International Journal of Engineering Research and Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 10, Issue 5 (May 2014), PP.01-05

Evaluation of Construction Risks Impact on Construction Project Manager's

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Abstract:- Risks have a significant impact on a construction project's performance in terms of cost, time and quality. As the size and complexity of the projects have increased, an ability to manage risks throughout the construction process has become a central element preventing unwanted consequences. Construction projects are always unique and risks raise from a number of the different sources. Construction projects are inherently complex and dynamic, and involving multiple feedback processes. A lot of participants – individuals and organisations a reactively involved in the construction project, and they interests may be positively or negatively affected as a result of the project execution or project completion. This naturally creates problem and confusion for even the most experienced project managers and contractors. This research work brings out certain common elements of risks and issues involved for any project life cycle. Here the project life cycle is arranged in six phases and the risk factor in each phase is assessed. For a construction project it is very important to look out for the threshold and risks involved for it to be handled easily and comfortably.

Keywords:- Construction industry, Importance Index, Infrastructure projects, Project Life cycle, Reliability Research, Risk management and Risk assessment

I. INTRODUCTION

Today, with globalization and urbanization, infrastructure construction projects are carried out all over world. Every project brings with it certain elements of risk. Management of these risks and issues are important so as to achieve the objectives of the project. For managing these risks and issues, risk assessment plan, risk management plan must be prepared along with construction management plans. Construction organizations know the importance of project management and scheduling of a project, they use several methods to assess the risk involved in the project.

Construction engineering has the feature of a long construction period, human and resources high input, and involves in many fields, thus a typical set of technical, human and capital fix upon the construction enterprise, making it has the characteristics of high input and risk. Risk Management has been identified as an inevitable tool to achieve the above objective.

Although India has spent a great portion of its GDP on infrastructure, it is still far from being adequate in amount and distributed properly geographically. The Indian government has realized that, just like other developing countries in the world, there are great deals of things for improving the performance in provision of infrastructure services. Inadequate funding and inefficient provision, operation and maintenance of infrastructure are the major problems that the government faces to in this sector. As one of the solutions to dealing with the problems, the central government and state government, have already given up their monopoly in this sector and encourage private involvement, including domestic private and foreign direct investment. Highway network plays an important role in the national economic development, by increasing the productivity and competitiveness. So, the Indian governments have taken numerous initiatives to improve the national highway network to keep pace with the demands of the economic development.

II. OBJECTIVES OF RISK MANAGEMENT

A. Definition of Risk

Risk is a negative discrepancy between the actual consequence of a certain activity or action and the expected objective thereof caused by an unfavourable event which would probably occur in the future.

B. Definition of Risk Management

Risk management may be defined as a process to control the level of risk and to mitigate its effects. It is a systematic approach for identifying, evaluating and responding to risks encountered in a project (Nummedal et al., 1996).The potential market of the construction project is very big, but it has long been occupied by a few transnational companies partially due to the serious risks involved in projects.

The purpose of risk analysis and project management is to help to avoid the most serious effects of risk can be summarized as follows:

- To keep within the cost estimate
- To achieve the required completion date
- To achieve the required quality and operational requirements

C. Risk identification and Risk Classification

The first step for risk management is to identify the risk and analyse it. And the risk identification is to identify the risk source, determine the risk occur condition, describe the risk features and evaluate the risk effect. Risk classification is a significant step in the risk management process, as it attempts to structure the diverse risks affecting a construction project life cycle. A population consists of the totality of the observation with which we are concerned (Walpole & Myers, 1998).

III. RESEARCH METHODOLOGY

The research methodology selected for this risk management project comprised a comprehensive literature review, a postal questionnaire to the construction industry practitioners and a statistical analysis of the survey data. The questionnaire consisted of two phases. Phase 1 solicited general information about the respondents. Phase 2 carried a total of 45 risks associated with construction projects life cycle and asked respondents to review and indicate the deduction of risks as low, medium, high, severity of loss due to the risks as very low, low, medium, high, very high, Probability of occurrence of these risks as very low, low, medium, high, very high and the level of impact on each project objective that would result in as high, medium or low. These risks were mainly sourced from Laya Parvizsedghy et al. (2011).

