters help may be needed to tide over thesituation. The risk management and allocation perception of participants on cost overrun risk is the same as that of completion risk with all the respondents agreeing that it should allocated to the contractor and the promoter.

Debt servicing risk

The risk of timely/scheduled repayment of debt (both interest and principal) is closely associated with many factors such as traffic realization, demand growth, promoter capability, financial structuring, debt servicing terms and escrow management over which the promoter and lenders have better control. The study shows that about 75% of the respondents rate the promoter as the best capable party to manage debt servicing risk. All the categories of survey participants agree that this risk should be allocated among promoters and lenders.

Direct political risk

Investments in infrastructure are large, long-term, irreversible and domestic market dependent. Any change in government policies related to these factors may adversely affect profitability (Bubnova, 1999). About 90% of the respondents confirm this fact and indicated the best capable party as government. There is a consensus among all the respondents that political risks are to be shared among the government and the promoter. Promoters do understand that political decisions under a democratic setup are unavoidable and they are ready to share part of this risk with the government. Very few respondents think that insuring against political risk is a good option in India probably due to the inadequacy of political risk insurance instruments and also the high cost involved in availing such instruments. The Model Concession Agreement (MCA) has provisions for compensating direct political risks. However, the promoters feel that the project cost calculation and the termination payment provision in MCA for compensating any adverse political decision/action or other government defaults are set arbitrarily and not adequate.

Risk acceptance of BOT project stakeholders

The success of any risk allocation process is largely influenced by the risk acceptance level of the major BOT road project participants. In this study, through the questionnaire survey and analysis, significant factors which are influencing the risk acceptance of three major stakeholders (government, promoters and lenders) of the Indian BOT road projects, have been identified. Multiple linear regression analysis was carried out for identifying the significant factors.

Factors influencing risk acceptance

Very few studies have explicitly identified variables affecting the risk acceptance of project participants. A survey research carried out by Touche (1989) has indicated that contractors' risk perception is influenced by many factors such as expected return, government's commitment, cost of tendering and long-term equity interest. Hall (1997) has discussed the concept of risk management capability in relation to risk attitude. Project Risk Analysis and Management Guide (PRAM) has highlighted the risk components of people, process, infrastructure, implementation and risk analysis as risk attitude issues (Simon *et al.*, 1997). Scott *et al.* (2001) have identified that maturity and knowledge of the project participant, project environment, and support significantly contribute to the risk attitude. Maturity is related to risk management capabilities of project participants while knowledge is associated with their experience. The support relates to favourable government policies, procedures and incentives available for risk allocation and mitigation. Aloysius (1999) has reported that the pooling of project risks among firms reduces the risk aversion of individual investors. He concluded that when different investors consider risky/uncertain project jointly, confidence of each investor for the collective gamble would be greater than the sum of the individual confidence equivalent. Most of the above literatures are related to conventional projects.

Tiong (1995) has studied the level of risk acceptance and guarantees offered in relation to competitive advantages in BOT concession. The study was conducted among BOT promoters and government representatives from various countries. Risk acceptance and allocation studies carried out for Australian BOO and BOOT projects show that commercial return, risk management capability and bargaining power influence risk acceptance (Arndt and Maguire, 1999b).

Factors influencing risk acceptance of different stakeholders in BOT projects are large in number. In the present study, the important factors/variables influencing risk acceptance of stakeholders in BOT road projects have been identified from the literature. Unstructured interviews and discussions with Indian BOT road project participants were carried out to validate/consolidate the factors identified in the first step. The 12 variables (influencing the risk acceptance of stake holders) shortlisted for this study are capability for risk management, bargaining power, experience, commercial return, need for work, level of competition, efficiency of legal system, efficiency of regulatory system, criticality of social

issues, criticality of environmental issues, social benefits and level of government support. These variables were assumed to be independent and measured through a five-point Likert scale. The extract from the questionnaire is shown in Appendix 1. Competition and commercial return were not considered in the analysis of government risk acceptance as they are not applicable in a BOT project.

