Measuring Safety Climate to Enhance Safety Culture in the Construction Industry of Pakistan.

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ABSTRACT

Construction is among the hazardous industries which raised the concern of stakeholders to improve safety performance by stream lining the safety management system attributing the safety climate perspective. The objective of this study is 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. A safety climate questionnaire has been surveyed (self interviewed and post mail) among 21 construction companies and 36 construction projects (diversified in type and location) in Pakistan, response rate was excellent (83.33%). By means of factor analysis, two significant safety climate factors were extracted, accounting for 23.567% of the total variance. Multiple regression analysis revealed two pivotal factors "Management dedication" and "Employees' involvement" portraying workers' perceptions of safety performance. This study indicates that high efforts of management needs to involve workers for safety related activities which helps for effective safety management system implementation and each employee to acquire safety knowledge which would develop capability for safe operation on construction sites. Finally, this work provides useful information for project managers and practitioners who desire to improve safety performance on construction sites.

Keywords: Safety Culture, Safety Climate, Safety performance, Pakistan.

1. INTRODUCTION

Construction industry has attributed to economically and socially importance but also recognized as most hazardous (Suao and Jaselskis, 1993; Hinze 1997; Sawacha et al. 1999; Choudhry et al.2008). Generally, construction sites are one of the most dangerous workplaces because of high incidence or accidents (Teo et al, 2005; Ahmed et al., 2000). Gradual increase in relative percentage of Construction with other industries for occupational injuries and diseases has been observed from 12.54 (2002) to 14.54 (2009), evident of poor safety practices at construction sites (Survey of Pakistan, 2002 - 2009). A mean value of Safety Performance Index of 0.52 indicates that even the basic practices required for safety are not present at most construction site in Pakistan. Also, the scattered safety performance levels of firms indicate lack of standard safety management system. (Farooqui et al. 2008). The construction industry is one of the most injury-prone industries worldwide in terms of serious injuries, lost work time, hospitalization, disability, and mortality, and there is great need to improve worker safety at construction sites (Kines et al. 2010). Improvements in working conditions and innovations in the equipment used in the industry are not enough to improve safety performance because organizational culture and human factors also play critical roles (Zhou et al. 2008). Construction safety culture is a subset of the overall culture of an organization and is seen as affecting the attitudes and beliefs of members in terms of health and safety performance (Choudhry et al. 2007), while safety culture is about good safety attitudes, it is also about good safety management established by organization (INSAG-4). Kennedy and Kirwan (1998) reveal that safety management is regarded as the documented and formalized system (policy, procedures, training, instructions, and resources) of controlling against risk or harm. The safety climate relies and focuses on current safety activities to establish the success of the safety management system rather than the system failure (Cooper and Phillips 2004; Choudhry et al. 2009). Safety performance portrays the occupational health and safety (OHS) status of construction work environment, which is measured in two ways i.e. reactive/lagging (Cohen 2002; Mohammad 2002; Hinze 2005) indicators and proactive/leading indicators (Hinze 2005; Choudhry et al. 2007). Positive performance indicator is stated to be safety climate "reflects employees' perceptions about the organization's safety management system including policies, practices procedures that how safety is implemented" (Choudhry et al. 2009). Neal et al. (2000) evaluated that organizational climate exerted a significant impact on safety climate and the effect of safety climate on perceived safety performance was mediated by safety knowledge and motivation. Guldenmund (2000) concluded that safety climate might be considered as an alternative of safety performance indicator. The power of the safety climate concept lies in its ability to predict safety performance (Pousette et al. 2008).

Present study is the pioneer effort to assess the safety climate in the construction industry of Pakistan as no prior valid research has been reported in this field.

1. To conduct a safety climate questionnaire survey on Pakistani construction sites that examine employees' perceptions for safety;
2. To determine the structural factors of safety climate which has major impact and need to be considered by management to improve the safety climate on construction sites;
3. To analyze the data statistically to evaluate the relationship between safety climate and perceived safety performance on construction sites; and
4. To suggest ways to improve the existing safety climate in the construction projects.

