PERCEPTIONS OF THE CONSTRUCTION PROFESSIONALS WITH REGARDS TO THE SAFETY FACTORS AND CRITICAL SAFETY MEASURES FOR THE ENHANCEMENT OF SAFETY PERFORMANCE ON THE CONSTRUCTION SITES IN THE KLANG VALLEY

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A project report submitted in partial fulfilment of the requirements for the award of Master of Project Management

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December 2020

DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

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ACKNOWLEDGEMENTS

First of all, I would like to convey my appreciation to my research supervisor, Dr. Chan Yuan Eng for his invaluable advice, guidance, and his enormous patience throughout the progress of this research study.

Further, I wish to thank my loving parents and friends who had given me encouragement in completing this research study. It is their encouragement that gave me the dogged determination to complete this research study.

Last but not least I am grateful that the respondents of the questionnaire surveys had contributed to the successful completion of this research study. The success of the pilot and field surveys would not have materialized without the participation of the respondents in the questionnaire survey.

ABSTRACT

The construction industry plays an important role in the aggregate economy in Malaysia and has contributed to the gross domestic product (GDP). Nevertheless, in line with the positive economic growth, the statistics show that the construction industry has higher fatality rates compared to other industries. The research aim and objectives of this research studies are to determine the perceptions of the construction professionals with regards to the most critical safety factor causing poor safety performance on the construction site in Klang Valley, to determine the perceptions of the construction professionals with regards to the relative importance of the critical safety measures to enhance safety performance on the construction site and to establish the method to improve safety performance on the construction site. A total of 10 critical safety factors and 10 critical safety measures for the enhancement of safety performance on the construction site were identified. Questionnaires were then designed and distributed to the construction professionals working in the respective construction companies located in Klang Valley. Pilot survey was conducted before the actual field survey. The collected data was analysed by using the Relative Importance Index (RII) and IBM-SPSS. The criticality of the safety factors and the relative importance of the critical safety measures perceived by the construction professionals was ranked based on the RII calculated. Cronbach's Alpha reliability test was conducted using SPSS to measure the reliability of the questionnaire. The research findings show that 'improper use or failure to use personal protective equipment (PPE) was the most critical safety causing poor safety performance and 'increase safety awareness among construction workers' was the most important critical safety measures to enhance safety performance on the construction site perceived by the construction professionals. The research findings have also implied that the effective ways to improve safety performance on the construction site are to increase compliance of construction workers to wear PPE on the job site and to promote safety awareness among the construction workers. This research study is useful for construction companies whereby the construction companies could focus on improving the safety performance on the construction site by planning and implementing effective actions to ensure PPE becomes a safety practice among the construction workers and increase the safety awareness among them.

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LIST OF SYMBOLS / ABBREVIATIONS

α	Cronbach's Alpha Value

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CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia is growing rapidly to achieve strong economic growth and is expected to be a developed country by the year 2020 (Hamid, et al., 2019). The construction industry plays an important role in the aggregate economy in Malaysia and has contributed to the gross domestic product (GDP). As reported by Works Ministry Secretary-General Datuk Seri Zohari Akob, although this sector is expected to record slower growth in 2019, the contribution of the construction industry to the GDP will remain positive for the year 2019 (The Star, 2019).

According to the construction statistics 2019, the value of construction work done in the fourth quarter of 2019 recovered by 1.3 per cent, which amounts to RM37.0 billion. The value of work done for 2019 amounted to RM146.4 billion has increased by 0.6 per cent as compared to RM145.5 billion in 2018 as shown in Figure 1.1 below.

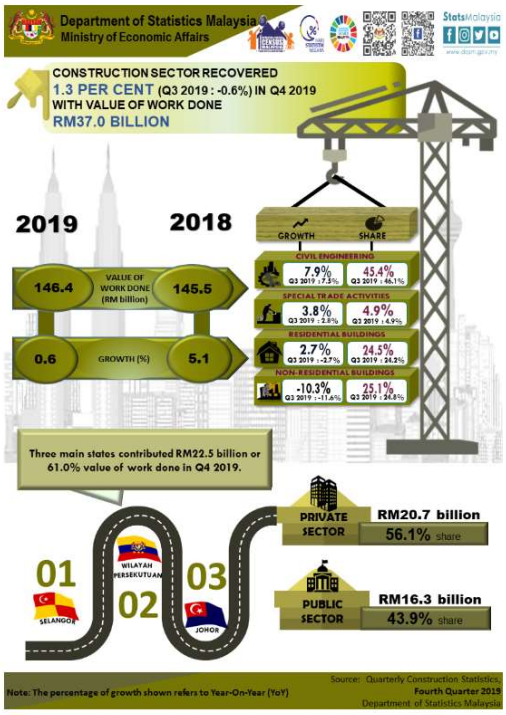

Figure 1.1: Malaysia's Construction Sector Recovered 1.3% in the Fourth Quarter of 2019

(Source: Department of Statistics Malaysia)

Nevertheless, in line with the positive economic growth, statistics have shown that the construction industry is one of the most dangerous industries due to fatality rates (Nawi, et al., 2016). Construction is often categorized as a dangerous industry. This is because it has the highest number of accidents involving injury and even death in the past compared to other industries (Hashem, et al., 2013). As reported by the Department of Occupational Safety and Health (DOSH) statistic 2019 as shown in Figure 1.2, the fatality rate is higher in the construction industry compared to other industries.

SECTOR	NPD	PD	DEATH	TOTAL
Hotel and Restaurant	186	2	8	196
Utilities (Electricity, Gas, Water and Sanitary Service)	235	2	7	244
Finance, Insurance, Real Estate and Business Services	295	4	11	310
Construction	190	13	72	275
Transport, Storage and Communication	291	8	16	315
Manufacturing	3829	182	59	4070
Wholesale and Retail Trade	69	1		70
Public Services and Statutory Authorities	71	3	3	77
Mining and Quarrying	39	2	4	45
Agriculture, Forestry and Fishery	907	19	34	960
TOTAL	**6112**	**236**	**214**	**6562**

LEGEND:
PD - PERMANENT DOSABILITY
NPD- NON PERMANENT DISABILITY

Figure 1.2: Occupational Accident by Sector Until October 2019.
(Source: International Policy and Research Development Division)

Over the years, falls from height are among the important leading causes of serious and fatal injuries for construction workers. The most common factors associated with falls from height are risky activities, individual characteristics, site conditions, organizational characteristics, scaffolds or ladders, and weather conditions (Nadhim, et al., 2016). The reported fatal accident cases have resulted in public outrage over the safety of construction workers. Table 1.1 shows the tabulation of fatal accident cases at construction sites recorded by DOSH in the year 2018, 2019, and 2020.

Out of 30 cases, the data reveals that more than half of the fatal accidents (17 cases) were caused by falling from the height which is mentioned by Nadhim, et al. (2016) in their research. The rest of the causes of fatal accidents that were reported in DOSH are falling from a sewage treatment plant (1 case), trapped in a manhole due to heavy water flowing while cleaning the waste clogging the manhole (1 case), drown

(1 case), crushed by the concrete panel, brick wall, sewerage pipe or other objects (6 cases), fell into drains (1 case), killed by falling bricks (2 cases) and explosion (1 case).

According to the Social Security Organization (SOCSO), there was a rise in the number of accidents and deaths in the construction sector from 2015 to 2018. In the construction sector, 143 deaths and 8191 accidents were recorded in 2018. The figures show an increase from 2017, which recorded 120 deaths and 7.870 accidents. The figures also show an increase from 2016, where 7,338 accidents and 106 deaths were reported in 2016. These statistics are worrying, particularly those fatal accidents. The figure would be higher if we consider the unreported cases as these statistics only covered the cases reported by DOSH.

According to Hamid, et al., (2019), accident rate can be reduced or controlled through various approaches, e.g. construction companies to enforce safety measures, establish safety management systems, and construction workers to comply with the Occupational Safety and Health Act 1994 (OSHA 1994) on the construction sites. Accidents at construction sites have a significant negative impact on many aspects (Arifuddin, Suraji, and Latief, 2019). The researchers concluded that construction accidents have cost and time implications on the projects.

The biggest impact of construction accidents is the construction delay. This might cause cost overrun as a result of liquidated damages or other expenses incurred because of accidents. The consequences of accidents also cause low productivity of the workers. Moreover, construction companies with high accidents tend to have bad reputations. Consequently, they become unattractive in their job tender. Further, Chong and Low (2014) state that a high accident rate may cause the economy to slow down.

The major cause of accidents was due to construction workers' poor safety performance combined with other contributing causes (Nawi et al., 2016). Even though there have been numerous approaches to reduce the number of accidents, fatal accidents in the construction industry have increased continuously. To improve safety performance, the root causes of poor safety performance at construction sites need to be investigated (Nawi et al., 2016). Furthermore, perceptions of top management especially the project managers and safety officers on the safety measures and

preventive actions for the avoidance of accidents on the construction site are important (Ismail et al., 2012).

Table 1.1: Summary Case of Fatal Accidents Happened at Construction Site.

