Assessment of Significant Factors Affecting the Implementation of Safety Practices in Construction Site

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Abstract: ***The second largest industry in India is the construction industry. With improvement and advancement in the construction sector, the safety of the workers is very significant to have effective implementation of the project without any risks, delay and cost incur. So it is essential to assess the significant factors which impacts the successful execution of safety measures and practices in the construction site. For assessing it, various responses were collected from the experienced personnel with the help of a questionnaire listing 15 main factors. Likewise, 80 samples were collected with different demographic properties from various personnel in the construction sector. The collected data is analyzed with SPSS and AMOS software for factor analysis and model fit. Finally, a proactive solution for effective safety implementation is given***

Keywords: Implementation of safety; Safety management; Structural Equation Modeling (SEM)

I. INTRODUCTION

Generally construction sector is regarded as high risk having high fatality rates. And with the present improvement and development in this sector in terms of automation technology and complexity, it is becoming more vulnerable to accidents to the personnel who are working on the construction site. Nowadays the construction sites are crowded with workers who undertake many dangerous activities on site. Even though the safety culture in the site is improved steadily nowadays, we are having a problem in the implementation of it. Most of the personnel are aware of safety culture but most of the time, it is failing to get implemented effectively. It is important to find out the gap and to prevent it proactively in order to reduce risk, accidents, cost incur and delay of the project. It is essential to take steps to bridge the gap. The foremost step is to properly analyze the factors and give some ways and solution to prevent it in the planning stage of construction itself.

II. OBJECTIVE

The main objective is to study the safety management factors in the site to improve the safety performance. In addition to that, the objective is to study the factors which stop successful execution of the safety measures and practices in the site. And also to provide a preventive and proactive solution for the problems in implementation, so that we can maintain a risk-free environment in the construction site which in turn will be a greater good for the construction sector in reduction of mishap and deaths in the site in addition to reducing delay and cost incur.

III. NEED FOR STUDY

To know the significant factors impacting the improper execution of the safety practices in the site. To try and get some reliable solution for the hidden problem behind the improper implementation of safety measures. Finally to recommend a proactive and preventive solution to the construction industry to be even more risk-free.

IV. RESEARCH METHODOLOGY

Firstly listing down the main factors which affect the implementation of safety measures through the literature review and the pilot study. Based on that the questionnaire is prepared. It consists of 2 sections in which one section is demographic details and other sections consist if the 15 factors which are impacting the safety measures implementation in the industry. The responses are collected based on the linear scale known as the Likert's scale. That is on a scale of 1 to 5. Here 1= no effect, 2= less effect, 3= neutral, 4= affecting, 5= strongly affecting. Totally 80 samples were collected and used for analysis. With the data, demographic analysis for checking how well the respondents are distributed, reliability analysis for checking the reliability of data for further analysis, mean ranking for simple ranking, correlation analysis for identifying the linear relationship within the factors, model fit analysis for assessing the goodness and acceptance of created model using structural equation modeling were done to assess the significant factors from the list of 15 factors. And with those results, the data is interpreted and conclusions are arrived based on the results.

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V. RESEARCH METHODOLOGY

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. In those collected 80 samples there is 62.5% of it are from the age group of 25- 30 years. The rest of the percentage is above 30 years. 57.5% has the education qualification of Btech/BE and the rest of the percentage are ME/Mtech, MS, Ph.D., and diploma. 71.3% are engineers and the rest are Directors, project managers, supervisors, and technicians. Finally, 57.5% of respondents have working experience range of 2-5 years and rest of them are above 5 year experience. So from these analyses, it is clear that the respondents are well distributed and we have responses from various age groups, experience, designation and work experience.

B. Reliability Analysis

Cronbach's alpha is a value which represents the reliability of the data which are collected for the research. In other words, it is the test to see if the multiple question Likert scale surveys are reliable. This value represents the whole data which we have collected in a single value. The value should be higher for having more reliability and it can indicate that further analysis can be done using this data. It will also tell us if the research setup which we have created is measuring the variable of interest. Below shows the table which represents the Cronbach's alpha value for the collected 80 samples of data.

