

## **FACTORS INFLUENCING SAFETY PERFORMANCE IN THE CONSTRUCTION INDUSTRY**

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### **ABSTRACT**

The construction industry is one of the industries that contributing significant impact in the achievement of Malaysian economy. However, the construction industry is also one of industries that always be associated with high risk of hazards and dangerous activities. The aim of the present study was to identify factors influencing safety performance in the construction industry. The research method adopted in the present study was the quantitative method involving the deliver and collect questionnaire. The questionnaire covered 14 factors that influencing safety performance in the construction industry. The targeted respondents were the construction firms in Sibu, Sarawak that are registered as Grade 5, 6 and 7 under Construction Industry Development Board (CIDB) in building works. Out of 48, there were 27 returned questionnaires. The response rate was 56.2%. The present study revealed that top five factors that influencing safety performance were “personal protective equipment”, “role of government and engineering societies”, “signs, signal and barricades”, “safety educating and training”, and “emergency planning and preparation”. The present study proposes that the employment of safety professional is essential in improving safety performance in the construction industry.

**Keywords:** quantitative method, questionnaire, safety performance, construction industry, Sarawak

### **INTRODUCTION**

Health and safety issues are very importance to be concerned in all branches of industry especially in the construction industry (Alhajeri 2011). Even though the construction industry is always facing changes such as adaption of new methods, new equipment and new machineries, it is never free from safety problems including fatalities (Cesarini, Hall & Kupiec 2013). Hence, health and safety issues always are major problems in the construction industry (Alhajeri 2011), especially those issues related to poor safety performance such as injuries and ill health (Haslam, et al. 2005; Prasad & Reghunath 2011). Over years, most of the countries including Malaysia have developed their own act in accordance to the safety and health. In Malaysia, Occupational Safety and Health Act (1994) is the act that regulate the safety and health issues in the construction industry. However, the statistics from the Social Security Organisation revealed that there was a spate of construction site accidents. 7,338 accidents were reported in 2016 compared to 4,330 cases in 2011 showing an upsurge of 69.47 per cent (Lee 2018). Furthermore, the construction industry is still contributing the highest number of death accidents amounting to the fatality rate of 14.57 per 10,000 people (“The construction industry: the highest accident rate” 2018). Several researchers have conducted studies about safety performance in the construction industry in West Malaysia such as employers’ behavioural safety compliance factors toward occupational, safety and health improvement (Mat

Zin & Ismail 2012), factors influencing the implementation of a safety management system (Ismail, Doostdar & Harun 2011; Lee & Jaafar 2012), enhancement of safety performance (Charehzehe & Ahankoob 2012), and occupants' satisfaction and safety performance level (Husin, et al. 2015). At the time of the present study, there is lack of study in safety performance in Sarawak, East Malaysia even though Sarawak has the second highest construction sector-related fatality cases in the country, after Selangor (Aubrey 2018). Hence, the present study aims to fill the gap by studying factors influencing safety performance in Sarawak construction industry.

## **REVIEW OF LITERATURE**

Previous studies have revealed several factors that influencing safety performance in the construction industry. Those factors are project nature (Amartey 2014; Alaqqad 2009; Charehzehe & Alankoob 2012; Fang, et al. 2004; Zekri 2013), emergency planning and preparation (Alaqqad 2009; Ismail, Doostdar & Harun 2012; Ng, Kam & Skitmore 2005), signs, signals and barricades (Alaqqad 2009), historic, human and psychological climate (Alaqqad 2009; Charehzehe & Alankoob 2012; Ismail, Doostdar & Harun 2011), welfare facilities (Alaqqad 2009; Amartey, 2014; Ismail, Doostdar & Harun 2011; Zekri 2013), administrative and management commitment (Alaqqad 2009; Amartey 2014; Charehzehe & Alankoob 2012; Ismail, Doostdar & Harun 2011; Lee & Jaafar 2012; Lin & Mills 2001; Ng, Kam & Skitmore 2005; Zekri 2013), safety inspection (Alaqqad 2009; Amartey 2014; Fang, et al. 2004; Lee & Jaafar 2012; Zekri 2008), safety meeting (Alaqqad 2009; Amartey 2014; Fang, et al. 2004; Ismail Doostdar & Harun 2012; Lee & Jaafar 2012; Lin & Mills 2001; Zekri 2013;), role of government and engineering societies (Alaqqad 2009; Amartey 2014; Charehzehe & Alankoob 2012; Lee & Jaafar 2012; Ng, Kam & Skitmore 2005; Zekri 2013;), work process (Alaqqad 2009; Lee & Jaafar 2012; Zeng, Tam & Deng 2004), safety educating and training (Alaqqad 2009; Amartey 2014; Charehzehe & Alankoob 2012; Fang, et al. 2004; Ismail, Doostdar & Harun 2011; Lee & Jaafar 2012; Lin & Mills, 2001; Ng, Kam & Skitmore 2005; Zekri 2013), disposal of hazardous materials and waste (Alaqqad 2009; Zekri 2013), personal protective equipment (Alaqqad 2009; Ismail, Doostdar & Harun 2011; Lee & Jaafar 2012; Zekri 2013), and economic investment (Alaqqad 2009; Amartey 2014; Charehzehe & Alankoob 2012; Ismail, Doostdar & Harun 2011; Lee & Jaafar 2012; Lin & Mills 2001; Zekri 2013).

