

PERFORMANCE EVALUATION OF SAFETY MANAGEMENT IN ROAD CONSTRUCTION

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Abstract:

The construction industry in India is growing day by day and at the same time it is complex in nature. Safety management is one of the main components of a construction project management. A literature survey has revealed that workers in construction sites are subjected to hazardous conditions all over the world and more so in developing countries. The construction sites are not following the safety management in proper way. Chennai, India is no exception. Three surveys namely worker's safety perceptions, manager's safety practices and cultural attitudes towards safety for both the workers and the managers have to be conducted in road construction sites in and around Chennai. These responses will be studied with statistical techniques like factor analysis and correlation analysis using SPSS.

Keywords: Safety management, factor analysis, SPSS.

INTRODUCTION:

Construction activity in India has travelled a long distance in a relatively short period of time. From the humble beginnings of building simple structures and roads and minor civil work projects, the industry has changed significantly particularly over the fifty years following independence. The construction industry in India today is very large in size and complex in nature. The social concern of the safety of construction workers and their protection against injury arising, out of their employment has been evident for a long term. However the measures taken to translate this social concern into concrete programmes of action legislative, administrative or education did not bring the desired results. This happened largely due to the peculiar nature of this industry, including the lack of formal organisation. Basically the rate of growth in this industry has been so rapid that the

legislation and standards as well as their implementation could not keep pace with it. This gap has to be narrowed down to the extent possible and in the shortest possible time. Construction is a relatively hazardous undertaking.

TABLE 1 : OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATE

INDUSTRY	TOTAL NO. OF CASES	WORKING DAYS LOST
Forestry	7.7	86
Mining	10.5	137.3
Construction	14.5	115.7
Manufacturing	10.2	75
Transportation, Utilities	8.5	96.7
Wholesale and Retail Trade	7.2	45.5
Finance, Insurance, Real Estate	2	13.2
Services	4.9	35.8

(Data represents total number of cases and working days lost per 100 workers in 1982)

ALL ACCIDENTS	
Fall of persons	30 %
Handling of goods	24.80%
Fall of materials	8%
Transport	5.40%
Lifting equipment	1.60%
Excavation and tunneling	0.60%
Miscellaneous	29.50%
FATAL ACCIDENTS	
Fall of persons	48.10%
Fall of materials	11.70%
Transport	11.70%
Lifting Equipment	8.40%
Electricity	5.20%

TABLE 2: ACCIDENTS REPORTED IN CONSTRUCTION (1976)

LITERATURE REVIEW:

Kondala Rao G (2018) analysed the road safety management in India. In this study, he studied the road accidents occurred in the various places of our country and also analysed the causes for the accidents. Rehan Masood and et.al (2016) aimed to assess the direction in safety management through determination of safety climate that would enhance safety culture and positively impact perceived safety performance on construction sites. Bima Abubakar Muhammad et.al (2015) investigated the direct and indirect cost involved in Health and Safety Performance of the Nigerian Construction Industry. The research targeted a sampling size of 60 professionals in the construction industry and adopted a random sampling technique. Kadiri Z.O et.al (2014) examined the major causes of accidents and suggested ways of mitigating the accidents on construction sites in Abuja. The information or data that was carried out used the methods of questionnaire and direct personal observations. A designed questionnaire was administered and

descriptive statistics tool such as frequency, mean, percentage and relative importance index were used for the analysis. R. Awwad et.al (2014) assessed the existence and extent of application of safety practices by Lebanese contractors, management commitment to safety, implementation challenges and opportunities for enhancing safe practices. The area of the study carried out by the researcher was Lebanon since its economy had become more dependant on construction industry and the country had not accompanied by any improvement of the construction laws to include safety regulations and standards. K. Mouleeswaran (2014) stated the reasons for the poor safety performance in construction site. He aimed to find out the factor that influences the non safety performance of construction firms in and around Erode zone.

ANALYSIS OF DATA

FACTOR ANALYSIS

The questionnaire surveys were carried out for worker’s safety perceptions, manager’s safety practices and prevailing safety culture originally consisted of 20, 18 and 39 variables (questions) respectively. Factor analysis, a multivariate statistical technique has been used on the responses for identifying and extracting smaller number of underlying dimensions for all the three surveys. Prior to actual factor analysis a data screening was done for all of them to check the suitability for factor analysis. A visual inspection of the correlation matrix for worker’s survey reveals good correlation among most of the variables.

PARAMETERS	SURVEY TYPE		
	Manager’s	Worker’s	Cultural
Initial number of variables	18	39	20
Number of Samples Surveyed	80	80	80

KMO (Kaiser-Meyer-Olkin) Statistic	0.335	0.509	0.483
Bartlett's Test of Sphericity:			
Approx. Chi-square	94.247	42.168	23.587
Df	78	45	28
P	0.102	0.593	0.703

Table 3: Summary of Factor Analysis

	FW1	FW2	FW3	FM2	FM2	FC1	FC2	FC3
FW1	1							
FW2	0.213	1						
FW3	-0.146	-0.228	1					
FM1	-0.117	0.335	0.331	1				
FM2	0.323	-0.226	-0.088	-0.149	1			
FC1	0.353	-0.032	-0.331	-0.027	0.077	1		
FC2	-0.468	-0.03	-0.173	0.021	0.446	0.265	1	
FC3	0.308	-0.318	-0.248	-0.141	0.323	0.409	-0.207	1

Table 4: CORRELATION AMONG THE EXTRACTED DIMENSION OF THREE SURVEYS.

