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RISK IDENTIFICATION ANALYSIS IN CONSTRUCTION PROJECT

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Abstract: ***Risk Management in construction projects has been recognised as a very important management process in the project life cycle. However, until now most research has focused on some aspects of construction risk management rather than using a systematic and holistic approach to identify risks and analyse the likelihood of occurrence and impacts of these risks. This paper aims to identify and analyse the risks associated with the development of construction projects from project stakeholder and life cycle perspectives. Postal questionnaire surveys were used to collect data. This paper is based on the construction phase's risks. This study related to architects, contractors, structural engineers and developers. For the data analysis RII technique and IMPI techniques are used. Among all the risk events "Poor design check by consultant regarding the level of complexity and type of construction","Poor or defective design due to using inappropriate design parameters","Mistake in design", "Change of design because of poor understanding of customer needs", "Not finding a bank to finance the project", "Delay in contract issue by owner of the project",these six events are commonly find by both RII and IMPI technique.***

Keywords: **Construction Phases, Life cycle of construction project, Management Phase, Risk Management, Risk Event.**

I. INTRODUCTION

Risk management may be described as "a systematic way of looking at areas of risk and consciously determining how each should be treated. It is a management tool that aims at identifying sources of risk and uncertainty, determining their impact, and developing appropriate management responses" (Uher, 2003).

A systematic process of risk management has been divided into risk classification, risk identification, risk analysis and risk response, where risk response has been further divided into four actions, i.e. retention, reduction, transfer and avoidance (Berkeley et al., 1991; Flanagan and Norman, 1993).An effective risk management method can help to understand not only what kinds of risks are faced, but also how to manage these risks in different phases of a project.

Construction projects can be extremely complex and fraught with uncertainty. Risk and uncertainty can potentially have damaging consequences for the construction projects. Therefore nowadays, the risk analysis and management continue to be a major

feature of the project management of construction projects in an attempt to deal effectively with uncertainty and unexpected events and to achieve project success.

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 are actively involved in the construction project, and they interests may be positively or negatively affected as a result of the project execution or project completion. Different participants with different experience and skills usually have different expectations and interests. This naturally creates problems and confusion for even the most experienced project managers and contractors.

Each PMI knowledge area in itself contains some or all of the project management processes. For example, project risk management includes:

- **Risk management planning;**
- **Risk identification;**
- **Qualitative risk analysis;**
- **Quantitative risk analysis;**
- **Risk response planning;**
- **Risk monitoring and control.**

II. METHODOLOGY OF WORK

Data Analysis Approach

The collected data were analysed through the following statistical techniques and indices:

The Relative Importance Index:The Relative Importance Index (RII) will be used to rank (R) the different risks. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the four groups of respondents (i.e. Architect, Contractors, Builder/Developer and Structural Engineer). Each individual risks‟s RII perceived by all respondents will be used to assess the general and overall rankings in order to give an overall picture of the risks of construction in Indian construction industry. This RII technique is used by many researchers like Fugar et al., (2010),Kometa et al.,(1994) to rank the causes of delay in construction projects of Ghana. The formula to calculate RII given below:

$$RII = \frac{\Sigma W}{AN}$$

Where,

W = Weighting given to each factor by the respondents (ranging from 1 to 4),
A = Highest weight (i.e. 4 in this case),
N = Total Number of respondents.

1. *Importance Index as a Function Of Frequency And Severity Indices.*

Assaf and Al- Hejji (2006) used this same technique to rank the causes of delay of large construction projects of Saudi Arabia.

Frequency index: A formula is used to rank risk event based on frequency of occurrence as identified by the participants.

$$\text{Frequency Index (F.I.) (\%)} = \Sigma\, a\, (n/N) * 100/4$$

Where,

a = constant expressing weighting given to each response (ranges from 1 for rarely up to 4 for always),

n = frequency of the responses,

N = total number of responses.

Severity index: A formula is used to rank risk event based on severity as indicated by the participants.

Severity Index (S.I.) (%) = Σ a (n/N) * 100/4

Where,

a = constant expressing weighting given to each response (ranges from 1 for little up to 4 for severe),

n = frequency of the responses,

N = total number of responses.

Importance index: The importance index of each event is calculated as a function of both frequency and severity indices, as follows:

Importance Index (IMP.I.)(%) = [F.I. (%)* S.I. (%)]/100

Sample Size Calculation

The number of population of various groups in various cities is shown in table 5.1.To obtain a statistically representative sample of the population, the formula shown in Eq. (1) was used (Hogg and Tannis 2009) :

$$n = \frac{m}{1 + \frac{m-1}{N}} \quad \text{----------------------- (1)}$$

Where n, m, and N = the sample size of the limited, unlimited, and available population, respectively. m is estimated by Eq. (2):

$$m = \frac{z^2 * p * (1 - p)}{\varepsilon^2} \quad \text{----------------------- (2)}$$

Where z = the statistic value for the confidence level used, i.e., 1.96, and 1.645, for 95%, and 90% confidence levels, respectively; p = the value of the population proportion that is being estimated; and ε = the sampling error of the point estimate. Because the value of p is unknown, Sincich et al. (2002) suggested a conservative value of 0.50 be used in a sample size.

$$m = \frac{1.96^2 * 0.5 * (1 - 0.5)}{0.05^2} = 385 \quad \text{----------------------- (3)}$$

Here confidence level is taken as 95% .Now,

$$n = \frac{385}{1 + \frac{385 - 1}{3755}} = 350 \quad \text{----------------------- (4)}$$

Table 1 Stastics of Architects, Contractors & Structural Engineers in Identified cities of South Gujarat

City	Architect (No.)	Contractor (No.)	Structural Engineer(No.)
Surat	25	25	25
Navsari	15	15	15
TOTAL	40	40	40
TOTAL	**120**		

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Survey Results

Table 2 Total Percentage of Questionnaire Distributed and Responses Received

Sr. No	Respondent	Questionnaire Distributed	Responses Received	Percentage of Responses
1	Architect	40	28	70%
2	Contractor	40	21	52.5%
3	Structural Engineer	40	20	50%
	Total	**120**	**69**	**57.5%**

Data analysis methods

Data were gathered through a survey & analysed by using two different techniques:

(1) Relative Importance Index (RII) Technique

(2) Importance Index (IMPI) Technique.