2. LITERATURE REVIEW

Zohar (1980) defined safety climate as "summary of molar perceptions that employees share about their work environment." The term safety climate refers to perceptions of policies, procedures and practices relating to safety in the work place. Glendon and

Stanton (2000) demonstrate that organizational climate refers to the perceived quality of an organization's internal environment. Flin et al. (2000) defined safety climate as the shared perceptions about safety values, norms, beliefs, practices and procedures. Mohamed (2003) stated that the safety climate is largely a product of safety culture and the two terms should not be viewed as alternatives. Choudhry et al. (2007) provided the definition that *safety climate reflects employees' perceptions about the organizations' safety management system including policies, practices, and procedures that show how safety is implemented in construction sites environments*.

Safety climate measures vary significantly, typically, factor analysis (FA) is employed to identify an underlying structure for questionnaire items. A cluster of obtained factors is interpreted to be as scales, factors, or dimensions of safety climate. Some studies have begun to explore the safety climate concepts in construction for example, Pousette et al. (2008) and Choudhry et al. (2009).

Dimensions of Safety Climate

Addressing safety climate dimensions specifically construction industry, Glendon and Litherland (2001) found six factors for safety climate in a road construction organization include communication and support, adequacy of procedures, work pressure, personal protective equipment, relationships, and safety rules. Mohamed (2002) has identified 10 dimensions of safety climate in construction site environments include management commitment, communication, safety rules and procedures, supportive environment, supervisory environment, workers' involvement, personal risk appreciation, appraisal of work hazards, work pressure, and competence. For Hong Kong construction industry, Fang et al. (2006) evaluated 10 dimensions as safety attitudes and management commitment, safety consultation and safety training, supervisor's role and workmates' role, risk taking behavior, safety resources, appraisal of safety procedure and work risk, improper safety procedure, worker's involvement, workmate's influence, and competence and Choudhry et al. (2009) reduced these factors to two as management commitment and employees involvement, and inappropriate safety procedures and work practices.

Safety Climate and Demographic Factors

The NIOSH studies demonstrated that safety climate was an important predictor of adherence to safe work practices, explaining far more variance than demographic or other individual factors (Hahn et al. 2008). Nonetheless, empirical justification for using personal demographics as a validation technique is required if safety climate research is to progress (Cooper and Phillips, 2004). Siu et al. (2003) investigated age difference in safety attitudes and safety performance in Hong Kong construction workers with data from 374 Chinese construction workers from 27 construction sites. The study found that the older workers exhibited more positive attitudes toward safety. Fang et al. (2006) used logistic regression to explore the relationship between safety climate and personal characteristics. Statistically, eight personal characteristics namely age, marital status, the presence of dependent family members, education level, safety knowledge, drinking habits, direct or indirect employer, and breaking safety procedures or not, were found to be related to safety climate perceptions. Five variables, including gender, work experience with the company, work experience in the construction industry, whether injured or not, and smoking habits were found to have no influence on perceptions of safety climate. Choudhry et al. (2009) found positive effects upon perceptions of older workers, who are married, and have more family members to support yet have little impact upon those who are in the youngest age, single, or have no family member to support. Workers with educational levels below primary had less perception of the safety climate. Respondents revealed that subcontractors' employees had a less positive safety climate as compared to the direct employees of the company.

Safety Climate and Safety Performance

Prioritizing and valuing safety (i.e., having a positive safety climate) have been shown to enhance safety performance and decrease employee injuries (Zohar, 2002). The influence of safety climate on individual safety behavior transfers to safety performance, termed as effective way (Fang et al, 2006)**.** Research studies provided evidence of correlation through identified dimensions or factors, a measure of safety climate with safety performance (Findley et. al, 2007). A safety climate is usually regarded as a subset of an organizational climate; similarly, safety performance is considered to be a subsystem of organizational performance. Hence, the safety climate can influence safety performance (Wu et. al, 2008). Recent meta-analytic evidence has confirmed that safety climate is associated with greater safety performance and decreased rates of accidents and injuries (Gentleman et al. 2010). Leading performance indicators (Safety climate) have the advantage of identifying weaknesses in safety management practices before they manifest as accidents (Mearns et al. 2003). This is supported by a previous study that if safety climate improvements are to have any impact on safety performance, then the survey must first produce changes in employee's knowledge and motivation (Neal et al. 2000). Mohamed (2002) developed a research model based on the hypothesis that safe work behaviours were the consequences of the existing safety climate in construction site environments. Broadly, safety performance measurement techniques can be categorized into statistical measures, behavioural measures, periodic safety audits, and a balanced scorecard approach. Guldenmund (2000) concluded that safety climate might be considered as an alternative safety performance indicator. Actually the power of the safety concept lies in its ability to predict safety performance (Pousette et al. 2008)

3. RESEARCH METHODS

From the literature review, potential safety attributes affecting safety performance on construction sites were identified. Based on the previous research by Choudhry et al. (2009), the present questionnaire was modified for measuring safety climate.

