



Safety Attitudes, Risk Perceptions and Safe Behaviours of Construction Workers and Sustainability at Workplace Environments

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Abstract

Attitudes towards safety refer to the mental predisposition of workforce to respond either proactively or reactively on the organisational safety belief, safety objective and safety plan. The safety attitudes not only tend to influence the choice of actions of the workforce but also their immediate responses to the imminent challenges faced by them at workplace. Risk perception refers to the subjective judgement made by the workforce with regard to their work place hazards and severity potentials. The safety attitudes and safety perceptions of workforce about their sustainable work environments form the safety climate at workplace. Safety climate is the measure of the safety culture prevailing at the organisational level. No iota of doubt that the sustainable organisations strive hard to protect its people at workplace and its stakeholders. Striking balance between the safety of people and profitability perceptions influence the behaviour at workplace. The positive safety attitudes and safety perceptions lead to safe work behaviour. Similarly, the negative attitudes and perceptions may lead to at risk behaviour

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at workplace which in turn culminates in accidents at workplace. The primary goal of this research is to ascertain the sustainability by measuring the safety attitudes and perceptions prevailing among the workforce involved at construction sites. In addition to the perceptions of workers the data for their personal experience with workplace accidents and primary causes for such accidents also collected. The accident data was compared with previous studies. The current study revealed that lack of concentration, irresponsible actions, reckless behaviour, lack of safety training and poor safety perceptions among the workforce are the primary reasons for the accidents. Improving safety climate at construction job sites is the need of the hour to inculcate the sustainable safety culture

Keywords: Construction, Sustainability, Attitudes, Perceptions, Behaviour, Safety Climate, Environment

1 Introduction

Culture is an integral part of human lives. No society can exist without culture and also it is learned and shared among the members of the particular society. Culture delineates the accepted ways of behaving for people of any specific society [1]. The Culture influences the attitudes, perceptions and behaviours to the major extent in a uniform and predictable manner [2]. The literatures reveal that the attitudes are closely associated with risk behaviour. Guldenmond [3] argues the safety belief has much more influencing ability than the safety attitudes in the context of safety culture. Safety behaviour is defined as observable safe acts that are considered in its own merit [4]. Safety belief is the foundation block for the safety attitude which leads to desired safety behaviour. Behaviour is influenced by the attitudes and perceptions held by the workforce about their workplace [5]. The attitudes and perceptions portray the prevailing safety climate and this observable and measurable safety climate in turn reflects the safety culture of the organisation. The safety climate construct encompasses the attitudes towards safety and safe work behaviour of employees in the organisation [6]. So, the safety climate instrument must incorporate perceptions of workforce on the conditions regarding management as well as the workplace environment [7].

The safety climate is dynamic in nature and it varies at worksites of same organisations and hence the safety culture also varies at every organisational level [8]. There is no iota of doubt that there is a concrete nexus between workplace safety climate and occupational accidents. The positive safety climate reduces accident potentials whereas the negative safety climate results in workplace accidents. In developing countries like India, it is a known fact that the accidents are under reported due to numerous reasons. The rate of fatal accidents in Indian construction sector is found to be higher by four to five times than that of organised sectors like factories [9]. This rate

of injury is very high and putting lot of mental agony on the family of victims and the diminish reputation of the nation in the global level. Hence, the higher rate of injury is the cause for greater concern as it holds back the economic growth as well. The construction workforce of India is about 7.5% of the world workforce but its contribution towards the global fatal occupational accidents is about 16.4% which is very high [10]. According to ILO 2005, in construction sector, at least there was one fatal accident in every ten minutes and at least one fatal accident in every six fatal accidents. In India, the rate of incident in construction industry is relatively high as compared to the global scenario. A substantial improvement in construction safety is witnessed in India for the past 15 years. However, the level of progress is very much behind as compared to other developed countries [11].

