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EVALUATION OF RISK FACTORS LEADING TO COST OVERRUN IN BOT CONSTRUCTION PROJECTS

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Abstract – *Since infrastructural investments are vital in developing countries, it'll not solely facilitate to foster the economic growth of a nation, however it'll additionally act as a platform within which new kinds of partnership and collaboration may be developed. The developments of BOT have attracted participation of native and foreign non-public sector capitalist to secure funding and to deliver projects on time, within the budget and to the desired specifications. There are many complexities in projects because of the variety of factors in project's trend and also the dependence of project primarily on national factors. Because of these complexities and their long-term operation, the projects meet with uncertainty and numerous risks. Effective risk management methods and good managerial skills are required in guaranteeing the success of the project. In recent years, due to substantial increase in the amount of construction companies along with the changes in the government administrations, the construction projects in India are exposed to cost and time overrun and has huge impact on the progress of works within the industry. In this paper, risk identification, allocation and analysis is conducted for cost overruns in BOT projects with the help of case studies in India.*

Key Words: ***BOT, risk analysis, cost overruns, delays***

1. INTRODUCTION

Infrastructure investments are important in developing countries as it improves the economic growth of the country. The Public–Private Partnerships (PPP), which is essentially an agreement or contract, may be a way for developing the country's infrastructure. There are different types of PPP contracts, one among that are Build Operate Transfer or B-O-T. The BOT scheme is actually a sort of leasing, where the government (project sponsor) allows a private entrepreneur (project promoter) to design, finance, and build an infrastructure facility. In return, the project promoter is permitted to collect tolls (user fee) and operate the facility for a specified period (called the concession period), during which he is expected to recover all of his expenses and earn a reasonable profit. At the end of the concession period, the ownership of the facility is transferred to the government. This arrangement facilitates the implementation of capital intensive infrastructure projects by the government with funds from outside the budget allocation, while transferring the risks involved to the private sector. Risk in BOT project is solitary and different but somehow always related to the phases in a project namely: initiation, implementation and operational phase. In order to accomplish the objectives, the risks need to be managed wisely.

The construction industry being one of the most complex, fragmented, schedule and resource driven industry, is always facing serious problems like low productivity, low quality, delay, cost overrun etc. Cost overrun in construction is a worldwide phenomenon, and its effects are normally a source of friction between owners, project managers, and contractors. As the construction industry continues to grow in size, so do planning and budgeting problems. This is because it is common for projects not to be completed on time and within the initial project budget. It is noted that there were more cases of cost overruns than time overruns. This makes the problem of cost overruns to be of great significance. In fact, it is one of the most important challenges facing the construction industry today. An out of control construction cost adds to investment pressure, increases construction cost, affects investment decision-making and wastes the national finance. Hence, it is important to identify the factors that contribute to cost overrun to avoid and reduce the problems.

1.1 Need for the study

The future of BOT projects is uncertain. The concessionaire may like to know the financial viability of a project when some variables like construction cost, operating & maintenance cost or revenues deviate from the expected values. It is therefore essential to identify and analyze the actual factors causing cost overrun and steps should be taken to avoid unnecessary additional costs associated in any construction project.

2. LITERATURE REVIEW

2.1 Risk Factors in BOT Projects

Build - Operate - Transfer (BOT) is a relatively new approach to infrastructure development, which enables direct private sector investment in large-scale projects such as roads, irrigation, telecommunication, bridges and power plants. The

risks involved in BOT projects are two-fold. First, there are risks involved with the start-up procedure, (financial and technical studies), and also construction and operational risks due to the nature of BOT approach; and secondly, being large-scale projects, there are also regulatory, political and economical risks involved. There are high risk levels associated with BOT projects for the negotiators and decision makers in both the private and public sectors who will need to carry out a careful analysis and then manage these risks.

2.1.1 Types of risks

Risks have been categorized into three major captions; financing, political and technical risks. The successes of a project are measured by the overall project cost, duration and quality of the final product or services delivered. Usually the risks are corresponding with these three parameters.