Factor analysis (Hair *et al.*, 1998) was carried out with an objective of reducing the number of independent variables. The method can be effectively used in combining variables based on certain common underlying properties such as their source of occurrence or nature of effects. Four identical variables were considered for analysis. The details of the data reduction using principal component analysis and varimax rotation are shown in Table 5. Factor loading represents the correlation between original variables and factors. Varimax rotation is carried out to increase the magnitude of loading for certain variables, at the same time decreasing the cross factor loading. The Factor_1 has high loading for variable number 1 and 2 whereas Factor_2 has high loading for 3 and 4. So the variable 1 and 2 can be combined. Efficiency of legal system and efficiency of the regulatory system can be combined to become a single factor/variable. The name of the combined variable is 'efficiency of legal and regulatory system'. Similarly, criticality of environmental issues and criticality of social issues are also combined to have a new variable (viz. 'criticality of social and environmental issues'). Since the communalities of all the variables were found to be much greater than 0.3, the factor model is reliable. With this modification, the total numbers of independent variables were reduced from 12 to 10 for the regression analysis.

The summary statistics of variables are given in Table 6. Capability of risk management, bargaining power, need for work and social benefits are almost equal for the Government, the promoter and the lenders. The government representatives rated the efficiency of legal and regulatory system slightly higher in comparison to promoters and lenders. Lender's rating for criticality of environmental and social issues is much higher in comparison to the government representative's rating.

Table 5 Results of factor analysis for variable reduction

No.	Variables	Factor_1	Factor_2
1	Efficiency of legal system	0.88	
2	Efficiency of regulatory system	0.85	
3	Criticality of social issues		0.88
4	Criticality of environmental issues		0.84
Varimax rotation	Variance explained/Eigen value	1.54	1.52
	% of variance	38.40	38.04
	Cumulative % of variance	38.40	76.45

Factor_1 : Efficiency of legal and regulatory system.
Factor_2 : Criticality of social and environmental issues.
Note: Factor loading > 0.4 is only considered.

Table 6 Summary statistics of the regression variables

Sr. No	Variables	Government		Promoter		Lender	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1	Capability of risk management	3.33	0.72	3.61	0.97	3.62	1.25
2	Bargaining power	3.33	0.61	3.22	0.73	3.12	1.08
3	Experience	3.26	1.33	3.61	1.09	3.06	1.06
4	Commercial return	–	1.48	3.44	1.19	3.18	0.91
5	Need for work	3.60	1.24	3.61	0.69	3.56	0.81
6	Competition	–	0.72	3.00	0.90	2.75	1.12
7	Government support	3.33	1.29	2.16	0.92	2.56	0.89
8	Efficiency of legal and regulatory system	2.63	0.79	2.00	0.48	2.43	0.79
9	Criticality of social and environmental issues	3.33	1.09	3.50	0.82	3.96	0.59
10	Social benefits	3.86	0.83	3.50	0.92	3.81	0.83
11	Risk acceptance*	1.63	0.65	1.76	0.66	1.70	0.61

Note: Variables are measured on a five-point scale with 1 as 'very low' to 5 as 'very high'.
Values for competition and commercial return for government are not included.
*The risk acceptance is calculated from the sum of six items (Appendix-2). Each item is measured on a five-point scale with 1 as 'strongly disagree' to 5 as 'strongly agree'.

The government does not expect any commercial return from BOT road projects.

Measurement of risk acceptance

A scale consisting of six items was used for measuring the risk acceptance of various respondents. The items included in the scale are shown in Appendix 2. The contents of the items included in the risk acceptance measurement were validated through discussions with experts. The respondent's degree of the agreement with a set of attitude statements is measured using five-point Likert scale. Internal consistency/reliability of the scale (to the extent that the items included in the scale are correlated) is evaluated using Chronbach's Alpha. High value of Chronbach's Alpha indicates that all the items included in the scale are measuring the same thing and their correlation among each other and with the latent variable measured though the items are very strong (DeVellis, 2000). As the average inter-item correlation increases, Cronbach's alpha increases as well.

The results of the reliability analysis of the items included in the risk aversion measurement of Government, promoter and lender are given Table 7. The results show that the items included in the scale for risk acceptance measurement are reliable. The lower limit for Cronbach's alpha is 0.6 in exploratory research (Robinson *et al.*, 1991, Hair *et al.*, 1998). The average risk acceptance level of all the three stakeholders of Indian BOT road project is given in Table 6 along with other variables.