Questionnaire

Safety climate deemed to investigate the perceptions of the employees regarding management commitment or to identify areas to improve safety, safety climate was the preferred term when psychometric questionnaire studies were employed as the measurement instrument (Hale and Hovden, 1998).

As mentioned before a safety climate questionnaire survey has been conducted by Choudhry et al. (2009) in Hong Kong construction industry, derived two factors upon 31 safety climate statements by performing principal component factor analysis, to construct safety climate for the construction company (Gammon Construction Limited). In term to investigate the safety climate on Pakistani construction sites this 31 items safety climate questionnaire was adopted then 9 additional items were included to make the questionnaire suitable in accordance with the safety management systems operational in accordance with the safety management systems operational in Pakistan.

The questionnaires were prepared both in English and Urdu versions. The questionnaire in its final form consisted of 60 statements about safety issues at the organizational, group, and individual levels and consisted of four parts. The first part of the questionnaire related to the respondents' general information. The questions include respondent's project name, name of the company, department and working group. Further questions included the respondent's job information that is he/she a worker or clerical staff, supervisor or a manager. The second part consisted of 40 safety climate items which asked the participants to endorse the statements using a five-point Likert -type (from 1 = "strongly disagree" to 5 = "strongly agree") scale. The third part consists of four questions. Two questions measured respondents' perception on safety performance for the surveyed projects. The other two questions measured respondents' perception of safe work behaviour. Respondents were asked to indicate, on average, the percentage of time they and their co-workers follow all of the safety procedures for the job they perform. The fourth part of the questionnaire included 10 questions on personal information, including demographic information such as age, gender, marital status, and number of family members to support, education level, direct employer, and work experience with the company and in the industry, habit of smoking at work. In addition respondents' trade or work type has been asked, which is only for workers. At the end of the questionnaire suggestions regarding safety and survey has been asked, which was optional.

Data Collection

Ojanen et al. (1988) argue that the only way to measure the safety climate is by surveys. A questionnaire survey has been conducted on 36 construction projects visited located in or near major cities of Pakistan. This survey has taken around two months to visit each construction site except sites in Hyderabad, Karachi and Swat (post mail questionnaire received). These projects were also diversified in type of work as Bridge (2), Educational Building (8), High rise building (5), Hospital (1), Housing(2), Industrial building (7), Mosque(1), Office Building (5), Residential Building (1), Road (3) and Ware House (1). Around 21 construction companies were visited varied in categories of Pakistan Engineering Council (CA=9, CB=2, C1=2, C4=5, C5=1, C6=1, OA=1). There were average more than 150 employees engaged on each project at the time of visit (including company staff, company worker, sub-contractor workers and consultant/client representatives as well). To check and avoid the problem bias, self interviews conducted with 110 respondents and 40 respondents filled questionnaire under Manager monitoring. Overall response of construction companies for the survey is appreciated even though no obligation from client and administration body forced.

Sample

Questionnaire survey to 36 construction sites has resulted 150 valid responses which is 83.33% of questionnaire distributed, representing true sample of the construction industry. There was least response received from Managers, Supervisors and workers , which were in the ratio of sample as 1.6 : 1.0 : 2.0.

From the 150 employees hereinafter called the valid sample or sample, 37.67% were between 21 to 30 years old, 37.67% were between 31 to 40 years, 13.33% were between 41 to 50 years old and the rest 13.33% were older than 50 years (see Figure 3.1). Gender-wise, 100% participants were male. Considering marital status, 77.33% of employees were married and 22.67% were single respondents. When asked how many family members are supported by you; 11.33% employees responded none, 18% are supporting one to two family members, 38% are supporting three to four dependent family members, 22% are supporting five or six family members, and 10.67% are supporting seven or more family members. 46% of the participants had an advanced degree, 21.33% were college graduates, 21.33% had a secondary education, 7.33% had a primary education, and 4% did not have a primary education. Most of the sample (19.33%) was subcontractor employees, 6% were employed by the joint venture, and 74.67% were directly employed by the company. Approximately 16% of the sample had worked for the present employer for more than ten years, and 15.33% had worked for more than six years, 44.67% had worked between one to five years, and the rest 24% had less than one year working experience with the present employer. As for construction industry experience, 15.33% of the sample had less than 3 years working experience, 34.67% had three to ten years working experience, and rest50% had more than 10 years working experience. Approximately (63.5%) of the sample did not have a smoking habit; 16.9% responded that they did not smoke at work; and the rest 19.6% used to smoke at work. All this personal information provided useful data for the safety climate research and the sample was quite representative of the total workforce.

