

Risk Assessment in BOT Project Financing

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Abstract – BOT (Built Operate Transfer) scheme is one of the prevailing ways for infrastructure development in India to meet the need of Indian future economic growth and development. BOT has been one of the recent innovations in project finance. The Build-Operate-Transfer scheme is limited resource financing technique. The main purpose of this study is to investigate financial risks associated with BOT Project. Major critical risks that are debt repayment risk, inflation risk and revenue risk. This paper presents a sensitivity analysis for a BOT project with a real case study. Traffic and cost are varied by 5% and O&M cost varied by 10%. Determine DSCR with different scenario.

Keywords – BOT Project, Risk, Sensitivity Analysis, DSCR-Debt Service Coverage Ratio, O&M Cost – Operating and Maintenance Cost, Revenue.

I. INTRODUCTION

There has been a growing trend in recent years for governments in many countries to place major public investments, particularly for infrastructure projects, into the private sector. Many have adopted the Build-Operate and Transfer or BOT approach so that the private sector has to finance, construct and operate the project facility and the transfer the ownership to the government after specified concession period. Therefore the BOT scheme is limited-resource project financing technique for implementing infrastructure projects by using private funding. The development of BOT has attracted participation of local and foreign private sector investor to secure funding and to deliver project on time, within budget and to the required specification. The financial success of a BOT project relies on the ability of project to service the debt and generate the expected equity rate of return.

BOT projects in India involve many risks and problem that are due to differences in legal systems, market conditions and culture. It is crucial for investors to identify and manage the critical risks associated with investment in India's BOT projects. Main purpose of this project is to investigate the financial risks associated with BOT projects by using risk measurement methods.

The study involves combination of methods for an integrated qualitative and quantitative research method. The first stage contains comprehensive literature review with lessons learn from the practice of BOT projects in developing countries, especially in India. The second stage

contains the introduction, nature, structure of BOT project and different parties involved in BOT project. The third stage contains BOT project financing and list of different financial risks associated with BOT project. The fourth stage contained techniques of risk measurements. Then, in the case study part, the details of the project have been noted and financial risk analysis by sensitivity and scenario analysis. Last part of this study is conclusion and references.

II. OBJECTIVE OF STUDY

Objectives of this study is

1. To study BOT project.
2. To study different types of risk in BOT project
3. To carrying out financial risk analysis of BOT project by using risk measurement tools.

III. SCOPE OF 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. The objective of the present work is to carry out financial analysis to determine the range of various financial parameters TPC (Total Project Cost), DSCR (Debt Service Coverage Ratio). In other words the concessionaire may want to conduct "sensitivity and scenario" analysis. This study can be further extended to prepare ideal financial model for bringing these different parameters on the same platform so that the financial model is applicable for any project.

IV. LITERATURE SURVEY

Ahmad Kreydieh [1] discusses the BOT model and risks involved in different project phases and suggest the methods to mitigate these risks to parties involved and contractual relationship between them, he also identified the causes of failure of projects. Swapan Kumar Bagui [2] presents the papers of sensitivity analysis for BOT project with real case study varying equity from 10% to 90%. Traffic and cost are varied by $\pm 20\%$ and financial analysis is carried out with spread sheet and test result are prepared in graphical form and presented. Total project cost (TPC), NPV, financial

internal rate of return are plotted. Petar Jovanovica [3] presents the paper of treats investment decision-making under uncertainty and risk. Some of the methods used for investment decision-making under uncertainty and risk are also presented: Break-Even Analysis, Sensitivity Analysis, Theory of Games and Decision Making Theory. Sensitivity Analysis is given special consideration and one of the procedures of its application in investment decision making under uncertainty and risk. Swapan Kumar Bagui and Ambarish Ghosh [4] present the paper of risk analysis of the projected traffic and alternatively revenue with a real case study and determine lower and upper limit of revenue and expected revenue has been determined using Monte Carlo Simulation Method. The paper presented by Dr. Hiren M Maniar [5] serves the purpose to investigate critical risks associated with Build Operate Transfer (BOT) projects in India.

V. THE BOT PROJECT

The term BOT (Built-Operate-Transfer) can be defined as major start up business venture where private organization undertake to build and operate a project, which would normally be undertaken by the government and return the ownership to the government after fixed concession period.

The term project financing refers to the financing of an economic unit in which a lender look initially to the cash flows and earning of that economic unit as the source of the funds from which a loan will be repaid and to the assets of the economic unit as collateral for the loan.

