

## GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES ANALYSIS OF CRITICAL FACTORS FOR BOT HIGHWAY PROJECTS

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### ABSTRACT

In our country, generally it is difficult for government or any public organization to arrange fund for any development activity, so this BOT type project are very useful. Now lots of project in India are taken in this scheme in various sectors like Highway, Bridge, Irrigation, Airport etc. Now the problem arises mainly to check whether a project is viable in this scheme or not. In this study we tried to find out main governing factor for a BOT project. In this study the critical factors will analyze and identify the hierarchy of these factors and their inter-relationship. This study can be used as reference before finalizing factors and their relationship for any BOT Highway project. This study can be used to check viability for any BOT project. For the successful implementation of Build- Operate and Transfer Project, careful evaluations of different parameters are must.

*Keywords- BOT, Highway projects, Critical Factor.*

### I. INTRODUCTION

The concept of BOT, Private Finance initiative (PFI), or any other privatization schemes, has been attracting both government and private sectors all over the world in recent decades. Although requirement of the infrastructure facilities are increased continuously, many government fail to implement the development projects owing to the government's inability to finance such major project that are remarkably high in cost. Thus, demand for such privatization schemes as BOT and PFI is drastically increasing in both developed and developing countries.

For this type of huge investment into the project require to understand or analyse those factors which may have an adverse effect in case of private investment. So details studies of those factors are very much essential and at the same time remedial action should be taken to cater all kind of problems coming underway. This study aims to identify and evaluate those factors and come up with recommendations in order to help BOT highway project participants.

### II. RESEARCH METHODOLOGY

After the objective of the project finalized we adopt a systematic approach to achieve those objectives, for that various steps are followed as enlisted below:

- Various literatures have been reviewed to get some initial factor involved in a BOT project.

- An initial questionnaire survey conducted to finalise the various factors involved in a BOT project.
- Initially we finalise twenty factors, incorporating all we found by literature survey and also those we find from the questionnaire survey among the experts.
- We decide to finalize the hierarchy of all those factors taking the expert opinion.
- Another survey conducted to get the expert opinion about the rank of the factors.
- Taking expert opinion we consider only those factor where we get the weighted arithmetic mean value greater than 0.5.
- Out of twenty factors fifteen of those are identified as the priority factor.
- This is find out in the process that influence of one factor over another are taken from the analysis.

### III. DENTIFICATION OF THE VARIABLES

To obtain consensus a questionnaire survey has been conducted. In the format of survey, some of the potential variables are enlisted, this initial potential variables are finalized by literature survey and after that taking expert opinion (as per expert criteria) all the other related factors are finalized. After finalizing all potential factors in our case(20 nos) the same has been enlisted into the survey format and expert are advised to rank them between 0 to 10 as per their

knowledge.

0 for the variables which are irrelevant.

10 for the variables which are most relevant.

These literature survey helps us to finalize some of the initial potential variable governing a BOT Project. The some discussion about the initial potential variable are as follows:

### 3.1 Criticality of project

Chan, et al (2005) mentioned that the criticality of the project under consideration is a very important governing factor. Depending upon this factor concessionaire decide whether to go for the bidding for a particular project. Also this governs whether a project is viable or not.

### 3.2 Type of project

Chan, et al (2005) mentioned that the type of the project is one of the most vital guiding factor which definitely governs the success of a particular BOT project. Depending upon the type of the project the involvement of different parties in a particular BOT project is governed. The importance of the project is also very much dependent upon the type which also governs the amount of money to be involved in that particular project. The interest of the concessionaire to take a project in BOT basis is always depends upon the field and the sector in which the project is floated.

### 3.3 Total time of completion of project

Shen (2005) discussed briefly in his literature that how the time estimated at the start of the project is very much vital and depending upon that the actual cost to the project depends. Any variation of time for the completion of the project has a direct effect over the cost involved to the project. This becomes a important factor from the risk point of view of the project.

### 3.4 Total initial cost of project

This factors is found to be important by many authors. Xueqing (2005) mentioned that, initial cost at the start of the project is one of the most important guiding factor for any kind of BOT Project as it is very much Important for any type of concessionaire to know how much amount to money amount to money needs to be arranged before bidding for any particular BOT project. Depending upon the initial cost requirement of the project the concessionaire has to decide that how that would affects their revenue and also the return they would get from that project whether that will be enough in compression to the initial investment. Quing (2004) mentioned in his literature that depending upon the investment required how the type of concessionaire changes in a particular project which ultimately affect the quality.

### 3.5 Competency of concessionaire

This is one of the most important guiding factors. Xueqing (2005) says that depending upon this factor the success of a BOT project very much depends. Most of the important influencing factors of a BOT project depends on this factor. The choice of the most eligible and efficient concessionaire is a very important part of a BOT project.

### 3.6 Revenue earned after completion of project

This is one of the most important guiding factor which becomes one of the foremost guiding factor to the concessionaire to decide whether to go or not to go for BOT project. Most of the authors discussed this factor as the foremost important. Chan, et al (2005) mentioned that ultimately the concessionaire looks at the earning from the project so any factors affecting the IRR must be checked even before go for bidding.

### 3.7 Economic condition of users

This is one of the most guiding and foremost important factors for any kind of BOT project. This factor definitely guides the concessionaire to decide whether to go or not to go for any particular project. This also guides a client to decide about the viability of project. (Quing,2004) discussed about this factor briefly. This mainly looked after by the concessionaire before going for the bidding. The risk mainly associated with the financial return from the project.