(Sources: Department of Occupational Health and Safety (DOSH))

Date	Title Case	Location	Summary Case
10th January 2020	Died falling from height	Construction, Selangor	A construction company manager died after slipping from a height of 3.9 meters while inspecting formwork
3rd January 2020	Died at sewage treatment plant	Sewerage Treatment Plant, Selangor	A general worker died after he lost control and collapsed while trying to rescue a colleague in a sewage treatment plant
20th January 2020	Drowned	Golf Course, Johor	A safety and health officer was found drowned after fell into the sand discharge area while preparing for a walkabout
9th November 2019	Died falling from height	Construction, Johor	A contractor worker was killed after fell from height of 9 meters while dismantling cross beam soffit
25th October 2019	Died at sewage treatment plant	Sewerage Treatment Plant, Johor	A general worker died after being trapped in a manhole due to heavy water flowing after the victim clearing the waste clogging the manhole
2nd February 2019	Died crushed by concrete panel	Construction, Selangor	The victim of a sub-contractor worker was killed after a concrete panel collapsed during a pre-dumping work on the diagonal prop wall precast concrete (WPC)
20th January 2019	Died falling from height	Construction, Johor	The victim of a general worker died after falling from 28th floor while doing work on refining the inner wall part
13th January 2019	Died falling from height	Construction, Melaka	The victim of a sub-contractor worker died after falling from the 19th floor while installing cantilever to be the platform
7th January 2019	Died crushed by brickwall	Construction, Penang	The victim of a worker died after bring crushed and stuck beneath the collapse concrete wall of a demolished home
28th December 2018	Died falling from height	Construction, Sarawak	Victims of a sub-contractor worker died after falling from level 11 while plastering wall
24th December 2018	Died falling from height	Construction, Perak	Victims of a construction worker died after falling from level 35 while working in the elevator shaft

Date	Title Case	Location	Summary Case
20th December 2018	Died falling from height	Construction, Johor	A construction worker died after 17 days of receiving treatment at the Sultan Ismail Hospital. Victims are suspected of falling from 1st floor at construction site
21st November 2018	Died falling from height	Construction, Selangor	A helper at construction site falling from a height of 15 meters high when it bore iron rebates to a crane sling
29th October 2018	Died crushed by object	Construction, Johor	The victim, a construction worker died after crushed by collapsed structure of T's ribs while the victim was making measurements under the rib
22nd October 2018	Died crushed by sewerage pipe	Sewerage Plant, Sarawak	A civilian was killed after a sewer pipe laid down by the roadside rolled to the victim and crushed
21st October 2018	Died crushed by brickwall	Construction site, Selangor	The tower crane operator died after a brickwall collapse and crushed the victim while on the way to the 7th floor resting area
8th October 2018	Died falling from height	Construction, Melaka	The victim, a subcontractor was killed after falling at the height of 8 meters into the sewer hole
4th October 2018	Died falling from height	Construction site, Selangor	The victim, a subcontractor worker died after falling from level 9 while installing aluminium formwork
24th August 2018	Died struck by object	Construction site, Selangor	A subcontractor's worker died being hit by debris from the broken pipe during the hydrostatic test on underground pipe
24th August 2018	Died fell into drains	Construction site, Pulau Pinang	A subcontractor's worker died after being fell into drains at depth of 1.5 meter
20th August 2018	Died falling from height	Construction site, Pulau Pinang	A construction worker has died after fell from 17th to 9th floor. Prior to the incident, he was jacking the cage platform from level 15 to 17
17th August 2018	Died falling from height	Construction site, Sarawak	A general worker has fell from height as he was installing the roof.
11th August 2018	Died falling from height	Construction site, Pahang	A construction worker died due to fell from floor 39th to 3rd floor as he was performing cleaning jobs on cantilever platform

20th August 2018	Killed by falling bricks	Construction site, Melaka	A construction worker has died after being hit by falling bricks
16th July 2018	Died falling from height	Construction site, Melaka	A construction worker has died after he fell down from 7th floor. He has carried down scaffold during incident
30th June 2018	Died falling from height	Construction site, Johor	A construction worker died as a result of falling from the height of 7.2 meter. He was working on scaffolds at the time of incident
19th June 2018	Stuck by falling bricks	Construction site, Johor	A construction worker died after being struck by falling bricks while doing some cleaning activities. The brick was said from level 18 of the building
8th June 2018	Died falling from height	Construction site, Sabah	A construction worker died as he fallen down at the height of approximately 22 meters. He was doing formwork
7th June 2018	Died due to explosion	Construction site, Johor	A subcontractor's worker died as a result of explosion incident as he was unlocking cabinet. His body was found 35 feets from the scene
9th January 2018	Died falling from height	Construction site, Kuala Lumpur	A construction worker died after falling from level 3 and subsequently crushed by concrete and scaffolding

1.2 Problem Statement

The construction industry contributes significantly to the economical growth of the country. Nevertheless, statistics show that the construction industry has higher fatality rates compared to other industries, as measured by work-related fatality and injury rates (Nawi, et al., 2016). The statistics from SOCSO demonstrate that the rate of accidents in the Malaysian construction industry is still high. These numbers clearly show that the construction industry is a critical sector in Malaysia. A big improvement is required in terms of safety practices on the construction site.

Based on the review of related literature, various research studies have been conducted on the factors that affect safety performance on the construction site. Nevertheless, when searching the available published Journal papers for review, it was found that there is a lack of research literature concerning the perceptions of the construction professionals with regards to the most critical safety factors causing poor safety performance on the construction in Klang Valley and the relative importance of critical safety measures factors to enhance safety performance on the construction site. Furthermore, there is also a lack of research literature on the methods to improve safety performance on the construction site.

To bridge this gap, this research study is conducted to determine what are the perceptions of the construction professionals with regards to the most critical safety factor causing poor safety performance on the construction site in Klang Valley, what are the perceptions of the construction professionals with regards to the relative importance of the critical safety measures to enhance safety performance on the construction site and how to improve safety performance on the construction site.

The findings from this research study would contribute to the construction industry with regards to the responses of construction professionals to field surveys on the most critical factor causing poor safety performance on the construction site in Klang Valley, the relative importance of the critical safety measures to enhance safety performance on the construction site and the method to improve safety performance on the construction site.

1.3 Objectives of the Project

Research Aims

To find out the perception of the construction professionals with regards to the critical safety factors and the relative importance of critical safety measures for the enhancement of safety performance on the construction site

Research Questions

a) What are the perceptions of the construction professionals with regards to the most critical safety factor causing poor safety performance on the construction site?
b) What are the perceptions of the construction professionals with regards to the relative importance of the critical safety measures to enhance safety performance on the construction site?
c) How to improve safety performance on the construction site?

Research Objectives

a) To determine the perceptions of the construction professionals with regards to the most critical safety factor causing poor safety performance on the construction site
b) To determine the perceptions of the construction professionals with regards to the relative importance of the critical safety measures to enhance safety performance on the construction site
c) To establish how to improve safety performance on the construction site

1.4 Methodology

To achieve the research objectives of this research study, it is vital to adopt a suitable and appropriate research methodology, so that the data can be collected, analysed and the findings can be interpreted accordingly. The quantitative research method will be adopted in this research as it is suitable for a large sample of research as it tends to save time and money while collecting data. Moreover, this method is convenient for respondents to answer the questions and collect the data needed for analysis. A questionnaire survey is used as a tool for collecting data.

To attain the objectives of this research study, the sources of primary and secondary data are studied. The source of primary research data is obtained through the design and distribution of questionnaires to the respondents who are related to the objectives of this research study. The scope of this research study is limited to the construction companies located in Klang Valley.

The construction professionals, such as the project architect, project engineer, project quantity surveyor, project manager, construction manager, project supervisor, and occupational safety and health officer working on the construction site are the main respondents to the questionnaire. Furthermore, secondary data is acquired from the literature review such as reference books, journals, articles, existing records, etc.

1.5 Contribution of Research Study

This research study is useful for construction companies. It has put an alarm on the construction industry that poor safety performance on the construction site was arising from improper use or failure to use PPE on the construction site. To improve safety

performance on the construction site, the construction companies should focus to implement actions to ensure that PPE becomes the safety practice among the construction workers. Further, after referring to this research study, the companies should realise that safety awareness among the construction workers is important to reduce accidents on the construction site.

1.6 Limitation and Scope of Research Study

The scope of this research study is limited to the construction companies located in Klang Valley. The construction practitioners, such as the project architect, project engineer, project quantity surveyor, project manager, construction manager, project supervisor, and occupational safety and health officer working on the construction site are the main respondents to the questionnaire.

1.7 Outline of the Report

Chapter 1 deals with the background of construction site safety. It also consists of the research problem, aim, and objectives. Moreover, the methodology used and the limitation and scope of the research study will also be discussed.

Chapter 2 reviews the available literature, journals, books, and internet sources on safety performance on the construction site. Moreover, the safety factors causing poor safety performance on the construction site and the critical safety factors to enhance safety performance on the construction site are discussed in this chapter.

Chapter 3 reviews the methodologies used by other researchers to conduct their research studies on safety performance on the construction site. It also deals with the research methodology used to collect information and data for this research study.

Chapter 4 deals with the field survey and discussion of the research findings based on the analysis obtained during the field survey.

Chapter 5 summarizes the entire research study, reviews the implication, and the contribution of the research study, and recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter aims to review the literature with regards to safety factors causing poor safety performance on the construction site and the critical safety measures to enhance safety performance on the construction site. Section 2.2 discusses the safety performance of the construction site in Malaysia. Section 2.3 deals with the safety factors causing poor safety performance on the construction site whereas Section 2.4 deals with the critical safety measures to enhance safety performance on the construction site. The literature reviewed is then discussed and commented on in Section 2.5.

2.2 Safety Performance on the Construction Site in Malaysia

The construction industry contributes significantly towards economic growth in Malaysia. Despite its contribution to the economic growth of the country, the construction industry has also contributed to large fatality rates due to the high rate of acciden. Several research studies have revealed the rapid growth in the number of work-related accidents, which involve injury and even death (Ayob et al., 2018; Othman et al., 2018; Ahmed, 2020). The main cause of accidents is due to poor safety performance on the construction site and a combination of contributing causes (Nawi et al., 2016).

Poor safety performance is always a major problem in the construction industry (Haslam, et al., 2005; Prasad and Reghunath, 2011). According to the former chairman of the National Institute of Occupational Safety and Health (NIOSH), Tan Sri Lee Lam Thye, the Malaysian construction industry still lags in health and safety performance (Babulal, 2020). He said that the fatal accident rate in Malaysia was ten times worse than that of the UK. Moreover, it has deteriorated by twenty percent since the turn of the century following the Construction Industry Development Board report.

The tragedy of a landslide on the construction site in Paya Terubong, Penang occurred due to safety lapses and inadequate attention given to the construction

workers (The Star, 2018). There were no slope protection or soil stabilization measures at the construction to protect the construction workers and to prevent any accidents. Another fatal case has happened on the construction site in Southkey, Johor Baru (Nordin, 2018). A foreign worker who had no experience in handling a forklift lost control of the vehicle before it rammed into a balustrade railing on the third floor of the construction site to the ground floor.

Moreover, work-related injuries suffered by the construction workers due to the collapse of the condominium structure in Taman Desa is another avoidable accident (Malay Mail, 2020). Investigations show that there are multi factors that cause the occurrence of these occupational accidents. They range from lack of supervision or adherence to safe work procedures, failure to wear personal protective equipment, failure to comply with the safe use of tools, machines, and vehicles. Another cause of this accident is due to the diverse background of foreign workers who face a language barrier to fit into the challenging work environment.

