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Constructability Risk Assessment in Construction Projects

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Abstract: ***Construction projects are started in a very critical and dynamic environment which results in more number of uncertainties and risks, which have the demand of time constraints. Now a days construction industries are changing their scenario by day to day basis based on their needs and uncertainties that prevails all over the world. By taking into consideration of all the uncertainties or risks, the important role played by few risks aspects which includes Constructability risks, financial risks, technical risks and administrative risks etc. In the above risks, the constructability risk plays major role which affect the entire process and progress of the work. From the past literatures it is to be observed that Technology risk, design risk, construction risk, procurement risk , management risk are considered to be more important. To overcome the above hurdles certain risk identification approach i.e. Formal approach, informal approach, and static approach. A special team can also be appointed by the clients to identify, analysis and to take preventive measure of the before the start of the work itself.***

Key Words: Risk Identification, Construction risk management, Constructability risk, Descriptive Statistics.

I. INTRODUCTION

Construction projects are started in a very critical and dynamic environment which results in more number of uncertainties and risks, which have the demand of time constraints. Now a days construction industries are changing day to day. The primary stakeholders are private investors and the real estate developers. The implementation of new technology arises of risk and to shows a great exposure than the traditional one. Thus there is a need of risk assessments. Risk assessment is a process to identify the risk in the projects and to identify the preventive measures to rectify them. Risk assessment is an exposure of uncertainty. Some of the subjective analytical methods based on the historical information and the experience of individuals are used to identify the risks and uncertainty in the projects. Therefore, risk assessment is a tool that aims to identify and estimate risk impacted upon by a project. **[1]**. Risk and uncertainties are more in construction industries than overall other industries. It is a very critical purposes of planning, executing and maintaining of all project activities because of its complexness and time comings. The whole process requires numerous people with a set of skills and coordination to undergo complex and interrelated activities. This complexness may arises due to many external factors.

The construction industry have more trajectory records of copying with risks which directly affects time schedules, targets and sometimes the scope the projects. Few risks can be predictable or be identified easily and still some are very difficult to predict **[2]**. The various methods can be applied to manage the risk by transferring the risks, to other stake holders, avoiding the risks, minimising the effects of risk and accepting the risk in rare cases. All clients should use a special team to know and identify about risk and to operate with them in a successful manner. The old record do not match the current project scope. Each project are unique in its own way. They have different scope and objective, so it requires a unique skill to identify and manage the entire life cycle of projects **[3]**. The structure and development forms in the existence cycle of a development venture have customarily been isolated. This partition of plan and development has caused numerous issues as the architect deals with his very own to create plans which may require exorbitant and muddled succession and technique to develop. The term Constructability is a downcast to earth approach which incorporates more development procedure to give an increasingly compelling and prudent answer for a development venture. As ventures become progressively muddled and development markets get increasingly aggressive all inclusive, there is a developing need to incorporate plan also, development to convey extends in the best way and eventually offer some benefit for cash to the customers. **[4]**

II. TYPES OF RISK

The types of risk is categorised into various range. The risk types may differ based on the business enterprise and from one worker to another. The risk can be differentiated based on risk monetary loss, the fundamental development of organisation, enterprise disputes leads to the organisation risks. It is mandatory to identify and find out the hazard as early as possible. Based on these findings we can take appropriate approach which prevents or reduces risk in the project. This may also reduce the terribleness that is going too occurred on the future. Risks can be seen as business, technical, or operational. Figure shows the classification of the risks**,**