Project nature includes the arrangement and organization of the construction site (Alaqqad 2009), volume of the project, cost of the project, application of new technology in project (Alaqqad, 2009; Fang, et al. 2004), type of owner (Alaqqad 2009; Zekri 2013), complexity of the design (Alaqqad 2009; Charehzehe & Alankoob 2012; Zekri 2013) and duration (Zekri 2013). The orderly arrangement and organization of the construction site would provide a high level of safety performance (Alaqqad, 2009). Complexity of design, volume and cost of the project, duration and application of new technology would influence the project's implementation that directly affecting its safety performance (Alaqqad 2009; Charehzehe & Alankoob 2013). The type of owner would influence safety performance through the moral responsibility in giving a safe working space (Zekri, 2013). The emergency planning and preparation includes the development of a plan to respond to emergencies and training worker to respond to emergency (Alaqqad 2009; Ismail, Doostdar & Harun 2012; Ng, Kam & Skitmore 2005). The planning should be appropriate as it is important in reducing the harmful consequence of an accident (Ng, Kam & Skitmore 2005). Construction firms play an important role in decreasing the percentage of the happening and

severity of loss with effective emergency planning and preparation. Signs, signals and barricades include the use of danger signs, caution signs, instruction signs, traffic signals, and barricades to close the construction site for the pedestrian. Construction firms should make sure the workers understood the symbolic signs exists in construction industry in order to protect the labors efforts (Alaqqad, 2009). Historic, human and psychological climate covers historical factors, human behavior and psychological climate. Historical factors consist of worker age, worker safety awareness (Alaqqad 2009; Ismail, Doostdar & Harun 2011), worker experience (Alaqqad 2009; Charehzehi & Alankoob 2012), worker education, worker marital status, knowledge and involvement, and worker accident's experience (Alaqqad 2009). Whereas, the relation between management and workers on construction site and interrelation between the workers on the construction site are grouped under human behavior. Human behavior is hard to be controlled but could be cultivated in safety habits in working place in order to improve safety performance in construction industry (Ismail, Dootsdar & Harun 2011). Work pressure of workers is grouped under psychological climate. The employees with less work load and high capability to carry out the job would reduce the risk to get into accidents on the construction site (Alaqqad 2009). Welfare facilities cover two main categories that are welfare (Alaqqad 2009; Ismail, Doostdar & Harun 2011; Zekri 2013) and medical (Alaqqad 2009; Amartey 2014; Zekri 2013).

Under welfare, it consists of first aid kits (Alaqqad 2009; Ismail, Dootsdar & Harun 2011; Zekri 2008), provision of food and drinking water, provision of adequate toilets, provision of special places for smoking, provision of an ambulance on the construction site (Alaqqad 2009; Zekri 2013), periodical medical examination of workers and permanent of a medical specialist on the construction site (Alaqqad 2009). On the other hand, medical covers a crucial care for injuries (Zekri 2013) and the availability of medical specialist on the construction site (Alaqqad 2009; Zekri 2013). Healthy employees would contribute to a better safety performance on the construction site (Ismail, Dootsdar & Harun 2011). Administrative and management commitment involves safety awareness of project managers and firm's top management (Alaqqad 2009; Charehzehi & Alankoob 2012; Ismail, Doostdar & Harun 2011), management's attitude towards worker's welfare (Alaqqad 2009; Lee & Jaafar 2012; Lin & Mills 2001; Ng, Kam & Skitmore 2005), availability of a clear company safety policy (Alaqqad 2009; Ismail, Doostdar & Harun 2011; Lee & Jaafar 2012; Zekri 2013), dissemination and implementation of in-house safety rules, safety program or manuals including emergency plan and procedures and conduction of safety policy review (Alaqqad 2009; Ismail, Doostdar & Harun 2011). Safety inspection is conducted by government authorities, insurance company (Alaqqad 2009) and firm's management (Alaqqad 2009; Fang, et al. 2004). Regular safety inspection would improve safety performance by reducing the number of accidents on the construction site (Zekri 2013).