Furthermore, a construction worker was killed falling from height while carrying out and plastering works on the construction site in Kuala Lumpur in the year 2014. A construction worker died falling from height while installing wall cladding to the building structure on the construction site in Johor in the year 2014. A construction worker was killed while doing formwork on the construction site in Sabah in the year 2018 (DOSH, 2020). All of these fatal accident cases were due to inappropriate usage and failure of wearing PPE.

In addition, two construction workers were died hit by a crane in Sarawak in the year 2017 due to the construction company fails to comply with OSHA 1994 for lifting works. The accidents could have been prevented if the construction company pay more attention to management and supervision works by adhering to safety regulations during the construction process (Borneo Post, 2017).

A research study carried out by (Ayob *et al.*, 2018) shows that the highest rate of work-related fatal work-related injuries that occurred on the construction site was reported in Johor, Selangor, and Sarawak. These three states accounted for 9.09% to 17.36% of fatal work-related injuries. Likewise, Hamid, Noor Azmi, et al., (2019) analysed the statistic from the Department of Occupational Safety and Health (DOSH)

and Social Security Organization (SOCSO) in their research study. These show poor safety performance on the construction site in Malaysia.

2.3 Safety factors causing poor safety performance on the construction site

2.3.1 Lack of regular supervision

Lack of regular supervision is a major contributory factor in influencing safety performance on the construction site (Nasrun, et al., 2016; Durdyev et al., 2017). Most of the accidents that occurred on the construction site were due to inadequate supervision of work by the site supervisor (Choudhry and Fang, 2008). Kadiri, et al. (2014) have carried out research to determine the critical safety factors affecting construction site safety. They found that the lack of attention from supervisors has the highest rank, which indicates the workers require regular supervision on site with regards to ensure safety on the construction site.

Shamsuddin et al. (2015) also conducted observations from three construction sites. They found that most of the workers are working under hazards which endanger their life. The site supervision was only carried out by the supervisor once a week which increases the risk of workers exposed to hazards at the workplace. Without a regular monitor or supervision, the worker might not wear PPE during work or wear it incorrectly (The Washington State Department of Labour and Industries, 2017). Regular supervision is essential to ensure that the workers wear their PPE properly when required (Guideline, 2018).

Moreover, some researchers claim that improper supervision is also one of the factors that lead to poor safety performance on the construction site. They are Haslam, et al. (2005), Cheng, et al. (2010), and Fass, et al. (2017). Examples of improper supervision include failure to correct a known problem, inadequate planning for supervision, and improper planning for operations. Most of the struck-by accidents on the construction site were caused by improper supervision (Abas, *et al.,* 2020). It is the responsibility of supervisors to take immediate action to prevent accidents and reduce the causes of accidents to the barest minimum (Nasrun, et al., 2016).

2.3.2 Under-reporting of work-related incident or accident

Under-reporting of work-related incidents or accidents is one of the principal factors causing poor safety performance on the construction site. It is a common phenomenon in the construction industries for under-reporting of work-related incidents or accidents that occurred on the construction site (Taylor, et al., 2013). According to Hamid, Majid, and Singh (2008), unreported accidents could be higher due to most of the Malaysian construction workers are foreigners. Some of them might have worked with the expired permit or without a permit that the work-related incidents or accidents often go unreported by the employers.

Ganesh and Krishnan (2016) found out that the accident database has the risk of under-reporting of less severe work-related injuries. This is because the willingness to report for less severe work-related injuries depends on the discretion of the workers. Thus, less severe work-related injuries often go unreported. This would cause the organization to not able to find out the root causes of accidents and take preventive actions (Satnam Singh, 2016) to prevent the reoccurrence of accidents on the construction site (Monaco, 2018).

According to Probst, Brubaker and Barsotti (2008), the under-reporting of accidents usually involved the construction companies with a poor safety climate. Safety climate affects the worker's safety performance directly or through motivation and knowledge (Wen Lim, et al., 2018). The fear of being allocated to unwanted lighter jobs, fear of being labelled by the supervisor as incompetent in their job, fear of disciplinary action, loss of overtime, etc. These are among the reasons construction workers refuse to report accidents on the construction site (Taylor, et al., 2013).

2.3.3 Construction workers under the influence of drugs and alcohol

Construction workers under the influence of drugs and alcohol are also one of the principal factors causing poor safety performance on the construction site (Deria and Yong, 2020). The construction industry is well known as the most dangerous industry in terms of both fatal and non-fatal injuries. The adding of alcohol and drug usage makes it worse in terms of workplace safety performance (Ntili, Fidelis and Thabiso, 2015). Laad, et. al. (2013) has found out that drug and alcohol usage is high among the workers in the construction industry and the usage has recently become a habit.

The impact of drugs and alcohol usage on workplace safety performance is an on-going issue, especially within the construction industry (Slade, et. al., 2012). A research study carried out by Ntili, Emuze, and Monyane (2009) has revealed that most of the construction workers use drugs and alcohol to cope with financial strains. Buddy (2020) also stated that the reason the construction workers use drugs and alcohol as relaxants is due to the stressful jobs on the construction site.

It becomes more important to eliminate the usage of drugs and alcohol on the construction site, not only for the safety of oneself but also for the safety of co-workers. The construction workers who are under the influence of drugs or alcohol may become short-tempered and illogical, which may cause danger to fellow workers (Bell, 2018). The construction workers may also expose to substantial risk because of co-workers indulging in drugs or alcohol. This is due to each worker is required to depend on the competence of the whole team to work safely (Abdelhamid, 2015).

2.3.4 Improper use or failure to use personal protection equipment (PPE)

A research study carried out by Ahmed (2020) and Pipitsupaphol and Watanabe (2000) show that failure to use PPE by construction workers was one of the causes of poor safety performance on the construction site. A research study carried out by Zerguine, Tamrin and Jalaludin (2018) also show that safety equipment was related to workplace injuries. This supports the research study carried out by Zerguine, Tamrin, and Jalaludin (2018) revealing that most of the accidents that occurred on the construction site were due to the workers' fail to wear PPE during work. Similar research studies carried out by O'Toole (2002) and Alinaitwe, Mwakali, and Hansson (2007) also proving that failure to wear PPE is the main factors contribute to accidents and injuries in the workplace.

Further, Kasuma, et al. (2019) has examined the relationship between the factors and safety performance at Sesco Sub-Station, Balingian, and Sarawak. PPE was found as the most important factor causing poor safety performance of the construction workers. The failure of workers to use PPE, e.g. safety boots, safety belts, goggles, safety helmets, etc as required by management while performing their job tasks may cause them to expose to higher risks (Hamid, Majid and Singh, 2008). According to Shamsuddin, et al. (2015), most of the construction workers are not aware of the importance of site safety and protection. They are not wearing proper PPE as required while performing site work.

Most of them are with negative attitudes and behaviours. Sometimes they use inconvenience as an excuse for not putting on PPE (Chong and Low, 2014b). Another reason for the worker's failure to use PPE was due to a lack of knowledge of using the PPE and the importance of PPE to prevent them from accident, injury, and illness (Tanko and Anigbogu, 2012). Ulang, et al. (2014) found that there is a lack of knowledge and a low level of awareness and among workers on the proper use of PPE. This might be due to a lack of enforcement and training on PPE by the top management.

2.3.5 Construction worker's negative attitude towards safety

The construction worker's negative attitude about safety could also influence safety performance on the construction site. According to Othman, et. al. (2018), poor construction workers' attitude about safety is one of the factors causing poor safety performance on the construction site. Amidi, Hidarnia, and Ghofranipour (2012) have discovered that safety performance on the construction site can be enhanced by promoting workers' attitudes to safety. It is important to promote a positive safety attitude and hence improving safety behavior to enhance safety performance on the construction site (Li, et al., 2019)

Mortazavi, Asilian and Ostakhan (2011) suggested that the safety attitude has a significant influence on safety performance. This is consistent with the research study carried out by Amidi, Hidarnia and Ghofranipour (2012). There are also some research studies conducted to develop questionnaires with regards to safety factors and occupational safety attitude was introduced as a safety performance indicator (Sexton, et al., 2006). Vahedian-Shahroodi, Mohammadi and Tehtani (2016) have also conducted a comprehensive review of several articles related to safety attitude. They found that all of these articles emphasize enhancing positive attitudes in the workplace.

According to Zhou, Goh and Li (2015), a lot of attempts have been carried out to enhance safety performance on the construction site by decreasing the number of accidents. However, these efforts have no reasonable results due to a lack of focus on workers' attitudes and poor strategy. Moreover, Gharibi, et al. (2008) and Kangavari, et. al. (2017) have found that a worker's positive safety attitude is significantly affected by the level of education. The research studies carried out by them revealed that a negative attitude could be reduced by increasing the education level.

2.3.6 Fatigue caused by working overtime

Cooper and Phillips (2004) and Yule, Flin and Murdy (2007) found that there is a negative relationship between working overtime and safety performance. According to Safe Site Solutions Incorporation (2020), the construction workers who are suffered from fatigue due to working overtime may cause a serious threat to the safety and the well-being of co-workers around them. This is because fatigue has decreased their alertness and energy. Fatigue caused by working overtime has been associated with poor safety performance across all industries (Industrial Safety & Hygiene News, 2012; Smith, 2015).

The construction workers who are working overtime are exposed to higher occupational risk (Lerman et al., 2012). Research studies carried out by Dembe, et al. (2005); Hänecke, et al. (1998) show that occupational accidents increase after the construction workers working for nine consecutive hours, double after construction workers working for twelve consecutive hours, and triple after construction workers working for sixteen consecutive hours.

Nevertheless, there is no OSHA code for fatigue in the workplace (La Duke, 2014). OSHA (n.d.) suggested that the construction workers can reduce the risk of workplace fatigue by adjusting the work schedules and environment, e.g. lighting or noise, and providing training on hazards of fatigue. Chan (2011) has surveyed the major risk factors causing accidents in oil and gas construction and he found that fatigue is the most critical risk factor. Construction workers tend to be fatigue due to the physical nature of the work, heavy workloads, and extended work hours.

2.3.7 Lack of safety awareness among construction workers

According to Vitharana, De Silva and De Silva (2015), lack of safety awareness is the main cause of poor safety performance on the construction site. Jackson, et. al. (2011) have suggested that awareness of surroundings is the most common factor to prevent critical accidents on the construction site. Leblanc and Hare (2008) found that older construction workers have a higher level of safety awareness compared to younger construction workers. This is because older construction workers have probably witnessed or being victims of more accidents than younger construction workers.