(1) *Financial Risk*: This is mainly due to the impact on the financial performance of any entity exposed to risk. Also most of the critical risk in BOT project is financial risk. It occurs due to change in availability of funds and change in cost of project. It is classified into following type:

a. Currency Risk
b. Interest Rate Risk
c. Equity Risk
d. Foreign Exchange Risk
e. Commercial Risk
f. Liquidity Risk
g. Counterparty Risk
h. Economic Risk

(2) Political Risk: In political risk category, the most critical risks due to Public opposition and Local conditions, politics and uncertainty about other actors. It is divided into two types:

a. Sovereign Risk
b. Country risk

(3) Technical Risk: Technical risks always present in engineering project, at the end which is transformed in financial risk. Among the technical and management category, open and honest communications among stakeholders and cost overrun were found to be the most critical risks. It's divided into two types:

a. Construction Risk
b. Operational and Maintenance Risk

2.2 Cost Overrun in Construction

Along with time and quality, cost is considered to be the most significant aspect of the construction management life cycle and as one of the main drivers of the project success. But apart from its proven significance, most of the construction projects (both in developing and developed countries) faced cost overrun when executed, which makes it a chronic problem in global manner. The main controllable causes of the project's cost overruns are:

a. Inadequate project formulation
b. Poor planning for implementation
c. Lack of proper contract planning and management
d. Lack of project management during execution

3. METHODOLOGY

Two types of data collection methods were followed. Data was collected from primary sources and secondary sources. The sources of collection of primary data are as follows: Studying various literature, journals, books and documents etc. The sources for secondary data collection are: Questionnaires surveys, Observations made from the questionnaires.

3.1 RESEARCH PROCESS

The research process begins with a detailed study of the theories and researches done by many experts and researchers in the Risk Analysis of BOT Projects. The inference made from the study of the theories concluded that there are eighteen risk factors which constrain the projects from timely completion. These constraints have been classified under four main domains, each domain signifying a phase in the project life cycle. These constraints can be summed up as:

a. Risks involved in the Prequalification Phase
b. Risks involved in the Tendering Phase
c. Risks involved in the Construction Phase
d. Risks involved in the Concession Phase

3.2 DATA ANALYSIS

This research uses RII analysis method to infer about the impact created by different risks involved in the project. RII method was used to test the reliability of the scale. RII is used to rank the constraints. . The following formula is used to carry out RII analysis:

$$\text{IMPI} = \frac{FI \times SI}{100}$$

where, RII→ Relative Importance Index, FI→ Frequency Index, SI→ Sensitivity Index.

Frequency Index- used to rank causes based on the number of times a risk find its place in the table as defined by the participants i.e. the frequency of occurrence.

$$\text{FI} = \sum a\frac{n}{N} \times \frac{100}{m}$$

where, FI→ frequency index, a→ constant weighting given to each response(1 to 5), n→ frequency of response, N→ total number of responses, m→ maximum value of scale and here it is 5.

Severity Index- used to rank the causes of delay bases on the severity of the risks as given by the participants.

$$\text{SI} = \sum a\frac{n}{N} \times \frac{100}{m}$$

where, SI→ severity index, a→ constant weighting given to each response(1 to 5), n→ frequency of response, N→ total number of responses, m→ maximum value of scale and here it is 5.

4. CASE STUDIES

4.1 CONSTRUCTION OF AN OFFSHORE CONTAINER TERMINAL AT MUMBAI PORT TRUST

4.1.1 Project Background

It's the first container privatization project at the Mumbai port. The project involves construction financing, equipping, operations and management of the offshore container terminal in the Mumbai Harbor on a Build Operate Transfer basis. The project is awarded to Indira Container Terminal Pvt. Ltd (ICT), which is a joint venture between Gammon Infrastructure Projects Ltd, Gammon India Ltd and Dragados SPL of Spain for a 30-year concession period. The project was approved in November 2007 with planned completion date of December 2010.
Due to delay and cost overrun along with other factors results to halt the project mid way and in 2018 the project was planned for re bidding because of financial crisis and Gammon Infrastructure Projects, the developer for Indira Container Terminal Private Ltd at the Mumbai Port Trust, has planned to make a one-time settlement.

