International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

Assessment of Significant Risk Factors in Different Construction Stages.

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Abstract*: Construction industry plays as a major sector In India. Among the various management system in project, Risk management system plays as a vital role. Risk management involves in various stage (i.e.) Identification, Estimating, planning and development. So in order to know the influential factors that concern in implementation of risk, a study must be made. Thus, pilot study is conducted to find the factors. A face to face interview is conducted to improve the efficiency of questionnaire. The responses are collected from the building professionals (contractors, engineers, architects, etc.) with the questionnaire containing 45 factors and used for analysis. The analysis process is done with the help of SPSS and AMOS software for collected sample. Based on the result a hierarchy of factors is created and prioritization of factors is done. Preventive measures are listed to minimize the degree of risk to a limited value

***Index Terms*: Construction Industry; Risk Management; Risk Factors.**

I. INTRODUCTION

Risk is the likelihood of a specific effect within a certain period. Generally, it is the complex function of consequences, probability of occurrences and vulnerability. In India, the project's success depends on various factors such as Material, Finance, Maintenance, labour quality, etc. Consideration of Risk also increases the success rate of project completion. Construction industry faces the risk more than any business industry in India. Construction projects are initiated in complex and dynamic environment resulting in circumstances of high uncertainty and risk which are compounding in demand of time and cost constraints. Construction industry has changed significantly since the involvement of private investors. Usage of mechanization in construction industry is increased due to the development of technology, thereby decreasing the timing and work intensity of labours. But implementation of new technology has severe effect in risk (i.e.) it increases the percentage of risk involvement. Generally varies risk involves in project like contract, financial risk, time period, Schedule Risk, political risk , Construction risk etc. To manage a project, risk management must be used as an essential part in construction management structure. The purpose of risk management is to add the value and delivery value and efficiency of the project undertaken. Risk assessment and risk analysis plays a critical role in risk management. Risk assessment is generally said as to identify the potential threats that causes the negative effect during the process. Risk Assessment probably use qualitative and quantitative methods of assessment. Risk analysis is the process of analyzing the obtained threats and making judgement based on the tolerance of the risk. Risk analysis can be done using various model and analysis.

Revised Manuscript Received on 30 July 2019.
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II. OBJECTIVE

As Construction sector involves in various activities, there will be some constraints like time, cost, material, etc. in multiple activities. So, the manager must take risk to complete the work. The main reason for this study is to identify the influential factors that cause risk and to assess the factors that cause risk in the Construction project in various stages (i.e.) pre-construction, Construction stage and post-construction stage. Suggestive factors related to preventive and proactive ways will help to reduce the degree of risk to an acceptable limit which can improve the efficacy of the project.

III. NEED FOR STUDY

- To determine the Influential Factors that causes risk in the construction project.
- To provide a reliable solution to the factors concerning the risk.
- Provision of preventive solution to reduce the degree of risk to an acceptable limit.

IV. METHODOLOGY

First, the literature review has been carried out to know the concept and existing method to analyze the factors. Once review of literature and interview with experienced personnel in the field is done the factors that causes risk that affected the overall process in the industry were identified based on the review. The factors were screened based on the suggestions given by the experienced personnel (To check the effectiveness of the obtained risk factors) . After the screening process the general and most efficient method of collection of data was carried out (i.e.) the factors were converted into questionnaire and the same was used for collection of data. The questionnaire was distributed to receive responses.

A Likert Scale of 1-5 was adopted in the survey where Likert scale is the Psychometric Response Scale Questionnaire and it is most common and efficient method used to specify the level of agreement of the identified factors from Strongly Disagree (1) to Strongly Agree(5). Totally around 142 Samples were collected, and it was used to evaluate the risk factors. Reliability analysis is done to check the reliability of the data collected to move further with the analysis. Adequacy test, correlation and ranking is done for the collected data. And finally the Goodness and acceptance of the created model is analyzed using Model fit analysis (Structural Equation Modelling).

V. RESULTS AND DISCUSSION

A. Demographic analysis

The demographic analysis is done based on the frequencies of each respondent's education qualification, designation, and work experience. These demographic facets of the respondents are listed below. Almost 47.9% of the respondents have 5-10 year of experience, 25.4% of respondent have 10-15 years of experience, 14.1% of the respondents have experience above 15-20 years of experience in construction industry. Thus the quality of data obtained will be good enough to move with the analysis.