IMPI Technique: In this method of analyzing data, for each risk event two questions were asked to find out Frequency Index and Severity Index and on basis of this Importance index is calculated for ranking to risks. These two questions were what is the frequency of occurrence for this risk? And what is the degree of severity of this risk on project delay? Both frequency of occurrence and severity were categorized on a four point scale. Frequency of occurrence is categorized as follows:

RII Technique*:* The procedure used in analyzing the results was aimed at establishing the relative importance of the various risk events responsible for project failure by giving rank to the risk event by RII technique. The questionnaire gave each respondent an opportunity to identify the factor that was likely to risks by giving the response "very important, important…..etc."

Frequently occurred Top Ten Risks

Based on the ranking, Frequently occurred Top 10 risks of construction project are following:

Table 3 Frequently Occurred Top 10 Risks (Frequency Index base)

RANK	RISK EVENTS	FI FI(%) = (100/(4*50))*∑w
1	Poor design check by consultant regarding the level of complexity and type of construction	92.77
2	Poor or defective design due to using inappropriate design parameters	92.77
3	Mistake in design	90.06
4	Design process doesn't include sensitivity study to assess the impact of natural hazards	88.55
5	Imposed unrealistic time planning for project due to insufficient or incorrect information	81.33
6	Conflict of laws related to one of contract clauses (laws are not consistent)	80.72
7	Poor time Management due to change of manager or	80.72

	management strategies of the project	
8	Consultant is not informed about the changes in project	82.83
9	Complexity of project time management due to complex nature of the project	82.53
10	Design changes at this stage	79.22

Table 4 Frequently Occurred Top 10 Risks (Severity Index base)

RANK	RISK EVENTS	SI SI(%)=(100/(4*50))*∑w
1	Poor design check by consultant regarding the level of complexity and type of construction	83.73
2	Poor or defective design due to using inappropriate design parameters	82.83
3	Mistake in design	82.83
4	Imposed unrealistic time planning for project due to insufficient or incorrect information	81.63
5	Conflict of laws related to one of contract clauses (laws are not consistent)	80.72
6	Poor time Management due to change of manager or management strategies of the project	80.12
7	Design process doesn't include sensitivity study to assess the impact of natural hazards	79.82
8	Design changes at this stage	78.31
9	Delay in contract issue by owner of the project	77.71
10	Litigation conflict with neighbour of the project	76.2

III. CONCLUSION

There are totally Fifty Nine risks were deemed to be able to influence the project phases like Twenty factors are related to feasibility phase, Seven factors are related to contract phase, Thirteen factors are related to design phase ,Fourteen factors related to Construction phase and Five factors related to Management Phase.

Following Seven risks are commonly find as per the both technique.

- Poor design check by consultant regarding the level of complexity and type of construction
- Poor or defective design due to using inappropriate design parameters
- Mistake in design
- Imposed unrealistic time planning for project due to insufficient or incorrect information
- Conflict of laws related to one of contract clauses (laws are not consistent)
- Poor time Management due to change of manager or management strategies of the project

- Design changes at construction stage

REFERENCES

[01] Abdou,O.A.(1996)ManagingConstructionRisks, JournalofArchitecturalEngineering2(1), 3-10.
[02] Ahmed, S.M., Ahmad, R. and Saram, D.D. (1999) Risk Management Trends in the Hong Kong Construction Indus try: a Comparison of Contractors and Owners Perceptions, Engineering, Construction and Architectural Management, 6(3), 225-234.
[03] Baker,W.andReid,H.(2005) IdentifyingandManagingRisk,FrenchsForest,N.S.W.: Pearson Education.
[04] Berkeley,D.,Humphreys,P.C.andThomas,R.D.(1991)ProjectRiskActionManagement, Construction Management and Economics, 9(1), 3-17.
[05] Chapman R.J. (2001) The Controlling Influences on Effective Risk Identification and Assessment for Construction Design Management, International Journal of Project Management, 19, 147-160.
[06] Chen,H.,Hao,G.,Poon,S.W.andNg,F.F.(2004)CostRiskManagementinWestRail Project of Hong Kong,2004 AACE International Transactions.
[07] He,Z.(1995)RiskManagementforOverseasConstructionProjects,InternationalJournalof Project Management,13(4), 231-237.
[08] MERNA, A. and N. J. Smith. 1996. Projects Procured by Privately FinancedConcession Contracts (v. 1 and 2). Asia Law & Practice, Hong Kong.
[09] Moser,C.A.andKalton,G.(1971)SurveyMethodsinSocialInvestigation,UK:Heinemann Educational.
[10] Perry, J.H. and Hayes, R.W. (1985) Risk andIts Management in Construction Projects, Proceedings of the Institution of Civil Engineering, Part I, 78, 499-521.
[11] Schuyler,J.(2001).RiskandDecisionAnalysisinProjects(secondedition),Pennsylvania: ProjectManagementInstitute,Inc,USA.
[12] Shen,L.Y.(1997).ProjectRiskManagementinHongKong,InternationalJournalofProject Management, 15(2), 101-105.
[13] Wang,J.Y.andLiu,C.L.(2004)RiskManagementforConstructionProjects, Beijing:China Water Publication.