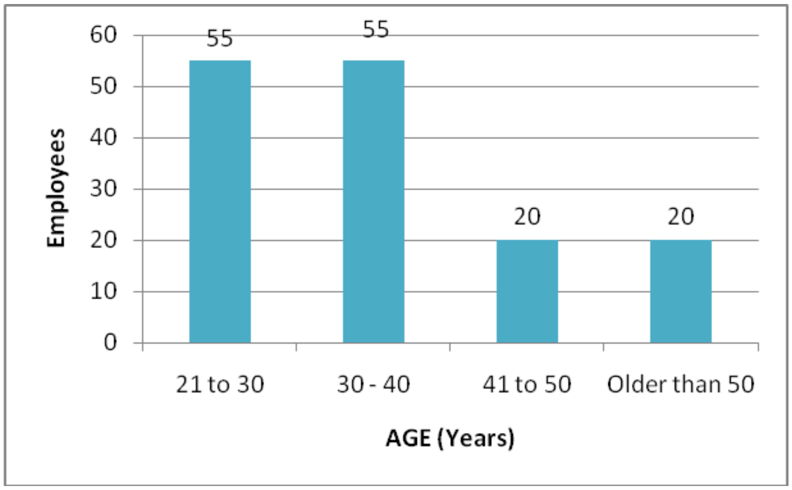

Figure 3: Age of participants of sample

The quantitative data collected was analyzed by statistical techniques adopted previously such as factor analysis and multiple regressions to evaluate the essential factors affecting safety climate and its impact on safety performance (Fang et al., 2006; Choudhry et al., 2009). SPSS version 17.0 has been used for statistical analysis. Lee (1998) found significant differences in safety climate scores by organizational level. Comparison of safety climate mean scores has been done for companies, projects (according to project type), and position, demographic factors (age, marriage status, family dependents, educational level, direct employer, industry experience and smoking habits).

4. RESULTS OF RESEARCH

Factor Analysis

The factor analysis technique was used to identify the underlying cluster of factors which affect safety climate. A principal component analysis (PCA) of factor extraction with Varimax rotation (converged in 29 iterations) on the 40 questions/statements (N= 150) was carried out through the SPSS 17.0 factor program. According to George and Mallery (2006, p.256), the KMO value (Kaiser-Meyer-Olkin Measure of Sampling Adequacy) should be greater than the acceptable threshold of 0.5 and a value greater than 0.6 is mediocre, > 0.7 is middling, > 0.8 is meritorious and > 0.9 is marvellous for a FA to proceed. In this study, the KMO-value was equal to 0.818, which is well above the acceptable threshold indicating that the data was appropriate for factor analysis. Barlett's test for sphericity was used to test the hypothesis that the correlation matrix was an identity matrix. In this case, the value of the test statistic for sphericity is large (chi-square value = 2636.943) and the associated significance level is small (p-value = 0.000), indicating that the population correlation matrix is not an identity matrix as a factor analysis would be meaningless with an identity matrix (George and Mallery, 2006). A significance value < 0.05 indicates that the data does not produce an identity matrix or differ significantly from identity. The overall Cronbach's Alpha value is 0.819, indicating that there is good internal consistency reliability between factors as a value of