Safety meeting consists of conducting safety meeting on the construction site by the site engineer, conducting safety meeting before each activity begins (Alaqqad 2009; Fang, et al. 2004) and conducting safety meetings by safety committee (Lin & Mills 2001). Regular safety meeting would improve safety performance by reinforcing the importance of safety concept and cultivating a culture of safety among the workers (Lee & Jaafar 2012). Work process involves crane and lifting equipment, excavation and trenching, scaffolds and transportation (Lee & Jaafar 2012; Zeng, Tam & Deng 2004). Work process would influence safety performance as the well-trained workers in work process would maintain the positive safety nature in construction industry (Alaqqad 2009). Safety educating and training consists of safety training and guidance (Alaqqad 2009; Amartey 2014; Fang, et al. 2004; Ismail, Dootsdar & Harun 2011; Lin & Mills 2001; Ng, Kam & Skitmore

2005; Zekri 2013) and education of safety (Alaqqad 2009; Amartey 2014). Role of government and engineering societies would influence safety performance by strict implementation of safety instructions (Ng, Kam & Skitmore 2005; Zekri 2013), punishment in case of violation of laws, standards regulation and legislation of safety (Alaqqad 2009; Amartey, 2014; Charehzehe & Alankoob 2012; Zekri, 2013), and issuance of laws, standard and regulations for safety (Alaqqad, 2009; Lee & Jaafar, 2012; Ng, Kam & Skitmore, 2005). Safety educating and training would improve safety performance by cultivating the awareness of accident risks (Charehzehe & Alankoob, 2012; Ng, Kam & Skitmore, 2001), understating the usage of protective equipment (Amartey 2014; Ng, Kam & Skitmore 2005 ;), first aid and emergency procedures (Alaqqad 2009; Zekri 2013). Disposal of hazardous materials and waste involves the development of a risk management plan (Alaqqad 2009; Zekri 2013), development of a waste management plan and quick transfer of construction waste out of the construction site (Alaqqad 2009).

The disposal of hazardous materials must be regulated by identifying and assessing the hazards in the construction site in order to achieve a better safety performance (Zekri 2013). Personal protective equipment consists of three categories that are the use of protective head, the use of protective foot and the use of protective clothing (Alaqqad 2009; Zekri 2013). Suitable and adequate equipment provided would improve safety performance by preventing the injuries on the construction site (Charehzehe & Alankoob 2012; Ismail, Dootsda & Harun 2011). Economic investment is related to safety incentives (Alaqqad 2009; Amartey 2014; Charehzehe & Alankoob 2012; Ismail, Dootsda & Harun 2011; Zekri 2013) and allocation of specific budget for safety requirements (Alaqqad 2009). Safety incentives as financial motivation to the workers in performing safety measures (Alaqqad 2009; Ismail, Dootsda & Harun 2011) while allocating specific budget for safety requirements would achieve a safer workplace (Fang, et al. 2004).