1. Parties Involved In Bot Project:-

Some or even all of the following different parties could be involved in any BOT project:

1. Government
2. Project sponsor
3. Contractor
4. Lenders
5. Purchasers
6. Operator
7. Insurance
8. Supplier

2. Risks In Bot Project

Risk factors for this study are classified into three types, namely

- 1) Technical risks,
- 2) Financial risk
- 3) Political Risk,

1) Technical Risks:-

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 is classified into two types

a) Construction risk:-

The most critical risks in Construction are project delay due to many reasons such as poor interface coordination, late design changes, late delivery of raw materials, changes in project schedule versus estimated project delivery schedule, bad weather condition, difficult ground condition etc. If project is delayed by one or more year automatically debt increase due to rolled up interest, can seriously affect the project's profitability.

b) Operational and Maintenance Risk:-

Inefficient team would lead to unnecessary high cost of operating and resulting lesser revenue to the consortium so the operation and maintenance team requires specialized technical skills and abilities in operating the facility.

2) Financial Risk:-

From past study most 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 types.

- a) Currency risks
- b) Interest risks
- c) Equity risks
- d) Foreign exchange risk
- e) Commercial risk
- f) Liquidity risk
- g) Counterparty risk
- h) Economic risk

a) *Currency risk*:-It occurs due to funding from international banks or foreign companies; creates volatility of the exchange rates. There are two currency risks facing project companies. The first risk is exchange rate fluctuation, payment in the project company's home currency, or the currency in which it must service its debt. The second risk is currency controls, i.e., the sovereign government limits the project company's access to foreign exchange to make foreign currency payments outside the country.

b) Interest risks:-

Interest rate fluctuations represent a significant risk for highly-leveraged project financings. Arranging for long-term financing at fixed rates mitigates the risk inherent in floating rates.

c) *Equity risks*: - Equity risk is related with the performance of the company which is measured by the share price of the company. The higher the share price goes, benefits the shareholder but the lesser it goes will affect the prestige of the concessionaire.

d) *Foreign exchange risk*:-Fluctuations in foreign exchange are considered another major risk which might affect the BOT project during the construction and operation. Foreign companies who are interested to invest in another country should be aware of the opportunities and threats associated

with international currency transactions before they proceed.

e) *Commercial risk*: - Commercial risk is described as a risk that can jeopardize the financial performance to the project. In spite of that, commercial risk in BOT project is characterized differently.

Commercial risk are classified into three categories

- a) risks related to the completion,
- b) during operation and
- c) Risks related to input or output of the project.

f) *Liquidity risk*: - Most of the BOT projects, the revenues are generated from the operation. To ensure the success of the BOT project, it should be able to generate sufficient amount of revenue to settle the debt within the stipulated time frame. An amount of profit that can be generated from the operating facility is determined by conducting analysis on the projected revenue during operational phase. The failure to generate the required revenue will result into the liquidity risk.

g) *Counterparty risk*: - . In a concession contract, transactions between two or more parties contain a risk that one party will default on an obligation of the commitment. Failure in financing the required cash flow for the BOT project is the most common issue that arises.

h) *Economic risk*: - This risk mostly related to the facility's operation which consists of materials supply, labour supply, equipment availability, inflations, tariffs, exchange rates. Project cash flow is affected by any financial aspects that relate to the economic parameters. Increment in the supply and maintenance cost, eventually will increase the operation cost, thus reduce the revenue. This could be seen as a threat to the promoter.

3) *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*: - Sovereign risk is related to the provision of loans to foreign government and commonly used in banking world. Sovereign risk occurs when the political environment is unstable and will affect the investor of the project. A BOT project might face serious risk when there are changes in government's policy and regulations due to changes in ruling government as can be learned from past experience.

b) *Country risk*: - Country risk is totally different from the sovereign risk. Before any BOT project implementation, the promoter should necessary conduct a thorough country risk profile.

3. MEASUREMENT OF RISK :-

There are different methods used for measurement of risk as follow

- 1) Sensitivity analysis
- 2) Scenario analysis
- 3) Break-even point analysis
- 4) Simulation analysis
- 5) Decision tree analysis

VI. CASE STUDY

Basic parameters for financial risk analysis are given below. The cost of BOT project is **424.6 Cr.**

Table I-Salient Features

Name of Project	BOT State Highway
Name of client	PWD (Pune)
Name of Independent Engineer	ABC Private Ltd.
Total Cost of Project	424.6 Crs.
Construction Period	3 years
Concession Period	25 years (including construction period)
Concessionaires Date of Work Order	1 January 2013
Length of Road	41.06 Kms

MEANS OF FINANCE

Table II – Means of Finance

Means of Finance	Amount (Rs. Cr.)
Government Grant	118
Equity	134.6
Dept	172
Total Project Cost	424.6

Concessionaire Data

Total Project cost includes construction cost, operation and maintenance costs of road, bridges and all components.

- 1) Construction Period – 3 years
- 2) Concession Period – 25 years
- 3) First annuity payment would be made 6 month after scheduled project completion date.

