A Study on the Factors Affecting Safety Behavior of Construction Workers

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Abstract

Construction industry, being one of the most injury-prone industries worldwide in terms of serious injuries, lost work time, hospitalization, disability, and mortality, is in a great need to improve occupational safety. Behavior Based Safety (BBS) is an approach that can be applied successfully in managing occupational safety; it is gaining more interest across industry sectors globally and has the great advantage of needing the involvement of the individual employee. This paper, therefore, aimed to investigate the factors governing construction workers' safety behavior. The factors which affect construction workers' safety behavior were identified through a comprehensive literature survey. Expert interviews were conducted in order to validate and generalize the factors found in literature to the Sri Lankan context.

Two categories of factors were basically identified which affect the safety behavior of construction workers, namely personal and organizational. The personal factors included age, marital status, education level, working experience, having dependents, and safety knowledge. Study indicated that personal factors such as habits and social life might also have an impact on a workers safety behavior yet need longitudinal research before generalizing to a particular context. Organizational factors identified were management commitment, OSH systems and feedback mechanisms, continuous monitoring of these systems, training and awareness for workers, accidents reporting, and workforce empowerment. The findings of this research were modeled in a model of construction workers' safety behavior.

The findings of this study can be used in enhancing the safety performance of the construction industry.

Keywords: *Safety behavior, Construction Industry, Occupational Safety, Construction Workers*

1.0 Introduction

Construction is a very accident prone industry worldwide. The poor safety performance of the construction industry continues to give international cause for concern (Li and Xiang, 2011). Further, Sri Lanka is considered to be one of the most vulnerable countries and is ranked at a low level for safety performance due to lack of improvement measures (Gunawardena and Priyangika, 2005). Workforce productivity, quality, and safety are the most important performance indicators at worker level. However, the construction industry is still striving to improve the performance in these areas (Gatti and Migliaccio, 2013). This fact was further affirmed by Jannadi and Bu-Khamsin (2002) as they clarified that worldwide, construction is one of the most hazardous industries due to its unique nature. Firstly, the industry is highly fragmented, which marginalizes efforts to safeguard safety and health (S&H) standards. Secondly, construction site activities are physically dispersed across various locations; thus, supervising and monitoring S&H issues in the workplace is much more challenging. Compared with other industries, construction is often classified as high risk because historically it is plagued with higher and unacceptable injury rates. Partly, this results from the fact that construction is historically

accepted to be one of the most "poorly performing" and hazardous of work sectors (Haupt, 2003; Loosemore and Lam, 2004), as confirmed by some relevant statistics.

For instance, in 2003-2004, there were 3,760 major injuries in construction in the UK, the majority of which resulted from falling from a height; while injuries causing a loss of three days or more from work stood at 7,509 of which 38 per cent involved manual handling (Health and Safety Executive (HSE), 2010). More alarmingly, during 2004-2005, there were 69 fatalities in the sector, this representing one-third of all worker deaths in that period (HSE, 2006). The poor safety performance of the construction industry continues to give international cause for concern (Li and Xiang, 2011). While there has been a modest decline in fatalities over recent years (rate of 4 per 100,000 workers), when collated with those in all industries, construction accounted for 31% of all work related deaths in 2002/03 in UK (HSE, 2010). The majority of construction fatalities in this year resulted from falls from height (46%) and struck by a moving vehicle (15%). Further, although the construction output is less in Sri Lanka, compared to developed countries in general, the magnitude of the accident rate in the construction industry is still significantly high as reported in other countries such as the USA (Chau*et al.*, 2004), the UK (Health and Safety Executive, 2010, Sacks *et al.*, 2009), Hong Kong (Siu *et al.*, 2004) and Singapore (Chau and Goh, 2004). It was reported that annual accidents in the construction sites were 750-900 and among them 50-60 were fatal (Amarasinghe, 2011). Further, this annual figure was represented a more than 30 percent of accidents which was about 13 times higher than in the other industries in Sri Lanka (Rameezdeen *et al.*, 2003; Amarasinghe, 2009).