As the safety performance at the individual and organisational levels is vastly influenced by the following three most influential characteristics prevailing among the workforce, the review on the same are essential for this current research.

- Attitudes towards safety
- Risk perception
- Safe work behaviour

1.1 Attitude towards Safety

Attitudes towards safety refers to the mental predisposition of workforces to respond either proactively or reactively towards an organisational safety belief, safety objective and workplace safety. The attitudes towards safety not only tend to influence the choice of actions of the workforce but also their immediate responses to the challenges faced by them at workplace. Attitude is one of the strongest predictors of the risk behaviour of workforce [12, 13]. Safety attitudes of workers and employees plays vital role in overall safety performance of the organisation and construction sites. In nutshell, the attitudes reflect the predominant safety culture of an organisation.

1.2 Risk Perception

According to Flin [14], the risk perception is one of the most important safety climate dimensions next to management actions in respect of safety. The literatures reveal that risk perception is significantly associated with risk behaviour at workplace. Also, the lack of risk perception leads to many accidents at hazardous workplace like construction sites [15]. A few of the researchers argue that the risk perception cannot be considered as safety climate as the same is influenced by several individual and personality

factors [16]. However, the vast majority of researchers considered risk perception as one of the predominant safety climate factors.

1.3 Safe Work Behaviour

Safety climate has positive and significant association with safe work behaviour. A well-managed safety climate leads to safe work behaviour at construction job sites [17]. Safety climate is an important framework which guides the workforce behaviour [18]. The attitudes and behaviour is distinctly visible in safety climate [19]. Hence, the review of literatures clearly reveal that the safety beliefs, safety attitudes, safety perceptions, risk perceptions are inherently related to safety behaviour which in turn influences the overall safety performance without any untoward accidents at the worksites. Niskanen [20] study revealed that the safe work behaviour and safe work habits enhance the productivity.

2 Research Methodology

Attitude and perceptions are intertwined, in other words, the perceptions influence attitudes and vice versa. The attitudes and perceptions can be measured through workplace safety climate questionnaire surveys [21, 22]. The literatures revealed that were plethora of safety climate questionnaires. However, the safety questionnaire used in previous survey in Pakistan was found to be suitable for the current study and the questionnaire were suitably modified in accordance with prevailing context and deployed among 130 construction workers and the responses were obtained in 5 point Likert scale [23]. The data obtained through safety climate survey was run through for the factor analysis by using SPSS software. In addition to the above, the personal characteristic data, injury sustained by the workforce due to previous accidents, severity of the incidents and cause of incidents were also captured in multiple choice and dichotomous scales. The workers were informed to provide the severity of previous accident at work place in multiple choice scales like first aid injury, restricted work case injury or lost time injury at the end of the survey for the descriptive analysis of accident statistics and cause of accidents.

3 Results and Discussion

3.1 Factor Analysis

Initially, the factor analysis was run with 25 variables for factor analysis. As the sample size was 130, the subject to variable ratio was 5.20 which is more than adequate for the factor analysis [24]. The variables which failed to score KMO statistic minimum of 0.5 were dropped one at a time in the first

phase. During further analysis, the variables which failed to score minimum required loading level of 0.5 were dropped one at a time for arriving at the final factor solution. Out of 25 variables only 17 variables were retained in the final factor solution. The visual inspection of correlation matrix was found to be fairly good and the KMO was 0.877 for the final factor solution which is more than adequate to proceed with the further course of analysis. The total variance explained by the factor solution was 71.86% which is more than the desired level of 60% [25]. Four factors were extracted and the eigenvalues for those factors were found to be more than the desire level of 1. The results of exploratory factor analysis with Chi-square statistic, degree of freedom and significance value are given in Table 1.

