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Critical Analysis of Risk Management and Mitigation of BOT Projects

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***Abstract*: It has been claimed by many researchers that "a risk driven approach" to project management is necessary to increase the success of construction projects. Literature is very rich in conceptual frameworks to overcome the informality of risk management efforts. However, risk management paradigms exist as methodologies rather than systems which can fully support the risk management process. The existing risk management support tools are usually based on quantitative risk analysis whereas the other phases are carried out external to the software. Risk registers and risk assessment tools are proposed as decision support systems which can only be used at specific stages of a construction project for specific purposes such as time/cost estimation at the bidding stage, country risk assessment during international market selection etc. Moreover, the proposed risk management support tools usually do not foster integration of risk management activities between the parties involved in the construction supply chain, do not consider impact of risks on all of the project success criteria, and cannot handle subjectivity. In the recent years, the research has shifted to information and process models in which risks and response strategies may be identified, analysed and managed in a formal way by the use of database and model management systems. The major objective of this paper is to make a critical review of existing risk management support tools and propose development of a risk management corporate memory coupled with a decision support tool for successful management of risk.**

***Keywords*: Risk Management, Project Management, BOT Projects.**

1. Introduction

A. Background

India is moving towards a phenomenal growth story with economic reform unleashing investment and growth and offering its citizens great opportunities. Even though the Indian economy has been resilient so far, the key issue that it faces is how to sustain this momentum. A turnaround of cities to release their dynamism will be critical to the sustenance of India's future economic growth. Indian economy, in order to maintain and augment its economic growth has to rely on urbanization. The urbanization that is happening so far in the cities is in the organic form rather than in a planned manner. So in order to provide for sufficient living standards a certain quality of infrastructure services has to be provided for in the cities. The long lasting implementation of project risk management in India can best be evidenced by the construction project procedure that has been in use for over 4 decades in India. The feasibility study was formally introduced into the procedure in 1992. A capital project (including infrastructure projects) must follow the procedure. When an organization has identified its need for a new facility, it must submit a project proposal defining the purpose, requirements and general aspects of the project, such as location, performance criteria, scope, layout, equipment, services and other requirements. The definition and planning of the project shall be carried out in coordination with agencies in charge such as provincial, municipal, autonomous region governments, central ministries or commissions. The project proposals of a medium or large sized project must be submitted to the agencies in charge for review and comments. The priority projects are subject to review and approval by the State Council.

B. Need for study

A BOT project is typically regulated by the government on key issues of the project performances and price of the service. The government can impose some regulations to modify the BOT project to satisfy certain requirements. In the BOT approach, the government grants a private sector the rights to finance, develop, and operate a revenue producing toll road for a defined time period (i.e., concession period) after which the facility is transferred back to the government.

Different pricing strategies of a BOT project are found to serve a wide range of objectives (project performances). From the private sector's viewpoint, the main concern is profit maximization, while under the government's perspective, social welfare maximization for the society is of interest. However, there exists a spatial equity issue in the sense that the changes of the benefits of road users travelling between different origin destination (O-D) pairs may be significantly different when imposing some pricing strategies. This could result in another kind of unfairness to the travelers and become a new obstruction on the implementation of a pricing policy due to public rejection.

There has been growing trends in recent years for government in many countries including India, to place major public investments, particularly, for infrastructure projects, into the private sector. Many of the countries have adopted the BOT

approach, so that the private sector has to finance and construct the project facility and then transfer the owner ship to Government after a specified concession period. Therefore, BOT scheme is a limited resource project financing technique for implementing infrastructure projects by using private funding. The main objective of this paper is to examine the financial risks in BOT in post construction period i.e. operation and maintenance period due to change in rate of interest (PLR) and corresponding change in concession period.