Table I Reliability test results

Cronbach's alpha value	Items
0.750	19

The conventional value for the Cronbach's alpha value for higher reliability is greater than or equal to 0.7. We are having a value of 0.75 which indicates the data are reliable and the research setup which we have created is measuring the variable of interest. So from this, we can do further analysis with those data.

C. Rank Analysis

The rank analysis is done based on the mean value of each factor. It can also be named as the mean rank analysis. In this case, the factor which has the higher mean value is given rank 1. The mean value for that is calculated first using the SPSS software as the initial step in the factor analysis. Then after the report generation from the software, the ranking is done for all the factors. The top 5 factors are taken out and listed out. The below table shows the factors which are ranked from 1 to 5.

Table II Rank analysis

Factors	Mean	Std Deviation	Mean Rank
lack of awareness among workers	3.93	0.959	1
lack of safety inspections	3.87	1.25	2
personal attitude of the workers	3.77	0.72	3
safety personal selection	3.72	1.01	4
lack of employee involvement in safety implementation	3.72	1.09	5

From the above table, it is evident that the factor, lack of awareness among workers has a higher mean rank of 3.93 is considered as the rank 1. Which means that the majority of the respondents have given a higher value in the Likert's scale. The rest of the factors are followed according to the mean values of it. The factor lack of employee involvement in safety implementation is having the 5th rank with a mean value of 3.72. Although irrespective of the ranks, it is essential to address the above-listed factors for the successful execution of safety measures in site.

D. Correlation Analysis

Correlation analysis is done for assessing the linear relationship between the factors which we have considered. Pearson correlation is used for the correlation analysis. The linear relationship between the factors is represented by values which are represented in the below table. And the values which are present in the table are significant values which have the p-value of less than 0.05. The 15 factors are represented by F1to F15. In which F1 is personal attitude of the workers, F2 is lack of awareness among the workers, F3 is understandability of the workers, F4 is language barrier, F5 is budget of the project, F6 is the lack of resources, F7 is lack of dedicated safety budget, F8 is lack of safety incentives, F9 is a lack of safety training for workers, F10 is lack of employee involvement in safety implementation, F11 is lack of safety-trained personnel, F12 is a motivation factor for the workers to adopt safety measures, F13 is the lack of safety inspections, F14 safety personal selection, F15 complex labour structure. From the correlation analysis, 2 factors came as a common relationship for the majority of factors. Those 2 factors are F13 and F9 that is, lack of safety inspections and lack of safety-trained personnel. Below tables shows the factors which have a significant relationship with values over 0.5 separately for F13 and F9.

Table III Correlations with respect to factor F13

Factors	R	Relationship
F2	0.592	positive
F9	0.714	positive
F11	0.592	positive

The values in table III are significant (2 tailed) in the Pearson correlation analysis. The relationship between the factors is a positive linear relationship. Form the above table we shall infer that safety inspection (F13) is highly related to safety training for workers (F9) (0.714), safety trained personnel (F11) (0.606). Awareness among workers (F2) (0.592).

Table iv Correlations with respect to factor F13

Factors	R	Relationship
F2	0.520	positive
F10	0.587	positive
F11	0.710	positive
F13	0.714	positive

The values in table iv are significant (2 tailed) in the Pearson correlation analysis. The relationship between the factors is a positive linear relationship. Form the above table we shall infer that safety training for workers (F9) is highly related to safety inspections (F13) (0.714), safety trained personnel (F11) (0.710). Employee involvement in safety implementation (F10) (0.587) Awareness among workers (F2) (0.520).

E. Structural Equation Modeling (SEM)

In this research, SEM is used to assess the model fit for the created model. SEM in the shorter term is nothing but a representation of a theory in a diagrammatic form and analyzing. So as mentioned earlier the theory is that 15 observed variables are affecting 1 unobserved variable Safety Measures Implementation (SMI). Figure 1 shows the diagrammatic representation of the research theory. Here F1 is personal attitude of the workers, F2 is lack of awareness among the workers, F3 is understandability of the workers, F4 is language barrier, F5 is budget of the project, F6 is the lack of resources, F7 is lack of dedicated safety budget, F8 is lack of safety incentives, F9 is a lack of safety training for workers, F10 is lack of employee involvement in safety implementation, F11 is lack of safety-trained personnel, F12 is a motivation factor for the workers to adopt safety measures, F13 is the lack of safety inspections, F14 safety personal selection, F15 complex labour structure. This model is designed in the fashion that all observed variables/factors are affecting the unobserved variable which is the interest of study SMI.

