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RISK MANAGEMENT IN CONSTRUCTION PROJECTS USING STATISTICAL ANALYSIS

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ABSTRACT

Risk management is an important step which should not be neglect or ignore in every project. Because of various risk involved in construction, it is difficult to maintain time, cost and quality as planned. Project undertaken in the construction sector are widely complex and have often significant budgets, and thus reducing the risk associated should be a priority for each project manager. The main purpose of this paper is to identify the key risk factors that affect construction project. Questionnaires has been prepared incorporating of 155 difference questions after which questionnaire survey was conducted where the questions has been focused based on (component of questionnaire) the respondents were selected based on their susceptibility to the risk. The data was analyzed using the Statistical package for social sciences (SPSS) version 21. The result shows that the inadequate planning in construction project, poor adoption of site safety, supply and use of defective materials and poor resources management in construction project are all among the forefront key risk factors which affect construction project, meanwhile, effective recommendations have been developed to increases the efficiency, speedy and minimises risk and abortive work in construction project.

***Keywords: Construction Industries, Construction Projects, Risks Management,* SPSS**

I. INTRODUCTION

Risk management is the systematic process of identifying, analyzing, and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to meet the project objectives (PMI, 2000) [6]. The success or failure of any venture depends crucially on how we identify and deal with the risk factors which affect construction of our project. Every construction activity no matter what its size and complexity are, involves risks, which may vary in their final affect on deliverables (Dey 2002; [3], Poon et al, 2004) [5]. And "no construction project is risk free. Risk can be managed, minimized, shared, transferred or accepted. It can not be ignored" (Lutham, 1994) [4]. Moreover, complexity is introduced in to construction projects due to the tendency of developing large-sized Mega projects, which involve intricate designs and novel materials, escalating the overall exposure to risk and uncertainty (Akintoye and MacLeod, 1997; [2], Abdelgawad and Fayek, 2010) [1]. Therefore, to respond to these threats and avoid the failure of projects due to unmanaged risks, risk management must be fundamental to project managers (Royer, 2000; [7] Raz et al, 2010) [8]. Construction projects have been inculcated with various numbers of risks hence the factors affecting the risks have to be identified, which calls for a proper attention for this study. The aim of this study is to identifying the key risk factors which affect construction projects and

suggest affective recommendations for successful constructions of projects. detailed analysis of various construction risks factors which affect construction project such as the inadequate planning, poor adoption of site safety, supply and use of defective materials and poor resources management in construction project as well as effective recommendations for a successful attainment of project objective have been adopted.

II. OBJECTIVE

The objective of this paper is to identify the key risk factors which affect construction process and present an affective recommendation for adoption to avert the threat which causes severity effect to construction project.To spread awareness regarding risk management in the construction industry. It is needed to study risk management because its execution is very less in the construction industry compared to other industries due to lack of knowledge. The study begins with understanding the process of risk management. Afterwards the factors were identified for risk analysis. Then the questionnaires were prepared on impact of risk and probability of occurrence of risk. Then the data were collected from various personnel from the construction industry with ample amount of experience. After that, the data were analyzed with Statistical Package for Social Science (SPSS) software.

III. METHODOLOGY

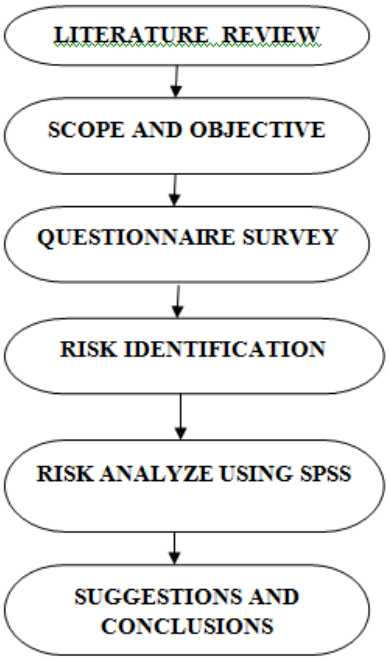


Fig 1 Project Methodology Flowchart

The paper adopted simple statistics method using qualitative data. A sample of 155 respondents was selected randomly from small and large construction companies in order to identify the key. The survey is done on 200 different construction companies. Totally 90 questions were asked which are meant to find out the key risk factors which affect construction process in their companies and to find out other various problems they face during construction. After the questionnaires have been collected, the analysis is done using Statistical Package

for Social Sciences (SPSS). The responses of the questions have been coded as numerals which resulted in finding out the frequency and percentage using the cumulative percentage formula.

3.1 Risks involved in the Construction Industry

The following Table:1 shows the different types of Risks involved in the Construction Industry.