Table 7 Results of reliability analysis of risk acceptance measurement

Category	Cronbach's alpha
Government	0.65
Promoter	0.64
Lender	0.62
Combined	0.61

Regression results

Separate linear regression models for risk acceptance of government, promoter and lenders in Indian BOT projects were developed using backward stepwise regression method (Levin and Rubin, 1998; Kirkpatrick and Feeney, 2001). The results of the regression analysis are summarized in Table 8. Though in regression analysis, the dependent variables are measured on an interval (continuous) scale, in practice an ordinal scale is usually good enough under the assumption that it is linear and the interval between the discrete measurements on the scale are equal. In many social science and management research, ordinal scale has been used for regression analysis (Couillard, 1995). In such research, the use of regression results is not used as hard scientific proof or as a predictor equation, but as indications of trends that will help in formulating the strategy for investment decisions.

When the regression was carried out with all the 10 short-listed variables, the R^2 value was about 0.75 for all the models. However, the regressions were not significant at 5%. The least significant variables were eliminated through stepwise regressions for arriving at the final risk acceptance models leading to minimum number of variables and reasonably high R^2 values at 5% significance level. The variables that are eliminated through stepwise regression and the minor variables, other than the 10 variables included/considered in the analysis, mainly contribute to the unexplained portion of the regression models. A detailed discussion on all the minor variables that are likely to influence the risk acceptance is beyond the scope of this paper. However,

Table 8 Regression models for government, promoters and lenders

Variables	Regression coefficients		
	Government	Promoters	Lenders
Constant	3.03	1.31	3.14
Capability of risk management	0.36	0.16	–
Bargaining power	–0.63	0.34	–
Experience	–	–	–
Commercial return	–	–	0.39
Need for work	–	0.55	–0.38
Competition	–	–	0.27
Government support	–0.31	0.37	–
Efficiency of legal and regulatory system	–	–1.07	0.24
Criticality of social and environmental issues	–0.17	–0.54	–0.67
Social benefits	0.28	–	–
R^2 value	0.69	0.71	0.66
ANOVA significance	0.03	0.01	0.03

explanations for significant variables influencing the risk acceptance are given in respective regression results.

Government's risk acceptance

The government's risk acceptance regression model explains 69% of the total variation in risk acceptance with five short-listed independent variables. The regression shows that the major variables affecting the risk acceptance of government (in the decreasing order of significance) are bargaining power, capability of risk management, government support, social benefits and criticality of social and environmental issues. Here, the multiple regression as a whole is significant at the 5% significance level. At the individual level, except government support, all the other variables are not significant at the above significance level. They are collectively significant but individually not.

Increase in government support leads to significant reduction in the risk acceptance level of the government in a BOT road project. Most of the government support in a BOT system involves direct/indirect cash outflow from public funds. The analysis shows that any additional risk responsibility beyond the normal government support (within the accepted government policy) is not acceptable to the government. The risk acceptance level of government is also reduced with an increase in their bargaining power. The government uses its bargaining power to pass on as many risks as possible to other parties. It is also concerned to keep tolls affordable to road users. The government may take more risks in a BOT road project if the social benefits from the project are high.

Promoters' risk acceptance

The coefficient of multiple determination ('R^2 value') of the regression model related to the promoter (Table 8), shows that about 71% of the risk acceptance level of promoters in an Indian BOT road project can be explained with the following six variables: need for work, efficiency of legal and regulatory system, criticality of social and environmental issues, government support, capability for risk management and bargaining power. The overall regression is significant at the 5% level. Except the capability for risk management and bargaining power, all the other short-listed variables are significant at the individual level.

The important factors influencing the promoter's risk acceptance level are efficiency of legal and regulatory system, criticality of social and environmental issues, need for work and government support. The summary statistics of the variables considered in the regression (Table 6) show how the average ratings for the efficiency of the legal and regulatory system in India. In the Indian BOT road projects set-up, land acquisition has been a major hurdle. Project developmental issues such as rehabilitation/resettlement/environmental problems can delay the project for a long period. When a BOT road project is susceptible to such issues, the promoter's general risk acceptance level is reduced and he will try to push the risks to the government or other parties. Unlike the government, promoters risk acceptance goes up with their bargaining power. Probably the promoter uses bargaining power to obtain more government support in other forms. With more government support for a BOT project, the promoter's confidence increases and his risk acceptance level also goes up in the general framework.