Finance Risk Analysis Techniques

It is important to keep in mind that when we analyze a potential project, it is forecasting potential not actual cash flows for a project. As we all know, forecasts are based on assumptions that may be incorrect. It is therefore important to perform a sensitivity analysis on its assumptions to get a better sense of the overall risk of the project. There are two risk-analysis techniques.

1. *Sensitivity Analysis*

Sensitivity analysis is simply the method for determining how sensitive our DSCR analysis is to changes in our variable assumptions. To begin a

sensitivity analysis, we must first come up with a base-case scenario. This is typically the DSCR using assumptions we believe are most accurate. From there, we can change various assumptions we had initially made based on other potential assumptions. DSCR is then recalculated, and the sensitivity of the DSCR based on the change in assumptions is determined. Depending on our confidence in our assumptions, we can determine how potentially risky a project can be.

2. Scenario Analysis

Scenario analysis takes sensitivity analysis a step further. Rather than just looking at the sensitivity of our DSCR analysis to changes in our variable assumptions, scenario analysis also looks at the probability distribution of the variables. Like sensitivity analysis, scenario analysis starts with the construction of a base case scenario. From there, other scenarios are

considered, known as the "best-case scenario" and the "worst-case scenario". Probabilities are assigned to the scenarios and computed to arrive at an expected value. Given its simplicity, scenario analysis is one the most frequently used risk-analysis techniques.

Determining a Project's Cash Flows

When beginning data analysis through capital-budgeting, it is important to determine the cash flows of a project. These cash flows can be segmented as follows

1. Initial Investment Outlay.

These are the costs that are needed to start the project, such as new equipment, installation, etc.

2. Operating Cash Flow over a Project's Life

This is the additional cash flow a new project generates.

TABLE III – PROFITABILITY STATEMENT

Year	Gross Revenue	Net Revenue	O&M Cost	Revenue(EBIDT)	Amount Of loan (Debt)	Interest @ 11.50%	Principal	Profit after int	Depr	PBT	TAX @ 33%	PAT
2015-16	10	10	1.00	9.00	172.00	10.00	0.00	-1.00	1.00	0.00	0	0.00
2016-17	26	26	4.00	22.00	171.30	20.00	0.70	2.00	3.00	-1.00	0	-1.00
2017-18	27	27	4.00	23.00	169.60	20.00	1.70	3.00	3.00	0.00	0	0.00
2018-19	29	29	4.00	25.00	167.00	19.00	2.60	6.00	3.00	3.00	0	3.00
2019-20	38	38	5.00	33.00	159.30	19.00	7.70	14.00	4.00	10.00	0	10.00
2020-21	41	41	5.00	36.00	149.80	18.00	9.50	18.00	5.00	13.00	0	13.00
2021-22	43	43	21.00	22.00	147.60	17.00	2.20	5.00	5.00	0.00	0	0.00
2022-23	53	53	22.00	31.00	139.90	17.00	7.70	14.00	6.00	8.00	0	8.00
2023-24	56	56	23.00	33.00	128.70	16.00	11.20	17.00	6.00	11.00	0	11.00
2024-25	60	60	7.00	53.00	111.50	14.00	17.20	39.00	7.00	32.00	0	32.00
2025-26	73	73	8.00	65.00	89.10	12.00	22.40	53.00	8.00	45.00	14.85	30.15
2026-27	77	77	8.00	69.00	63.30	9.00	25.80	60.00	9.00	51.00	16.83	34.17
2027-28	81	81	9.00	72.00	35.80	6.00	27.50	66.00	9.00	57.00	18.81	38.19
2028-29	102	102	34.00	68.00	6.60	3.00	29.20	65.00	12.00	53.00	17.49	35.51
2029-30	107	107	34.00	73.00	0.00	0.22	6.66	72.78	12.00	60.78	20.06	40.72
2030-31	113	113	35.00	78.00	0.00	0.00	0.00	78.00	13.00	65.00	21.45	43.55
2031-32	142	142	14.00	128.00	0.00	0.00	0.00	128.00	16.00	112.00	36.96	75.04
2032-33	150	150	15.00	135.00	0.00	0.00	0.00	135.00	17.00	118.00	38.94	79.06
2033-34	157	157	16.00	141.00	0.00	0.00	0.00	141.00	18.00	123.00	40.59	82.41
2034-35	199	199	19.00	180.00	0.00	0.00	0.00	180.00	23.00	157.00	51.81	105.19
2035-36	209	209	53.00	156.00	0.00	0.00	0.00	156.00	24.00	132.00	43.56	88.44
2036-37	220	220	54.00	166.00	0.00	0.00	0.00	166.00	25.00	141.00	46.53	94.47
2037-38	269	269	58.00	211.00	0.00	0.00	0.00	211.00	31.00	180.00	59.40	120.60
2038-39	283	283	26.00	257.00	0.00	0.00	0.00	257.00	32.00	225.00	74.25	150.75
2039-40	297	297	28.00	269.00	0.00	0.00	0.00	269.00	34.00	235.00	77.55	157.45
2040-41	312	312	21.00	291.00	0.00	0.00	0.00	291.00	35.00	256.00	84.48	171.52
2041-42	327	327	31	296	0.00	0.00	0.00	296.00	37	259	85	173.53
2042-43	169	169	16	153	0.00	0.00	0.00	153.00	19	134	44	89.78