C. Importance of Study

The growth of the infrastructure sector in India has been relatively slow compared with the industrial and manufacturing sectors. The energy shortage, an inadequate transportation network, and an insufficient water supply system have caused a bottleneck in the country's economic growth. The Build-Operate-Transfer (BOT) scheme is now becoming one of the prevailing ways for infrastructure development in India to meet the needs of India's future economic growth and development. There are tremendous opportunities for foreign investors. However, undertaking infrastructure business in India involves many risks and problems that are due mainly to differences in legal systems, market conditions and culture. It is crucial for foreign investors to identify and manage the critical risks associated with investments in India's BOT infrastructure projects. Based on the survey, the following critical risks are identified: delay in approval, change in law, cost overrun, dispatch constraint, land acquisition and compensation, enforceability of contracts, construction schedule, financial closing, tariff adjustment, and environmental risk. The measures for mitigating each of these risks are also discussed. Finally, a risk management framework for India's BOT infrastructure projects is developed. Main purpose of this paper is to investigate critical risks associated with Build Operate Transfer projects in India.

D. Objectives

Build, Operate and Transfer (BOT) is an approach the private sector utilizes to obtain a granted concession for completing a specific project independently. However, the ownership of the project has to be returned to the public sector once it is entirely completed. To carry out a BOT project, both sectors take an advantage of risk sharing from each other. For the public sector, it is already known that its inherent risks in financial, technological as well as managerial problems have been greatly reduced. For the private sector, by contrast, what is known is the magnitude of concession contract negotiation and what is unknown is the critical risk among many uncertain factors. The issues related to the risks for the BOT project, however, still remain unclear. Therefore, this study tries to identify what the risks are and assess those the private sector faces in holding a BOT project.

Risk assessment predominates the success in investment and contract that risk assessment serves as a significant incentive in dealing with engineering contracts also showed its importance in bidding activity and contract negotiation for the BOT projects. Risk analysis studies in the current literature can be classified into two broad categories, namely qualitative and quantitative analysis. To identify the various types of risk will occur in BOT projects and to suggest various mitigation measures to reduce the risks in BOT projects.

E. Scope of study

The review and approval procedure makes sure that the project complies with the national economic and social development programs and there are sufficient resources available to the project. Once the proposal is approved site selection and feasibility study shall follow. The feasibility study involves the process of risk identification and analysis. Various matters should be considered when selecting the site for the proposed project and feasibility study is made, such as climate, topographical and geological conditions, resources, transportation, potential natural calamities, environment conservation, available services, and utilities and so on. Usually, several alternative sites and proposals should be considered and compared with each other in terms of the various factors influencing the project.

2. Literature review

Rasheed A. Salawua, Fadhlin Abdullah(2014) Assessing risk management capability (RMC) of contractors prior to their selection for a project would contribute significantly to project successful delivery. This paper assessed current RMC of Federal highway projects contractors in Nigeria. The study involves review of literatures and questionnaire survey of eighteen rehabilitation projects across Southwest of Nigeria. Maturity levels of the contractors were assessed on four level scale using Fuzzy set theory. The result suggested that overall risk management maturity level of the contractors is 'novice'. It also indicated maturity levels of contractors on different RMC attributes and provides additional decision support information for selecting winning bid.

Since 2001, successive Federal Governments of Nigeria embarked upon extensive rehabilitation and expansion of the existing Federal highways across the six geopolitical zones of Nigeria. Almost all the fully and substantially completed highway projects had failed to achieve their original performance objectives. Although studies carried out by Moura, Teixeira and Pires (2007) revealed that time overrun is a global issue, the percentage increase is often higher in developing countries and uncertainty factors leading to the overrun vary from one country to another.

The methodology for assessing the risk management capability of the construction organizations on highway rehabilitation projects was adapted from the researches undertaken by Carr and Tah, (2001), Zou, et al., (2010) and Mu et al. (2013). The assessment procedure underlying this paper involved project specific questionnaire surveys of the construction organizations and the executed sixteen highway

rehabilitation projects in the South west of Nigeria selected as case studies for the research. Attributes and dimensions of risk management capability were identified through extensive review and evaluation of the existing models and literatures on organizational risk management capability. Four attributes and twenty six question items on the dimensions of risk management capability were identified. The attributes and dimensions were used to construct a hierarchical structure of risk management capability attributes and dimensions using cause and effect diagram.