The older construction workers are more aware of the potential hazards on the construction site. Young construction workers do not have the experience to recognize and avoid workplace hazards. They have low safety awareness and this may expose themselves to the risk of illness, injury, and death (Nawi et al., 2016). Some of them are new to the works and are often underestimate the risk as they do not have the knowledge and awareness (Trotto, 2016). According to ILO (2018), it is required to raise awareness among new and young workers of their Occupational Safety and Health (OSH) rights and responsibilities.

Having said that, according to Fung and Tam (2013), although older workers care more about health and safety on the construction site, they may not adhere to safety measures but mainly believe in their own experience. Eaves, Gyi and Gibb (2016) also found that older construction workers tend to attribute changes to their wealth of experience compared to younger workers for safer practice, e.g. wearing weight-lifting belts to aid heavy lifting. Safety awareness on the construction site needs to be improved by conducting monthly or weekly safety meetings (Mat Yaacob, 2016) to discuss issues relating to safety matters. (Tan and Razak, 2014).

2.3.8 Lack of safety signs on the construction site

Cheng, et al. (2010) found that one of the causes of poor safety performance on the construction site is the lack of safety signs in the working environment. Safety signs tell everyone on the construction site that hazards are present and how to avoid those dangers (Byrne, 2016). Without safety signs, the construction workers would lose direction during the crisis (Ng, Lo and Chan, 2011). The construction workers will not know necessary to operate safely without an understanding of the hazards present in different workplaces (American Society of Safety Professionals, 2019).

Masayuki (2006) opines that a safety signage board is required to show the safety signs to the construction workers so that to enhance their safety awareness. The safety signboard serves as a safety reminder to the construction workers to follow safety protocols for the task ahead (Construction UK Magazine, 2019). Different kinds of safety signboards can give a different kind of safety notices. For example, a safety signboard can issue a reminder to the construction workers to wear headgear or protective clothing, to warn construction workers of uneven surfaces or electric shock hazards, or to show emergency information such as the locations of emergency exits or fire extinguishers (The Mix Seattle, 2019).

Generally, there are three types of risk-severity classifications for building construction safety signboard. They are cautious signs to warn against unsafe practices that could lead to injuries, warning signs to indicate a threat that can cause more serious injuries, and danger signs to alert the construction workers against highly dangerous risks that can result in serious injury or death. Moreover, there are also building site safety signboards, which is not used to alert the construction workers to risk, but they are used to point out directions, deliver important messages and regulations, and identify safety equipment to be equipped (Houston Sign Company, n.d.)

2.3.9 Lack of training of construction workers

Cheng and Wu (2013) analysed the causes of accidents on the construction site in Taiwan and discovered that one of the critical causes of accidents on the construction site is due to insufficient safety training for new workers. Toole (2002) also carried out a research study in the USA and suggested that a lack of proper training is one of the factors that causing poor safety performance on the construction site. Furthermore, Kavya and Pradeep (2019) found that one of the preventive measures that can be taken to reduce accidents on the construction site is to provide safety training to construction workers.

There is often a lack of training on the construction site due to the time pressure of projects. This has significantly increased the construction workers' occupational risk (Kongtip, Yoosook and Chantanakul, 2008). Lack of knowledge and training of workers is one of the impactful causes of poor safety performance at the construction. (Ahmed, 2020). Untrained workers who operate heavy machinery such as forklifts or electrical wiring are the main causes of accidents in the workplace. Sometimes these accidents are caused by inadequate training or replacement of temporary workers with no training to operate the heavy machinery (Shamsuddin, et al., 2015).

According to Kadiri, et al. (2014), any construction worker without provided with proper training and information may cause work-related injuries in the workplace. According to Paringga (2010), lack of training to operate the plant and equipment may cause a human error that may lead to accidents and to enable construction workers to carry out a repetitive task with skills. Without providing proper safety training to the construction workers, the construction workers will have a lack of knowledge and skills to carry out their daily tasks safely (Sarkam, et al., 2018).

2.3.10 Lack of toolbox safety meetings

According to Mohd Nawi et al. (2016), lack of toolbox safety meetings is one of the factors causing poor safety performance on the construction site. Regular toolbox safety meeting before the commencement of work should be practicable so that information related to hazards are conveyed to the construction workers. The construction workers can raise any difficulties faced by them during the toolbox meeting (Department of Occupational Safety and Health Ministry of Human Resources, 2017). Toolbox safety meetings should be conducted regularly to educate the construction workers on safety practices and stay compliant with safety regulations (Jones, 2020)

Jones (2020) also added that any injury or accident that occurred and how injury or accidents could be avoided should be briefly discussed during the toolbox safety meeting. Eggerth et al. (2018) have studied the effectiveness of toolbox safety meetings. They found that toolbox safety meetings can increase Occupational Health and Safety knowledge, improve the workplace safety climate, and increase the impact of safety training. Adinyira and Ghansah (2019) stated that a properly conducted toolbox safety meeting can effectively monitor safety on the construction site.

Furthermore, Kavya and Pradeep (2019) mentioned that safety or toolbox meetings could prevent accidents on the construction site. Safety or toolbox meetings bring the construction workers together, educate them on the best safety practices, and build a strong safety culture among them (Jack, 2019). As emphasized by Industry Safe Incorporation (2019), certain hazards should be focused on during the safety or toolbox meeting. They are the ‘Fatal Four’ hazards, which include falls, electrocutions, being struck by an object, and caught-in/ between objects.

2.4 Critical safety measures factors to enhance safety performance on the construction site

2.4.1 Close supervision by the safety supervisor

According to Hojati (2018), safety performance on the construction site can be enhanced through close supervision by the safety supervisor. Safety supervisors can set a role model by adhering to the safety regulations and correcting safety issues when necessary (Labour, 2016). Every construction site must have a competent safety supervisor to implement safety measures, safety policies, and regulations as well as supervising the workers (Tobias, 2019). Appropriate supervision must also be provided in the workplace by a competent safety supervisor, who allocates tasks according to the workers' ability (Durdyev, et al., 2017).

Continuous supervision and inspection by safety officers are crucial to ensure the construction use the safety measures accurately and follow work procedures (Hoque, Ahmed and Sobuz, 2017). Every construction site must have regular supervision to enforce safety at the workplace (Heinrich, 1941). The accidents can be prevented if the workers' duties in the workplace are closely supervised by ensuring that the construction workers comply with the OSHA 1994 during the construction process (Borneo Post, 2017). By having close supervision on the workers, the safety supervisor can monitor and ensure that the PPE is correctly worn and the equipment is handled with proper care by the workers. (Nawi, et al., 2016).

The safety supervisor has the responsibility to provide their workers with adequate supervision to ensure that the workers use the safety equipment provided properly (Chan et al., 2008). They have the power to influence the conditions which could improve safety performance at the workplace (Marín and Roelofs, 2017). The safety supervisor's commitment to safety has been emphasized by Conchie, Moon and Duncan (2013) as essential elements to improve workplace safety performance.

2.4.2 Reporting any work-related incident or accident immediately

The construction workers who actively report work-related incidents or accidents have a significant contribution to the enhancement of safety performance on the construction site (Charehzehi and Ahankoob, 2012). Work-related incident or accident reporting and investigation enables the experts or specialists to control the safety and health procedures on the construction site before the more serious incident occurs. Actively report of work-related incidents or accidents should be a culture of the workers in the workplace (Yilmaz and Celebi, 2015).

Occupational Safety and Health Administration (OSHA) requires the safety officer to record and report the accident information at the construction on a form named Occupational Injuries and Illness Annual Survey Form (United Stated Department of Labour, 2017). This information can help in risk assessment and to develop solutions to safety problems as well as preventing injuries and control costs from accidental losses. The procedures for reporting incidents or accidents should be implemented according to the Occupational Health and Safety (OSH) Regulations. Further, all the documents e.g. accident case and analysis of safety must be in order and updated accordingly. (Abd Rahman and Ramli, 2013).

According to Nawarathna (2017), it is also required to have an effective accident reporting and recording system on the construction site to improve the safety performance at construction. The availability of reliable data on accidents is important to prevent and develop preventive measures of accidents (Amaral, et al*.,* 2013). The work-related incident or accident reporting allows the enforcing authorities to identify where and how risks arise and whether they need to be investigated. This allows them to target their work and give advice on how to prevent work-related deaths, injuries, and illnesses (Health and Safety Executive, 2013).

2.4.3 Periodic checking to ensure construction workers follow safe work practices

The statistic of accidents shows that the Malaysian construction industry is a dangerous sector that requires further improvement from the current site safety practices (Othman et al., 2018). According to (Hashim and Ee, 2018), the rate of accidents can be reduced if the construction workers use PPE properly on the construction site. However, most of the construction workers do not understand the safety regulations and they do not have safe work practices (Ahmed, Sobuz, and Haque, 2018). Therefore, it is important to educate and train the construction workers on construction site safety and make the punishment rule on PPE practice to reduce the accident rate. (Ahmed, 2020)

Safe work practices can be maintained on the construction site through regular inspection and monitoring of the organization's safety level (Sarkam, et al., 2018). An effective and regular investigation needs to be incorporated into the safety management system. This encourages the construction workers to practice safety measures on the construction site (Enshassi, Mohamed and Abushaban, 2009). The construction workers must be regularly supervised to ensure that they follow the safety instruction and procedures of using the work equipment (Kadiri, et al., 2014).

According to Charehzehi and Ahankoob (2012), some of the construction workers have a preventive attitude towards accidents. Some of the workers are more prone to accidents than others. The attitude of the construction workers is the key success factor of the implementation of safety and health practices on the construction site. The construction workers should have a positive attitude and participate actively in the various strategies to implement safety and health practices on the construction site. (Hashem, Omar and Yahya, 2013)

2.4.4 Enforcing safety and health policy and regulation

In Malaysia, the role of enforcing the law on occupational safety and health introduced in 1994 falls under the Department of Occupational Safety and Health (DOSH) (The Star, 2019). OSHA 1994 was introduced to control the safety of workers in the workplace (Salleh, et al., 2012). According to Ismail, et al., (2018), a clear policy for the management of safety and health should be introduced in every construction organization so that everyone in the organization is aware of the health and safety aims and objectives. A good health and safety policy improves safety performance on the construction site. Safety performance on the construction site can be enhanced through the enforcement of safety and health policy and regulation (Alam, n. d.).