Thus, Construction industry, being one of the most injury-prone industries in Sri Lanka and worldwide in terms of serious injuries, lost work time, hospitalization, disability, and mortality, is in a great need to improve worker safety (Ahmed *et al.* 2000; Teo *et al.* 2005; Kines *et al.* 2010). Discussed in the literature are safety culture (Hale, 2000; Glendon and Stanton, 2000; Cooper, 2000; Fang *et al.,* 2006), regulatory frameworks governing safety (Langford *et al.*, 2007), BBS (Dedobbeleer & Beland, 1991; Burton, 2012, French and Geller, 2012) to make an impact in the industry to boost safety. However, due to the fact that more than 80% of accidents are down to employee behavior or the human factor, in the form of acts or omissions, among the above strategies, BBS could play a vital role (Burton, 2012). Thus, it is important to study BBS and its applicability for the construction industry to safeguard construction worker.

1.2 Safety behavior

Safety culture relates to the humanitarian aspects as well as safety as an integral component. The interactive relationships between people's behaviour, their attitudes and perceptions they hold, and the situation or environment in work place should be taken into account (Dedobbeleer & Beland, 1991). Creating a robust safety culture is about more than removing hazards and institutionalizing safety procedures. It is about working with people to change their attitudes, behaviors and thoughts, and improve their situational awareness — all within the dynamics of today's world. Further, French and Geller (2012) asserted that a total safety culture can only be achieved with a systems approach, including balanced attention to all aspects of the corporate culture. Three basic domains, for example, need attention when designing and evaluating safety processes: namely, Environment factors (such as equipment, tools, machines, housekeeping, engineering, management systems); Person factors (employees' knowledge, skills, abilities, intelligence, motives, and personality); Behavior factors (employees complying, recognizing, communicating, and actively caring). These researchers suggest that people factor is as important as, or more so, in promoting OSH in an organizational context. According to French and Geller (2012), to encourage employee engagement in safety, the safety infrastructure must invite employees to become actively engaged. When people choose to change their behavior, they adjust their attitudes and beliefs to be consistent with their actions. Change in attitude can influence more behavior change and then more attitude change – a spiraling, reciprocal interdependency between our outward actions and our inward feelings. This is how small changes in behavior and attitude can eventually lead to personal commitment and total involvement.

Thus, studying behavioural safety management is seemingly promising in improving safety performance with in an organizational context.

The emphasis of the behavior based approach to safety is on employees' behavior. Through influencing behavior, this system can reduce injury rates. The behavioral based approach to safety is focused exclusively on the observable, measurable behaviors critical to safety at a particular facility (Burton, 2012).The application of behavioral research to the solution of human problems is building and demonstrating the first effective and reliable technology of behavior change in human history (Cambridge Centre for Behavioural Studies, n.d.). In workplaces with troublesome rates of unsafe performance, safety behavior programs, properly implemented, produce significant improvements in safe performance and major reductions in workplace injuries and illnesses (Cambridge Centre for Behavioural Studies, n.d.). Thus, it is important to recognize safety behavior of workers in improving the overall safety performance of an organization. By identifying the factors that affect safety behavior of workers, how safe behaviors can be reinforced can be examined. Thus, the objective of this research is to identify the factors affecting safety behavior of construction workers in Sri Lanka.

2.0 Research Method

The study was structured in several steps. Initially in-depth knowledge gained regarding the research stream which was sorted upon the degree of relevance to the study. Based on knowledge gained from literature, a comprehensive interview guideline was developed. The guideline consisted of two stages. As the first step, a brief introduction to the study was provided to the interviewees with the purpose of explaining the background and the objective of the research. Secondly, a number of factors were introduced to the interviewees under two categories as personal and organizational to attain their views on how those factors would affect safety behavior of workers. Experts were selected from the fields of occupational safety and health as well as construction, based on their years of experience in the respective industries. Five professionals, each having more than ten years of industry experience, were interviewed in the purpose of validating the literature findings. Three district factory inspecting engineers, from the 31 professionals, available island wide, were selected based on the availability and proximity. Other two experts were project managers from two different construction projects. Each expert interview was conducted for 40 to 50 minutes. Experts affirmed most of the literature findings while they clarified that some of the factors need longitudinal research before they could be generalized in to a particular context. Further, they added 'accidents reporting' as an organizational factor that could positively affect safety behavior of construction workers. The next section will discuss the literature findings and the views of experts regarding those.