Alfredo Serpella, Ximena Ferradab, Larissa Rubioa, Sergio Arauzo (2014)

Construction organizations in developing countries, approach risk management in construction projects by using a set of practices that are normally insufficient, produce poor results often, and limit the success of project management. This paper describes the development of an instrument based on an organizational maturity model for evaluating the risk-management capability of construction organizations. This instrument has been applied to both, clients and contractors and is part of a general knowledge based system. Outcomes of this research will allow a client or contractor first, to develop or improve its project risk management

Risk is a term that has long been studied in different areas. Hillson (2013) defines risk as the uncertainty that can be measured, and uncertainty is a risk that cannot be measured. To try to mitigate or eliminate the risk, we count on risk management, which is an integral part of project management. Risk management is a positive and proactive process intended to reduce the likelihood of unsatisfactory consequences to the project in its different stages, such as design, construction and operation (Mills, 2001; Rohaninejad & Bagherpour, 2013). Risk management is an important area of project management then, since it allows anticipating the occurrence of events that could adversely affect a construction project and to define actions that could minimize their impacts. It is well known that one of the major roles undertaken by any project manager is to deal with contingencies or risks that occur continuously during the management of a project and this role is particularly complex and inefficient if risk management has not been performed or supported adequately since the start of the project.

It is possible to analyze project risks from two different perspectives. From the point of view of the client, who is key to decision-making in the project, and from the point of view of the contractor, who traditionally increases costs to hedge risks, but given that the margin utility is getting lower, is facing a practice that has become unprofitable (Baloi and Price, 2003). These two groups have different behaviors against the risks of the project and different possibilities of transferring risks to the party best able to manage them

Hayne E. Leland (1998)The author develops a model that unifies elements of two capital structure theories—the tax-based arbitrage theory of Modigliani and Miller and the agency-based theory of Jensen and Meckling. The model incorporates the tax benefits from the usage of debt in the capital structure and combines it with the agency costs from the firm's increasing asset risk once the debt is in place. The model's results indicate that agency costs are small relative to tax benefits; however, creditor risk from asset substitution causes a substantial increase in yields. Contrary to conventional wisdom, hedging benefits often are inversely related to agency costs.

The development of capital structure theory has been limited in two respects. First, the M–M and J–M approaches have not been integrated. A general theory would need to explain how M–M and J–M approaches interact to optimize the joint choice of asset risk and capital structure. Second, a general theory would also need to provide quantitative advice regarding specifics of debt in the capital structure, including amount, maturity, and call provisions. Because of these limitations, the existing theories have had limited application to corporate decision making. The author concludes that the model's limitations are that the model assumes managers behave in shareholders' interests, that dividend payout policies are exogenous, and that information asymmetries are ignored. These limitations provide challenges for future research.

Brain M. Kleiner, Thomas H. Mills (2015) Safety management in construction is an integral effort and its success requires inputs from all stakeholders across design and construction phases. Effective risk mitigation relies on the concordance of all stakeholders' risk perceptions. Many researchers have noticed the discordance of risk perceptions among critical stakeholders in safe construction work, however few have provided quantifiable evidence describing them. In an effort to fill this perception gap, this research performs an experiment that investigates stakeholder perceptions of risk in construction. Data analysis confirms the existence of such discordance, and indicates a trend in risk likelihood estimation.

With risk perceptions from low to high, the stakeholders are architects, contractors/safety professionals, and engineers. Including prior studies, results also suggest that designers have improved their knowledge in building construction safety, but compared to builders they present more difficultly in reaching a consensus of perception. Findings of this research are intended to be used by risk management and decision makers to reassess stakeholders' varying judgments when considering injury prevention and hazard assessment.