Enforcement of health and safety regulations is very important to ensure the efficiency of regulations (Chong and Low, 2014). Health and safety regulation acts as a guideline to control the safety of the construction workers performing tasks in the workplace. Disciplinary action can be taken to the construction workers who violate the established health and safety regulations on the construction site (FHWA, 2011). The construction workers would fully adhere to the safety regulations when the management issues warnings or penalties to the construction workers who do not comply with safety regulations (Probst and Estrada, 2010).

On the other hand, incentives can be given to the construction workers who comply with safety regulations on the construction site (Chan, Chan and Choi, 2010; Haines, Merrheim and Roy, 2001). It is viewed as a psychological approach that motivates the construction workers for health and safety regulations compliance on the construction site (Panuwatwanich, Al-Haadir and Stewart, 2017). A combination of incentives and punishment could be viewed as an approach to instil safe behaviours among the construction workers on the construction site (Salah, 2016).

2.4.5 Correcting unsafe conditions and unsafe acts

Ridley (1986) found that 99% of the accidents are due to either unsafe conditions or unsafe acts or both. Unsafe acts are theoretically categorized into two conditions (Aksorn and Hadikusumo, 2007), The first case is that the construction workers do not realize that they are acting unsafely. The second case is that the construction workers act unsafely due to factors, e.g. their personalities, the nature of the tasks being undertaken, managerial and workgroup influence, etc. The first can be easily tackled by providing safety education or training to the construction workers (Huang and Yang, 2019) and close supervision (Li et al., 2018).

The second case is more complex to tackle as they are fully aware that they are working unsafely and yet decide to carry on with such an unsafe act. Therefore, knowing the causes behind the unsafe act is important for the top management to develop the proper strategies to improve the construction workers' work practice (Aksorn and Hadikusumo, 2007). It is the responsibility of the management to correct unsafe conditions and unsafe acts of construction workers in the workplace. This is because unsafe conditions and unsafe acts are developed due to the failure of the management to anticipate issues, e.g., not providing training, maintenance of plant and equipment, and safe systems at the workplace (Kadiri et al., 2014).

Choudhry and Fang (2008) suggested that management has the responsibility to identify the unsafe conditions of every construction activity before including new tasks. A thorough evaluation and safety analysis followed by the development of written safety operating procedures encourage the construction workers to improve their safety acts when performing work tasks. To improve the construction workers' safety acts, priorities must be given to encourage hazard awareness and technical competence by having proper prevention methods, e.g. the use of PPE (Olson et al., 2009). For example, construction workers who work in high places must be equipped with PPE to prevent fall accidents (Hamid, Majid and Singh, 2008).

2.4.6 Increase safety awareness among construction workers

Safety performance on the construction site can be enhanced by improving the safety awareness of construction workers (Shafii, Bin-shahna and Meryam, 2019). The site safety can be improved when construction workers have awareness of potential risk factors and knowledge of how to minimize these risk factors (Vitharana, De Silva and De Silva, 2015). The construction workers who aware of the importance of safety would have a change in their safety behaviour (Huang and Yang, 2019). When the construction workers who aware of the safety risks in the workplace tend to address safety concerns and follow safe work practices (Roshanira and Nur Atiqah, 2008).

Providing safety training to the construction workers as well as using print media such as posters also helps to increase safety awareness among the construction workers. This is because the importance of safety is emphasized during the training and the poster helps to remind the construction workers of the potential risks (Wachter and Yorio, 2014). Toolbox training also helps to improve the construction workers' safety awareness as it acts as a safety role model (Hardison, et al., 2014). A research study carried out by Jeschke, et al. (2017) also shows that the safety awareness of the construction workers has increased from before to after the toolbox training.

All parties including the construction workers must be committed to safety. The construction workers' safety awareness can be created if they are allowed to be involved in safety planning. This is because the construction workers would feel that employers are concerned about occupational safety (Ulang, et al., 2014). They would be more aware and deal safely with deficiencies or any changes occurring in the workplace (Rich, Lepine and Crawford, 2010).

2.4.7 Increase the number of health and safety signs

According to Muiruri and Mulinge (2014), health and safety signs provide means of communication associated with health and safety information. Health and safety signs help to inform and alert construction workers of the potential safety hazards and risks that they may be exposed to in the workplace (Ng, Lo and Chan, 2011). The provision of safety signs is one of the safety measures in labour regulation to improve safety in the workplace. Arghami and Poya (2008) state that the use of safety signs is one of the methods of accident and injury prevention. The construction workers who perceive warning information will recognize the hazard and make the decision to avoid it (Arphorn et al., 2003).

Masayuki (2006) suggested that a safety board to show the safety signs on the construction site should be provided by the management as a reminder to the construction workers to be aware of the potential hazards and risks. The research studies conducted by Chan and Chan (2011) revealed that the safety signs have to be evaluated of their comprehension before using. The safety signs should be distinctive and attractive to provide good communication to the construction workers (Arphorn, et al., 2003). The safety signs should be large and clear enough so that they are easily be seen and understood (Health and Safety Executive, 2009).

Safety signs without supplementary text are more effective in transferring safety information. The high visual effect for influential information transfer, language independence as well as concise informing can be provided (TALAB, et al., 2013). However, safety signs without supplementary text may not attract sufficient attention to the construction workers. They may also convey a different inverse meaning (Davies, et al., 1998). Thus, in different scenarios, safety signs with supplementary text can be substituted as it is more visible from great distances compared to safety signs without supplementary text (TALAB, et al., 2013).

2.4.8 Conducting Safety Training for Construction Workers

According to Alarcón, et al. (2016), workers' safety training acts as the best preventive strategy to enhance safety performance on the construction site. Even though most of the construction skills can be learned from the job site, safety is one of the skill set that is required to be learned before the construction workers start work in the workplace (Hojati, 2018). Effective safety training is important for the achievement of occupational health and safety programs because it helps to enhance the behavioural skills, safety knowledge, and attitudes as well as predicting accidents, especially for new workers (Vinodkumar and Bhasi, 2010).

The safety training such as training courses, workshops, seminars, and other related safety training can be provided to the construction workers to train them on techniques to identify hazards, proper use of personal protective equipment, and control hazards (O'connor, et al., 2014). The safety training provides construction workers with the skills required to identify and control hazards (Jeelani, Albert and Gambatese, 2017). Moreover, it also helps to educate the construction workers about the importance of compliance with health and safety rules and regulations (Cooper and Cotton, 2000; Díaz-Cabrera, Hernández-Fernaud and Isla-Díaz, 2007).

Blair (2003) highlighted that supervisors must provide education and training to the construction workers to ensure that they are effectively developed and ready to contribute to safety. Regular safety training should also be provided to experienced workers to refresh their knowledge of standard safety (Swider, 2019). Safety training provides ways of making accidents more recognizable. To enhance the safety performance, the organization should institute systematic and comprehensive safety training to train new and experienced workers, to raise awareness of safety, and to train the workers to meet hazardous situations (Vinodkumar and Bhasi, 2010).

2.4.9 Conducting regular toolbox safety meeting

A safety meeting is one of the ways to sensitize the construction workers on their health and safety on the construction site and thus should be held regularly (Muiruri and Mulinge, 2014). It is a gathering to convey information related to safety issues to the construction workers and for discussion about the hazards, accidents, incidents (Bizzell, 2008). Before commencing work on a new project, a safety meeting should be conducted with all the workers at the job site (Jones, 2020). A regular safety meeting coupled with safety inspection can reconcile safety issues on the construction site (Aksorn and Hadikusumo, 2008; Saurin, Formoso, and Cambraia, 2008).

Safety performance would be improved through regular safety meetings. Through regular safety meetings, the importance of safety can be strengthened to the construction workers and the safety culture could be cultivated among the construction workers (Abd Rahman and Ramli, 2013). Bizzell (2008) suggested that the top management must enforce a rule where a daily safety meeting is conducted every morning before the commencement of work. Better safety performance was found for the projects where the safety issues were discussed in regularly held toolbox safety meetings (Mathis, 2001). To improve safety performance, a daily safety meeting is advised to be conducted on the construction site (El-Mashaleh, et al., 2010).

Monthly or weekly safety meetings provided can increase safety awareness on the construction site (Mat Yaacob, 2016). The safety matters such as current safety accident statistics, safety measures, the activities and tasks that will be conducted and other safety issues can be discussed during the safety meeting (Tan and Razak, 2014). Safety meeting helps to educate the construction workers on the tasks to be performed by them (Mahalingam and Levitt, 2007). By educating and providing feedback to the construction workers, they would learn from their mistakes as well as improving safety consciousness.

2.4.10 Overcome language barriers among foreign workers in the workplace

According to Valitherm, Tunku, and Rahman (2014), safety performance on the construction site can be enhanced if the language barriers with foreign workers could be overcome. Many researchers found that the rate of workplace accidents for foreign workers is higher than domestic workers in countries such as Australia, Japan, Singapore, UK, and Taiwan (Cheng and Wu, 2013). Trajkovski and Loosemore (2006) also proved that foreign workers are usually exposed to higher levels of health and safety risks compared to domestic workers.

This is due to their knowledge of procedures on safety is often lacking as a result of language barriers in communication. Forensis Group (2011) realized that many foreign workers on construction sites are unable to speak and understand the English language. The poor safety performance on the construction site is due to foreign workers who do not speak or understand the local language (Hikmal, Eing and Yahaya, 2019). They cannot understand the work orders, safety regulations and to read safety warning signs. These are among the factors that contribute to poor safety performance on the construction site (Tasso, et al., 2015).

Valitherm, Tunku and Rahman (2014) suggested that language barriers can be improved by providing training classes that involve a person who speaks the language of the workers. By overcome language barriers with foreign workers, the effectiveness of health and safety training can also be improved (Trajkovski and Loosemore, 2006). Further, hands-on training which requires the workers to demonstrate their understanding can be conducted to improve the effectiveness of health and safety training (Vázquez and Stalnaker, 2004). During the hands-on training, the workers are shown how to work safely at the workplace. This is more effective than classroom training which has lower literacy.

