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Qualitative Study on Construction Project Risk

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ABSTRACT

Construction industry involves complex interrelated unique activities of varying nature. The nature of different projects are in themselves complex and big and involve a lot of finance from various stakeholders. Many project managers neglect the risk assessment and take actions only if any risk emerges which is again a new task and may affect the project in terms cost, time schedule,and quality Hence, to reduce these losses a proper and efficient management of a construction risk management is required. The aim of this study is to emphasize the importance of risk management in construction, identifying factors which contribute to risk and their impact on the project. Findings of this study suggest that controlling and minimizing the level of the risks in construction projects and taking optimal precautions for different risks are important in order to prevent failure of a project.

Keywords: construction projects, riskmanagement, factors

INTRODUCTION

In India, the construction industry is the second largest employer when compared to agriculture. Buildings have been considered as one of the most valuable assets of a nation to provide people with shelter and facilities for work. Building construction projects are some of the most dynamic, risky and complex endeavors (K. Jayasudha, 2014). The construction industry is one of the largest segments of the Indian economy. India's construction industry will continue to expand over the forecast period (2016–2020), with investments in residential, infrastructure and energy projects continuing to drive growth. Various government flagship programs – including "100 Smart Cities Mission", "Housing for All", "Atal Mission for Urban Rejuvenation and Transformation" (AMRUT), Make in India and Power for All (The Future of Construction Sector in India, 2016).

A proper management system is required to carry out the project and moreover,various risk isinvolved in the construction of such complex projects. The construction firms operate in a very uncertain environment where conditions can change drastically due to the complexity of each project (Akintola S Akintoye, 1997).

However, it should be kept in mind that risk management is not a tool which gives an idea of success but acts as a tool which helps to increase the probability of achieving success.

Risk is defined as "a situation where there exists no knowledge of its outcomes. Project risk management is an important aspect of project management.

According to the Project Management Institute's PMBOK, risk management is one of the ten knowledge areas in which a project manager must be competent. Project risk is defined by PMI as, "an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives (Project Management Institute, 2013).

Risk is a high possibility in the construction industry due to the vast difference in construction practices. The construction process is quite complicated and of long duration, hence the likelihood of the occurrence of an event or risk cannot be predicted at the start of the project with assurance. There can be several risks such as legal, political and environmental which can occur which were not predicted during conception phase (Hyun-Soo Lee & Moonseo Park, 2012). Risk management in a particular project deals with identifying factors that

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could potentially negatively impact a project's cost schedule or quality baselines; quantifying the associated impacts of the identified risk and implementing measures to manage and mitigate the potential impact. The riskier the activity is, the costlier are the consequences if the wrong decision is made. Knowing how much risk is involved will help to take a decision regarding the choice of measure to be taken for reduction of risk or acceptance of risk depending on severity. Risks such as natural disaster, are unavoidable and affect the project and humans hence should be mitigated by proper management (Mehdi Tadayon & Nasri, 2012).

METHODOLOGY

Risk Identification is done by questionnaire or previous data and records. "Risk identification" is the process of determining risks that could potentially prevent the program, enterprise, or investment from achieving its objectives (Project Management Institute, 2013) It includes documenting and communicating the concern. However, risk identification remains a poorly understood process and its tools and techniques are less developed compared to those used in the risk analysis phase.

Qualitative methods are applicable when risk is to be placed on descriptive scale low to high which will refer to a numerical value as assigned by (Project Management Institute, 2013).Once all major risks in a project are identified, risk qualitative assessment is necessary to be conducted (Patterson & Neailey, 2002)which is a process for further analysis by assessing and estimating the probability of occurrence and impact of each risk.

Thispaper emphasizes on Qualitative Risk Management approach to minimize the impact of risk. From literature survey, it has beenobserved that several factors contribute to risk and their nature varies from project to project. Factors are subdivided into ten groups which comprise of total 66 sub -related factors. The major thirteen groups have been summarized in Table 1

Table 1.List of risk groups

Sr .No	Major Risk Factors	No of subfactors
1	Financial	11
2	Legal	07
3	Construction	19
4	Political	02
5	Regulatory	02
6	Physical	03
7	Management	06
8	Design	09
9	Environmental	02
10	Safety	04
	Total	65

Primary data associated with risk analysis was collected through questionnaire survey circulated among different experts working in the construction sector. The respondents rated these risks on basis of the probability of occurrence and impact. Further, this qualitative information was used to calculate a riskscore.