3.0 Research Findings and Discussion

The findings suggest that factors affecting construction workers' behavioural safety mainly fall under two categories as personal and organizational. The following sections discuss these in detail.

3.1. Personal Factors

The study identified that 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 can influence individual safety behaviour. Seven personal factors are listed under the research findings as age, marital status, having dependants, educational level, knowledge on safety, industry experience, gender, and habits those may have an impact on individuals' safety behavior (Table 1).

Table 1: Personal Factors affecting safety behavior of construction workers

Factors	Findings
Age	Experts have observed that the workers who are older in age are more cautious about work safety than youngsters in the industry. With age the daringness of workers tame and they tend to behave more safely for their own protection (Hinze, 1997).
Marital Status & Dependants	Workers also tend to be more careful in what they do when their social responsibilities are higher (Fang *et al.*, 2006). Experts did clarify that those workers who are married and have more dependants in their families tend to follow safety instructions and guidelines onsite than others.
Educational Level	Educational level does have a positive impact on behavioural safety of workers (Hinze, 1997). They stated that it is easier to maintain safety standards when the workforce consists of individuals with a sound educational background. According to the experts, individuals with good education see the importance of following safety guidelines in work. A project manager explained that people with secondary or higher education are easier to handle and to get complied with safety practices than those with an education level of primary or lower.
Knowledge on Safety	Knowledge on safety also plays a major role in enhancing safe behaviors of employees (Fang *et al.*, 2006). Experts clarified that, if the workers don't, or even worse, don't want to understand why or how safety matters in construction, there is a bigger chance of them behaving unsafely during their work hours. So, knowledge in safety matters very much to develop behavioural safety.
Experience	More experienced workers in the industry are less likely to be behaving unsafe manner while they work (Siu *et al.*, 2003). Experts suggest that, experience let the workers know what sort of danger they are dealing with and what would the consequences be of work related accidents in construction. Thus, workers with more years of experience in the industry would naturally accustomed to safe behaviors than those with less experience, as per the experts.
Gender	Experts clarified that 'gender' as a personal factor cannot be stated with certainty, because, construction industry in Sri Lanka is male dominated. Although this fact is common to other countries, literature has highlighted gender as a governing factor of behavioural safety (Hinze, 1997).
Habits	Personal factors such as smoking habits and drinking habits can also affect the safety behaviour of workers (Fang *et al.*, 2006; Masood *et al.*, 2012). However, according to the experts, such information needs longitudinal research before it can be generalized in to a particular context.

Fleming and Lardner (1999) have discovered the personal factors contribute to 80 – 90% of all industrial accidents. Hinze (1997), in his study, identified that 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 can influence individual safety behaviour. 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 behaviour of workers. 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. These findings suggest that personal factors such as age, marital status, having dependants, educational level, and knowledge on safety, experience, gender and habits may have an impact on individuals' safety behavior.

3.2 Organizational Factors

Not only personal and demographic factor, but also the organizational factors play a vital role in affecting safety behaviors of the workers. The study identified six organizational factors those may affect the safety behaviors of construction workers. Table 2 briefs the elaboration of these factors, supported by the literature references.

Table 2: Organizational factors affecting safety behavior of construction workers