2.5 Discussions and comments

Most of the time during the accident investigation, OSHA would cite the employer for not providing adequate supervision on the work being accomplished. Hence, it is of utmost importance for a safety supervisor to provide regular supervision at the job site so that the hazardous conditions and unsafe work practices can be uncovered, eliminated, or minimized before the workers get injured or killed. The accidents caused by the failure or incorrect use of PPE could be also due to a lack of regular supervision at the job site. The tragedy could be prevented if the safety supervisors have regular supervision at the job site.

Furthermore, the research study conducted by Hadi, et al. (2017) revealed the prevalence of non-reporting of the accident in the Malaysian construction industry. This may cause a variety of threats to safety to go unnoticed and unresolved. Therefore, the incidents must be reported immediately or within the day of its occurrence despite its severity by filling out an incident report form provided at the workplace. Reporting of work-related incidents or accidents is essential as it raises the organization's awareness about hazardous conditions. By reporting an accident, the root cause of accidents can be investigated. Preventive and corrective actions can be taken promptly.

The data recorded by DOSH reveals that falling from heights was the main cause of accidents and fatalities in the construction industry, followed by contact with electricity or machinery and being struck by moving vehicles (DOSH, 2019). The effects of drugs and alcohol use make this worse. Nowadays, an increasing number of construction companies are taking action, implementing steps to ban drugs and alcohol from construction sites. A routine drug and alcohol testing program is introduced as a proactive way not only to improve the worker's well-being in general but also to meet the legal requirements of the Health and Safety at Work, i.e. OSHA Act 1974.

Increasing non-compliance with PPE protocols is an alarming trend and a serious risk to the worker's health and safety. It is undeniable that most of the work-related injuries at the job site were due to failure or incorrect wearing of PPE. Eye injuries due to failure of wearing eye protection at the time of an accident or wearing the wrong kind of eye protection for the job are an example. To encourage greater PPE compliance, the top strategy is to educate the workers on the importance of PPE.

Instead of handling eye protection to the workers and tell them to put it on, the workers should be informed of why they need to use each specific type of PPE for their job. They should also be informed of the dangers of not using the respective PPE and the impact of PPE on their safety and health if they wear PPE for their job.

Further, the workers' attitude towards safety is correlated to the safety performance on the construction site. The workers with a negative attitude complain about everything, including having to practice safety. They tend to ignore the safety precautions, thus putting themselves and co-workers at risk. On the other hand, the workers who have a positive attitude will take personal responsibility for their safety and that of their co-workers. They develop safe work habits and think first before taking action. They can recognize potential hazards and deal appropriately with them. They usually focus solely on the task on hand, particularly when handling machinery and equipment. This reduces the risk of their exposure to hazardous conditions.

There are no specific OSHA guidelines about fatigue, but this does not mean that it does not affect safety performance on the construction site. Fatigued workers are less attentive, less concentration, less dexterity, and more prone to make mistakes that can lead to serious injury or fatal accidents. This may result in vehicle crashes on the job, accidents when operating machinery, lifting injuries, and other preventable accidents. The risk of fatigue-related accidents increases with the number of working hours. Over time, the stress of working overtime may lead to serious illnesses, such as heart disease, depression, musculoskeletal disorders, and digestive problems.

Additionally, every worker must have safety awareness at all times. Being constantly aware of safety when operating at work and being able to recognize hazards helps to mitigate work-related injuries on the construction site. Daily or toolbox meetings related to safety can help to raise the safety awareness of workers. Training and awareness courses can be provided to the workers to ensure that safety is on everyone's mind. The workers should not only train the workers on how to operate procedures. Rather they should incorporate the reasoning behind the procedures during the training sessions. By understanding the reason, the workers may be more attentive.

Work-related injuries always seem to happen on the construction site no matter what preventive actions have been carried out. Therefore, safety signs and labels are

essential to be provided on the construction site for workers' safety and awareness. Safety signs can help to remind the workers of hazardous conditions and ways to protect themselves from injury. A properly placed safety signs and labels at the hazardous area helps to alert the workers of possible hazards and the precautionary measures that need to be taken by them. The safety signs and labels shall be displayed everywhere on the construction site, from the main entrance points of the construction site to different areas of the job site to increase the safety awareness of the workers.

Training of construction workers may be the most important part of an effective safety program. The construction industry is a dangerous place that becomes worse when untrained workers are working at the workplace. Most of the accidents that occur on the construction site could be due to insufficient or improper training before starting the project. Effective training is crucial to ensure that the workers are equipped with knowledge and skills to perform their work safely and prevent creating hazards that could place themselves or their co-workers at risk. There are many tools, vehicles, and equipment that can be potential hazards. Through safety training, the workers learned to aware, identify, control, and report workplace hazards.

Moreover, it is expected that the workers may forget about what they have learned from the training months ago. Therefore, safety meetings can be a great tool to remind the workers about the potential hazards and safe work practices that they have learned during the training. Safety meetings shall be conducted regularly to remind the workers of the importance of safety. This will increase the awareness of the workers for the hazards they may face in the course of their work. The more aware the workers are of the potential hazards and importance of safety practices, the more likely they are to prevent an avoidable incident.

However, the fact is that most of the workers do not follow safe work practices nor adhere to safety and health policy and regulation. It is undeniably that a safe workplace starts with workers follow safe work practices and perform their jobs according to the established safety and health policy and regulation. Therefore, regular inspection and monitoring are required to maintain safe work practice on the construction site. Periodic checking is required to ensure that all the workers wear PPE at all times and follow procedures while carrying out the task at the job site. It is also

important to ensure that all the workers practice safety training skills and use the right equipment during work and never attempt to fix the defective equipment, but report the defects or any near misses to the supervisor immediately.

Lastly, language issues among foreign workers have become increasingly problematic in the construction industry. The language issues have contributed to a high accident rate in the construction industry. This is due to the foreign workers cannot understand the instructions, safety rules, and interpreting warning signs in English or Malay language. Thus, the language shall be one of the considerations during creating training. The training has to be presented in such a way that all the workers will be able to learn from it. For example, foreign workers may not be literate. So, it would be better to rely on visual aids instead of the written word. A person who speaks the language of workers must also be involved in the training to improve the effectiveness of training.

2.6 Conclusion

This chapter deals with the relevant literature with regards to safety performance in the Malaysian construction industry, the principal factors causing poor safety performance on the construction site, and the critical safety measures to enhance safety performance on the construction site. Furthermore, this chapter also deals with the discussions and comments on the literature that has been reviewed in this chapter.

The next chapter shall state and describe the methodology to be used for data collection and data analysis for conducting this research study. The construction companies located in the Kuala Lumpur and Selangor are used for this research study.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter reviews the research methodology used by other researchers in section 3.2. In addition, the methodology review is analysed and commented in sections 3.3 and 3.4. The research methodology used in this research is presented in section 3.5. Finally, section 3.6 shows the research process of this research.

3.2 Review of Methodology used by Other Researches

3.2.1 Nawi, et al. (2016)

This research aimed to identify the factors causing poor safety performance on the construction site to reduce the rate of accident occurrence. The research data was obtained through the distribution of questionnaires to 40 respondents. Likert scaling method was used to analyse the questionnaire survey. The Likert scaling method formula used by Nawi et al. (2016) is as follows:

$$\text{Scale index interval} = \frac{\text{Highest min score} - \text{Lowest min score}}{\text{Total scale usage}}$$

$$\text{Scale index} = \text{Lowest min score} + \text{Scale index interval}$$

Table 3.1: Scale Index

Scale (S)	Level of agreement	Index
1	Strongly disagree	3.03≤minimum index≤3.28
2	Disagree	3.28≤minimum index≤3.53
3	Moderate	3.53≤minimum index≤3.78
4	Agree	3.78≤minimum index≤4.03
5	Strongly agree	4.03≤minimum index≤4.30

Table 3.2: Minimum Score.

Total respondent (R)=30 person		Scale (S)					Total score	Minimum score	Scale index (level of agreement)
Category: Factors affecting safety performance		1	2	3	4	5	(C)	(M)	
No	Items								
A	Management	0	0	6	9	15	129	4.30	Strongly agree
B	Safety culture	0	1	6	15	8	120	4.00	Agree
C	Behaviour	2	4	17	5	2	91	3.03	Strongly disagree
D	Awareness	1	1	6	4	18	127	4.23	Strongly agree

Tables 3.1 and 3.2 below show the Likert scaling data analysis method used by the researchers in their research study. The Likert scale ranges from '1' to '5' was used for the respondents to rate each of the factors. The total score was calculated as below:

$$\text{Total Score (C)} = \frac{1N + 2N + 3N + 4N + 5N}{30R}$$

Where N = Number of respondents, and R = Total respondents

$$\text{Minimum Score (M)} = \frac{\text{Total Score (C)}}{R}$$

Where R = Total respondents

The respondents strongly disagree with a particular factor if the minimum score is between 3.03 and 3.28, disagree with a particular factor if the minimum score is between 3.28 and 3.53, moderate if the minimum score is between 3.53 and 3.78, agree with a particular factor if the minimum score is between 3.78 and 4.03, and strongly agree with a particular factor if the minimum score is between 4.03 and 4.30.

3.2.2 Sawacha, Naoum and Fong (1999)

The first research objective is to show a relationship between the construction workers' background and attitude towards safety. The second objective is to identify the factors causing poor safety performance on the construction site. Exploratory interview discussions that focused on the causes of accidents and the construction workers' attitude towards safety were conducted. A pilot survey was then conducted. A trial questionnaire was designed and distributed to 20 respondents. A certain modification was made to the pilot survey questionnaire before the final questionnaires were distributed to the respondents.

The response to each question was measured by the Likert Scale, ranges from 'strongly disagree' to 'strongly agree'. A total of 200 questionnaires were distributed to the respondents and 120 were returned in use. Each question was given a numeral. For instance, the respondents' age (V1.1) was categorized into 5 groups. Age below 21 was under numeral 1. Age between 21-28 was under numeral 2. Age between 28-

35 was under numeral 3. Age between 35-45 was under numeral 4. Lastly, age of 45 above was under numeral 5.

The data was then analysed by statistical computing package SPSS (Statistical Package for Social Science). Tables 3.3 and 3.4 show Pearson's Correlation Coefficient and the Factor Analysis used by the researchers. Pearson's Correlation Coefficient was used to measure the relationship between the identified variables and safety performance. This is to find out whether there is a connection between the two variables, i.e. age and safety performance.