0.70 or above is acceptable as desired value of the Cronbach's Alpha (George and Mallery, 2006 p. 231; Lee and Harrison, 2000; Cooper and Phillip, 2004). Since the requirements of KMO measure, Barlett's test of sphericity and Cronbach's Alpha values were all achieved, the factor analysis for this research can proceed with confidence. A total of 12 components or factors were extracted from the 40 item questionnaire and from 150 valid responses accounting for 69.33% of the variance (see Table 4.3), which is comparable to other related research studies (Choudhry et al., 2009) i.e. 59.5%, for example Fang et al. (2006) was 47.6%. SPSS drops components 13 to 40 because their eigenvalues are less than 1.0, implying that they are less influential than the 12 obtained group factors. The original 40 safety climate influencing variables/statements were all included in one of these 12 underlying factors. According to Pallant (2007), smaller sample size (e.g. 150 cases) should be sufficient if solutions have several high loading marker variables (above 0.75 or 0.8). Items with low communalities (e.g., less than 0.3) and displaying low factor loadings in the rotated component matrix were removed (Pallant 2007, p. 196). In first attempt items C06, C11, C15, C20 and C36 with low communality values of -0.375, -0.658, -0.528, -0.476 and -0.442, removed. In second attempt two more items as C21 and C40 with low communality values of -0.316 and -0.398, removed. Lastly only one item C39 found with low communality of 0.321, which was removed. The removal of problem items is useful if one is interested to improve the scale after a survey. In result KMO value increased 0.829 (>0.5), for Barlett's test for sphericity chi-square value reduced 1956.953 but with associated significance level is small (p-value = 0.000), indicating that the population correlation matrix is not an identity matrix as a factor analysis would be meaningless with an identity matrix (George and Mallery, 2006). Varimax rotation is still valid and rotation converged to 11 iterations. Twelve components now reduced to ten components (cumulative variance of 68.651%) with more loading (>0.75) in first and second components but later components comprise of only of variable with loading more than 0.75, except component 3 and 4 (no variable above 0.75 found). Rotation sums of square loading are described component wise 1 (18.591%), 2(30.419), 3(36.625%), 4(41.864%), 5(46.994%), 6(51.971%), 7(56.507%), 8(60.577%), 9(64.619%) and 10(68.651%).

Table 4.1 contains the details of factor loading which indicates the strength of relationship between a particular variable (denoted by C01, C02 … C32) and a particular factor. Moreover no variable found under component 3 and 4 with loading above 0.75, so not inducted in the table.

Almost all loadings of the 32 individual factors were greater than 0.80, or close to 0.75 preferred (Pallant, 2007). Thus, the values show the degree of contribution of individual variables to each underlying factor. A positive sign of the factor loading means that the variable is directly proportional to safety climate, whereas a negative sign means that the variable is inversely proportional to safety climate. For example, accidents are inversely proportional to safety climate. Figure 4.13 is a scree plot between eigenvalue of each factor with component numbers. The gradual trailing off of the plot is the "scree" because it resembles the rubble that forms at the base of a landslide (George and Mallery, 2006). The Figure 4.1 confirms that derived factors are influential as with low variance differences these merge on elbow of scree plot, considered for research model.

No.	Item	Factor Loading
Factor 1: Management dedication; Eigenvalue 5.949; % of Variance 18.591 ; Cumulative % 18.591		
Q 23	Management motivate site employees for working safely	0.783
Q 24	Management clearly communicates safety issues to all levels within the organization	0.760
Factor 2: Employee's engagement; Eigenvalue 3.785; % of Variance 11.827 ; Cumulative % 30.419		
Q 28	It is in my interest to maintain a safe workplace.	0.786
Q 33	I participate in safety planning, according to our safety policy if being asked	0.757
Q 32	My aim is to achieve high levels of safety performance	0.748
Factor 5: Employee's partcipation; Eigenvalue 1.642; % of Variance 5.130 ; Cumulative % 46.994		
Q 02	Suggestions to improve health and safety are seldom acted upon.	0.813
Factor 6: Employee's involvement; Eigenvalue 1.592; % of Variance 4.976 ; Cumulative % 51.971		
Q 03	I feel involved when health and safety procedures / instructions / rules are developed or reviewed.	0.867
Factor 7: Inadequate implementation of safety rules; Eigenvalue 1.452; % of Variance 4.536 ; Cumulative % 56.507		
Q 26	Current safety rules and procedures are so complicated that some workers do not pay much attention to them	0.826
Factor 8: Work pressure; Eigenvalue 1.302; % of Variance 4.070 ; Cumulative % 60.577		
Q 04	Productivity is usually seen as more important than health and safety by management.	0.831
Factor 9: Insufficient Safety knowledge; Eigenvalue 1.294; % of Variance 4.042 ; Cumulative % 64.619		
Q 12	People are just unlucky to suffer an accident.	0.801
Factor 10: Responsibility for safety; Eigenvalue 1.290; % of Variance 4.032 ; Cumulative % 68.651		
Q 05	People here always work safely even when they are not being supervised.	`

Table 4.1 Factor Structure by Principal Factors Extraction and Varimax Rotation.