## **RESEARCH METHODOLOGY**

The present study adopted the questionnaire survey with delivery and collection method. This method is more reliable and easier to administrate compared to the postal questionnaire (Phuc 2011). Furthermore, this method creates a direct contact with the respondents which would increase the return rate of respondents compared to postal questionnaire (Gray 2014). The questionnaire consisted of close-ended questions with five-point Likert scale (e.g. 1 = unimportant, 2 = less important, 3 = moderately important, 4 = important, and 5 = very important). The questionnaires were sent to all construction firms that registered under CIDB Grade 5, Grade 6 and Grade 7 in Sibul, Sarawak. The reason of choosing construction firms in Sibul is due to Sarawak Government is embarking on an ambitious plan for the development of the central region where Sibul is located. The estimated amount of development is around 72 million that involving the construction of infrastructure, sewerage system and building works (Chua 2018). Out of 48, 27 respondents returned the questionnaire. The response rate was 56.3%. It was higher than the typical response rate (i.e. 5-15%) of the questionnaire survey conducted in the Malaysian construction industry (Idrus, et al. 2008). As recommended by Wong (2010), a well-selected and targeted small sample would produce the significant results for the present study because the respondents were from the top and middle management. The information provided was reliable as they were the main decision maker in their firm. The data collected from the questionnaires was analyzed by Statistical Package for the Social Science (SPSS) IBM SPSS Statistic 19. As recommended by Mahmood, et al. (2014), means of response were interpreted by extrapolating the following scales:

1.0 to 1.49 = not very important, 1.5 to 2.49 = less important, 2.5 to 3.49 = moderately, 3.5 to 4.49 = important and 4.5 to 5 = very important. These scales are commonly be used for the interpretation of five-point Likert scale, especially for descriptive analysis.

## RESEARCH FINDINGS AND DISCUSSION

Table 1 shows that top five factors influencing safety performance in the construction industry are “personal protective equipment”, “role of government and engineering societies”, “signs, signal and barricades”, “safety educating and training”, and “emergency planning and preparation”. Findings of the present study agrees with previous studies (Alaqqad 2009; Zekri 2013) that personal protective equipment is the most important factor that influencing safety performance in the construction industry. Personal protective equipment is the first line to protect construction workers to be severe injuries as it can protect body parts such as eyes, ears, hands, head, foot, and body from any hazardous elements. Non-compliance with personal protective equipment agreement is an alarming trend as personal protective equipment is equivalent to the workers’ safety. However, findings of the present study oppose findings of previous studies in West Malaysia (Ismail, Dootsda & Harun 2012; Lee & Jaafar 2012). Those previous studies found that some construction firms in West Malaysia were not willing to invest in safety equipment and provide personal protective equipment to their workers.

The present study revealed that government and engineering societies play an important role in influencing safety performance on construction site concurring with previous studies (Amartey 2014; Lee & Jaafar 2012; Ng, Kam & Skitmore 2005). Findings of the present study showed that without implementation of regulations, laws and rules by government, construction firm is normally unwilling to comply with safety rules on the construction site (Amartey 2014). Government’s role in the organizational management and safety commitment is essential for the construction industry (Lee & Jaafar 2012; Ng, Kam & Skitmore 2005 ;). Besides, findings of the present study support that engineering societies should be formed to inspect the construction site regularly in order to improve safety performance on the construction site (Amartey 2014). However, the present study disagree with previous studies in Gaza Strip (Alaqqad 2009) and Dubai (Zekri 2013). Those previous studies claimed that the respective government did not play an important role in safety performance on the construction site due to poor law enforcement. Alaqqad (2009) found that construction firms in Gaza Strip did not implement safety laws during the construction period although the tender documents consisted of laws related to safety. Zekri (2013) found that the majority of projects in Dubai were not getting safety and health approvals before the construction activities begin as there is no strict safety regulation.

**Table 1: Factors Influencing Safety Performance in the Construction Industry**

Factors	Mean	Standard Deviation	Rank	Remarks *
Personal Protective equipment	4.34	0.59	1	Imp.
Role of Government and Engineering Societies	4.26	0.71	2	Imp.
Signs, Signals and Barricades	4.23	0.71	3	Imp.
Safety Educating and Training	4.23	0.82	3	Imp.
Emergency Planning and Preparation	4.18	0.66	5	Imp.



Administrative and Management Commitment	4.11	0.74	6	Imp.
Safety Inspection	4.01	0.82	7	Imp.
Work Process	3.97	0.79	8	Imp.
Project Nature	3.85	0.81	9	Imp.
Historic, Human and Psychological Climate	3.69	0.93	10	Imp.
Disposal of hazardous materials and waste	3.67	0.76	11	Imp.
Economic Investment	3.65	0.74	12	Imp.
Safety Meetings	3.64	0.90	13	Imp.
Welfare Facilities	2.96	0.98	14	Mod. Imp.