Zheng Qizhen (2009) With the rapid development of economic and technology in China, structural forms are becoming more and more complicated, which requires more rigorous construction technology and construction management. However, the risk management in our country is still in its infancy, and managers are short of awareness of risks and lack of ability to manage risks. Study on risk management methods mode of conventional construction process shows that only relying on the qualitative analysis by perfecting manage system and engineering experience cannot satisfy the construction requirement of the complicated structures.

Thus, integrating the ideal, characteristics, procedure and

goal of risk management meanwhile combining the achievements of computer simulation technology in building structures, this paper presents a new construction technology risk management model, takes overall lifting of steel gallery engineering project of Shaoxing World Financial Center as an example and validates its applicability of the management mode to engineering projects construction.

Barbara Gładysza, DorotaKuchtaa, Artur Duchaczek (2015) This paper proposes a mathematical model supporting the management of project risk. The model distinguishes between risks which have to be accepted and risks which can be eliminated at some cost, helping to decide which risks should be eliminated so that the customer requirements with respect to project completion time can be satisfied at minimal cost. The model is based on a modification of the PERT method and can be reduced to a mixed linear programming problem. The model is illustrated by means of a real world case concerning a construction project. Taking all this into account, it should be stated that in the area of construction projects, as in many other areas in which projects with significant uncertainty concerning duration are executed, it is necessary to conduct research into methods for scheduling such projects considering the risk of delay. Of course, such research has been conducted for many years.

We propose a PERT-based model supporting time-related project risk management. The newness of the model with respect to the existing literature is that it distinguishes between various project risk categories, depending on the existence or non-existence of risk elimination possibilities. For the risks which can be eliminated at some cost, the model helps to decide which ones to eliminate to satisfy the time requirements at minimal cost. The advantage of the proposed model over the existing project risk management approaches is that it helps to find the optimal application of risk elimination measures to the risks which can be eliminated. In the traditional approaches the elimination measures are usually selected intuitively. Here, the cheapest selection is determined, which, taking into account large costs of construction projects and the high competitiveness on the construction market, may be of high importance. Also, to the knowledge of the authors it is the first formal model which distinguishes various categories of project risk. Further research should follow two directions. First, other risk categories (for example risks that cannot be eliminated, but can be transferred or mitigated) should be included in the model, as well as other probability distributions, if it transpires that this would be justified in practice. The other direction would be to verify the model using other real world cases of construction projects. Any contribution to knowledge on how to manage the risks of construction projects (as well as other projects, especially those consuming substantial financial resources, often public ones) in terms of delays is important as each delay causes important losses: money, time, opportunities, image, etc. Thus, in our opinion, the research line started in this paper should be continued.

3. BOT approach and risk management

A. BOT approach

To meet the growing demand for public services, many countries have adopted private-public partnerships for the development of public infrastructure. A popular approach is to use a build-operate-transfer (BOT) project delivery method for the needed infrastructure. Under the BOT approach, the project sponsor is responsible for financing, designing, and constructing the project and operating it for a certain concession period. During the concession period, the project sponsor collects revenues from operating the project to repay the project costs as well as to provide a profit. At the end of the concession period, ownership of the completed project is transferred to the host government.

Project participants include the granting authority, which typically is a government agency; the project sponsor; and one or more financial institutions. The granting authority identifies project requirements, establishes the concession period, solicits tenders, and awards the contract. The project sponsor typically is a consortium or joint venture of engineering, construction, and venture capital firms, and may include equity investors such as the host government or institutional investors. Investment capital may come from commercial banks, insurance companies, or the sale of bonds. The relationships among the project participants are shown in Figure 1. The constructor typically invests equity during the early phases on the project, but often sells its position upon the completion of construction. At the end of the concession period, all operating rights and operational responsibilities revert to the granting authority

