

Psychological Factors Affecting the Perception of Personal Safety of Construction Workers in a Developing Country

Muhammad Dawood Idrees¹, Maria Hafeez¹, Jung-Yong Kim^{1*}

¹Industrial and Management Engineering, Hanyang University, Ansan, Republic of Korea
Dawoodidrees[at]hanyang.ac.kr, mariahafeez[at]hanyang.ac.kr, jungkim[at]hanyang.ac.kr

Abstract: *Psychological factors are very important in the perception of personal safety of workers in the construction industry. This study was carried out to examine the effects of psychological factors on the perception of personal safety in the construction industry in Pakistan. A questionnaire-type survey was designed based on existing studies and was tailored to the culture and environment of the construction industry in Pakistan. Data were collected from 124 workers from different trades at seven construction sites in Pakistan. A hypothetical structural model was developed based on psychological factors that could affect worker perception of safety. In the hypothetical structural model, five psychological factors were studied: (1) workload, (2) organizational relationships, (3) mental stress, (4) job satisfaction, and (5) job security. Structural equation modeling (SEM) was used to test the hypothetical model. The results of this study confirmed that psychological factors have direct and indirect positive effects on the perception of personal safety at construction sites in Pakistan.*

Keywords: Construction industry, Accidents, Safety of workers, Structural equation modeling; Psychological factors

1. Introduction

The construction industry is considered to be the most dangerous of all industries, in which safety is a leading burden because of poor safety practices [1]. Internationally, the construction industry experiences more than 100,000 casualties annually [2]. Construction work is considered a high-risk industry, and worker safety is complex because the work often involves heights, complicated machinery, and outdoor operations and because workers demonstrate varying attitudes and behaviors regarding safety [3]. In developing countries, the construction industry is socially and economically important [4] as it is a major source of employment. In recent times, the construction growth rate has been very high in developing countries, and it has become more challenging for workers to comply with safety policies and standards [5].

Pakistan is a developing country, and its construction sector is growing rapidly. The construction industry in Pakistan is a major source of employment. Most of the employees in the construction industry are unskilled workers who have migrated from rural to urban areas in search of employment, while the skilled workers are university graduates. Unfortunately, current national safety policies do not directly apply to this sector, and due to lack of implementation of safety regulations, workers in this sector face dangerous conditions [6].

Accidents occur due to many factors, but normally they are classified as having resulted from unsafe circumstances or the unsafe habits of workers [7]. Worker behaviors are reported major cause of accidents [8]. Psychological factors are strongly related to worker attitude, satisfaction, performance, commitment, and motivation [9] but also are related to worker organizations, supervisors, work environments, and organizational relationships [10]. Sawacha, Naoum [9] have

explained that psychological factors include personal care, safety training, supervisor behavior, co-worker behavior, and the impacts of health and safety.

Frequent causes of job accidents include the attitudes of workers, working conditions, working procedures, workload, job insecurity, job satisfaction, role clarity, and mental stress. Organizational factors such as working conditions and workload are negatively associated with job satisfaction. Excessive workloads and poor physical work conditions reduce workers' job satisfaction. Organizational relationships (an indication of workers' feelings toward the organization) significantly affect job satisfaction [11].

The major cause of stress and anxiety in workers is fear of job the continuity [12]. Signs of job-related stress include irritation, poor attitude, sleep disorders, difficulty concentrating, headaches, and poor relationships with friends and family [13]. There is a clear relation between work stress and mental health. Mental health in the workplace can be interpreted as the psychological health of the workers in an organization [13].

Industrial disasters and accidents are mediated by job satisfaction [14]; thus, job satisfaction has a significant relationship with worker safety. Workers satisfied with their jobs are frequently more safety conscious [15] and have fewer accidents than those unsatisfied with their jobs [16]. Workers who experience job insecurity, stress, and anxiety demonstrate reduced motivation for safety [16].

Psychological factors can be explained as the interactions between a worker and the work environment, workload, working conditions, organizational relationships, co-workers, supervisors, and managers. Psychological factors have a strong relationship with personal safety and safety performance. Workers who are conscious of personal safety have fewer accidents than those who neglect safety [9].

2. Literature Review

The unsafe practices of workers are considered to be a major cause of accidents [17]. Understanding the elements of human error in any accident at a construction site is very important, but these elements are generally not discussed, which is why accidents continue to occur. It is assumed that psychological factors influence workers' perceptions of safety, and researchers have considered the impacts of different psychological factors on the perception of safety of workers at construction sites. It is important to analyze such psychological factors, as they are directly and indirectly related to accidents.

