Investigation of demographic factors relationship with safety climate

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Demographic factors as age, education, experience, marital status, dependents, employment and habits have influenced workers’ safety perceptions. Perceptions portray the psychological construct of safety culture i.e. safety climate, which needs to be clear and positive. Safety climate as pivotal construct (perceptual) of safety culture shared common grounds as beliefs, values and attitudes for safety. This study is an attempt to investigate the relationship between demographic factors and safety climate, benchmark the perceptual trends in Pakistan. A safety climate questionnaire (40 statements with likert scale) survey was conducted on 36 construction projects with excellent response rate (83.33%). Mean safety climate score approach was adopted for current study to compare the categories of demographic factors. Results showed 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 and positive perceptions. In addition, bridge project type found to be with clear safety implementation approach. Lower categories (of construction companies) striving for safety and higher category have varied approaches. This study provides workers’ perception for safety in relation with demographic factors (identify worker groups for training) and in accordance with company or project type (drive direction for improvement upon current practices/trends).

Keywords: Safety climate, mean safety climate score (MSCS), demographic factors, Pakistan

Introduction

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 (Ahmed et al. 2000; Teo et al. 2005; Choudhry et al. 2009; 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). Safety culture is becoming critically important to the safety of employees on construction sites (Choudhry and Fang, 2006) and considering area of interest for researchers in recent years because of variation in workforce’ behaviour which is based on perceptions (safety climate). Safety practices in world constructions industries are unique due to demographics, legislation and stakeholders ‘contractual agreements. Implementation of a safety, health, and environmental management system is no widespread in developing countries (Koehn et al. 1995) and Pakistan is not exceptional. According to statistics (FBSa, 2011) 16% directly and 30% to 40% indirectly (manufacturers of construction materials, electrical, plumbing, wood work, HVAC, finishing products etc.) of total workforce of the country (all industries) related to construction industry. A gradual increase has been found in relative percentage for occupational injuries and diseases of industries (FBSb, 2002 - 2011), from 12.54 (2002) to 13.10 (2011), evident the lacking safety practices. Collectivistic and higher uncertainty avoidance attitudes of workers prevailed on construction sites as workers are diversified in demographics (Mohamed et al. 2005). Poor safety performance due to less incentive insurance mechanism which depends on legislation (Farooqui et al. 2008) and inappropriate safety behaviour with lacking awareness (Saqib et al. 2010). Safety climate measure portrays the perceptions of workers which are influenced by demographic factors as age, education, experience, employment, marital status, dependents, habits etc. Lack of safety records (lagging indicator of safety performance) on construction sites provides space to safety climate
(leading indicator of safety performance) for research to drive positive safety culture (Flin et al. 2000; Masood et al. 2011).

**Safety Culture and Climate**

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). Safety culture is crucial (Fang et al. 2006) to construction and its ability to embrace all managerial, behavioral and psychological factors made it the major issue in academic research on construction safety. The three main dimensions of safety culture (psychological, situational and behavioral) can be measured through a combination of qualitative and quantitative methods (Cooper, 2000).

Cooper and Philips (2004), safety climate is concerned with the shared perceptions and beliefs that managers and workers hold regarding safety in the workplace (i.e., safety climate is, to some degree, dependent on the prevalent safety culture). It can be, therefore, argued that safety climate is largely a product of safety culture, and the two terms should not be viewed as alternatives. It is regarded as a descriptive measure reflecting the workforce’s perception of, and attitudes toward, safety within the organizational atmosphere at a given point in time (Gonzalez-Roma et al. 1999). O’Toole (2002) proposed that there is a connection between management’s approach to safety and employees’ perception of how important safety is to the management team. Flin et al. (2000) reviewed existing safety climate measures in an attempt to establish a common set of organizational, managerial, and human factors that are being regularly included in measures of the safety climate.

**Safety Climate and Demographic Factors**

Substantial influence has been determined for demographic factors as personal characteristics as age, gender, marital status, education level, working experience in the industry, and other personal information. These demographic factors can influence safety climate and consequently influence individual safety behavior (Hinze, 1997). 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. Cooper and Phillips (2004) suggested that differences in types of work activity and other site situational conditions are much more important in climate research than personal demographical variables, such as age, job experience, or accident involvement. This finding makes sense, since safety climate measures tend to investigate employees’ perceptions about how on-site safety operates, which is theoretically and conceptually distinct from employees’ personal characteristics. Lee (1998) found significant differences in safety climate scores at by organizational level.

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.

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).
Objectives

1. To assess the perception for safety through safety climate survey;
2. To investigate the demographic factors relationship with safety climate.
3. To benchmark the perceptual demographic trends.

Research Methodology

Following are the main phases of the research study:

1. Initially in depth knowledge gained regarding the research stream through review of books, conference papers, journal papers, articles, internet browsing etc., which were sorted upon the degree of relevance to the study.

2. A questionnaire, developed by Choudhry et al. (2009) of 31 safety climate items, which has been formatted with required modification, inducting the pivotal research aspects derived from earlier studies for Pakistani construction industry (adding 9 more safety items). Main aspects covered were safety attitude and management commitment; safety consultation and safety training; supervisor’s role and workmate’s role; risk taking behaviour; safety resources; appraisal of safety procedure and work risk; improper safety procedure; worker’s involvement; workmate’s influence, and competence. The questionnaire in its final form consisted of 45 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, 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 (1 = “strongly disagree”, 2 = “disagree”, 3 = “neither”, 4 = “agree” and 5 = “strongly agree”) scale.