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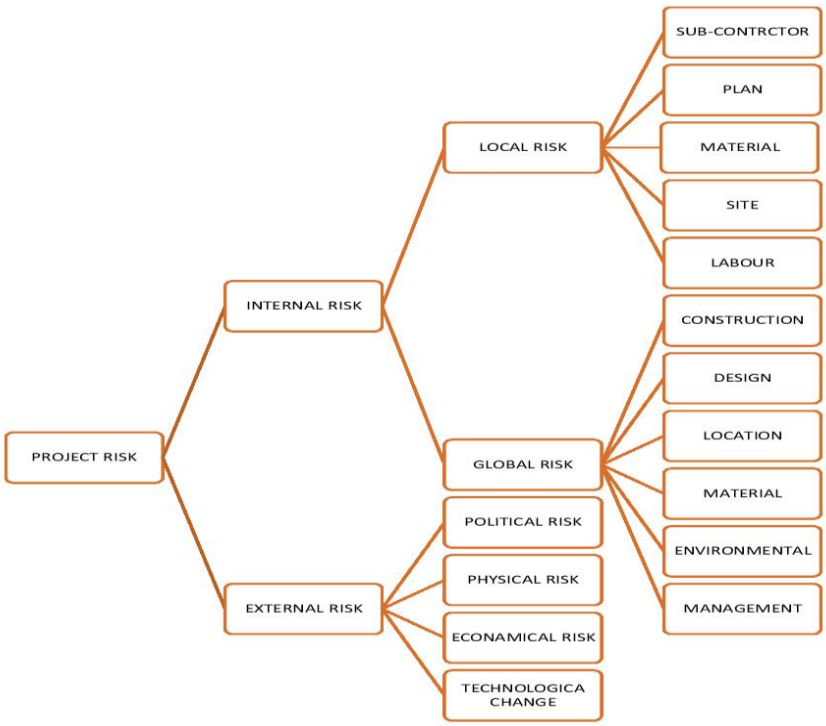

Fig 1 Types of risk

III. CONSTRUCTION RISK MANAGEMENT SYSTEM

The risk in construction projects are inter related with technical, management, logistical, socio – political, and natural disaster. In some areas, a biggest challenge to the managements is the risk effects which leads to unsatisfied requirements, quality, and delay in scheduled time and increase in cost than estimated. A systematic process of risk management is categorised into three main process they are, Risk identification. Risk assessment and Risk Analysis Risk response

A. Risk identification.

Identifying the risk factors is the first and foremost step. This identification helps for taking decisions, taking appropriate preventive measures as early as possible before the likelihood of the vent occurs. This records may useful till the final assessment of risk is made the whole project.

B. Risk assessment and Risk Analysis

This is the secondary stage in the risk management system. It consists of two process assessment and analysis. It aims to find the factors and effect of those factors and how it influence the whole project from start to end. There are some certain tools and methods to calculate the risk factors. It includes probability techniques, sensitivity analysis, decision tree analysis, fuzzy logic, Monte-Carlo simulations.

C. Risk response

This next step of the RMP suggests what action need to be taken towards the identified dangers and threats. The response approach and strategy chosen rely on the kind of risks concerned. Other requirements are that the chance desires to have a supervisor to display the development of the response, which will be agreed by the actors involved in this hazard administration process.

IV. CONSTRUCTABILITY RISK

The word constructability is grew in USA (1980). This would help in the planning and administration process in the way to facilitate the construction operations and reducing issues during construction. The Construction Industry Institute framed guidelines to implement constructability at various stages of construction process. The US the Construction Industry Institute (CII US) defined constructability as “the optimum integration of construction knowledge and experience in planning, engineering, procurement and field operations to achieve overall project objectives” **[4].** Constructability is sometimes referred to as buildability. Some researchers later found out that there is a slight difference the conceptual framework of the two techniques. The difference is buildability focuses purely on the design aspects of the project but the constructability focuses on the associated project management concepts. The important aspects of constructability are or eliminate schedule delays and enhance the construction phase by warranting that the whole process is coordinated based on the plans developed during the preconstruction stage. **[31]** Thus a workable concept of constructability is The risks that may have adverse effect on the task cost and time table can be divided as (i) website based totally risks, (ii) design/ development associated

chance due to lack of coordination between team and the client, (iii) human useful resource and substances primarily based risk, and (iv few different external factors. A chronologically developed chance management is required for the precise exercise in the industry.**[3].** To enhance constructability, the subsequent actions to be taken are:

- Design with quantified assessments.
- Reviews on constructability risks; and

Initiating constructability programs at construction project.