Table 2. Probability -Impact Range

P-I Range	Very Low	Low	Moderate	High	Very High
Probability	0-0.1	0.11-0.2	0.21-0.4	0.41-0.7	0.71-1.0
Impact	0.05	0.10	0.20	0.40	0.80

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Table 3. P-I Matrix with corresponding Risk Score

Impact	Probability	Very Low	Low	Moderate	High	Very High
		0.05	0.1	0.2	0.4	0.8
Very High	0.9	0.05	0.09	0.18	0.36	0.72
High	0.7	0.04	0.07	0.14	0.28	0.56
Moderate	0.5	0.03	0.05	0.10	0.20	0.40
Low	0.3	0.02	0.03	0.06	0.12	0.24
Very Low	0.1	0.01	0.01	0.02	0.04	0.08

A Probability-Impact was prepared from corresponding values from range as per Table *2*. **Probability - Impact Range**

A risk acceptability matrix is based on a simple multiplication of the scale values assigned to probability and impact. Probability is given scale between 0.1 and 0.9 and impact between 0.05 and 0.8, these two dimensions are combined to determine whether a risk is considered low, moderate, or high.

The P-I matrix can be developed using ordinal or numerical scales; linear or non-linear (Project Management Institute, 2013).The values finalized for probability are 0.1, 0.3, 0.5, 0.7, 0.9 and impacts are 0.05, 0.1, 0.2, 0.4, 0.8.

P-I matrix which is preparedwhere the upper right value in right section is critical, values lying in lower bottom portion are non-critical and the values lying in middle are moderate.

Note: The values have been round off upto two decimal.

DATA ANALYSIS

The survey result wasanalyzed using risk equation. To assess the relative significance of risks, previous literature study suggests establishing a risk matrix by calculating the significance score for each risk is important. For calculating the significance score probability of occurrence is multiplied by the degree of impact.Thus, the significance score of each risk assessed by each respondent can be obtained through (Risk equation)

$$R=P \times Q \qquad \text{……Equation 1(Risk equation)}$$

Where:

R= the degree of risk

P= Probability of risk occurrence

Q= the consequences or perceived impact of risk

Table 2. Risk Score with main factors

Sr.No.	Major Risk Factors	Risk Score
1	Financial	0.18
2	Legal	0.14
3	Construction	0.16
4	Political	0.20
5	Regulatory	0.19
6	Physical	0.10
7	Management	0.24
8	Design	0.18
9	Environmental	0.17
10	Safety	0.20

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From above results, it was observed that Management risk scored highest. Also from management risk point of view, the major subfactor contributing is improper resource allocation, which is also major area of to be planned, as resource includes men, material, machines. However optimum use is not being achieved it will lead to waste of material, loss of working hours.

Also from Political risk the major sub factor with highest risk score is interference of local political parties which halts the project activities.

RESULT AND DISCUSSION

Table 3. Ten Major Sub factors contributing Risk

Sr.No	Sub Factors	Respective Main factor	Risk Score	Result	Comments
1	**Additional expense due to towards delay**	Financial	**0.28**	High	Requires Action
2	Delay in decision making after disputes	Legal	0.20	High	Requires Action
3	**Unavailability of construction workers**	Construction	**0.28**	High	Requires Action
4	Interference of local political parties	Political	0.20	High	Requires Action
5	Change in Housing rule (RERA)	Regulatory	0.20	High	Requires Action
6	Natural disaster	Physical	0.14	Moderate	Requires Monitoring
7	Improper resource allocation	Management	0.24	High	Requires Action
8	**Frequent design change (revision)**	Design	**0.28**	High	Requires Action
9	Bad weather	Environmental	0.20	High	Requires Action
10	No safety training	Safety	0.18	High	Requires Action

Table 3shows the top 10 sub factors with the highest risk score, the results of risk score of theses sub factors lies between 0.14 to 0.28 where 0.14 being the moderate and 0.28 being the high score. It can be seen thatfrequent design change, unavailability of construction workers, and additional expenses due to delay are with highest risk score of 0.28 which requires action.