3. In data collection phase, a questionnaire survey was conducted on 36 construction projects (of different type as industrial, facility, housing, community buildings etc) located in different cities of Pakistan, moreover both lower and higher categories of contractors (as per P.E.C). Cumulative 150 valid responses (83.33% of distributed questionnaires) received and interview based questionnaire filled was 73.33% of valid responses.

4. Mean safety climate score (MCSC) was introduced which represents average value upon Likert scale against all safety items, further evaluates weak or strong perception regarding safety. Comparison of (MSCS) has been done for companies, projects (according to project type), position, demographic factors (age, marriage status, family dependents, educational level, direct employer, industry experience and smoking habits).

5. The results of the data analysis provided thought provoking issues for development of safety culture and termed to be taken as valid addition to safety research in perspective of Pakistani construction industry.

Data analysis

Mean safety climate score in respect to demographic factors, projects types and company category provides insight for relative perceptual trends.
Demographic Factors

Demographic factors include age, marriage status, dependents, education level, employment status and experience in the industry. According to Figure 1, mean safety climate score of age group (41 to 50 years) have clear and strong perceptions regarding safety on construction sites. According to Figure 2, mean safety climate score of married respondents is higher than single and take in account the safety during work.

![Figure 1: MSCS Score VS Age](image1)

![Figure 2: MSCS VS Marriage Status](image2)

According to Figure 3, mean safety climate score of respondent having more dependents (>7) have strong perceptions about safety. According to Figure 4, the number of respondents according education level is Secondary or below (49), Diploma (32), College or Higher (69) and all the respondents have basic knowledge, safety climate score is above average for all levels showed each respondent have some knowledge about safety, adequacy not emphasized here. There were only 17 respondents having primary or below education, which is small sample for comparison with rest.

![Figure 3: MSCS VS Family members/dependents level](image3)

![Figure 4: MSCS VS Educational level](image4)

According to Figure 5, mean safety score for respondents employed in joint venture projects have strong perceptions about safety. According to Figure 6, mean safety score for respondents having more than 16 years experience have deep and clear perceptions about the importance about safety. Employees at initial stage of career take interest in safety but decreases due to company policies. At peak of their career they put individual effort for safety when on higher posts.
According to Figure 7, mean safety score for respondents who do not smoke have clear perceptions about safety aspect. Smoking is prohibited on construction sites because it creates hazardous conditions which lead to disaster as fire etc.

**Project Type**

In each type of project at least 03 projects has been taken. Lowest score has been found for Facility Building (2.20) and highest score for Bridge project (4.03). This showed that perception about safety are well conceived for Bridge project due to complexity and hazardous jobsite conditions but for facility building less scores for safety found.
According to 21 construction firms categories ranged as CA, CB, C1, C2, C3, C4, C5, and C6 by Pakistan Engineering Council (PEC), a study for investigating safety climate has been conducted. Figure 9, showed minimum safety score is 3.15 (CA) and maximum safety climate score is 4.23 (CA).

**Company Category**

*Figure 8: Mean Safety Climate Score – Project Type*

*Figure 9: Mean Safety Climate Score – Company Type*
Discussion

Main objective of study was met by reviewing the relationship of demographic factors with safety climate, including project type and construction company category. The results showed that 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.

Workers are more mature in later stage of their service life stipulated with experience which helps them to address safety aspect and scrutinize the hazardous situations. Marriage relationship binds the worker to cater the social responsibility which is also strongly associated with his own life. Pakistani society is man dominant, where father bear all the expenses which put huge responsibility on him. Low education level responsible for poor perceptions about safety climate but current study showed all respondents have average positive safety attitude but collectivism of working groups supersedes individuality.

Bridge project found to be with clear safety implementation approach. Lower categories (of construction companies) striving for safety and higher category have varied approach. According to contract there is an amount assigned (approximate 2% of estimated contract sum) in the Bill of quantities (BOQ) for safety, contractor has to justify the expenses in this regard so that the amount is released. This BOQ item measures the personal protective equipment, signs, billboards, safety training and other preventive measures. According to the Environment, Transport and Works Bureau (ETWB 2005) in 1995, “pay for safety scheme” was implemented that must be included in all BOQ by the Engineer / Surveyor, which are separately paid. This scheme is seems to be valid for high budget projects accompanied with hazardous site conditions. Contractor on the bridge construction project (under study) showed high value because of legal binding by contract agreement through BOQ safety item (compulsory purchase of personal protective equipments, notices, banners etc.). Teo et al. (2005) showed contractors with higher categories in UK have clear perception for safety. Variation in scores found in CA category exhibits variation in perceptions. If the score of the lower classes is examined which are good in average entail the striving for positive safety culture, with the establishment in the market, and address all the aspects for employees and employers (clients).

Conclusion

Result of the study indicated that safety climate perceptions influenced by demographic factors such as age, education, experience etc. The results showed that 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. Bridge project found to be with clear safety implementation approach but the facility building (education) have low safety score. The construction companies of CA category have variation for safety perception but lower categories have average good perception about for safety aspect respective to organization maturity level. In effort to develop strong positive perceptions all the factors should be considered which results safe work practices.

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