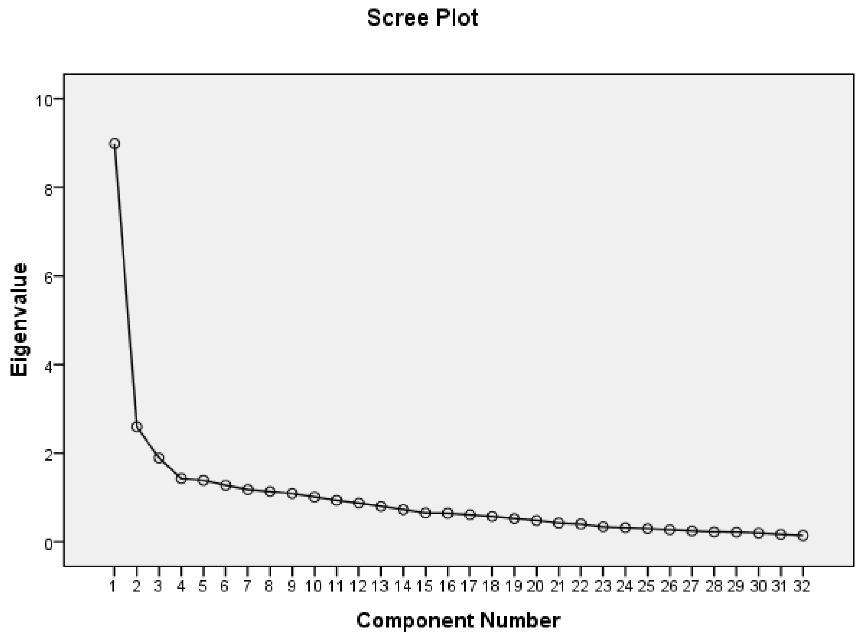

Figure 4.1: Scree-plot of the 32 variables influencing safety climate

Table 4.1 lists the grouped safety climate influencing factors (8 numbers) in descending order of significance to determine underlying features that linked them as Factor 1 (Management Dedication), Factor 2 (Employee's engagement), Factor 5 (Employee's participation) , Factor 6 (Employee's involvement), Factor 7 (Inadequate implementation of safety rules) Factor 8 (Work pressure), Factor 9 (Insufficient Safety Knowledge), Factor 10 (Responsibility for safety)

Model of Safety Climate and Safety Performance.

A regression model is a mathematical model that can relate a number of independent variables to a dependent variable and can summarize data or the relationships among variables (Chan et al., 2005, p.34). A regression model having more than one independent variable is called a multiple linear model. Multiple linear regression analysis was used in this research to study the relationships between safety performance (dependent variable) and safety climate factors (independent variables). A stepwise variable selection was adopted as it is the most frequently used method for model building (Norusis, 2005; George and Mallery, 2006) to identify the critical success factors. The stepping method criteria selected the p value = 0.05 for a variable to enter the regression equation and p value = 0.10 to remove an entered variable (Norusis, 2005; George and Mallery, 2006). The model gives an equation which contains a constant (intercept) and partial regression coefficients for each of the critical success factors. Eight safety climate factors extracted by factor analysis from the 32 variables were used as independent variables in evaluating the relationship with perceived safety performance (dependent variable question Q41) on the 36 construction sites. Dependent variable question Q41 asked respondents to evaluate the overall safety performance of your site on a scale of one to five (from 1 = Poor, 2 = Marginal, 3 = Average, 4 = Good and 5 = Excellent).