In this research, 10 projects were selected which were executed or under execution and some interviews were conducted with their professionals by closed questioning methods. Consequently, the risks of these projects were identified and generalized in order to constitute a comprehensive checklist to identify the various types of projects' risks in project life cycle. The methodology adopted in this research is outlined in figure 1.

A. An Overview of Risks in a Project Life Cycle

A questionnaire containing six phases and checklist with 45 factors was developed to facilitate data collection for a project management process as followed

1. Stage I: Concept and Feasibility Study
2. Stage II: Fund Raising & Financial Closure
3. Stage III: Tendering, Bidding & Award of Project
4. Stage IV: Project Planning & Main Procurement
5. Stage V: Contract Execution, Monitoring and Control
6. Stage VI: Project Closure, Claims Settlement and Defect Liability

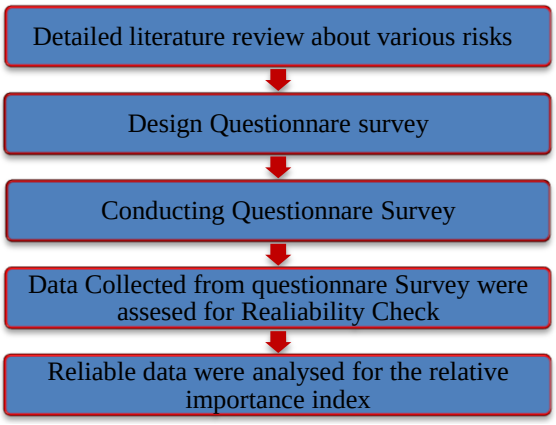

Figure.1 A brief Outline of methodology adopted in this study

B. Risk Breakdown Structure

Each risk was included in the group that was considered to be mostly significant even though, it could take place in another phase too. The risk breakdown structure is presented in table 1.

Table. 1: Risk Breakdown structure

Risk Breakdown Structure	
Concept and Feasibility Study	• Political policy changes in the country • Economic feasibility of project • Lack of clarity about legal framework and restriction
Fund Raising And Financial Closure	• The change of government • Inflation of major material cost • Detailed project report prepared is not based on realistic data
Tendering, Bidding, and Award of Project	• Failed to discuss about the technical details ,drawings • Various permissions to be obtained from Authorities • Non availability of drawings &Technical specification data
Project Planning and Main Procurement	• Escalation for the major resources • Client's decision on major procurement, and technical decision Procedure for payment of imported components
Implementation Phase: Contract Execution and Design	• Land acquisition necessary for Project • Lack of safety precautions • Variation in quantities
Project Completion and Handing Over	• Change in scope or quantity variation • Delays in Settlement • Cost overruns of maintenance expenses

IV. QUALITATIVE ANALYSIS

A. Internal Consistency of Four Parameter

In order to prioritize risks upon their average importance index of 4 parameter i.e. deduction of risk, severity of loss, Probability of occurrence and risk impact on project a questionnaire with the pre-defined risks was developed in which each expert was asked to answer 4 questions for each item and they were:

- First: Can deduction of risk in advance in the range of 1 to 3
- Second: severity loss in their project in the range of 1 to 5
- Third: what was probability of occurrence in their project in the range of 1 to 5 and
- Fourth: they should have rated the risk based on its impact on the project in the range of 1 to 3

After gathering up the questionnaires, Reliability of the research was done and followed by the data analysis. The reliability of a survey is the degree of consistency which measures the attribute; it is supposed to be measuring (Poilt and Hungler, 1985). The less variation and survey produces in repeated measurements of an attribute, the higher its reliability. Using Cronbach's Alpha the reliability of scales of the questionnaire between each field measured. The normal range of Cronbach's coefficient alpha value between 0.5 and + 1.0, and the higher values reflects a higher degree of internal consistency. As shown in table 2, the Cronbach's coefficient alpha was calculated for the four category of risk assessment of the questionnaire.

Table. 2: Internal consistency of four attributes

Reliability for four parameter	Cronbach's alpha	Internal Consistency
Deduction of Risk	0.841	Good
Severity of Loss	0.959	Excellent
Probability of occurrence	0.957	Excellent
Impact on Project delay	0.928	Excellent

B. Data Analysis

Deduction Index: A formula is used to rank the risks in project life cycle based on deduction of risk as identified by the participants.