Jones and James [18] characterized the psychological climate of industry as including conflict, ambiguity, job challenges, importance, variety, leadership, facilitation, management support, workgroup cooperation, relationships, affection, organizational and professional cleverness, and job standards. The organizational relationship is the psychological relationship between an organization and its employees [19]. Employees who have good relationships with their organizations show high commitment to the practice of safety [20]. Management performs a central role in promoting safety, and management commitment is a major component of the safety climate [21]. Workers are more concerned about their safety and intend to cooperate to improve safety when they believe the management is concerned about their safety [22]. The management is responsible for ensuring worker safety at construction sites, and workers often believe that nothing is possible without the support of the management [3].

Mohamed [23] examined the relationships between the safety climate and the elements of the safety climate and developed a broad hypothetical model based on the notion that safe work behaviors and their reciprocal unsafe behaviors result from five independent factors of work pressure, management, risk, safety, and competence. The results indicate that management has a direct and significant relationship with safety.

The industrial climate is a useful concept to elucidate the psychological factors associated with accidents [24]. It is extensively recognized that psychological factors influence worker safety at construction sites [3]. Parker et al. [10] performed a meta-analysis to examine the relationship between the psychological climate and work outcome. Their findings indicated that there is a significant relationship between the psychological climate and worker attitude, motivation, and performance.

Sawacha, Naoum [9] used factor analysis to identify the factors that most strongly influenced worker safety. The results revealed that historical, economical, and psychological factors are strongly correlated with the safety of workers. Workers feel greater ease and comfort with supervisors who care for their safety [3]. The economical factor is also one of the most important factors in worker safety. Monetary worker productivity incentives can cause workers to work unsafely in order to achieve maximum productivity [9].

3. Methodology

3.1 Research approach

This research was based on a literature review of past experimental studies of construction safety published in academic journals. A questionnaire-based survey was conducted at different construction sites in Pakistan in order to investigate the effects of psychological factors on the safety of workers. A two-part questionnaire-based survey was developed to obtain data. The first part of the survey consisted of seven questions based on demographic data, and second part composed of 36 statements focused on the psychological factors and their effects on the perception of personal safety of construction workers. The questionnaire used in this study was adopted from previous literature; some modifications were made to these questionnaires, according to the construction industry environment and culture of Pakistan.

3.2 Participation

The feedback of all participants was listed on Likert-type scale. In total, 124 participants were selected randomly from seven different construction sites in Pakistan, including managers, Engineers, construction managers, supervisors, and workers from different construction trades. Demographic data of the participants are presented in Table 1.

Table 1: Demographic of participants

Item	Category	Frequency
Age (Years)	18-25	24
	25-35	58
	35-45	32
	45-55	8
	Above-55	2
Household	Single	36
	Married	88
Education	None / Primary	17
	Secondary School / Matric	24
	Intermediate / Diploma / Degree	83
Employment level	Laborer / Worker / Helper	36
	Supervisor	46
	Site Engineer	31
	Site / Project Manager	11
Employment status	Permanent	49
	Temporary	75

3.3 Construction of hypothetical model

A hypothetical structural model was developed based on psychological factors that could impact the perception of safety of construction industry workers. Initially, the hypothetical structural model included six latent variables, each of which had six indicators (questionnaire items), as shown in the initial model in Figure 1. This hypothetical structural model included the five psychological factors of (1) workload, (2) organizational relationships, (3) mental stress, (4) job satisfaction, and (5) job security. It was hypothesized that these psychological factors affect the perception of personal safety, whether directly or indirectly, at construction sites. Further, it was hypothesized that the

effects of workload, organizational relationships, and mental stress on safety would be completely mediated by job satisfaction and job security.

Structural Equation Modeling (SEM) was used in the current study. The hypothetical model shown in Figure 1 was developed based on the results of previous studies. SEM alone cannot resolve causal ambiguities or determine causal relationships in models; thus, the researcher's judgment and theoretical insights are important during the development of the model [25]. Therefore, multiple papers were reviewed to determine the causal relationships between the psychological factors and the perception of safety.