Table 1 Summary of Factor Analysis

Description of Measures	Values
Variables Considered for EFA	25
Sample Size (N)	130
Subjects to Variable (STV) Ratio	5.20
KMO (Keiser Meyer- Olkin)	0.88
Bartlett Test of Sphericity (Chi-Square)	1541
Degree of Freedom (d _f)	136
P Value	0.00
Factors Obtained	4
Variables Retained after EFA	17
Total Percentage Variance Explained	71.9

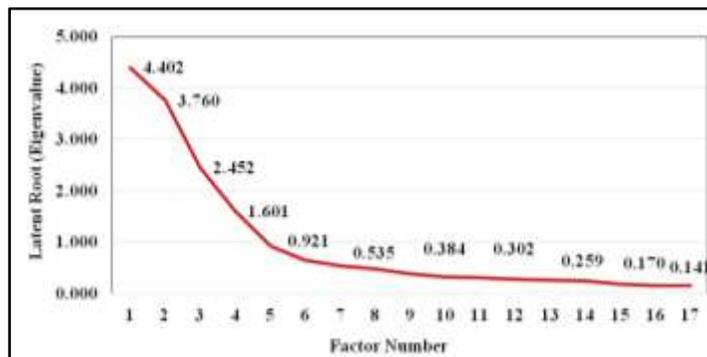


Figure 1 Eigenvalue Plot for SCREE Test Criterion

The factor analysis for the safety climate survey extracted four factors which has eigenvalues greater than one. The first three factors were labelled

subjectively in accordance with previous studies [26]. The fourth factor emerged in this study was labelled as risk perception. The risk perception factor had two variables namely excitement in risky jobs and identification of potential hazards at worksite. The scree plot for the eigenvalues obtained through exploratory factor analysis is presented in Figure 1.

Table 2 Results of Factor Analysis

Factors	Variance %	Cronbach's Alpha	Eigen Value
Physical Environment	25.897	0.894	4.402
Awareness & Beliefs	22.119	0.876	3.76
Supportive Environment	14.426	0.864	2.452
Risk Perception	9.419	0.882	1.601

Table 3 Factors, Items and Factor Loadings

Factors and Variables	Loading
Factor 1: Physical Work Environment	
Time constraints	0.609
Anxiety at workplace	0.691
Shortcuts to override safety	0.766
Safety responsibility	0.747
Right equipment for the job	0.859
Reporting Safety Concerns	0.868
Resolving safety issues	0.793
Factor 2: Awareness and Beliefs	
Safety priority	0.822
Management safety action	0.800
Personal Protective Devices	0.879
Safety procedures	0.856
Hazards at worksites	0.779
Factor 3: Supportive Environment	
Safety feedback	0.821
Safety Communications	0.838
Skill oriented safety training	0.697
Factor 4: Risk Perception	
Excitement in risky jobs	-0.855
Hazard identification	0.832

The results of exploratory factor analysis with factor wise variance explained, eigenvalues and Cronbach's alpha are given in Table 2. The

Cronbach's alpha measure was calculated for each factor in order to measure the homogeneity or composite reliability. The values for the Cronbach's alpha measure for all four factors were well above the 0.70 level which was adequate [27] to proceed with the further course of analysis. The factor wise variables retained after factor analysis and factor loadings of each variable are given in Table 3.

3.2 Factor Interpretation

The first factor was labelled subjectively as physical work environment which scored 25.90% of variance with seven variables. Five out of seven variables in this factor scored loadings well above 0.70 level and only two variables were scoring between 0.60 and 0.70 which were well above the required level of 0.50. The seven variables contained in this factor were: time constraints for completing the job in safe manner, unsolicited anxiety about the future while working at site, consciously resorting to short-cut approaches to complete the jobs on time by violating safe work procedures, responsibility of workers towards safety, supply of right and fit for work equipments to do the jobs safely, freedom and mechanism to report the safety concerns to the management and resolving the reported safety concerns proactively by the management. The mean for the physical work environment factor was 3.34. It can be interpreted that this environment is moderately safe for the workforce.