TABLE IV- DEBT SERVICE COVERAGE RATIO CALCULATION.

Year	PAT	Depr	Interest	Net Inflow	Loan Repayment	Interest	Net Outflow	DSCR
2015-16	0.00	1.00	10.00	11.00	0.00	10.00	10.00	1.10
2016-17	-1.00	3.00	20.00	22.00	0.70	20.00	20.70	1.06
2017-18	0.00	3.00	20.00	23.00	1.70	20.00	21.70	1.06
2018-19	3.00	3.00	19.00	25.00	2.60	19.00	21.60	1.16
2019-20	10.00	4.00	19.00	33.00	7.70	19.00	26.70	1.24
2020-21	13.00	5.00	18.00	36.00	9.50	18.00	27.50	1.31
2021-22	0.00	5.00	17.00	22.00	2.20	17.00	19.20	1.15
2022-23	8.00	6.00	17.00	31.00	7.70	17.00	24.70	1.26
2023-24	11.00	6.00	16.00	33.00	11.20	16.00	27.20	1.21
2024-25	32.00	7.00	14.00	53.00	17.20	14.00	31.20	1.70
2025-26	30.15	8.00	12.00	50.15	22.40	12.00	34.40	1.46
2026-27	34.17	9.00	9.00	52.17	25.80	9.00	34.80	1.50
2027-28	38.19	9.00	6.00	53.19	27.50	6.00	33.50	1.59
2028-29	35.51	12.00	3.00	50.51	29.20	3.00	32.20	1.57
2029-30	20.36	7.00	0.00	27.36	6.66	0.00	6.66	4.11
2030-31	43.55	13.00	0.00	56.55	0.00	0.00	0.00	
2031-32	75.04	16.00	0.00	91.04	0.00	0.00	0.00	
2032-33	79.06	17.00	0.00	96.06	0.00	0.00	0.00	
2033-34	82.41	18.00	0.00	100.41	0.00	0.00	0.00	
2034-35	105.19	23.00	0.00	128.19	0.00	0.00	0.00	

Based on the information given in above table-III, DSCR are calculated. A summary of the project financial indicators for the selected years is presented as follows.

Min. DSCR: - 1.06

Max. DSCR: - 4.11

Avg. DSCR: - 1.50

In addition to the Base Case, the following scenarios were projected, keeping other factors constant:

Scenario I - Decrease in Base Traffic by 5%

Sensitivity analysis carried out by decreasing the 5% base traffic. The sensitivity addresses the impact of lower than expected toll revenues arising due to lower than projected traffic plying on the Project State Highway.

Scenario II - Increase in O&M Cost by 10%

In second scenario, sensitivity analysis carried out by increasing 10% O&M cost. Sensitivity addresses the impact of increase in O&M cost by 10% over that assumed in the Base Case.

Scenario III - Combined Adverse Case

This is a combination of the adverse scenario of decrease in Base traffic by 5% and increase in O&M cost by 10%.

The results of the sensitivity analysis on the above-mentioned adverse parameters are summarized in table below:

TABLE V – RESULT OF SENSITIVITY ANALYSIS

Description	Min. DSCR	Avg. DSCR
Base Case	1.06	1.50
Scenario I	1.04	1.42
Scenario II	1.09	1.46
Scenario III	1.03	1.38

Debt Service Coverage Ratio (DSCR) should be always greater than or equal to 1.00. Lesser DSCR indicate issues in loan repayment.

VII. CONCLUSION

Every BOT project is subjected to multiple risks. Finally all risk converted into financial risk. Lender and investor always analyze financial risk associated with project before financing it. The investors of the project are more interested in knowing the DSCR and financial viability of the project. It is only the DSCR which indicates the soundness of the project with regards to its debt repaying capacity.

The traffic projections for the purpose of profitability of project are based on the traffic study of State Highway. The projected financials are robust to service the debt repayment and interest repayment.

On the basis of above analysis and subject to the risks, debt servicing capability of the Project is considered satisfactory and adequate. Based on the various operating, financing and regulatory assumptions, the Project State Highway is expected to achieve the projected profitability.

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