4.1.2 Causes of cost overrun

a. Delay in financial closure
b. More dredging work than estimated
c. Slow mobilization by EPC contractor
d. Delay in project site handover
e. Delay in awarding dredging work contract
f. Delay in completing work by dredging contractor
g. Lack of integrated project master schedule
h. Delay in obtaining security clearance

4.2 Delhi Gurgaon Expressway

4.2.1 Project Background

The National Highways Authority of India (NHAI), under the Ministry of Road Transport & Highways (MoRT&H), was entrusted the responsibility for implementation of the Golden Quadrilateral project (Highway Project connecting the four metro cities of New Delhi, Mumbai, Chennai and Kolkata). As a part of this project, it proposed the conversion of a very busy section of NH-8 connecting Delhi to Gurgaon into a 6/8 lane access controlled divided carriageway. The project was awarded to the consortium of Jaypee Industries and DS Construction Ltd under BOT model for a concession period of 20 years. It is a 27.2 km long expressway and its work began in 2003. This project has enabled to cover the former 65 minute route in only 25 minutes. It was built in three phases: Phase 1- VIP route; Phase 2- daily commuter's traffic and Phase 3- tourist paradise.
The Project was completed and the concessionaire commenced the commercial operations of the Project, on 25th January 2008. The Expressway has 11 flyovers and overpasses. This expressway is the busiest inter-city route in India and handles more than 180,000 Passenger Car Units (PCUs) daily, starting at DhaulaKuan in Delhi and terminates on the outskirts of Gurgaon. This was the first BOT project in India to have been awarded on negative grant basis where in the concessionaire offered to pay an upfront fee to NHAI in return of the concession as against a capital grant from the Government.

4.2.2 Causes of cost overrun

a. Land Acquisition
b. Clearance from authorities
c. Addition to scope of work

4.3 Tuni Anakapalli Annuity Road Project

4.3.1 Project Background

The Tuni Anakapalli project is a road expansion project undertaken by the National Highways Authority of India (NHAI) as one of the several projects under the Golden Quadrilateral programme. The project's scope was to strengthen the existing two lanes and widen it to a four lane dual carriageway of an aggregate 59 kilometer stretch between Tuni and Anakapalli on National Highway NH5 (Chennai to Kolkata) in Andhra Pradesh on PPP basis. Keeping in mind the lack of attractiveness in tolling the road, NHAI decided to take up the project on the Build Own Transfer (BOT) Annuity model. The GMR Group, in consortium with United Engineers Malaysia (UEM) Berhad Group, was awarded the project contract.
It is a 59 kilometre long road which stretches on National Highway 5 from Chennai to Kolkata. The project commenced operations in December 2004. It has been progressing well without any issues.

4.3.2 Causes of cost overrun

a. Financial problem
b. Construction Time Overrun Risk
c. Construction Risk

5. ANALYSIS AND RESULT

From the case studies, literature reviews and questionnaire surveys the factors results in the increase of risk in BOT projects are identified and allocated. Among the identified factors, each of them contributes to various impacts on the project. It is pointed out that time and cost overruns are the major risk factor which affects the success of the projects. Most of the cases these factors arise during the construction phase. This is the face where the actual works begin and this

phase mainly faces problem of financial crisis. The debts may increase and the fund may run out. Hence analysis is carried out only for factors contributing to cost overruns ie, in construction phase.

Table -1: RII Analysis

No	Factors	FI	SI	RII
1	Construction Phase			
1.1	Land acquisition problems	0.909	0.909	0.8264
1.2	Change of scope of work	0.6727	0.7818	0.5259
1.3	Arbitration and litigation	0.6545	0.7454	0.4879
1.4	Complicated procedure clearances from the authority in concern.	0.6181	0.7454	0.4608
1.5	Financial crises and delays	0.5636	0.8363	0.4714
1.6	Inappropriate risk allocation	0.6363	0.7636	0.4859

Table -2: Rating Of Risks from RII Analysis

RII VALUE	IMPACT
0-0.20	Not Critical
0.21-0.40	Fairly Critical
0.41-0.60	Average Critical
0.61-0.80	Very Critical
0.81-1.00	Extremely Critical

Table -3: Ranking According To RII Analysis

Sl. No	Factors	Rank
1	Construction Phase	
1.1	Land acquisition problems	1
1.2	Change of scope of work	2
1.3	Arbitration and litigation	3
1.4	Complicated procedure clearances from the authority in concern.	6
1.5	Financial crises and delays	5
1.6	Inappropriate risk allocation	4

After searching the points responsible for failure of BOT based projects in India, and through applications of tool (RII), it is quite clear that Land Acquisition plays a vital role in failure of BOT based projects. In such projects, government approval is required at each stage creates a barrier in development period, again many of BOT contracts are based on one sided, in which only Government is in winning situation, so investors are not willing to invest in such projects. The host government in the BOT projects is although an owner, there are many facts in which government also plays an important role to create a win-win situation. Through creating win-win situation, it will help the government to attract the investor to invest in such projects. Although Land Acquisition Bill and other land bill are there in existence, they are not adopted in effective way as they should have been adopted. Deviation from the predetermined scope is mainly due improper or incorrect data regarding the project. Huge loss to contractors revenue is mainly because of wrongly conducted survey or details regarding project, therefore it is unable to generate the desired profitable revenue in the concession period and in major cases in India, contractor end-up in huge loss. Many highway projects failed due to the inappropriate traffic survey.