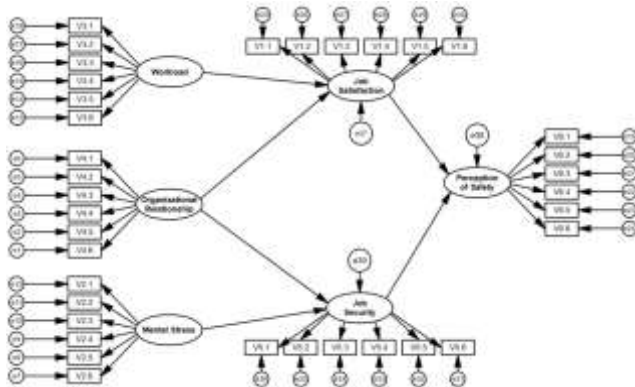


Figure 1: Initial hypothetical structural model

3.4 Data analysis

Structure equation modeling was used to analyze the hypothetical structural model shown in Figure 1. A statistical computer program, AMOS Version 22, was employed for modeling. A two-step method is used in SEM [26], the first step of which is confirmatory factor analysis (CFA), and the second of which is SEM.

Prior to further data analysis, reliability analysis is necessary [27]. A reliability value of 0.7 or higher is commonly required for the data to be accepted [28]. The reliability Cronbach's alpha values of our data are shown in parentheses: job satisfaction (0.79), mental stress (0.86), workload (0.81), organizational relationship (0.85), job security (0.81), and safety (0.83). The range of values from 0.79-0.86 indicates an adequate level of reliability for the obtained data.

Confirmatory factor analysis is the initial stage of SEM, in which the relationships between constructs are examined, and the goodness-of-fit (GoF) of the model is tested. The hypothetical structural model contained six latent variables, each of which consisted of six indicators, such that the questionnaire contained 36 variables. CFA was used to develop a strong measurement model, so indicators with insignificant relationships with the latent variables were eliminated at this step. For the analysis of hypothetical model, several manipulations were performed to achieve the suggested GoF measures. A GoF model based on different types of measurement fit indices [29] was used to measure the normed Chi-square (X^2/DF), goodness of fit index (GFI), comparative fix index (CFI), and root mean square error of

approximation (RMSEA). The maximum likelihood method was used as the estimate procedure [30], with a 95% confidence interval.

While the hypothetical structural model initially consisted of 36 indicators, the number of indicators was reduced to 28, as two indicators (2.3 and 2.4) of mental stress, three indicators (4.1, 4.2, and 4.4) of organizational relationship, one indicator (5.2) of job security, and two indicators (6.3 and 6.4) of safety were eliminated from the hypothetical structural model, as shown in Figure 2. In total, eight indicators were eliminated because they did not have significant relationships with their latent variables.

4. Final Structure Model and Results

After CFA, the final structural model fulfilled the recommended GoF measures. The normed Chi-square (X^2/DF) value of 1.75 was acceptable, as values ranging from 1.0 to 2.0 are recommended [30]. The value of CFI was 0.89 (values from 0.0-1.0 are recommended, and a value closer to 1.0 indicates a good fit). The RMSEA value was 0.078, which also indicates a good fit of the model, as the recommended value for RMSEA is less than 0.08 [29].

The hypothetical model was tested using SEM, so that the predicted directions of the relationships between pairs of latent variables could be inspected. The results obtained from SEM analysis confirmed the predicted directions of all relationships in this model. The two psychological factors of workload and organizational relationships positively affected the job satisfaction of workers at construction sites. Organizational relationships and mental stress also positively affected job security. Job satisfaction and job security positively influenced the safety of workers at construction sites, as shown in Figure 2. In the final structural model, each latent variable had three to six indicators, and the error terms in the latent variables and indicators were omitted.

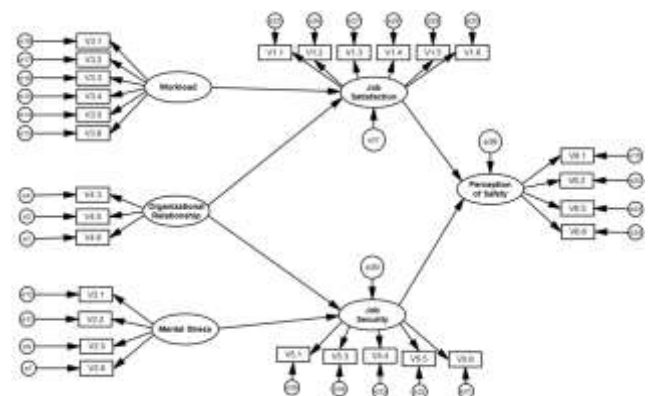


Figure 2: Structural model after CFA.