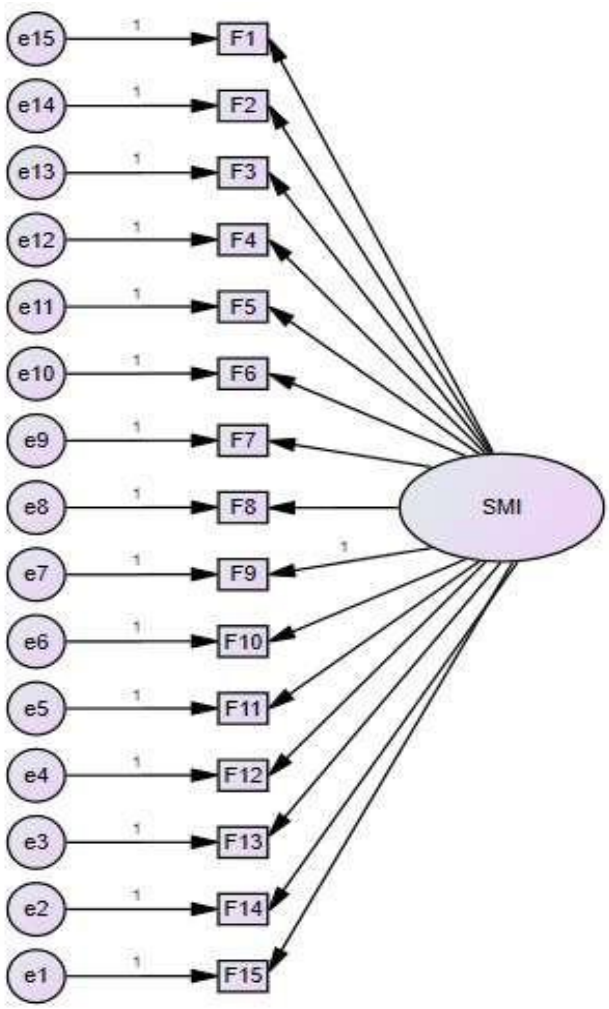

Figure 1 The model of the research study

A. Structural Equation Modeling (SEM)

The above-mentioned model is tested for model fit. Model fit is addressed based on the indices as shown in table v. And results are shown below. It is clear that the model created for finding out our variable of interest is having a good model fit. The values obtained from various measurements from different indices shows the created model is having a good fit.so we can infer that the model created is valid.

Table v model fit results

Indices	Measures of fit	Permissible value range	Obtained values
goodness of fit index	CMIN/DF	close to 1 and not exceeding 3	1.668
Incremental fit index	CFI	Values close to 1	0.803
Absolute fit index	GFI	Values greater than 0.80	0.821
Parsimony fit index	PGFI	Values ع than 0.50	0.602
Parsimony fit index	PNFI	Values ع than 0.50	0.565

VI. CONCLUSION

With statistically reliable and valid factor analysis for finding out the hidden significant factor affecting the safety measures implementation we can conclude with the inferences of various tests performed. From the results we can say that the factors like safety personal selection, lack of employee involvement in safety implementation, personal attitude of the workers, lack of safety inspections, lack of awareness among workers, safety training for workers are the factors which came out significantly in the tests which are made in this research. For a solution we can actually rely on the results of correlation analysis in which there were many significant positive linear relationship. So it is recommended to increase the quality of safety inspection with stringent framework, which will automatically increase the safety performance in terms of safety training for workers, safety trained personnel. Awareness among workers. And we can also have another way by increasing the safety training for the workers will increase the safety performance in terms of safety trained personnel. Employee involvement in safety implementation, Awareness among workers. So it is recommended to take necessary planning at the time of planning stage itself to ensure proper safety inspections and safety training for workers to reduce risk of hazards and create the construction site a risk free environment.

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