Though the primary objective of any business promoter is profit, the regression results show that Indian promoters have not rated commercial return from a BOT road project as a major factor for risk acceptance. Considering the complexity of BOT road projects set-up and as most of the BOT road projects in India are at the initial stages of implementation, it appears that they are more concerned with the successful completion of a project, rather than the commercial return. Need for work is a significant factor that increases the risk acceptance of the promoters. However, promoters accept only those risks that can be managed within the margin of their contingency provisions. Competition (among promoters) does not appear to be an influencing factor for promoters' risk acceptance in Indian BOT road project.

Efficiency of the legal and regulatory environment's influence on promoters is only marginal in comparison to the lender. The promoter accepts the complexity of the Indian legal and regulatory environment and tries to factor these issues into the rate of return. Though one-to-one correlation between risk acceptance and efficiency of legal and regulatory system is marginally positive, the relation is negative in the combined regression with a high coefficient value. This is due to multicollinearity between two independent variables, i.e. legal and regulatory efficiency with criticality of social and environmental issues.

Lenders' risk acceptance

Regression as a whole is significant at the 5% significance level and the selected variables explain about 66% of the risk acceptance variation. Unlike government and promoters, the risk management capability and bargaining power does not influence the risk acceptance of the lender in Indian BOT road projects. The regression results show that commercial return, competition and criticality of social and environmental issues are the significant factors. Financing BOT projects represents profitable lending opportunity for financial institutions

and banks since the margins they earn are normally well above those of comparable corporate loans.

An attractive commercial return from the project lending significantly increases the risk acceptance of lenders. In a BOT road project arrangement, profit arising out of the increased traffic demand is not shared with lenders. On the contrary, in case of low traffic revenue realization, lenders are exposed to debt servicing risk. Commercial returns from the pre-determined interest rate (many BOT road project financing in India have fixed interest rates) significantly contribute to lenders' risk acceptance. In comparison to promoters and government, lenders will look into the financial viability of the project more meticulously before lending. Many banks and institutions are keen to add BOT road projects into their portfolios, if the legal and regulatory system improves and the problems associated with developmental efforts (rehabilitation, land acquisition, environment, etc.) are minimum. Adequate legal and regulatory framework is a precondition for both lenders and promoters in BOT road project participation. However, the influence of legal and regulatory environment on risk acceptance is more in case of lenders. The majority of Indian lenders are institutional lenders and work under the framework of the Reserve Bank of India regulations and audit. The lenders cannot factor the inefficiency of legal and regulatory system into their rate of return because of the above restrictions. They often look for ways or provisions of safe lending within the existing legal framework.

The regression results show that competition (among lenders) significantly influences the risk acceptance of the lenders. With an increase in competition among financial institutions for lending to projects, their risk acceptance increases. Need for work is an indication of fewer projects requiring financing. When few projects are available, the lenders are more sceptical about the project viability. With more projects and higher competition, lenders feel comfortable by diversifying their risk through debt syndication and also among different projects.

Comparison of risk acceptance models

All three stakeholders are influenced by the criticality of social and environmental issues associated with Indian BOT project. The promoters and lenders have rated this issue as one of the most significant factors influencing their risk acceptance. Both bargaining power and government support reduces the risk acceptance of the government, while it increases the promoter's risk acceptance. The influence of bargaining power on government's risk acceptance is considerably higher compared to other factors. However the promoter is highly influenced by the efficiency of legal and regulatory systems, social and environmental issues, need for work, etc. Commercial return is a significant factor for lenders but the government and the promoter do not see it as a reason to influence their risk acceptance. Only government is influenced by social benefits. Need for work significantly influences the promoter and the lender, but in different ways. Lenders' risk acceptance is influenced significantly if competition is high. But it is not so for the promoters.

Conclusions

An all-India research survey was carried out to evaluate the perception of major BOT road project participants with respect to risk criticality, risk management capability of various project participants and their preference of risk sharing/allocation in Indian projects. Eight risks have been identified as very critical in the Indian road sector under BOT set up with traffic revenue risk being the most critical.

There is a fair agreement among survey respondents (government, promoter, lender, and consultant) with respect to the risk management capability of stakeholders of BOT road projects in India.