Table:1 Risks involved in the Construction Industry

1. TECHNICAL RISK	**6. FINANCIAL RISK**
Incomplete design	Loss due to fluctuation of interest rate
Inadequate site investigation	Loss due to rises in fuel prices
Improper project planning and budgeting	Price fluctuation
Inadequate specification	Tax rate increase
	Foreign currency exchange rate fluctuation
2. TIME RISK	**7. POLICY AND POLITICAL RISK**
Excessive approval procedures in administrative government departments	Changes in laws and regulations
The contractor does not pay worker wages in due time	Restrictions on fund repatriations
Tight Project Schedule	Requirement for permit and late approvals
Inappropriate time allocation	Loss incurred due to Corruption and Bribery
3. CONSTRUCTION RISK	**8. ENVIRONMENTAL RISK**
Selection of material and equipments	Natural Disaster (Floods, earthquakes,.. etc.)
Equipment failure	Difficulty to access the Site (Very far, settlements)
Shortage of labours	Adverse weather conditions
Shortage of equipment	
Quality variations by the labours	
New technology implemented	
4. LEGAL RISK	**9. SAFETY RISK**
Breach of contract by project partner	Accidents on workers
Improper verification of contract documents	Unexpectedly falls of the floors
5. MANAGEMENT RISK	Electrical fires occurred
Change of top management	
No past experience in similar projects	
Internal management problems	

IV. DATA COLLECTION & ANALYSIS

The data were collected from total 155 numbers of respondents from different cities. The respondents were with ample amount of experience working in the construction industry. The collected data entered in a spreadsheet for further analysis. Analysis was done with Statistical Package for Social Science (SPSS) software.

Table: 2 Stastical Analysis in Risk Factors

Sl.No	Description of Risk	Mean
	TECHNICAL RISK	
1	Incomplete Design	3.019
2	Inadequate site investigation	3.0129
3	Improper project planning and budgeting	3.0645
4	Inadequate specification	2.8839
	TIME RISK	
5	Excessive approval procedures in administrative government departments	2.7871
6	The contractor does not pay worker wages in due time	2.8581
7	Tight Project Schedule	3.0065
8	Inappropriate time allocation	2.8774
	CONSTRUCTION RISK	
9	Selection of material and equipments	2.8323
10	Equipment failure	3.0452
11	Shortage of labours	3.0516
12	Shortage of equipment	3.0710
13	Quality variations by the labours	2.9097
14	New technology implemented	2.8129
	LEGAL RISK	
15	Breach of contract by project partner	2.9355
16	Improper verification of contract documents	3.0581
	MANAGEMENT RISK	
17	Change of top management	2.9548
18	No past experience in similar projects	3.2258
19	Internal management problems	3.0774
	FINANCIAL RISK	
20	Loss due to fluctuation of interest rate	3.1419
21	Loss due to rises in fuel prices	3.1161
22	Price fluctuation	3.3806
23	Tax rate increase	3.1290

24	Foreign currency exchange rate fluctuation	3.1548
	POLICY AND POLITICAL RISK	
25	Changes in laws and regulations	3.0903
26	Restrictions on fund repatriations	3.1484
27	Requirement for permit and late approvals	2.9935
28	Loss incurred due to Corruption and Bribery	3.1742
	ENVIRONMENTAL RISK	
29	Natural Disaster (Floods, earthquakes,.. etc.)	3.3484
30	Difficulty to access the Site (Very far, settlements)	3.2645
31	Adverse weather conditions	3.1355
	SAFETY RISK	
32	Accidents on workers	2.9613
33	Unexpectedly falls of the floors	3.3419
34	Electrical fires occurred	3.1161

Frequency Analysis

Frequency Analysis is used to find out the detailed information about each variable entered into a spreadsheet.

Table 3 Designation

	Frequency	Percent	Valid Percent	Cumulative Percent
General Manager	4	2.6	2.6	2.6
Project Manager	31	20.0	20.0	22.6
Project Engineer	45	29.0	29.0	51.6
Assistant Engineer	7	4.5	4.5	56.1
Site Engineer	63	40.6	40.6	96.8
Quantity Surveyor	3	1.9	1.9	98.7
Planning Engineer	2	1.3	1.3	100.0
Total	155	100.0	100.0	