RESULTS AND DISCUSSION:

Awareness and belief (FW1) of the workers was found to be negatively correlated with work dynamism (FW3). However a significant negative correlation was observed between FW2 and FW3. The rest of the correlations among the dimensions of worker safety perceptions were found to be statistically insignificant. The two dimensions of manager's safety practices i.e., strategic (FM1) and operational (FM2) were found to be slightly negatively correlated. The cultural dimensions were observed to be positively correlated with one another. The power distance (FC1) and uncertainty

avoidance (FC3) showed a strong correlation. The correlations among the dimensions of three different surveys revealed interesting trends. No significant correlation was observed between awareness and belief (FW1) and cultural dimensions (FC1, FC2, FC3). It was only slightly negatively correlated with the strategic (FM1) dimension of manager's safety practices. Physical work environment (FW2) was negatively correlated with (FM1) and power distance (FC1). The work dynamism (FW3) was observed to be positively correlated strongly with FM2 and negatively correlated weakly with power distance (FC1).

CONCLUSION

Structured questionnaire surveys consisting of three sets of queries for worker's safety perceptions, manager's safety practices and prevailing safety culture were conducted among eighty construction sites. The questions were based on the literature survey revealed and similar studies conducted in other developing countries. A screening of the observations was performed before factor analysis. The results have been presented in the following:

- It has been noted that awareness and belief of the workers have no significant correlations with the cultural dimensions in the surveyed site. It shows that the workers' safety awareness is not influenced by any ideas embedded in culture which is expected in a contemporary society. It also means that workers would abide by reasonable logic for taking safety measures but would not be tied to any preconceived notion.
- Worker awareness is weakly related to manager's strategic plan. It indicates that the workers pay some but not serious attention to the safety planning of the management. It is so expected because the workers would not have full information or training about the managers safety planning.

- Physical work environment is negatively correlated to power distance. As the power distance that is the respect to authority increases the workers' sensitivity to safety hazards decreases. The workers tend to think less about safety aspects and expect that the managers would advise about these. Similarly, work dynamism is negatively correlated with power distance. It shows that as the respect to authority increases the workers' sensitivity in reacting to managers' safety feedback decreases. The workers seem to expect that the managers would advise them continuously for the safety actions.
- Work dynamism is positively correlated with collectivism. Work dynamism that is the safety training and feedback acceptance would increase with the cultural collectivism that is the tendency of group thinking. The training and feedback acceptance is also positively related to strategic safety plan. This is so expected because an increase in safety planning should also increase the receptivity of safety feedback.
- Physical work environment that is workers' sensitivity to safety awareness is positively correlated with operational practices of managers. This is an important finding. It indicates that the safety practices adopted at site by managers would have a trickledown effect in increasing the workers' safety perceptions.
- Strategic management is positively correlated with collectivism. It indicates that as the safety planning increases the collectivism that is group thinking about safety also increases. It signifies that the training involved with the safety planning has a positive impact on group thinking about safety perceptions. There would be no inbuilt cultural resistance from workers in imposing safety rules. Secondly, the training imparted on the managers would percolate through the workers' safety perceptions. Since trainings

to managers are logistically easier and comparatively economical focus of safety training on managers would result the desired effect of higher safety perceptions to the workers.

REFERENCES

- 1) S. Seetharaman, Construction Engineering & Management, fourth edition, Umesh Publications Delhi, 2008.
- 2) G. K. Kulkarni, "Construction industry: more needs to be done," Indian Journal of Occupational and Environmental Medicine, vol.11, no. 1, pp. 1-2, 2007.
- 3) E. Koehn, and D.C. Regmi, "Labor cost calculations in international construction," AACE Trance., Proc., 35th Annual Meeting Assoc. of Cost Engineers, Seattle, wash, 1991.
- 4) E. E. Koehn, R.K. Kothari, and C.S. Pan, "Safety in developing countries: Professionals and bureaucratic problems," Journal of Construction Engineering and Management, vol.121, no. 3, pp. 261-265, 1995.
- 5) E. Sawacha, S. Naoum, and D. Fong, "Factors affecting safety performance on construction sites," International Journal of Project Management, vol. 17, no. 5, pp. 309-315, 1999.
- 6) J.G. Everett and P.B. Frank, "Costs of accidents and injuries to the construction industry," Journal of Construction Engineering and Management, vol.122, no. 2, pp. 158-164, 1996.
- 7) J.M. Wilson Jr., and E. Koehn, "Safety management: problems encountered and recommended solutions," Journal of Construction Engineering and Management vol. 126, no.1, pp. 77-79, 2000.
- 8) C. Anumba, and G. Bishop, "Importance of safety considerations in site layout and organization," Canadian Journal of Civil Engineering and Management, vol. 24, no. 2, pp. 229-236, 1997.
- 9) The Occupational Safety and Health Administration (OSHA, 1990). Analysis of Construction Fatalities, US Department of Labor, Occupational safety and Health Administration, Washington, D.C.
- 10) L. S. Pheng, and S. C. Shiua, "The maintenance of construction safety: riding on ISO 9000 quality management systems", Journal of Quality in Maintenance Engineering, vol. 6, no. 1, pp. 28-44, 2000.