A specific issue is the absence of consolation from the development associations. A noteworthy contrast was additionally seen between people in general and private areas, with huge numbers of the respondents guaranteeing that undertaking administration are conceivable on a huge scale in the private division however not in the general population part. The explanations behind this distinction are government arrangements, for example, over the top organization, poor execution of undertakings, bargains on quality and norms, individual interests, low straightforwardness and debasement. Likewise, a vast dominant part of respondents concurred that the development business does not have a structure or example; that apparatuses, for example, venture administration can give the structure required; and with the assistance of this structure the business ought to have the capacity to defeat the issues associated with expanded modernization and straight forwardness and be better arranged for future difficulties.

B. Risk management

1) Definition and dimensions of risk

Risk is defined as the chance or probability of occurrence of danger, loss, injury etc.

Some of the other definitions of risk are:

- The uncertainty inherent in plan which has a

possibility of happenings that can affect the prospects of changing project goal.

- Lack of predictability about structure, outcome, or consequences in decision or planning situations. The essence of risk is characterized by three factors namely the event, the likelihood and the impact of the event.

1. Event: A possible occurrence which could affect the achievement.
2. Likelihood: The probability of the risk event occurring within the time period.
3. Impact: The financial value of the effect of the risk event on the project objectives.

Risk management encourages the project team to:

1. Minimize adverse impacts on project scope, cost, and schedule.
2. Maximize opportunities to improve the project's objective with lower cost, shorter schedules, enhanced scope and higher quality.
3. Find out the alternative approaches to achieve the project objectives.

Risk is an intangible concept and will be viewed differently by different people, but we do need to try and rationalize it as far as possible. One way to do this is to consider the various questions we might want answers to before we make any decision on risk. These will include the following:

- How long will we be at risk for (Time)?
- How big is the risk likely to be (Size of exposure)?
- What is the probability of occurrence (probability)?
- How close to the expected outcome is the risk event likely to be (volatility)?
- Is it a simple risk to understand (complexity)?
- How many types of risks are involved (inter-relationships)?
- Can I manage this risk (influence)?

C. Benefits and uses of risk data

1) Project Justification

The primary goal of project risk management is either to develop a credible foundation for each project, showing that it is possible, or to demonstrate that the project is not feasible so that it can be avoided, aborted, or transformed.

2) Lower Cost and Less Chaos

Knowledge of the root causes of problems enables the project problems enables to reduce the cost of rework and the frustration caused by avoidable problems.

3) Project Priority and Management Support

High-risk projects may begin with lower priority, but a thorough risk plan, displaying competence and good preparation for possible problems, can improve the project priority. Support from managers, other project stakeholders and the project team are easily won when projects are based on thorough, understandable information.

4) Project Portfolio Management

The ideal project portfolio includes both lower- and higher-risk projects in proportions that are consistent with the business objectives. Risk data as a key factor to maintain an appropriate mix of ongoing projects.

5) Establishing Management Reserve

Risk analysis is useful in setting reserves for schedule and/or resources. Risky projects require a window of time (or budget), instead of a single-point objective. Project commitments should be established with less aggressive goals, reflecting overall project risk. Project risk assessment data provides both the rationale and the magnitude for the required reserve.

6) Project communication and control

Project communication is more effective when there is a solid, credible plan. This causes people to work in ways that avoid project difficulties. Risk data can also be very useful in negotiations with project sponsors. It helps in defining objectives, determining budgets, obtaining staff, setting deadlines, and negotiating project changes.