Independent Variable (Safety	Un-Standardized Cefficients (β)	Un-Standardized Cefficients (β)	Adj. R^2 (Partial)	Adj. R^2 Change (Part)	t-value	Sig.
y-intercept (i.e. constant)	0.727				2.099	0.038
Factor 1: Management dedication	0.575	0.501	0.258	0.239	7.082	0.000
Factor 6: Employee's involvement	0.145	0.163	0.036	0.025	2.309	0.022

Table 4.2: Results of Stepwise Multiple Regression
(Note: Dependent Variable – Please evaluate the overall safety performance)

Table 4.2 shows the un-standardized and standardized regression coefficients (β), adjusted R2, R2 change, t-value and significance level for the sample. Employee's engagement (Factor 2), Employee's participation (Factor 5), Employee's involvement Inadequate implementation of safety rules (Factor 7), Work pressure (Factor 8), Insufficient Safety Knowledge (Factor 9) and Responsibility for Safety (Factor 10) were excluded from the regression model because they failed the entrance criteria of stepwise variable selection described above. Management dedication (Factor 1), Employee's involvement (Factor 06), were significantly different from $p \leq 0.000$ to $p \leq 0.044$. Hence the Multiple Linear Regression equation for safety performance is:

Safety Performance = 0.727 + 0.575(F1) + 0.145 (F6) [Equation 4.1]

The equation 4.1 gives the relationship between perceived safety performance and significant safety climate factors. Wherein the β values indicate the relative influence of the entered variables, that is F1 (Factor 1) has the greatest influence on safety performance (β = 0.575) followed by F6 (Factor 6) with β = 0.145, with positive Direction. An R square change value of 0.239 indicates that 23.9% of the variance in safety performance is explained by Factors 1, followed by 2.5% by F6. On separate note adjusted R square value of model is 30.5% with Pearson correlation of independent variables as 0.221 present strength of relationship.

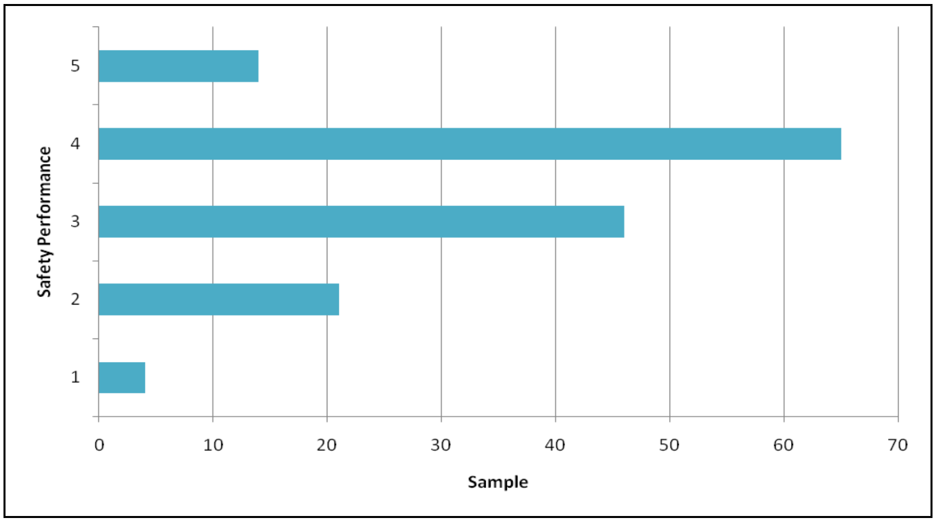

Figure 4.1 Frequency distribution diagram for the sample (N = 150)

Figure 4.1 exhibits the frequency distribution of the safety performance measure for all respondents of the sample. The x-axis represents the number of respondent and y-axis represents the safety performance scores entered by the respondents ranging from 1 to 5. The result shows that only 2.7% respondents rated a score of 1(poor), 14% of 2(Marginal), while a score of 3 (average) is rated by 30.7%, score of 4 (good) by 43.3%, and score of 5 (excellent) was rated by 9.3% respondents meaning that 52.7% respondents consider that safety performance of their company is good.

Demographic Factors and Safety Climate

Mean safety score has been analysed in accordance with demographic factors to investigate the perception about safety climate as age group (41 to 50 years), married respondents, respondents with more than 7 dependents, all respondents with basic education, respondents employed in joint venture projects respondents having more than 16 years experience and respondents who do not smoke, have clear perceptions.