V. FACTORS IDENTIFICATION

Based on the above study the factors which would cause the constructability risk are identified. The main factors of constructability risks are construction risk, management risk, technology risk, procurement risk, environmental risk. The other sub factors are represented in the flow chart given below.

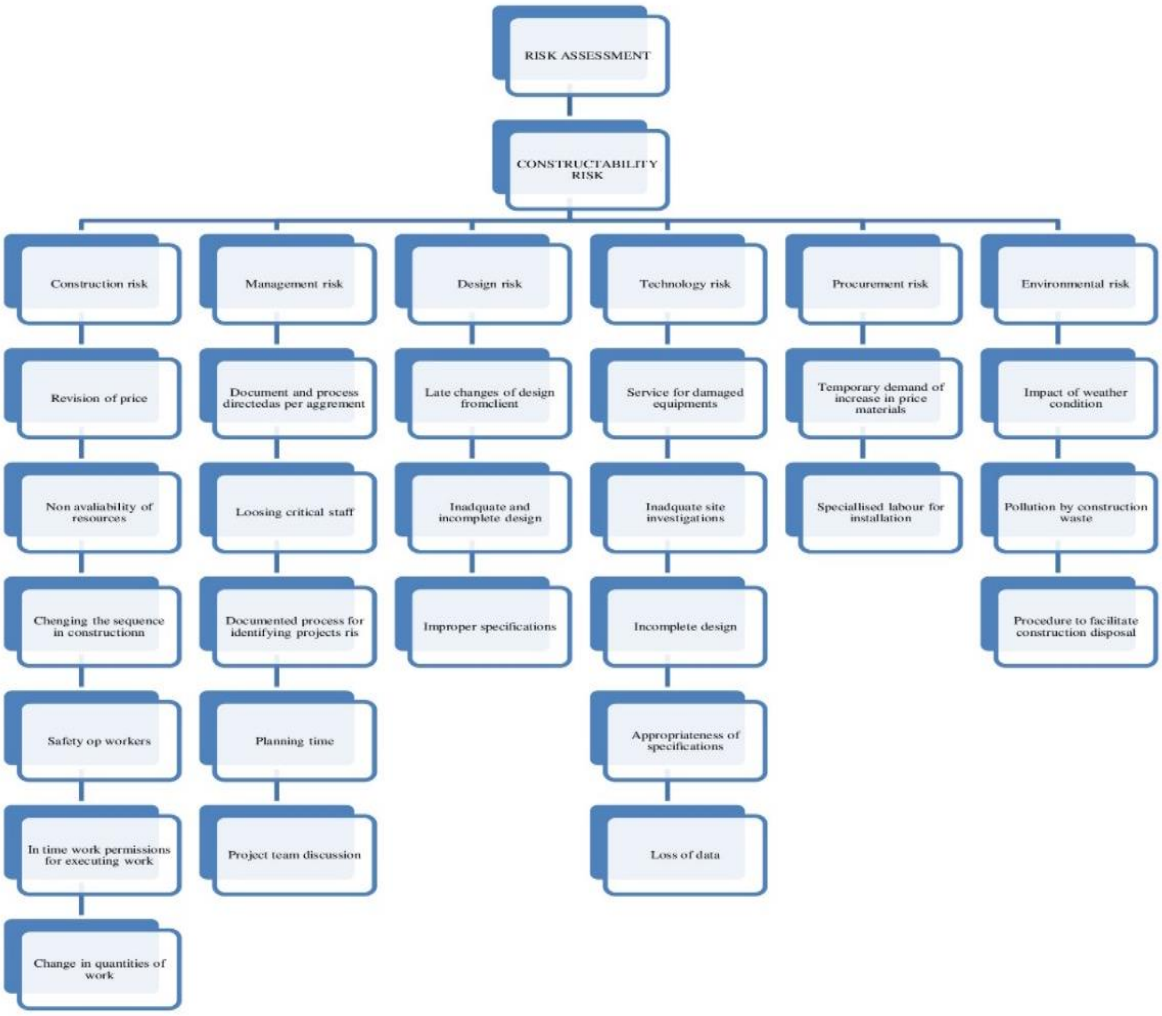

Fig 2 Factors of constructability risk

VI. RESULT ANALYSIS

Based on the literature survey questionnaires were prepared and distributed. Percentage of response for each question is represented. From the site engineers, contractor and project manager for constructability risk the survey is made through the Google forms. The analysis shows the factors which lead to risk in construction projects. The mean, standard deviation, variance for the factors are analysed and are ranked below in table 1. The frequency analysis for each responses is done in SPSS and represented below in table for each question in fig 3 to fig 9.