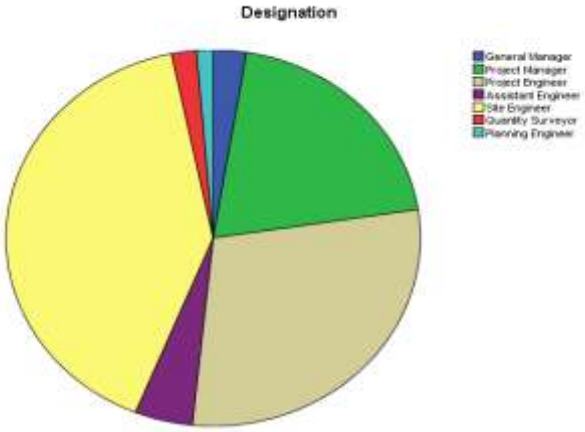


Fig: 3 Designations

Table 4 Educational Background

Educational Background				
	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	27	17.4	17.4	17.4
B.E	106	68.4	68.4	85.8
M.E	22	14.2	14.2	100.0
Total	155	100.0	100.0	

Fig 4 Educational Background

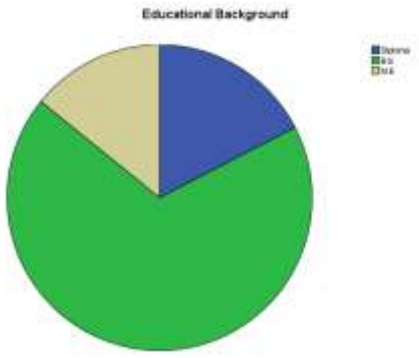


Table 5 Types of Organization

Types of Organization				
	Frequency	Percent	Valid Percent	Cumulative Percent
Government	24	15.5	15.5	15.5
Public	17	11.0	11.0	26.5
Private	114	73.5	73.5	100.0
Total	155	100.0	100.0	

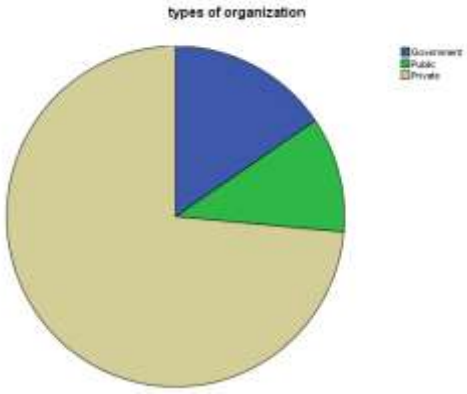
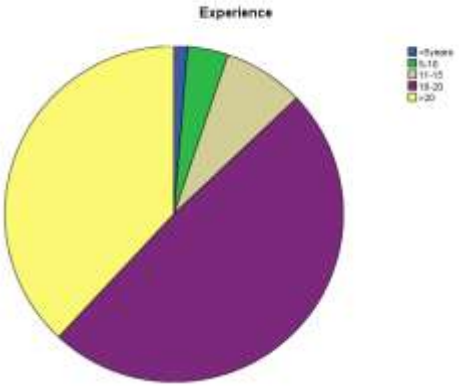


Table 6 Experience

Experience				
	Frequency	Percent	Valid Percent	Cumulative Percent
<5years	2	1.3	1.3	1.3
5-10	6	3.9	3.9	5.2
11-15	12	7.7	7.7	12.9
16-20	76	49.0	49.0	61.9
>20	59	38.1	38.1	100.0
Total	155	100.0	100.0	

Figure 6 Experience



V. RESULTS AND DISCUSSION

Totally for 200 companies the questionnaires were given, out of which 155 had an effective reply. Thus the response rate is 78% which is considered a good response in this type of survey. All the questionnaire survey was done from project manager, project engineer, site engineer of the project at the construction site. In some cases, consultant gave the answers on behalf of their clients, both from the owner and the contractor side. Even email reply was accepted since it was difficult to get the direct one to one meeting with the Project managers.

Risk management in construction of any project is very essential and a process to be giving priority by every construction company, larger, medium or smaller sized. The success of every construction project mostly is determined by the ability of the construction team to manage the risk and the process of implementing the project. it is conclusively identified that adequate planning, adoption of site safety, use of good and quality materials in construction as well as effective and efficient use of all the available resources are among the forefront factors for success that mitigate the amount of risk in construction project under the period of the study.

Therefore, to eliminate if not completely eradicate the number of risks usually encounter during construction of project one have to fully identify the factors that causes risk in construction of project and a possible process of mitigating them. For a project to be successful the following recommendations are hereby presented:

- Adequate planning should be provided before the commencement of project construction.
- Safety, rules and regulations in construction site should fully be maintained from the initial to final stage of construction.
- Durable and quality materials for construction should be supply and use properly.
- Efficient and Economical use of all the available resources should be adopted by all members of construction team.
- Land, Materials, Machineries and all other needed equipment should be supply immediately for effective utilization.

- Effective communications and corporations between all members of construction team should be adopted.
- Well trained and experienced workmen should be employed where necessary.

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