The Pearson correlation coefficient matrix was then evaluated by the researcher to investigate the complex inter-relationships that exist between the research variables. The researcher found that there is a cross-correlation between the variables at a significant level. The factor analysis technique was then applied to reduce a large amount of data to a small number of factors showing the group of factors that has the most influence on safety performance.

Table 3.3: Significant level of factors that influence safety performance.

	Variable	Significant level $P <$
1	*Historical factors*	
V1.1	Operative's age	0.01
V1.2	Operative's job experience	0.05
V1.3	Operative's trade	Not significant
V1.4	Operative's background safety training	Not significant
2	*Economical factors*	
V2.1	Danger money	0.001
V2.2	Banksman training	Not significant
V2.3	Productivity bonous payment	0.001
V2.4	Safety bonous payment	0.001
3	*Psychological factors*	
V3.1	Personal care for safety	0.001
V3.2	Impact of H and S act	0.001
V3.3	Ongoing safety training on site	0.02
V3.4	Supervisor's safety behavior	0.001
V3.5	Workmates' safety behavior	Not significant
4	*Technical factors*	
V4.1	Asbestos awareness	0.002
V4.2	Asbestos handling	Not significant
V4.3	Use of ladders	0.01
V4.4	Scaffolding fixing and inspection	0.001
V4.5	Steel erection	0.01
V4.6	Plant driving skills	0.01
5	*Procedural factors*	
V5.1	Provision of safety clothing and equipment	Not significant
V5.2	Training on use of safety clothing	0.001
V5.3	Training on use of safety equipment	0.001
V5.4	Issue of safety booklet	0.05
6	*Organizational factors*	
V6.1	Worker-management relationship	0.001
V6.2	Trade union involvement	Not significant
V6.3	Control on sub-contract's safety behavior	0.02
V6.4	Site safety representative	0.01
V6.5	Management–worker co-operation on safety	0.02
V6.6	Safety committee policy	0.01
V6.7	Talk by management on safety	0.01
V6.8	Safety poster display	0.01
7	*Environmental factors*	
V7.1	Tidy site	0.02
V7.2	Company COSHH information	Not significant
V7.3	Planned and organized site (layout)	0.001

Table 3.4: Results of the factor analysis.

Variable	Correlation coefficient of factor analysis	Correlation Order
V1.1 Operatives' age	–0.12346	No order
V1.2 Operatives' job experience	0.15278	No order
V1.3 Operatives' trade	0.27660	No order
V1.4 Operatives' training	0.01079	No order
V2.1 Danger money	–0.12659	No order
V2.2 Banksman training	–0.06157	No order
V2.3 Productivity bonous	0.05479	No order
V2.4 Safety bonous	0.14237	No order
V3.1 Personal care for safety	0.20786	No order
V3.2 Impact of H and S act	0.35663	No order
V3.3 Safety training on site	0.51302	11
V3.4 Supervisor safety behavior	0.07668	No order
V3.5 Workmate safety behavior	0.02376	No order
V4.1 Asbestos handling	0.29024	No order
V4.2 Asbestos awareness	0.06910	No order
V4.3 Scaffold fixing	0.54183	10
V4.4 Steel erection	–0.19451	No order
V4.5 Proper operation of plants	0.56187	7
V5.1 Provision of safety clothing	0.59082	5
V5.2 Proper use of safety cloths	–0.22404	No order
V5.3 Using safety equipment	0.68687	3
V5.4 Issue of safety booklets	0.71314	2
V6.1 Worker-management relation	0.26517	No order
V6.2 Trade union involvement	0.27734	No order
V6.3 Subcontract safety behavior	0.40461	No order
V6.4 Site safety representative	0.58229	6
V6.5 Management–worker cooperation	0.49376	No order
V6.6 Safety committee policy	0.54582	9
V6.7 Management talk on safety	0.73257	1
V6.8 Safety poster display	0.43874	No order
V7.1 Tidy site	0.59277	4
V7.2 Company COSHH Info.	–0.17226	No order
V7.3 Planned and organized site	0.55836	8

Note: No order means the variable showed low correlation in the Factor Analysis Matrix and therefore excluded from the analysis and discussion.

3.2.3 Yap and Lee (2019)

The research study aimed to observe the level of safety awareness on the construction site. Further, the research study aimed to find out the critical factors that influence safety performance. The research study also aimed to assess the potential measures to improve safety awareness on the construction site. A cross-sectional quantitative method was adopted in this research study. A field survey was conducted. 30 pilot survey questionnaires were distributed to the respondents to ensure that the content is clear, unambiguity, and comprehensible.

The respondents from different backgrounds were involved in the questionnaire survey. Construction professionals, technicians, and general workers working in the construction industry are the targeted respondents. The reason for the involvement of respondents with different backgrounds in the questionnaire survey was to get a different perspective of the research topic. Cronbach's alpha value was used to ensure the internal consistency of the pilot survey questionnaire.

140 sets of questionnaires were distributed to the construction professionals, technicians, and general workers working in Kuala Lumpur and Selangor face to face and through email. A total of 104 valid responses were collected and then analysed with SPSS Version 23. To avoid the research result to have common method variance (CMV) bias, the questionnaires were drafted in clear and simple language.

Moreover, the length of the questionnaires was kept to 15 to 20 minutes to avoid survey fatigue and the respondents have to be assured anonymity. Harman's single-factor analysis was used to statistically evaluate the CMV. A factor analysis with varimax rotation was also carried out. The research methodology adopted by the researcher was considered as the most efficient tool aimed to obtain a snapshot safety scenario in the Malaysian construction industry at a given point in time.

3.2.4 Lee and Jaafar (2012)

The research study aimed to identify the criticality of factors that influence safety performance at construction sites based on the perception of the contractors. A questionnaire was designed and distributed to 110 respondents. The target respondents of the field survey are the famous Grade Seven (G7) construction companies located in Malaysia. The questionnaire was categorized into two parts. The first part of the questionnaire focused on the respondents' profile. The second part of the questionnaire focused on the critical factors that affect safety performance on the construction site.

A Likert Scales ranges from '1' for 'least important' to '5' for 'most important' was used to determine the criticality of factors causing poor safety performance on the construction site. The level of criticality for each factor was calculated as below:

$I = \frac{\sum_{i=1}^{5} W_i X_i}{\sum_{i=1}^{5} X_i}$, where

i = Response category index; whereby 1=not important, 2= slightly important, 3= moderately important ,4= very important, 5= extremely important

W_i = Weight assigned to ith response =1, 2, 3, 4, 5 respectively.

X_i = Frequency of the ith response given as percentage of the total responses for each cause.

The index with a higher value indicates a higher level of criticality of each factor. The calculated indices were then used to rank the different factor elements from the perspective of the contractors. Among the 110 distributed questionnaires through hand delivery, the researchers received 63 responses, with a response rate of 57%.

3.2.5 Sarkam, et al. (2018)

The research study was carried out with the aim of (1) to find out the relationship between time barriers, safety awareness, and management commitment towards the safety performance on the construction site and (2) to find out the most critical detrimental factor for safety performance on the construction site. A quantitative research method was adopted for this research study. 89 employees from a construction site were selected as the respondents of this field survey. The respondents were selected using stratified random sampling. According to Sarkam, et al. (2018), 73 respondents are sufficient as the sample size suggested by Krejcie and Morgan (1970).

IBM-SPSS software was used to analyse the data. Cronbach's Alpha reliability test was carried out to find out the reliability of the variables in the questionnaire. The researcher has referred to the research method written by Sekaran and Bougie (2016) to determine the reliability of the variables. According to Sekaran and Bougie (2016), Cronbach's alpha less than 0.60 is considered to be poor, those in the 0.70 range are considered acceptable and those over 0.80 are considered good. Further, correlation analysis was adopted using Pearson Correlation Analysis to measure the statistical relationship between the independent and dependent variables.

The results of the Pearson Correlation Analysis test show a strong correlation between safety awareness and safety performance with a coefficient value of r=0.739, a moderate relationship between time barriers and safety performance with a coefficient value of r =0.574, and a weak relationship between management commitment and safety performance with a coefficient value of r=0.326. Finally, a Multiple Regression Analysis test was carried out to model the linear relationship between the independent and dependent variables.

The results of the R square value in the Multiple Regression Analysis shows 0.165. This means that 61.5% of the variance in safety performance is explained by the three independent variables, i.e. management commitment, time barriers, and safety awareness. The remaining 38.5% is unexplained, which might be explained by other variables outside the scope of the research study.

3.2.6 Ahmed (2020)

The research study was carried out with the research aims of identifying and ranking the causes and effects of the accident on the construction sites in Bangladesh. A wide literature was reviewed for designing a questionnaire. A questionnaire survey method was used to obtain research data. This research method was suitable because of its ability to collect a wide range of agreement from the respondents, to deal with a large sample size of respondents, and to have a better generalization of the results obtained from the field survey.

A wide range of literature was reviewed and an open discussion with construction professionals was conducted to sort out a list of causes and effects of construction accidents in Bangladesh. A questionnaire was then designed and distributed to the construction professionals to elicit their level of agreement towards the causes and effects of accidents on the construction sites in Bangladesh. The questionnaire consists of three parts with Part 1 concerning the background information of the respondents, Part 2 concerning the causes of accidents under 14 major groups, and Part 3 concerning the effects of accidents in the Bangladesh construction industry.

Likert scale ranging from '1' for 'not important' to '5' for 'extremely important' is used to measure the level of agreement of the respondents. The questionnaires were distributed and collected by visiting the construction sites. 147 sets of questionnaires were distributed and 108 sets of questionnaires were returned. The rate of response is about 73.5%. The collected data was analysed using IBM-SPSS software and Microsoft Excel 2016. RII was also used to analyse the respondents' responses to the causes and effects of construction accidents on the construction sites in Bangladesh. The equation used is as follows:

$$\text{Relative Importance Index (RII)} = \frac{\sum W}{A \times N} \qquad (1)$$

In the above (1) equation 'W' is the weighting given to each factor by the respondents (ranging from 1 to 5), 'A' is the highest weight (i.e. 5 in this case), and 'N' is the total number of respondents in this study (i.e. 108 in this study).