**Source: Questionnaires**

(Note: \* means 1.0 to less than 1.49 = unimportant, 1.5-2.49 = less important, 2.5-3.49 = moderately important, 3.5-4.49 = important, from 4.5-5.0 = very important)

The present study supports that signs, signals and barricades would influence safety performance in the construction industry especially at high risk hazardous construction site, concurring with previous studies (Alaqqad, 2009; Zekri, 2013). The present study agrees with the previous studies in Gaza Strips (Alaqqad 2009) and Dubai (Zekri 2013) that the installation of warning, caution and instruction signs and signals on the construction site is essential in order to keep the workers in a stable working condition for unexpected accidents. Every construction firm should provide appropriate signs, signal and barricades to warn the workers in order to avoid accidents happened on the construction site (Praveen 2011). The present study also found that the understanding and knowledge of construction workers towards symbols of safety signs is important to help them in recognizing the signs and signals, which concurring with previous studies (Alaqqad 2009; Zekri 2013). This indicates that safety awareness campaigns or training should be held regularly in the construction industry to enhance the knowledge and understanding especially for those low educated workers (Alaqqad 2009; Zekri 2013). Besides, the colours and symbols of signs, signals and barricades provided in the construction site should be correspondence to international standard (Praveen 2011).

Findings of the present study agrees with previous studies (Amartey 2014; Charenzehi & Aloonkoob 2012; Ismail, Dootsda & Harun 2012; Ng, Kam & Skitmore, 2005) that safety educating and training would influence safety performance by promoting worker's safety on the construction site. Regular safety educating and training should be held to enhance safety performance by improving workers' awareness of potential dangers on the construction site (Ng, Kam & Skitmore 2005). Safety educating and training program like Green Card Program by Construction Industry Development Board would train workers to know about the safety and health on the construction site through grouping them into certain trade and skill level such as general workers, semi-skilled and skilled workers (Ismail, Doostdar & Harun 2014). However, the present study disagrees with previous studies (Alaqqad 2009; Fang, et al. 2004; Lee & Jaafar 2012; Lin & Mills 2001; Zekri 2013) as previous studies did not regard those elements related to safety educating and training at the organizational and project level as an important factor influencing safety performance in the construction industry. Respondents' firm size of the present study were relatively smaller compared to previous studies. Larger construction firms which handle big project with higher risks of accident normally have already established safety policy outlining the safety theory and information for the workers to follow (Lin & Mills 2001). Hence, safety educating and training is only be provided to several different levels of personnel on the construction site if needed (Fang, et al. 2004).

The present study agrees with previous studies (Alaqqad 2009; Ng, Kam & Skitmore 2005) that emergency planning and preparation is an important factor influencing safety performance in the construction industry. A proper emergency planning and preparation is essential in minimizing the harmful consequences of an accident that happened on the construction site (Ng, Kam & Skitmore 2005). An effective emergency planning and preparation would reduce the percentage of the accident happened and the severity of loss due to accidents on the construction site (Alaqqad 2009). However, findings of the present study disagree with previous study (Ismail, Doostdar & Harun 2014). This may due to the targeted respondents of Ismail, Doostdar and Harun (2014) were mostly semi-skilled workers who have different perspectives from respondents of the present study who were top and middle management. Those semi-skilled workers were more concern with the need of firm's management to provide more knowledge and information about safety issues instead of the development of emergency planning and preparation.

## **CONCLUSION**

In the present study, fourteen factors that influencing safety performance in the construction industry were highlighted. A questionnaire survey was conducted with all construction firms that registered under CIDB Grade 5, Grade 6 and Grade 7 in Sibul, Sarawak. The descriptive analysis was carried out by examining the mean and standard deviation. Findings of the present study indicate that top five important factors that influencing safety performance in the construction industry to be "personal protective equipment", "role of government and engineering societies", "signs, signal and barricades", "safety educating and training" and "emergency planning and preparation". Hence, the present study proposes that all construction firms should employ qualified safety professional to monitor closely with regular enforcement of the usage of personal protective equipment by workers as well as the installation of proper signs, signals and barricades on the construction site. The respective safety professional should collaborate closely with government authorities and engineering societies providing relevant safety educating and training. Furthermore, the respective safety professional should develop and establish an effective emergency plan responding immediately to any accidents on the construction site. As the present study only covered construction firms in Sibul, the future research should extend the coverage to the entire Sarawak.

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