B. Reliability analysis

This test is most common method to identify the internal consistency of the obtained data when we use questionnaire for data collection. Cronbach's Alpha represents the reliability of the collected data since we use Likert's scale in sample and convert into a single value. It was calculated with the help of SPSS And the result obtained was about 0.835. As the limit for Cronbach's ranges from 0.7-0.99, it indicates that the data is highly reliable. Table 1 shows Cronbach's alpha value for the collected data.

Table 1 Reliability analysis

Cronbach's alpha	No of items
0.835	25

C. Adequacy analysis

This Test was conducted to identify the adequacy of the sample. The best method to find the adequacy of sample is Kaiser-Meyer-Olkin Measure (KMO-Test) . The KMO represents the ratio of the Squared relation between the variables and the values ranges from 0 – 1 and the result obtained must be nearer to 1 which indicates that the analysis gives distinct and reliable result . The value obtained was 0.765 which is good enough to continue with the research. Thus the above-mentioned result indicates that the test sample collected is Adequate enough to proceed further with the Analysis.

D. Analysis

Here, rank Analysis is done based on the Mean Value of the Factors and result based on correlation Analysis of different construction stage. The ranking is based on the higher mean values to lowest value. The mean value is generated for the factors based on the data in SPSS Software. Descriptive analysis which is part of factor analysis provides the Mean Value for the factors. Thus the result is generated based on the output in SPSS Software for different Construction Stage. The Ranking is done based on mean values And Result based on correlation. and it is shown in Table. The Factor having mean value greater than 0.39 is ranked and shown in Table 2.

Table 2 Rank analysis For Different Stages

Factors	Mean	Mean Rank
Pre-Construction Stage:		
Improper Budget Allocation and planning	4.2324	1
Inexperience Of Staff/Employee	4.2113	2
Compromise in Quality and costing During Optimization	4.1127	3
Insufficient Time Period of Bidding	4.056	4
Construction Stage:		
Exhausting the Quantity of materials	4.2676	1
Lack of internal knowledge, skill	4.232	2
Improper Material Management	4.201	3
Limited/shorter period for construction	4.179	4
Unknown site condition	4.160	5
Care not taken in project cash flow statement	4.1338	6
Improper planning for Accommodating the delay in schedule	4.007	7
Post-Construction Stage:		
Poor Maintenance of building	4.260	1
Process of handing over the completed site without providing the basic guidelines.	4.2113	2
Delay in Corrective measures has some serious effects.	4.160	3

It is seen that Allocation of budget and improper planning has topped the list in preconstruction stage which indicates that most significant factor in the Pre-construction stage among other factors. While Exhausting the material Quantity and Poor maintenance of the building has topped the list in Construction and Post-Construction Stage respectively. Although irrespective of the ranking other factors should also be considered since all other factors can also create an impact in Projects success factor.

E. Structural Equation Modeling (SEM)

SEM is used to analyze and assess the created model. SEM is second generation analysis where the analysis is done using both Theoretical and modelling technique. Figure 1 shows the diagrammatic representation of the Sample Model of preconstruction Stage with one unobserved variable And Table 2 represents the Factors that used for Model Fit Analyzation .

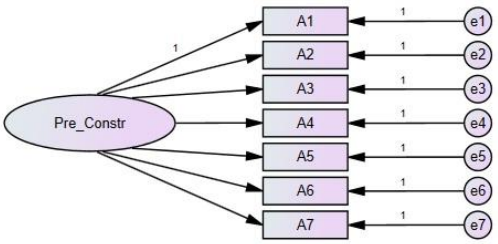

Figure 1 The Sample model of the Pre-Construction Stage

Where A1,A2….,A7 represents the factors of Pre-Construction Stage in Table 3. This model is designed in the fashion that all observed variables/factors are affecting the unobserved variable which is the interest of study. This Process is done for other stages also.