Factors	Findings
Management commitment	Management commitment to safety is vital if an organization wants to promote safe behaviors among the workers (Choudhry *et al.*, 2007). According to experts, there is so little that can be expected from workers regarding safety if the top management's attitude to safety is dull. A project manager viewed that, people want to get the work done one way or another. So if they see no commitment from the top management to anything let along safety, the management cannot expect much from them. So, top management commitment is vital to safety if a firm is to assure workers' behavioural safety.
Proper OSH systems and feedback mechanisms	All the experts interviewed affirmed that proper OSH systems and feedback mechanisms must be there to monitor employee behaviour towards safety. They clarified that if these systems are well design to capture every error and rectify them, employees automatically adhere to these systems.
Continuous monitoring	Continuous monitoring of OSH systems was regarded as vital in affecting behavioural safety of workers by experts. They viewed that without continuous monitoring any good system can fail eventually. Also, monitoring process will give the workers a sense of been watched over and that will definitely lead to safe behaviors of them.
Training and awareness for workers	Experts identified training and awareness programmes for workers is also important. They will be a guide to proper and safe way of behaving while work and will clarify the need of safety while work.
Empowering the workforce	They also pointed out that empowering the workforce with necessary equipment, resources and authority is also important to enhance workers' behavioural safety. According to the experts, no matter how careful the worker/individual is or how cautious he is, if he is not provided with the right personal protective equipment, if he has no authority to act appropriately in a situation, they might hinder his safety performance.

Reporting of occupational accidents	Apart from these discussed above, the empirical data revealed that reporting of occupational accidents is also important. According to a district factory inspecting engineer, if the workers are certain that their every wrong move is been reported and recorded, they are more likely to adhere to safety behaviors. These experts pointed out that because of the major case of under-reporting of construction accidents, people have no accurate idea about how accident-prone the industry really is. But there was a 100% accident reporting system in existence, the behavioural safety could be enhanced.

Literature viewed that promoting a positive safety culture is the best way to influence behavioural safety of the workers. Individuals who work in a strong safety culture are likely to adapt safety behaviors than others who are not under the influence of such culture because safety culture is an organizational atmosphere where safety and health is understood to be, and is accepted as, the number one priority (Flin *et al.*, 2000). Moreover, Choudhry *et al.* (2007) asserted that management commitment to safety; management concerns for the workforce; mutual trust and credibility between management and employees; workforce empowerment; and lastly continuous monitoring, corrective action, review of system and continual improvements to reflect the safety at the organization will strengthen the safety culture which will lead to positively affect the behavioural safety of the workers of the organization. In another research conducted by Pidgeon and O'Leary (2000), the authors argued that a good safety culture may be promoted by four factors: (1) Senior management commitment to safety; (2) Realistic and flexible customs and practices for handling both well-defined and ill-defined hazards; (3) Continuous organizational learning through practices such as feedback systems, monitoring and analyzing; and a (4) Care and concern for hazards which is shared across the workforce.

When comparing these factors identified by different authors, it can be observed that they, with slight overlaps among them, do point at the same direction. Management commitment to OSH, employee involvement and empowerment, proper OSH systems and feedback mechanisms, continuous monitoring of OSH systems can be identified as the most important factors that help to strengthen the safety culture within an organization and hence enhance the safety behaviors of its employees.

3.3 Conceptual Framework

A model is established from the identified personal and organizational factors (Figure 1). The model illustrates how individuals are exposed to construction hazards and that individual workers' behavioural safety may affect overall safety performance of the organization. The two categories of factors that affect construction workers are depicted in the model under the topics, 'personal' and 'organizational'. Personal factors those might affect individual behavioural safety, yet need more longitudinal research are indicated in the Framework as well.