D. Sources of risk

Progress of a project is corresponding with the occurrence 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. The risks could be clustered as global and elemental risks. Global risks are defined as being exerted externally to the project environment. Adversely, elemental risks originate from the sources within the project structure which are manageable within the elements of the project. Promoter should thoroughly investigate the various sources of risk before making any decision in a BOT project. Based on the literature review, major types and sources of risks have been summarized in Table. Appropriate mitigation solutions also have been shown to overcome the identified risks which might occur at different times during the concession period. It has become the responsibility of the promoter to assess and manage the risks with diligence to minimize or prevent any obstacle to the overall progress of the project. Risks have a vital role in a BOT project. Delmon has stated that, there are also other sources of risk that should be considered: capital budget, construction time, construction cost, operation cost, politics and policies, market conditions, stakeholders' cooperation and credibility as well as global economic environment.

4. Risks in BOT projects

Types of risks in BOT project

These risks can be categorized as follow:

A. Financial risks - currency risks, internet rate risk, equity risk, foreign exchange risk, commercial risk, liquidity risk, counter party risk and economic risk
B. Political risks - sovereign risks and country risk
C. Technical risks - construction risk and operation and maintenance risk

D. Other risks - market risk, inadequacy of concession contract, shareholders' risk and risks associated with changes among key management personnel Inexperienced promoter might overlook the risks in the BOT project due to lack of information and uncertainty about future condition and that also could be a risk. Consequently, alleviation measures must be established and supervised with care by means to reduce and manage the risks effectively to an acceptable level and minimizing the chances of project failure.

A. Financial risk

Investors and lenders are aware of certain risks and willing to face it, in order to gain the profit from their investment. The higher the risk, the higher the profit shall be gained.

- Project not bankable
- Lender(s) not comfortable with project viability
- Failure to arrange equity in time
- High change in the cost of debt
- Delay in debt syndication
- Risk aversion/apprehension of lenders to BOT financing
- Adverse investment climate (legal and regulatory environment)

B. Political risk

The project company and the lenders face the risk that the project execution may be negatively affected by acts of the contracting authority (Government), another agency of the Government or the host country's legislature. Such risks are often referred to as political risks

- Nationalization of project
- Changes in law
- Development approvals
- Adverse government action or inaction
- Payment failure by government
- Increases in taxes
- Political force majeure (including changes in government)

C. Technical risk

Technical risk could be classified into construction risk and O&M risk. Essentially, technical risk is the most common and well understood form of risk. Technical risk is the subject of close surveillance. To minimize the technical risk, the concessionaire is responsible to evaluate the risk in detail to ensure the project will be constructed accordance to the design specification and host government's requirements and functioning well. Thus, well reputed and established consultant together with an experience contractor should be hired to implement the BOT project without any tolerance to the standard codes and practice.

D. Other risk

Apart from the discussed risk previously, there are also other risks associated to the BOT project. Market risk is based on the demand of the facility upon the completion the project. Thus, the promoter has to carry out extensive market research before embarking on the project. The revenues are generated upon completion of the project and very much depending on the end user. Poor feasibility study could cause the BOT project fail if there is no demand or failed to attract consumers. Significant risk occurs to the promoter when there is inadequacy in the concession's contract. This problem occurs during the tendering stage whereby some promoters simply tender in without properly understanding the major terms and conditions of the project as stipulated by the host government. The standard terms should be adopted during constructing the construction contract, operation and maintenance contract and other ancillary documents and agreed by both parties. Therefore, it is always recommended to call upon renowned tenders to bid or negotiate the project. Exit clause is very crucial in a BOT project. Disputes might occur in later stage due to unforeseen clauses of the project if the exist clause was not done properly and variation according to time or economic condition is not provided in the contract. Therefore, conflicts are reduced by referring the concession contract with the similar and proven contract. Good legal advisor who are familiar with the industry should be employed by concessioner and concessionee to check thoroughly the contracts before accepting it. The contract should benefit both parties without burdening the consumers. Personnel in key management of concession are very crucial and consist of a range of expertise. An ideal concessionaire organization must hire highly skilled and competent management personnel. They will be the backbone of the consortium as their involvement not just limited to project initiation, negotiation, implementation and project management or during transfer to the principal. They are familiar not only with the BOT process but with all contractual terms of the concession contract and actual project management as well. These personnel must be sustained to ensure the management team always efficient and productive. Poor working conditions and benefit could lead them to leave the organizations. In East Asia, very few promoters are providing benefits to their key management personnel in terms of employee share ownership scheme, profit sharing etc. This will enhance the productivity and level of performance of the team and sustain them.