F. Model fit Analysis

The above-mentioned model is tested for model fit. Model fit is addressed based on the indices like the goodness of fit, incremental fit, absolute fit and parsimony fit indices. And the results are shown below.

Table 4 Model fit results

Measures of fit	Permissible value range	Obtained values For Pre-Construction	Obtained values For Construction Stage	Obtained values For Post Construction
Normed Chi-square CMIN/DF	values close to 1 and not exceeding 3	1.549	1.612	1.536
CFI	Values close to 1	0.820	0.815	0.838
GFI	Values greater than 0.80	0.916	0.903	0.921
PGFI	Values less than 0.08	0.062	0.068	0.059

From the above-Mentioned (Table 4) result , it infers that the model created for finding out the significant variable is having a good fit. The values obtained from various measurements from different indices shows the created model is having a good fit. Thus the Created model is valid.

VI. CONCLUSION

The construction company need to include risk as an integral part of their project management. This Study has shown that risk factor are the significant factors in project objectives. From the Result we can say that the factors like Allocation of budget and improper, inexperience of Staff/Employee and Compromise in Quality and costing during Optimization in preconstruction stage, While Exhausting the material Quantity, Lack of internal knowledge, Improper material management in Construction Stage and Poor maintenance of the building has topped the list in Post-Construction Stage are the most significant factors. To reduce the risk in Preconstruction Stage, Proper Brain storming session can be done and Analysis of historical data can also be helpful to formulate the proper strategy. Trained Staff can be allotted for major projects to reduce the risk level thereby improving the time frame for better planning. Contractors can use Risk Rating system which can help the contractors to develop a strategy to mitigate the risk. As for Construction Stage Proper Material management is must and experienced professional must be allotted for Management and must be reviewed frequently for timely order placement of material without exhausting the material in the site. We can also use inventory Control Technique for better material management in the site. Proper Maintenance record of stockage of material is must. Must provide Experienced and Technical professionals for site for better execution and Faster suggestion of strategy to improvise the current situation. In Post construction Stage, Proper maintenance of building must be done. Detailed Instructions must be given to the Facility Managers to reduce the risk level. Planning for Proper maintenance schedule will help in the Risk management. Although irrespective of the ranking other factors should also be considered since all other factors can also create an impact in Projects success factor. Proper Implementation of Risk Management in each project can be done to reduce the risk level.

Table 5 Risk Factors in different construction stages

ID	QUESTIONS
	PRE-CONSTRUCTION STAGE:
A1	Does terms of payment affect the project thereby increasing the risk?
A2	Does Improper budget allocation and planning increase the risk?
A3	Does Insufficient time period for bidding increases the risk percentage?
A4	Does delay in provision of resource deployment schedule result in increase in risk?
A5	Does Compromise in quality and costing during optimization invokes the risk?
A6	Does the Inexperience of staff/employee result in risk?
A7	Does lack of consistency in BOQ, specification increases the risk?
	CONSTRUCTION STAGE:
B1	Does Unknown site condition increases the risk?
B2	Does Exhausting of quantity according to work order increase the risk?
B3	Does Lack of safety increases the probability of risk occurrence?
B4	Does the commitment of work without getting proper clearance from the concerned authority increases the probability of occurrence of risk?

B5	Does the improper planning for accommodating the delay in schedule increases the risk?
B6	Does the risk level increases when care is not taken on the project cash flow statement?
B7	Does the lack of internal knowledge, skill and expertise increases the risk?
B8	Does the Pressure from any localized party (political risk) increases the risk?
B9	Does improper Material management increases the level of risk?
B10	Does improper maintenance of documents related to approval leads to risk?
B11	Does interruption in work due to medical outburst cause risk during the construction stage?
B12	Does the limited /shorter time period for completion of work leads to occurrence of risk?
B13	Does Implementation of new technology increases the risk level?
	POST-CONSTRUCTION STAGE:
C1	Does the Poor maintenance of building results in risk?
C2	Does the Poor involvement of commissioning agent and project team invoke the risk?
C3	Does delay in corrective measures has some serious effect in occurrence of risk?
C4	Does the process of Handing over the completed site without providing the basic guidelines to the facility manager increase the level of risk?
C5	Does the Delay in provision of project completion certificate from the client cause risk?

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