Delays and cost overruns are too frequent and too large to be accounted for by imperfect techniques, contractual incompleteness and inflationary fluctuations. Delays and cost overruns reduce the efficiency of available economic resources and limit the growth potential of the entire economy. Thus additional cost which will contribute to delay is high risk factor and corrective measures should be taken so that the project get completed within the allocated budget.

The success of any construction project is largely dependent on the availability of continuous, skilled labor at all levels. Shortage of skilled workers hinders the progress of work leading to delay in meeting deadlines i.e. timely output. Skilled manpower will result in better quality of work and minimize re-work which will result in timely completion of projects.

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Sr. No.	Main factors	Sub factors
1.	Financial	a) Unavailability of budget for the whole project b) Loss in Profit due to Scope Change c) Expense towards breakdown of heavy machinery d) Expenses towards taxes e) Additional expense due to towards delay f) Bill of Quantity increase due to change in design g) New technology or material used at mid-stage of project which was not in tender h) Cash flow problems i) Business disruption of partners j) Loss due to defaults of contractors or suppliers k) False Estimate
2.	Legal	a) Conflict between contractor and client b) Misinterpretation in contract and tender c) Lack of communication between the involved parties d) Delay in decision making after disputes e) Frequent changes in contract terms f) No arbitrator appointed for legal issues g) Documentation incomplete
3.	Construction	a) Unavailability of construction workers b) Unbalanced tender c) No leadership d) No decision making (one Control) e) Standard material not used f) Poor quality g) Low productivity h) Lack of database i) No planned schedule j) Delay in estimated activity k) Frequent sickness and absence of officers l) Change in engineering staff m) Unavailability of equipment's, machines n) Poor ground conditions(geotechnical) o) Damages during construction p) Coordination failure of construction workers q) Theft(Internal/external) r) Poor communication among staff, engineers s) Low quality and unavailability of contractors and sub-contractors

4.	Political	a) b)	New government laws and legislation Interference of local political parties
5.	Regulatory	a) b)	Change in Taxation system (GST) Change in Housing rule (RERA)
6.	Physical	a) b) c)	Breakdown of epidemic /disease Natural disaster Act of God
7.	Management	a) b) c) d) e) f)	Poor site management Lack of supervision by concerned (in charge) Improper resource allocation Ambiguous planning Frequent change in top management Change in scope of work
8.	Design	a) b) c) d) e) f) g) h) i)	Frequent design change (revision) Inaccurate BOQ Defective design Work not executed as per drawing Frequent change in top management Change in scope of work Likelihood of design changes at mid stage Late confirmation & approval on design No co-ordination between site and structural engineer
9.	Safety	a) b)	Pollution at site Bad weather
10.	Environmental	a) b) c) d)	No safety engineer No safety training Accidents Injured while performing task

Changes usually occur at any stage of a project due various causes from different sources and have considerable impacts. Lack of timely and effective communication, lack of integration, uncertainty, a changing environment and increasing project complexity are the drivers of project change. Additionally, these changes in project can cause substantial adjustment to the contract duration, time, total direct and indirect cost or both. Conflict over project changes can be minimized when the problem is found at the earlier phase of the project.

The least subfactor is natural disaster from Physical risk as chances of such occurrence is very rare.

CONCLUSION

The identification and assessment of risks related to construction activities play an important role in successful completion of the project. This study has investigated risk assessment of different construction activities in the residential project.