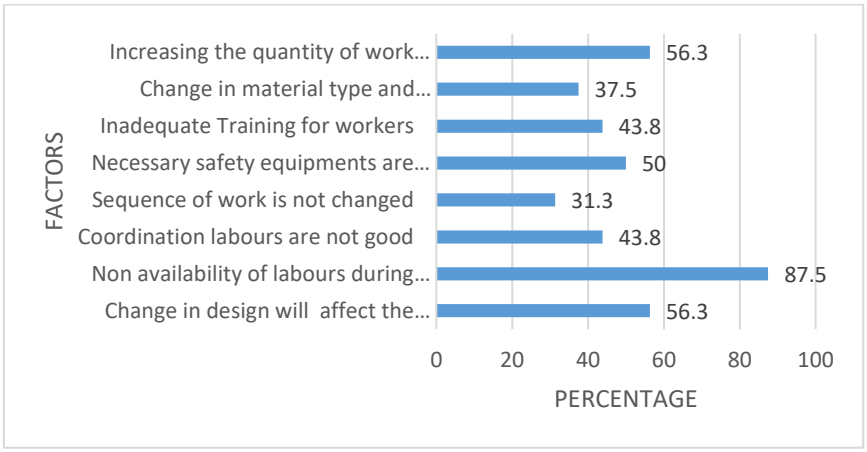

Fig 3 Percentage of Responses for Construction Risk

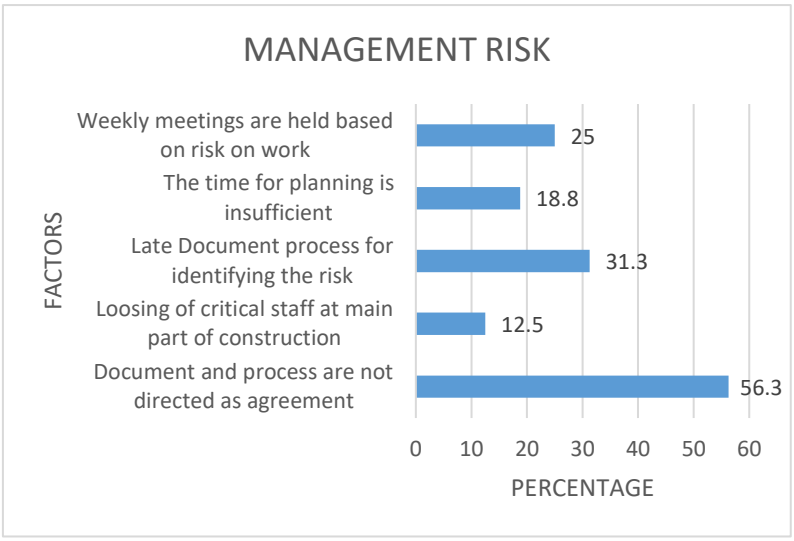

Fig 4 Percentage of responses for Management risk

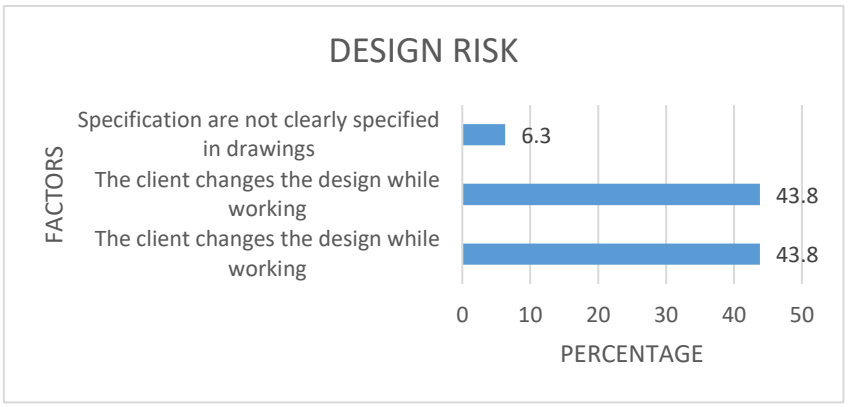

Fig 5 Percentage of responses for Design risk

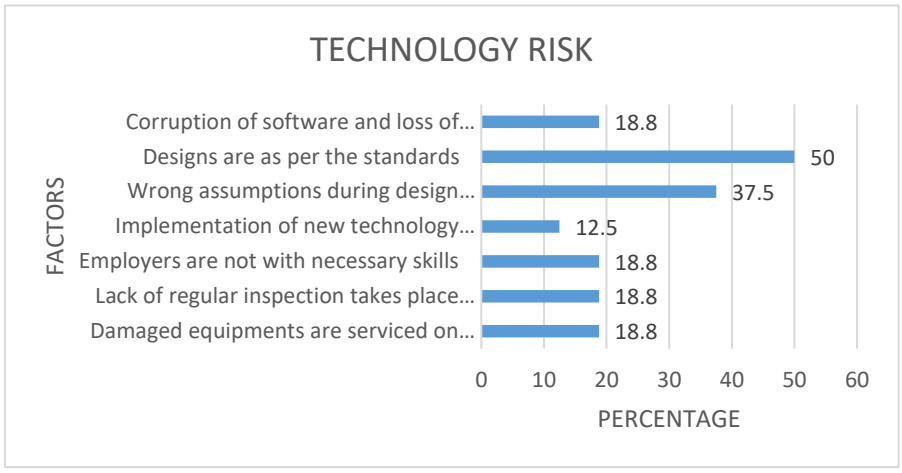

Fig 6 Percentage of responses for Technology risk

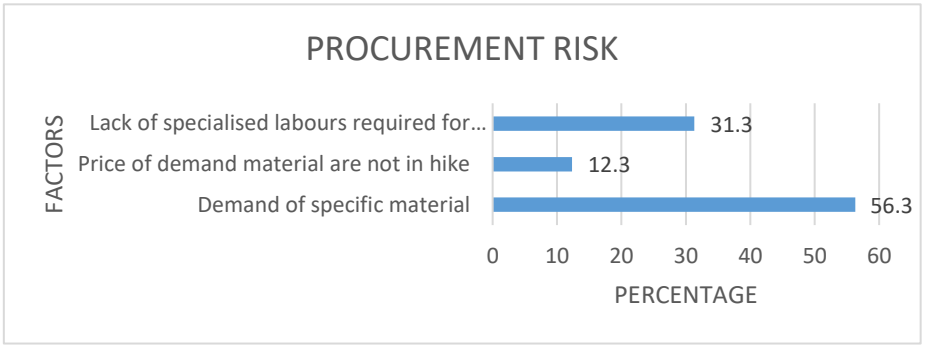

Fig 8 Percentage of responses for Procurement risk

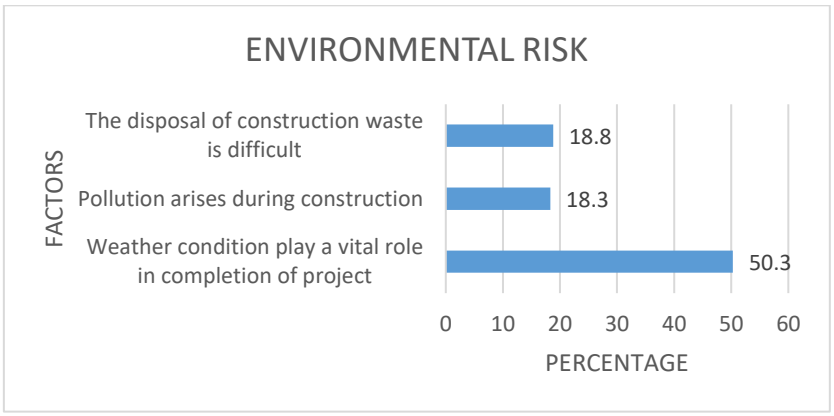

Fig 9 Percentage of responses for Environmental risk

Table 1 Descriptive Statistics for Constructability Risk

Factors	Mean	Std. Deviation	Variance	Rank
Change in design will affect the construction	2.125	1.50000	2.250	12
Non availability of labours during construction	1.812	.65511	.429	15
Coordination labours are not good	2.687	1.07819	1.163	6

Sequence of work is not changed	3.000	1.26491	1.600	4
Necessary safety equipments are available for workers	3.000	1.46059	2.133	4
Inadequate Training for workers	2.687	1.35247	1.829	6
Change in material type and specification causes risk	2.000	.96609	.933	11
Increasing the quantity of work than estimated	2.437	1.09354	1.196	8