The second factor was labelled subjectively as awareness and belief which scored 22.12% of variance with five variables. Four out of five variables in the factor scored loadings well above 0.80 level. Only one variable scored 0.78 which is well above the required level of 0.50. The five variables contained in the factors were: safety at workplace considered as top priority for everyone, management actions towards promoting safety at works through various safety interventions, supply of basic safety personal protective devices like safety helmet, shoes, goggles and job specific PPEs as and when required, adherence to safe work procedures for the routine and non-routine activities and awareness on hazard potentials at construction jobsites. The mean for the awareness and belief factor was 3.90. It can be interpreted that the safety awareness and safety belief of the workforce is relatively appreciable to enhance safety level at workplace

The third factor was labelled subjectively as supportive work environment which scored 14.43% of variance with three variables. Two out of three variables in the factor scored loadings well above 0.80 levels and only one variable scored about 0.70 which is well above the required level of 0.50. The three variables contained in the factors were: management encourages feedback from workers, management ensures proper safety

communication so as to reach the grass root level and management arranges skill and job specific safety training to the workforce instead of generic safety training. The mean for the supportive environment factor was 3.576. It can be interpreted that support from the management is moderately good for the workforce enhance safety level at workplace. Supportive work environment manifests the level of co-workers and management support as well to encourage safe work behaviour.

The fourth factor was labelled subjectively as risk perception which scored 9.42% of variance with two variables. Both the variables in the factor scored loadings well above 0.80 levels and only one scored negative loading for the variable pertaining to excitement in risky jobs. It shows that the workers would not override safety practices and indulge in risky activities. The mean value for the variable capability of workforce to identify the potential hazards at worksite was 4.03. It can be interpreted that the risk perception prevailing among the workforce is relatively appreciable and hence the workforce would not indulge in at-risk behaviour.

3.3 Demographic Profile of Workforce

The personal characteristic details for the workforce like age, basic education, safety training, experience, skill levels and marital status were captured during the survey.

Table 4 Personal and Accident Characteristics

Characteristics	Personal	Accident
1. Age in Years		
Below 30 years	51%	41%
Above 30 years	49%	59%
2. Basic Education		
Attend School	48%	24%
Not Attend School	52%	76%
3. Safety Training		
With safety training	40%	38%
No safety training	60%	62%
4. Experience		
Below 10 years	42%	27%
Above 10 years	58%	73%
5. Skill Level		
Skilled	75%	65%
Semi-skilled	25%	35%
6. Marital Status		
Married	76%	76%
Unmarried	24%	24%

The summary of demographic profile of workforce is presented in dichotomous scale in Table 4 for the further descriptive analysis.

3.4 Occupational Accident and Injuries

According to Hamalainen [28], in India, about 48,000 workers per year lost their precious lives and about 37 million workplace injuries resulted in at least four days absence from routine work in any case. The rate of fatality is about 11.40 for every 100000 labours and the rate of injury is 8.70 for every 100 workers. According to ILO survey 2009, about 16.5 for every 100 workers sustained occupational injuries at construction jobsites [29]. It was attempted to compare the aforesaid injury data with the current study.

The descriptive analysis for self-reported accidents statistical data of the workforce revealed that about 93% of workers reported that they sustained at least one injury at construction site throughout their experience. The reported average work experience in years for the construction worker in this current study is 11.84 years. The annual rate of injuries is worked out to be (93/11.84) 7.85 injuries per 100 workers which is relatively lower than the injuries reported in the previous studies. The reasons attributable to this relatively lower rate of injuries can be interpreted as below. Firstly, the descriptive analysis for the risk perception factor shows that the mean value for the first variable (i.e.) capability to identify the hazards among the workforce was 4.03. Secondly, it can be seen from the risk perception factor that the second variable (i.e.) excitement and inclination for taking risks at workplace scored higher negative factor loading (-0.885) which means the workforce would not indulge in at-risk behaviour.