Other critical factors that were analyzed through RII analysis are proper clearances through government and their approvals, which are required at each stage of the project takes a lot of time and due to it, the construction period get delayed, government should work on it and make this procedure easy and time effective. Because of one sided contract, there is always inappropriate risk allocation, due to which financial crises are suffered by the contractor, so government should work on the framework of contract.

To avoid the risks that a BOT project bears it is important to use some mitigation strategies to minimize the effect of the risks. The research study concludes some important mitigation strategies which are effective in solving and handling almost any risk. Mitigation strategies are necessary to avoid cost overruns and prevent time delays.

Table -4: Mitigation Strategies to Major Risks Factors

Sl. No	Factors	Recommendations
1	Construction Phase	
1.1	Land acquisition problems	Regulatory Framework and Guidelines
1.2	Complicated procedure clearances from the authority in concern.	Regulatory Framework and Guidelines and Support from Government
1.3	Arbitration and litigation	Swift Courts for Dispute Resolution
1.4	Change of scope of work	Standard Phase Evaluation
1.5	Financial crises and delays	Stable currency-Local currency and proper risk management teams
1.6	Inappropriate risk allocation	Risk Management Team

5.1. COST OVERRUN IN THE PROJECTS

For the project; Construction of an Offshore Container Terminal at Mumbai Port Trust, the estimated cost by both MbPT and ICT are 445 crores and 1016 crores respectively. Whereas in the revised estimate, final cost was increased by 610 crores and 1429 crores. A cost overrun of 37% and 41% occurred. If the project was completed then on financial front the project cost was expected to increase by 40 percent from INR 1461 crore to INR 2040 crore.

For Delhi Gurgaon Expressway, at the time of bidding, Jaiprakash Industries had a controlling stake of 51% and DS Constructions held 49%, during the course of project implementation, Jaiprakash Industries reduced its stake in the SPV to about 1.2%. The funding for the project at the time of financial closure was a total of 547.5 crore with debt amount 383.3 crore and equity amount of 164.2 crore. The actual cost of the project was eventually 1,175 crore. The project cost overrun was funded by the promoters, by withholding payments to DSC Limited and from the amount received from NHAI (155.25 crore) on account of changes in scope. Also including a grant of 61 crore.

And for the project; Tuni Anakapalli Annuity Road Project, the estimated project cost of the project was 315 crore. The project achieved financial closure on 26 June 2002. The project was funded on a debt-equity ratio of 3:1. The term loan component was 154 crores, the non convertible debentures component was 82 crore and the equity component was 78.69 crores.

6. CONCLUSIONS

Every BOT project is subjected to multiple risks. Thus it has become the responsibility and liability of the promoter to mitigate the risks to ensure the success of a BOT project by recruiting a strong management team. The greatest opportunity for a successful outcome for a BOT project is obtained when the extensive efforts and costs involved in the risk study process are shared by all parties. The responsibility of the decision maker is to identify, understand and analyze the many risk factors both, qualitative, (linguistic in nature) and quantitative, that will affect funding, procurement, developing, construction and operation, before proceeding with the build stage of the project. The promoter requires support and cooperation from the host government and investor to assist them in accomplishing the project. The host government should play more active role by providing guarantees for a BOT project that will benefit the public. It always recommended to the lender and investor to conduct feasibility studies before they finance a BOT project, similarly to the promoter before they embark on the project. The BOT projects are highly vulnerable to cost overruns and long delays. To avoid this risk the private sector enters with the contractor in a fixed turnkey contract that addresses this risk and then the risk goes to the contractor who should be in a position to control this. It can be concluded that a comprehensive risk management for any BOT project should be conducted and the mitigation plan must be followed strictly in ensuring the success of the project.

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