Document and process are not directed as per agreement	1.687	.94648	.896	16
Relieving of critical staff at main part of construction	2.250	.93095	.867	10
Late Document process in identification of risks	2.312	1.25000	1.563	9
The time for planning is insufficient	3.125	1.45488	2.117	2
Weekly meetings are held based on risk on work	2.312	1.13835	1.296	9
The client changes the design while working	1.812	.83417	.696	15
It takes more time to complete the design may affect the work progress	2.000	1.26491	1.600	11
Specification are not clearly specified in drawings	3.062	1.34009	1.796	3
Damaged equipments are serviced on time	2.812	1.32759	1.762	5
Lack of regular inspection takes place on site	2.812	1.42449	2.029	5
Employers are not with necessary skills	3.312	1.40089	1.962	1
Implementation of new technology increases productivity	2.812	1.27639	1.629	5
Wrong assumptions during design leads to risk	1.937	1.06262	1.129	13
Designs are as per the standards	1.812	.98107	.963	15
Corruption of software and loss of data leads to risk	3.000	1.46059	2.133	4
Demand of specific material	1.875	1.25831	1.583	14
Price of demand material are not in hike	2.500	.96609	.933	7

Lack of specialised labours required for installation of equipments	2.000	1.03280	1.067	11
Weather condition play a vital role in completion of project	1.687	.87321	.762	16
Pollution arises during construction	3.000	1.54919	2.400	4
The disposal of construction waste is difficult	3.000	1.41421	2.000	4

VII. CONCLUSION

From the past literatures it is to be observed that Technology risk, design risk, construction risk, procurement risk , management risk are considered to be more important. To overcome the above hurdles certain risk identification approach i.e. Formal approach, informal approach, and static approach. From the responses collected, it was observed that constructability risk i.e. Non availability of labours during construction, Weather condition play a vital role in completion of project, Demand of specific material, Wrong assumptions during design leads to risk, etc., creates major impact on the project. A special team can also be appointed by the clients to identify, analysis and to take preventive measure of the before the start of the work itself.

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