Deduction Index (D.I.) (%) = $\sum$ a (n/N) x 100/3

Impact Index: A formula is used to rank the risks in project life cycle based on Impact on project as identified by the participants.

Impact Index (I.I.) (%) = ∑ a (n/N) x 100/3

Frequency index: A formula is used to rank the risks in project life cycle based on frequency of occurrence as identified by the participants

Frequency Index (F.I.) (%) = ∑ a (n/N) x 100/5
Severity index: A formula is used to rank the risks in project life cycle based on severity as indicated by the participants.
Severity Index (S.I.) (%) = ∑ a (n/N) x 100/5

- Where as a denotes the constant expressing weighting given to each response, n is the no of the responses, and N is the total number of responses

Importance index: The importance index of each cause is calculated as a function of deduction, Impact, frequency and severity indices, as follows:

Importance index: (IMP.I) (%) = ((F.I (%) x S.I (%))/100+ (I.I (%) x D.I (%))/100)/2

Data from questionnaires were processed statistically and the important index for the factors was computed. Importance index (I.I %) for the top 20's will be listed below as per Table 3.

Table. 3: Importance index for top 20's

S.NO	FACTORS	GROUP	IMPORTANCE INDEX (%)	RANKING
1	Change of government	STAGE II	70.36	1
2	Land acquisition	STAGE V	67.14	2
3	Exchange rate of currency	STAGE II	62.22	3
4	Lack of safety precautions	STAGE V	62.10	4
5	Inflation of major material cost	STAGE II	61.52	5
6	Political policy changes in the country	STAGE I	60.94	6
7	Non–availability of materials & proper subcontractors	STAGE V	59.32	7
8	Escalation for the major resources	STAGE IV	58.96	8
9	Variation in quantities	STAGE V	58.86	9
10	Project estimate is reachable.	STAGE II	56.87	10
11	Clarification about the technical details ,drawings	STAGE III	56.13	11
12	Client's decision on major procurement	STAGE IV	55.45	12
13	Quantity Variation clause	STAGE V	54.66	13
14	Procedure for payment of imported components	STAGE IV	54.47	14
15	Key procurement items	STAGE IV	54.43	15
16	Non availability of drawings &Technical specification	STAGE III	53.71	16
17	Approval of design or change in design	STAGE V	52.74	17
18	Various permissions to be obtained from Authorities	STAGE III	51.73	18
19	Approval of detailed drawings and layout design	STAGE IV	51.71	19
20	Coordination between various external agencies	STAGE VI	51.71	20

Furthermore, average importance index proved that the largest total number was also related to the implementation phase of project life cycle with relatively high difference and next phase with high difference is planning and procurement, while other four phase had approximately of equal scores. The Average Importance Index of each phase is shown in table 4.

Table.4 Average Importance Index of Each Phase

Phase	Description of Phase	Phase average importance index	Ranking
STAGE V	Implementation Phase/ Execution & design	23.90%	1
STAGE IV	Project Planning and Main Procurement	18.19%	2
STAGE II	Fund Raising And Financial Closure	16.98%	3
STAGE III	Tendering, Bidding, and Award of Project	15.90%	4
STAGE VI	Project Completion and Handing Over	15.11%	5
STAGE I	Concept and Feasibility Study	9.93%	6

As a result each risk was grouped in either the very high, high, medium, low or very low. Analysing the results of risk groupings resulted in that 24% of the risks factors were in the implementation phase.

V. CONCLUSIONS

While most research has focused on some aspects of construction risk management, this research endeavoured to identify key risks associated with the achievement of all project objectives in terms of cost, time, quality, environment and safety. On the basis of a survey with industry practitioners owning robust experience and knowledge of construction projects,45 key risks were highlighted on a comprehensive assessment of their deduction in advance, severity of loss Probability of occurrence and level of impacts on project objectives. Checklist of identified risks will be helpful for contractors to identify their potential risks in the future projects in different phases, they can be specialized due to conditions of their project. The scores of importance index will help these contractors prioritize risks and also they can do a survey to score on their own conditions. Moreover, contractors should determine their strategy to mitigate top risks effects and increase their chances of success. The items proposed as responses for top ten risks should be reviewed and the best action to decrease the negative impacts of risks in these projects should be taken. Further considerations should be taken in the implementation phases of projects as the results show that this phase is vulnerable to the highest risks.

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