5. DISCUSSION

Safety Climate Factors/dimensions

The discussion is concentrated on only two factors derived from Multiple regression analysis i.e. Management dedication (Factor 1) and Employee's involvement (Factor 06). Management dedication/commitment as potential dimension for the development of positive safety climate and widely accepted in many studies (e.g., Zohar 1980; DeDobbeleer and Beland 1991; Flin et al. 2000; Mohamed 2002, Fang et al. 2006 and Choudhry et al. 2009). Genuine and consistent management commitment to safety, including: prioritization of safety over production; maintaining a high profile for safety in meetings, personal attendance of managers at safety meetings and in walkabouts; face-to-face meetings with employees that feature safety as a topic; and job descriptions that include safety contracts (Mearns et al. 2003). Several studies show that the management's commitment and involvement in safety is the factor of most importance for a satisfactory safety level (Jaselskis et al. 1996). An insight of this factor portrays the perceptions regarding the proactive management involvement, managers' safety related communication and enforcement of safety programmes. Managerial policies and practices develop the level of commitment inducing the responsibility. Management's accountability for emphasizing on safety drive the dedication embedded with leadership approach. Employee commitment for safety is associated with management commitment and leadership. The pragmatic approach stemming with management's dedication for safety positively influence the employee's perceptions for safety. Safety knowledge and safety performance are also enhanced with real dedication of management for safety. The role in the capacity to management' support, involvement and commitment have on the efficiency and success of any safety performance scheme. (Sawacha et al, 1999). It can be evaluated from the discussion above that strong management commitment to safety and to demonstrate this dedication to employees at all level will enhance safety culture in positive direction.

Employees' involvement to develop or review safety rules/procedures address the significant role of workers to improve safety which is supported by studies (e.g., DeDobbeleer and Beland 1991, Mohammad 2002, Fang et al. 2006 and Choudhry et al 2009). Involvement of employees including; empowerment, delegation of responsibility for safety and encouraging commitment to the organisation (Mearns et al. 2003). Workers' involvement includes such issues as procedures for reporting injuries and potentially hazardous situations (Mohammad, 2002). In stance to encompasses the ability to address specific project objectives in relation to safety, appraisal of physical work environment, and workers' constructive involvement. (Mohammad, 2002).

Safety Performance Model

The results of multiple regression analysis identified the critical safety climate factors affecting respondents' perceptions of safety performance on construction sites. The results showed that the two factors, i.e., "management dedication" (Factor 1) and "employee involvement" (Factor 2) were significant contributors to perceptual safety performance on the construction sites (see Eq.4.1). "Management dedication" is found to be the most significant factor which affects perceptual safety performance but "employee involvement" found to be less significant. This finding consistent with Choudhry et al, (2009) that derived "management commitment and employee involvement" as first factor and "inappropriate safety procedure and work practices" as second factor. Current findings reduced to first factor and develop the significance of each element of the factor separately. Further the current factors are consistent with Jaselskis et al. (1996) that management's commitment and involvement in safety was the most important factor for a satisfactory safety level. This factor also emphasized the importance of employees' involvement and safety resources available for safety on the construction sites. Cheyne et al. (1998) have recently reported management commitment as a prime factor in their predictive model of safety behaviours, giving some support to the primacy of this factor. Employees' involvement in safety inspection enhanced the safety conditions as the hazards are identified on work site, but critical in nature due to varied attitude for safety.

Employee involvement can include seemingly simple practices such as input in decision making; yet, interventions or programs that are solely determined by management can fail to promote change at the level of front-line workers (Gittleman et al. 2010). Both the factors derived from multiple regression correlation has positive relation (positive coefficients) with safety performance in regression equation. There is need of dedication from management which is previously derived as commitment, stipulated with the intervention of employees, will enhance the safety culture.

5. CONCLUSION

Stakeholders' awareness on construction safety culture and safety climate plays an important role in making construction sites a safer and healthier place to work. From FA, two principal components were established and they are namely: (1) management dedication and (2) employee involvement. These two factors are regarded as the most embracing attributes for this research in construction site environments. These factors have been regressed with the perceived safety performance scores to establish the causal relationship between safety climate and perceived safety performance. During the multiple regression analysis, the two underlying factors were used as independent variables in evaluating the relationship with perceived safety performance. All two factors were identified as significant in explaining the perceived safety performance in Pakistan from the multiple regression results. The regression results showed that "management commitment and employee involvement" were the most significant factors relating to perceived safety performance because it contributed the most for establishing positive safety climate on construction sites. Finally, the findings of this study may be useful in creating safer construction sites.

7. ACKNOWLEDGEMENTS

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