### 3.8 Availability of materials nearby

This is very essential factor for any kind of BOT project. This has affect on both time and overall cost of completion of any kind of BOT project (Chan, et al, 2005). This also very important guide line concessionaire decide to go or not to go for any project.

### 3.9 Availability of labors nearby

This is very essential factor for any kind of BOT project. This has affects on both time and overall cost of completion of any kind of BOT project. This somehow even guide the factors like availability of the row material in the project as the reachability to the site depends upon this factor. (Chan ,etal, 2005). This also very important guideline for any concessionaire to decide whether to go or not to go for any project. Though the permanent labours of any contractor can solve this issue to some extent.

## IV. EXPERT CRITERIA

The initial potential variables require an assignment of weights, rank toward the project viability, and comparing their relative importance. This process

requires gathering of the necessary information from experienced professionals in the industry who had participated in the development of BOT projects. In this research, the selection of the professional group respondents was based on several criteria as follows:

- The expert should have been directly involved in developing at least one major BOT highway project.
- The expert should have minimum three years experience in BOT highway project.
- The expert should have actively participated in the activities of the project management team.

**V. QUESTIONNAIRE SURVEY**

The questionnaire survey conducted between the expert of different participants of a BOT project as:

- Concessionaire.
- Contractors.
- Sub contractors.
- Consultants.
- Questionnaire survey format for Rank of the Variables are as follows:**

Sr. No.	Different Viable Factor in BOT Project	Rank Given by Experts													
		0	1	2	3	4	5	6	7	8	9	10			
1	Total initial cost (Size) of project														
2	Total time of completion of project														
3	Type of project														
4	Criticality of project														
5	Total period of operation and maintenance														
6	Cost involved in maintenance														
7	Type of client														
8	Competency of concessionaire														
9	Competency of consultant														
10	Previous experience about similar type of work														
11	Revenue earned after completion of project														
12	Political condition														
13	Economic condition of users														
14	Amount of risk involved														
15	Reliability of data forecast														
16	Availability of materials nearby														

**0:** for irrelevant variables, and **10:** for most relevant variables.

- > If you would like to add any other Factor please mention and rank also.

## VI. FINALIZATION OF VARIABLE

Once the factors are identified the based on questionnaire survey the factors were finalize. then hierarchy of the variables and there corresponding level of importance are to be find out with the help of MICMAC software. also at the same time we can analyze their inter-relationships. A set of different and directly related element are structure into a comprehensive systemic model.

The method is interpretive as the judgment of the group decides whether and how the variables are related. It is structural as on the basis of relationship, an overall structure is extracted from the complex set of variables. The analysis are discuss stepwise as follows:

- Variables are listed out, which can be objectives, action, individuals etc. and a contextual relationship is established among variables with respect to which pairs of variables would be examined.
- A Structural Self Interaction Matrix (SSIM) is developed for variables, which indicates pair wise relationship among variables of the system.
- A Reachability Matrix is developed from the SSIM and is checked the matrix for transitivity.
- A Reachability Matrix is portioned into different levels.
  - The Reachability Matrix is developed in its conical form, i.e. with most zero (0) variables in the upper diagonal half of the matrix and most unitary(1) variables in the lower half.
  - Based on the above, a Directed Graph(Diagraph) is drawn and transitive links are removed and the resultant Diagraph is converted into an MICMAC by replacing variables node with statements.

## VII. MIVMAC ANALYSIS

- Selection of factor.  
It content selection of variable and rank those variable under the guidance of expert opinion. For the conversion of rank variable into Structural self-interaction matrix(SSIM).
- Develop Structural self-interaction matrix(SSIM).
  1. V: i is depend on j.
  2. A: j is depend on i.
  3. X: i and j depend on each other.

4. O: i and j are not dependant.

- Reachability Matrix:

The SSIM has been converted into a binary matrix, called the reachability matrix by substituting X, A, V and O by 1 and 0. Then its transitivity is checked.

1. If the (i, j) entry in the SSIM is V, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.
2. If the (i, j) entry in the SSIM is A, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.
3. If the (i, j) entry in the SSIM is X, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1.
4. If the (i, j) entry in the SSIM is O, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

- For MICMAC Analysis:

It takes the input of SSIM matrix as a voting manner. Initially all the direct relations are taken into account. It also automatically take the linked relations as an example says, if A relates to B and B relates to C, it automatically take A relate to C but in our case this may not be the case so all those relations needs to re-establish after the initial input also the links which are exists can be initially omitted as an example that if A not relate to B, and B relate to C, so automatically it can take A not relate to C but in our case which may not be correct. So after giving initial input we need to check whether all the information as per the SSIM matrix has been given or not. If seen some are wrong or missing that needs to be carefully incorporated by secondary information link. Then after completing the input if generates graph of inter-relation of variables of the factor under consideration.

## VIII. CONCLUSION

This study can be summarized from the analysis of the data that none of the factors are independent. All factors or variables are very much related to each other. Care should be taken to those factors, which are affecting most of the other guiding factors, i.e. the factors that are very much influencing must be considered seriously. In this study the factors like Type of Project, Availability of labour and material, reliability of the data forecast are coming at top level of variables, it means these factors governing most of the other factors. In this study the factors like Initial cost, Time of completion are coming bottom level



variable, it means that those factors are mainly dependant of on the behavior of the other factors. This study can be used for any BOT Highway project to finalise the main guiding factors and there inter relationships.

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