Result of this study indicate that most of the activities considered under study falls in the range of High Risk which requires an immediate action followed Low Risk, where occurrence of such risk is not predictable and

if it occurs will have very high impact on project as in case of natural disaster this analysis will help construction managers to identify the various risk associated in construction activity together with its probable consequences on the project and plan for risk monitoring and control. Risk monitoring involves tracking of identified risk, new risk,and evaluation of risk response. The main output of risk monitoring and control is to create a corrective action plan and decrease the impact of risk on a construction project for timely completion, without increasing the estimated cost, no change in scope of the project and give quality which is of prime importance

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Factors are subdivided into ten groups which comprises of total 65 sub related factors are summarized as shown Table

Table 4 Probability-Impact Scale

	Very Low	**Low**	**Moderate**	**High**	**Very High**
Probability	0-0.1	0.11-0.2	0.21-0.4	0.41-0.7	0.71-1.0
Impact	0.05	0.1	0.2	0.4	0.8

The values given in **Table 4**

Table 5 Probability-Impact Matrix

Impact / Probability		Very Low	Low	Moderate	High	Very High
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Low	0.3	0.02	0.03	0.06	0.12	0.24
Very Low	0.1	0.01	0.01	0.02	0.04	0.08

Risk =Probability x Impact .....Equation 2

Where:

R= the degree of risk

P= Probability of risk occurrence

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Q= the consequences or perceived impact of risk

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2	Legal	0.14
3	Construction	0.16
4	Political	0.20
5	Regulatory	0.19
6	Physical	0.10
7	Management	0.24
8	Design	0.18
9	Safety	0.17
10	Environmental	0.20

Low	0.01,0.02,0.03,0.04	Transfer
Moderate	0.05,0.09,0.07,0.05,0.14,0.10,0.06,0.12,0.08	Required Monitor
High	0.18,0.36,0.72,.0.28,0.56,0.20,0.40,0.24	Requires Action

Rank	Sub Factors	Respective Main factor	Risk	Severity	Actions
1	Additional expense due to towards delay	Financial	0.28	High	Requires Action
2	Delay in decision making after disputes	Legal	0.20	High	Requires Action
3	Unavailability of construction workers	Construction	0.28	High	Requires Action
4	Interference of local political parties	Political	0.20	High	Requires Action
5	Change in Housing rule (RERA)	Regulatory	0.20	High	Requires Action
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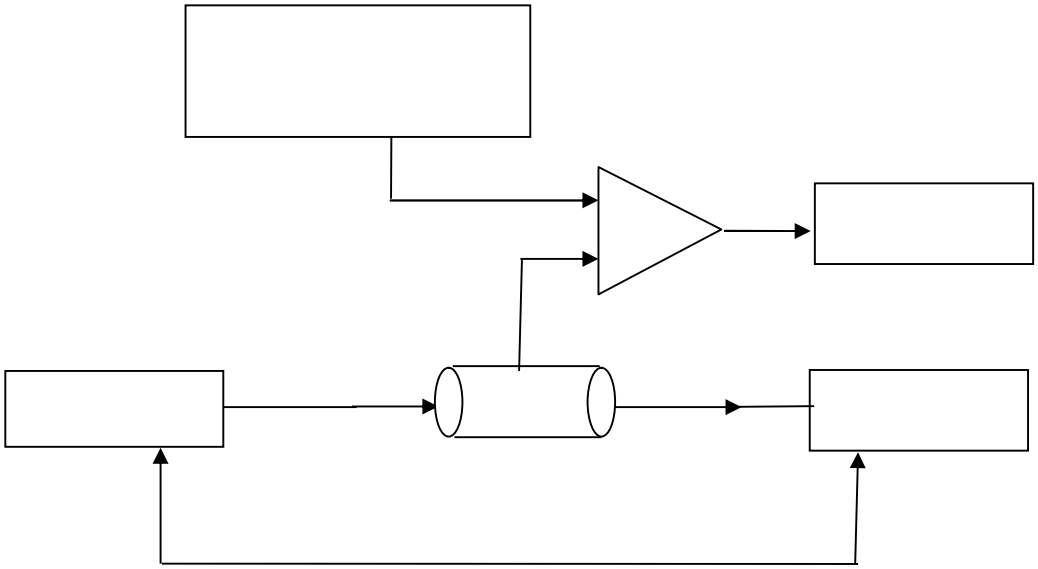

Fig 1: Image

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