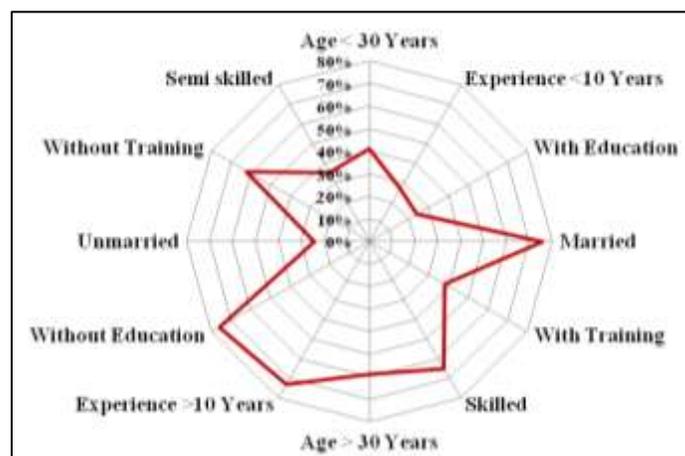


Figure 2 Accident Data in Dichotomous Scale

Only 7% of workers reported that there were no injuries for them. Further, 52% of workers reported medical treatment injury or restricted work case injury which reduces the efficiency in productivity. However, it does not result in absence from work for the injured worker. About 28% of workers reported lost time injury which result in absence from work for more than 48 hours for the injured worker. About 59% of workforce reported more than one injury. The self-reported data revealed that the prominent causes for the workplace injuries are their own unsafe behaviour, recklessness, misuse of tools, non-adherence to personal protective equipments, lack of risk perception and unforeseen risks. The self-reported accident data for the workforce is presented in Figure 2 as dichotomous scale for the six personal characteristics reported in Table 4.

The findings of this study and suggestions for the improvements for improving the workplace safety at construction sites are detailed as under.

- It is to reiterate that the construction companies must conduct safety attitude and risk perception surveys at their construction sites to comprehend the attitudes and perceptions of the workforce and employees as well separately [30] in order to improve the safety climate at worksite.
- Literatures reveal that the safety climate construct can predict the unsafe or risk behaviour of the workforce at construction work sites. Hence, the predictive ability of this safety climate construct is to be tested and validated so that this construct can be put into wider use across the organisations for the prevention of injuries at workplace.
- The accident history of workforce is to be documented while recruiting the workforce and employees as well so that the same can be used as training module to prevent the recurrence of such untoward incidents. Also, these lessons learnt from incidents resulted in injuries would serve as an excellent tool for the organisations to inculcate the safe work attitude and safe work behaviour among the workforce.
- Hazard identification and elimination of hazard potential is of paramount importance for the incident prevention and to enhance the status of physical work environment. Management action towards this aspect also demonstrates the management commitment for the improvement in supportive environment.

4 Conclusions

The current study was carried out to examine the safety climate prevalent among the workforce in the construction industry. The prime objective was to figure out the most suitable safety climate variables to investigate the attitudes and perception of the construction workforce. The exploratory factor analysis for the safety attitudes and perceptions of workforce revealed the existence of an additional factor labelled as risk perception for the current

study. Risk perception is an important aspect of safety climate to enhance the safety perception and safety attitude among the workforce through proper skill specific or job specific safety training rather than generic safety trainings. The self-reported accident statistics reveal that the lack of basic education from the workforce and lack of safety training from the management is the predominant cause for the concern. The generic safety training offered by some organisations to the workforce breeds only boredom to the workforce and does not add any value to the organisation. The other causes for the accident in the context of current study are the reckless or unsafe behaviour of the workforce in addition to the poor risk perception among the workers. Further study is also required to test and validate the predictive ability of safety climate construct so that the at-risk or unsafe behaviour of workforce can be predicted earlier and hence the undesired accidents could be prevented at worksite through appropriate safety training. In order to ensure the sustainability at construction jobsites, the safety climate is to be improved so as to inculcate the sustainable safety culture.

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