In this model, job satisfaction and job security had significant direct relationships (0.54 and 0.60, respectively) with worker perception of safety, confirming the hypothesis. Additionally, workload and organizational relationships had significant direct relationships (0.85 and 0.57, respectively) with worker job satisfaction, and organizational relationships and mental stress had significant direct relationships (0.38 and 0.79,

respectively) with worker job security, in agreement with the hypothesis.

The results of this model indicate that the psychological factors with the greatest influence are workload and mental stress, which directly influence job security and job satisfaction and thus indirectly affect worker perception of safety. The result also confirms that job satisfaction and job security are the best mediators between psychological factors and worker perception of safety.

5. Discussion

The effect of psychological factors on the perception of personal safety among construction workers is an important subject. Psychological factors related to the environment and culture of the construction industry in Pakistan and that might significantly affect the safety of workers were studied in this research.

A number of previous studies using different approaches have been conducted to measure the perception of worker safety in the construction industry of Pakistan. In this study, the SEM technique was used to measure the effects of a unique combination of psychological factors on construction workers' perceptions of safety in this country. The results indicate that psychological factors dominantly affect workers' perceptions of safety, both directly and indirectly. This analysis also confirmed the predicted directions of all the relationships in the hypothetical model and demonstrated that job satisfaction and job security are the best mediators of the effects of psychological factors on safety. The model in Figure 3 indicates that workload and mental stress are the most influential factors in the current construction industry in Pakistan; thus, workers' perceptions of safety can be improved by improving these factors.

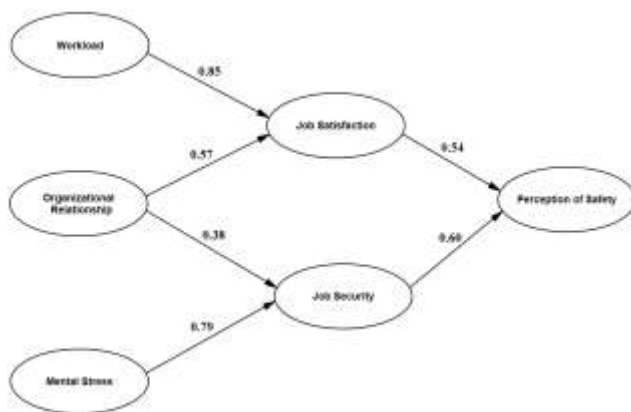


Figure 3: Final structural model

5.1 Limitations of study

This study focused on measuring the safety of workers at construction sites in Pakistan. Accident records in the construction industry of Pakistan or past statistics were not available. However, psychological factors are comprehensive indicators that can be used to evaluate possible causes of accidents. Thus, psychological factors with a positive outcome (perception of safety) can be used to prevent workers from having various accidents.

It was quite difficult to procure worker time for this survey, as the participants were busy performing their duties. An appointment for the survey was made before the visit. A single questionnaire required 20-30 minutes to complete. Data were obtained successfully from 124 subjects, which is a substantial amount of data in the SEM technique.

The proposed structural model was based upon hypothetical assumptions. Different models were developed, and the relationships among variables were examined using CFA. The results of the GoF tests of this model were satisfactory, as suggested by past studies.

6. Conclusion

This study was an attempt to examine psychological factors that directly or indirectly affect the safety of workers at construction sites in Pakistan. This research was supported by theory and past experimental studies. The findings of this research support the hypothetical structural model and reveal that psychological factors have statistically significant direct and indirect relationships with the perception of safety of workers at construction sites in Pakistan.

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Author Profile



Muhammad Dawood Idrees received bachelor's degree in Industrial Engineering and Management from Pakistan. He is doing MS leading to PhD from the department of Industrial and Management Engineering at Hanyang University. Currently he is working on Psychological and Physiological impact on safety of workers at construction industry. He has very broad working experience in construction industry.



Maria Hafeez received bachelor's degree in Electronics Engineering from Pakistan. She is doing MS leading to is PhD. from the department of Industrial and Management Engineering at Hanyang University South Korea. She is working on Psychological and Physiological aspects of Behavioural Addictions.



Professor Jung Yong Kim is an Ergonomist and human factor specialist. He has completed several national and international projects related to human factors engineering. He also has published above 50 research papers in this field in different journals. He has been active members of following societies: Psychophysiology in Ergonomics (PIE), Human Factors and Ergonomics Society (HFES), Ergonomics Society, American Society of Mechanical Engineer (ASME), American Society of Biomechanics (ASB), Korean Society for Human Engineering, Korean Industrial Management System Society, Korean Industrial Engineering Association, Emotional Science Society.