E. Risks in various stages

1) Gestation risk

The main risk involved in the gestation stage relate to the costs being incurred in the research, appraisal and development of the concept of the project. There is a high probability that the concept of the project itself may not be accepted and be scrapped, thereby making all the costs incurred for the formulation of the study a bad investment that cannot be recovered. Furthermore, even if the decision is taken to develop

and implement the project, there is a possibility that the costs incurred at this stage may simply keep on increasing and occur again at the development stage.

2) Development stage

The main risks at the development stage relates to:

- Possibility of litigation impeding the progress of development of the project
- Rejection of the proposal by the concerned authority
- Possibility of alteration in the scope and basis of the project by the Government due to inadequacy of research at the gestation stage
- Delay in obtaining the requisite approvals to commence the project
- Risks associated with undertaking negotiations with the government body
- Risks relating to mobilization of finance, finding suitable equity investors.
- Risks relating to inability in obtaining suitable contractors for a suitable price and on suitable term.
- Risks relating to the acquisition of land for the project
- Political risk, for example, delay may be caused due to change in government and government policies.

3) Construction and Start-up stage

The general risks during the construction phase can be categorized into:

- Physical
- Construction
- Design
- Technology risks

The physical risks relate to ground conditions, natural conditions, adverse weather conditions, physical obstructions that would adversely affect the implementation of the construction activities at the project site. The construction risks relate to the factors adversely affecting the very ability to undertake construction activities such as availability of resources, industrial relations, safety during construction, quality of raw materials, workmanship, delay in supplies and construction activities, construction techniques, failure to comply with construction milestones, cost of construction, insolvency, etc. The design risks relate to, as the term itself suggests, the risks associated with the design of the project facility. These relate to incomplete design, design life, availability of information, compliance with standards, completion of design, viability of design, etc. The risks associated with technology used for the construction of the facility essentially relate to obsolescence of technology, thereby resulting in a relatively poor quality infrastructure facility and change in construction costs due to alteration in the technology being used.

4) Operational and Maintenance Stage

The risks during the operational phase can be divided into

- Operation risks
- Maintenance risks
- Revenue risks
- Personnel risks

The operating risks relate to conditions of operation of the facility, interruption of operations due to various reasons, fluctuation in costs associated with continued operations of the facility and actual demand or usage of the facility. The maintenance risks relate to the ability to conduct the required maintenance of the facility to maintain it at the standards stipulated. These risks include availability of resources, availability of sufficient time for carrying out the maintenance, number of times the maintenance is required to be carried out, the quantum of expenses related to maintenance activities, the degree of maintenance required: whether of a routine or major nature. Generally, even during the operation stage the monitoring mechanisms similar to those established for the constructive phase are continued in order to provide for some level of control over the risks faced by the lenders during the operation phase of the project. The revenue risk during the operation phase relates to the quantum of demand for the project facility or the services or commodities provided by the facility, as the case may be. This relates not only to the demand but the actual amount paid by consumers or users of the facility.

5. Conclusion

As a conclusion, risk analysis and mitigation is an important process necessary in order to achieve a successful project financing .The case study describes the project background, the project contractor, the financing of the project, the risk involved in each phase; the method used to limit the risks, the problems encountered the current status of the projects, as well as an overall assessment of the success or failure of the project. A BOT project in roads is affected by various options relating to the toll structure, toll revision schedule, extent of government grant, and the duration of the concession period. This paper described facilitates the study of the financial viability of a BOT project as affected by the concession period, as demonstrated by the case study. It is driven by European regulations on energy performance of buildings, what constitutes an element of the sustainable development policy.

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