The government representatives feel that the promoter is best capable of handling traffic revenue and demand risks but other stakeholders think that the government is equally capable or even better than promoters of managing these risks. The views of the survey participants with respect to preference of allocation are divergent for traffic revenue risk and demand risk. Government wants the promoter and the lender to bear the traffic revenue risk. Promoters and lenders wish to share this risk among government, the promoter and the road user. Few government representatives preferred to allocate traffic revenue and demand risk to road users. Promoters and lenders want government to share demand risks, direct political risks and delay in financial close. Government is willing to share only land acquisition and direct political risk. However there is general agreement on their preference of risk allocation for delay in land acquisition, construction risk, debt service risks and political risks.

The rationality of risk sharing in BOT road projects is based on the principle that the party best capable of managing the risk should assume it. Often this principle is not followed or accepted in many of the Indian BOT road projects because of the difference in risk perception among project participants with respect to risk management capabilities. Traditionally, Indian construction contracts have been one-sided in favour of government. A complete shift towards equitable and rational risk allocation in construction contracts are yet to be evolved and accepted by the government. Though the commercial risk should have been assigned to private sector in private infrastructure projects, the management capabilities of Indian promoters and lenders with respect to these risks

in the prevailing legal, regulatory and political set up are very limited. Substantial government support and partic-ipation is necessary to minimize the impact of these risks.

The significant factors influencing the risk acceptance of each stakeholder have been identified through regression analysis. The study reveals that the factors and their relative influence on the risk acceptance of stakeholders are considerably different. For the government, the most significant factor is the degree of support it extended to BOT projects. Bargaining power, criticality of social and environmental issues and risk management capability also influence the risk acceptance level of government.

The important factors influencing promoters risk acceptance are the efficiency of legal and regulatory system, criticality of social and environmental issues, need for work, government support, bargaining power and risks management capability. The influence of bargaining power and government support on risk acceptance of the promoter and the government is opposite. Lenders in Indian BOT road projects feel that competition from other lenders and commercial return from projects can significantly influence their risk acceptance in a positive way. Unlike promoters, increased need for work reduces the lender's risk acceptance. Criticality of social and environmental issues is the only factor that influences all the stakeholders in same way. The factors and their relative importance (influencing the risk acceptance) identified in this study are based on the current trend in the Indian BOT road project environment. Any improvement/change in the system may change their relative influence.

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Appendix 1: Questionnaire on variables influencing risk acceptance

Please rate the magnitude of following factors on a five-point scale. Though some factors are project specific in nature, you may respond for the average BOT environment prevailing in India (Based on your experience)

No.	Factors influencing risk preference/acceptance	Very Low	Low	Medium	High	Very high	Not Applicable
A	Your ability to analyse and manage the risks in BOT road projects is						
B	Your bargaining power in contract negotiation of a BOT road project is						
C	Your experience in Indian BOT road projects is						
D	Your likely commercial stake/return in BOT road projects is						
E	Your need for work/business/projects in BOT road sector is						
F	Level of competition you face form your competitors in BOT road projects (market compulsions) is						
G	Efficiency of legal system in India is						
H	Efficiency of regulatory system applicable to BOT road projects in India is						
I	Criticality of environmental issues associated with BOT road project development in India is						
J	Social benefits you attain through a BOT road project is						
K	Criticality of social issues such as resettlement & rehabilitation problems in BOT road projects are						
L	Level of Government support (loan/ guarantee/ subsidy/Equity participation etc.) in Indian BOT road projects is						

Appendix 2: Questionnaire for risk acceptance

The questions in this section (six-item scale) are for evaluating the risk acceptance/preference of major participants in Indian BOT road projects. Based on your degree of agreement with the statement, please tick the appropriate box

No.	Description/items	Opinion					
		Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not applicable
a)	We use our bargaining power (during BOT road project contract negotiation) to pass as many as risks to other participants						
b)	We have pre-determined/fixed risk preference and not ready to accept additional risks even if it is warranted for project viability/bankability						
c)	We do insist on guarantee(s) from other BOT project participants for most the assigned contractual responsibilities						
d)	We accept critical risks in BOT road projects only under market/social/business compulsions						
e)	We have pre-determined/fixed risk preference and not ready to accept additional risks even if it is warranted for project viability/bankability						
f)	Generally we accept critical risks in a BOT road project only when we are able to transfer/ reallocate them to another party						