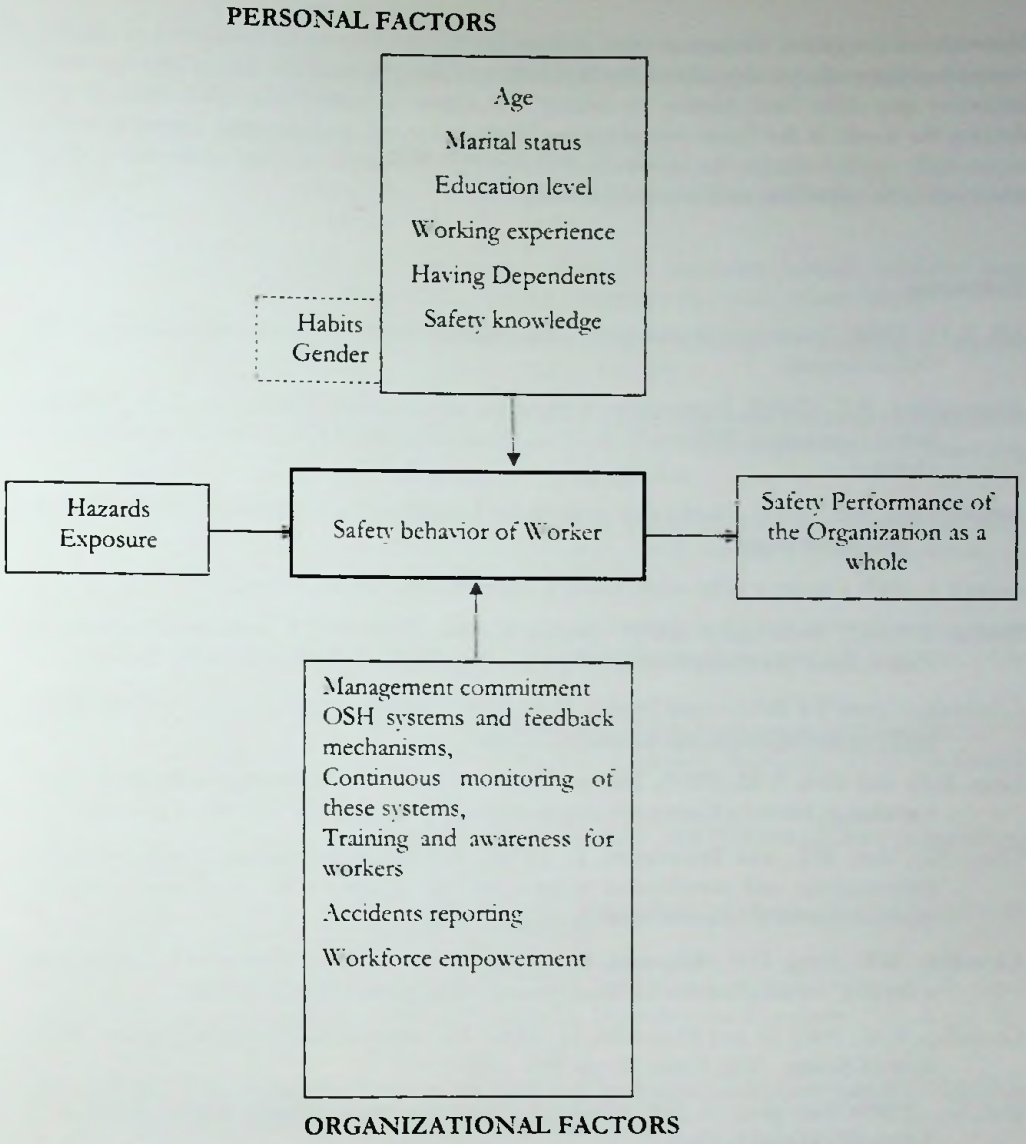

Figure 1: Conceptual Framework for Safety performance of an organization

Conclusion

This paper presents the findings on factors affecting construction workers' safety behavior, validated by the industry experts. First, the abstract of the paper together with the methodology adapted are presented. Next, existing concepts, theories, and literature from numerous disciplines reviewed to provide the theoretical grounding for the research are discussed. Then, the main research findings, those been the factors affecting construction workers' safety behavior, from literature and as validated by the experts are presented under two categories; namely, personal and organizational. Under personal category, study identified seven factors, namely, age, marital status, having dependents, educational level, and knowledge on safety, industry experience, gender, and habits. Management commitment, proper OSH systems and feedback mechanisms, continuous monitoring, training and awareness for workers, empowering the workforce, and reporting of occupational accidents are the six factors identified under organizational category. Finally, a model is been developed to illustrate how the safety behavior is affected by various factors and how it ultimately affect the whole organization's safety performance.

However, as it appears, numerous other influencing factors have to be considered to obtain a comprehensive understanding about the Sri Lankan context, because the factors affecting safety behaviors may differ from country to country and region to region. Thus, the authors plan to develop the model in the future contributions. Furthermore, the same research approach may be successfully applied outside the construction industry. For example, it could be applied to other labor-intensive industries, such as manufacturing.

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