IBM-SPSS software was used to perform the reliability test of the data obtained from the field survey. Cronbach's Alpha was used to measure the internal consistency of the factors in this questionnaire. Cronbach's Alpha value ranges from 0 to 1. A higher

value denotes a higher degree of consistency among the factors according to Zhou, Goh, & Li (2015). Cronbach's Alpha value, $\alpha \geq 0.7$ indicates that the correlation between the factors is acceptable, while Cronbach's Alpha value, $\alpha > 0.8$ is more preferable (George et al., 2016 and Pallant, 2016).

3.2.7 Durdyev, et al. (2017)

The research study was conducted to determine the main factors that limit safety performance on the construction site in Cambodia and to determine the main factors that influence safety performance in Cambodia from a set of variables. A questionnaire survey was adopted to investigate the main factors affecting safety performance in the Cambodian construction industry. The questionnaire was designed to comprise of main safety factors.

The questionnaire was designed to be easily understood by the respondents. A Likert scale of '1' to '5' was adopted was used to solicit the respondents' perception of the different levels of impacts. '1' indicates 'very low' and '5' indicates 'very high'. Before the field survey, a semi-structured interview was conducted to test the viability of the questionnaire. 5 contractors and 5 safety engineers with more than 10 years of experience were involved in this pilot survey.

The questionnaires were distributed and collected face-to-face and through the online survey method. This questionnaire distribution method allows direct access to the respondents. It also enhances the respondents' interest to answer the questionnaire. The research data collected from the field survey was tested for reliability using IBM-SPSS software. It includes Bartlett's test of sphericity, Cronbach's Alpha test, and Kaiser-Meyer-Olkin (KMO) test.

3.2.8 Wong and Soo (2019)

The research study aims to find out the factors causing poor safety performance on the construction site. A quantitative method involving a questionnaire survey was adopted in the research study. The researcher believed that the questionnaire survey approach is more reliable and easier to be administrated. This approach allows direct access with the respondents and this increases the rate of responses. The designed questionnaire comprising of 14 factors causing poor safety performance on the construction site.

A Likert Scale ranges from '1' for 'unimportant' to '5' for 'very important' is used for the questionnaire survey. The target respondents in the field survey are the construction companies located in Sibu and Sarawak and are registered as G5, G6, and G7 under CIDB. Out of 48 sets of questionnaires distributed, 27 sets of questionnaires were return. The response rate was 56.20%. The data collected from the field survey was analysed using IBM-SPSS. The means of responses on the Likert Scale were interpreted by using the following scales: 1.00 to 1.49 = 'not very important', 1.50 to 2.49 = 'less important', 2.50 to 3.49 = 'moderately', 3.50 to 4.49 = 'important' and 4.50 to 5.00 = 'very important'

3.3 Analysis of Reviewed Methodology

Research	Nawi, et al. (2016)	Sawacha, Naoum and Fong (1999)	Yap and Lee (2019)	Lee and Jaafar (2012)
Research Objectives	To determine the factors affect safety performance on the construction site to reduce the rate of accident occurrence	To find out the factors causing poor safety performance on the construction site	To examine the level of safety awareness on the construction site, to find out the critical factors influencing safety performance, and evaluate the potential measures to improve safety awareness on the construction site	To identify the degree of importance of factors influencing safety performance at construction sites perceived by the contractors
Research Method	Quantitative	Qualitative & Quantitative	Quantitative	Quantitative
Materials/ Instrument	Questionnaire survey	Interviews and questionnaire survey	Questionnaire survey	Questionnaire survey
Tools for pre-test (if any)	-	Pilot Survey	Pilot Survey	-

Research	Nawi, et al. (2016)	Sawacha, Naoum and Fong (1999)	Yap and Lee (2019)	Lee and Jaafar (2012)
Sampling	Not stated	• Operatives, Site Managers, Site Officer	• Construction companies in Kuala Lumpur and Selangor • Construction professionals from a different background (i.e. project manager, engineer, architect, quantity surveyor, electrician, carpenter, plumber, general workers)	• Well-known Grade Seven (G7) construction companies in Malaysia.
No of the questionnaires being distributed (if questionnaires are the instrument for collecting data)	40	200	140	110

Research	Nawi, et al. (2016)	Sawacha, Naoum and Fong (1999)	Yap and Lee (2019)	Lee and Jaafar (2012)
Data collection procedure	Not Stated	Name and personal contacts of the respondents were obtained through conferences seminars and published material	Hand-delivery and email	Hand-delivery
Rate of responses	Not Stated	60% (120 responses out of 200)	74% (104 responses out of 200)	57% (63 responses out of 110)
Data analysis method	Likert scaling method	• Pearson's Correlation Analysis • Factor Analysis	• Cronbach's Alpha test • Harman's single-factor analysis • Principal component factor analysis with varimax rotation	• RII

Research	Sarkam, et al. (2018)	Ahmed (2020)	Durdyev, et al. (2017)	Wong and Soo (2019)
Research Objectives	To find out the relationship between time barriers, safety awareness, and management commitment towards the safety performance on the construction site and to find out the most critical detrimental factor for safety performance on the construction site	To identify and rank the causes and effects of the accident on the construction sites in Bangladesh	To identify the main factors limiting safety performance in the Cambodian construction industry and to identify the principal factors influencing safety performance from the identified sets of variables	To find out the factors causing poor safety performance on the construction site
Research Method	Quantitative	Quantitative	Quantitative	Quantitative
Materials/ Instrument	Questionnaire survey	Questionnaire survey	Questionnaire survey	Questionnaire survey
Tools for pre-test (if any)	-	Pilot Survey (open discussion)	Pilot Survey (semi-structured interview)	-

Research	Sarkam, et al. (2018)	Ahmed (2020)	Durdyev, et al. (2017)	Wong and Soo (2019)
Sampling	• Selected employees from a construction site (proportionate stratified random sampling)	• Owners, consultants, labors, and contractors	• Construction professionals in Cambodia	• Respondents working in construction companies located in Sibu and Sarawak and registered as G5, G6, and G7 under CIDB
No of the questionnaires being distributed (if questionnaires are the instrument for collecting data)	89	147	114	48
Data collection procedure	Not stated	Visiting construction site	Hand-delivery and online survey method	Not stated
Rate of responses	89	73.5% (108 responses out of 147)	80.7% (92 responses out of 114)	56.25% (27 responses out of 48)

Research	Sarkam et al. (2018)	Ahmed (2020)	Durdyev, et al. (2017)	Wong and Soo (2019)
Data analysis method	• Cronbach's Alpha test • Pearson Correlation Analysis • Multiple Regression Analysis	• RII • Cronbach's Alpha reliability test	• Cronbach's Alpha test • Bartlett's test of sphericity • Kaiser-Meyer-Olkin (KMO) test	• Analysis of Likert Scale result using IBM-SPSS

3.4 Discussions and Comments

All the research studies reviewed are related to safety on the construction site. The questionnaire survey was employed by all the researchers relating to safety factors except Sawacha, Naoum and Fong (1999) who have conducted exploratory interview discussions with construction professionals on top of the questionnaire survey. The questionnaire survey was suitable due to its ability to collect a wide range of data from the respondents, to collect a large number of responses, and to enable a better generalization of the result.

Among the eight research methodologies reviewed, four researchers have conducted a pilot survey to test for the feasibility of the questionnaire before the actual distribution of the questionnaire. There are two researchers, namely Ahmed (2020) and Durdyev, et al. (2017) who have conducted the pilot survey by open discussion and a semi-structured interview with the experts with at least 10 years of experience to clarify the concept and design of the questionnaire. A pilot survey is crucial to ensure the content of the questionnaire is clear, unambiguity, and comprehensible.

Through the pilot survey, the questions that do not make sense or may lead to prejudiced answers could be identified and removed. Furthermore, the length of the questionnaires must be kept to 15 to 20 minutes when drafting the questionnaires to avoid survey fatigue and the respondents have to be assured anonymity according to Yap and Lee (2019). The questionnaire needs to be designed as simple as possible to ensure that the respondents understand the questions being asked in the questionnaire and answer the questions accordingly (Durdyev, 2017)

Most of the researchers have used the Likert Scale to solicit the respondents' responses concerning the extent to which they agree or disagree with the questions set in the questionnaire. Likert Scale was used in the research study that intends to seek perceptions of the respondents. For example, Nawi et al. (2016), Sawacha, Naoum and Fong (1999), Lee and Jaafar (2012), Ahmed (2020), Durdyev, et al. (2017), and Wong and Soo (2019) used the Likert Scale to seek the perception of the respondents on the level of agreement of the factors in the questionnaire

By using the Likert Scale, the respondents are not forced to express either/or opinion, rather allowing them to be neutral in their perception. Further, the responses received from the respondents are easy to be analysed. The most common data analysis methods used by the researchers were Cronbach's Alpha reliability test, Pearson's Correlation test, and RII (Sawacha, Naoum and Fong, 1999; Yap and Lee, 2019; Lee and Jaafar, 2012; Sarkam, et al., 2018; Ahmed, 2020 and Wong and Soo, 2019).

The response rate could be maximized by distributing the questionnaires through hand-delivery and email. This was proved by Yap and Lee (2019), Ahmed (2020), and Durdyev, et al. (2017) who have a high response rate for their questionnaire survey. To increase the response rate, a follow-up email could be sent out to the participants or a phone call could be made to the participants who have not yet taken the survey a few days after sending an initial email (Yap and Lee, 2019), Besides, online survey method could be used as it is cost-efficiency, convenience, time-saving and allow direct access to the person (Durdyev, et al., 2017).

Lastly, it is important for a researcher to carefully define the scope of the research study. The scope of the research study shall not be too broad nor too narrow to ensure that the researcher can get an accurate result and the research study could be completed in a certain period. For example, Yap and Lee (2019) have limited research scope of study in their research. The target respondents, the sampling size, and geographic location were clearly defined by Yap and Lee (2019) in their research study. In contrast, Lee and Jaafar (2012) have covered a wide range of geographic areas, i.e. the construction companies in Malaysia as the scope of the research study. This might be one of the reasons they have a slightly lower rate of responses.

3.5 Methodology for this Research

3.5.1 Research Method

In this research, the quantitative research method is used as the research method because the objectives of this research are quite similar to the research studies reviewed in Section 3.2 which are related to the safety factors. The quantitative research method is suitable in this research study because it allows the author to collect a wide range of perceptions from the respondents with regards to the critical safety factors causing poor safety performance on the construction site and the critical safety measures to enhance safety performance on the construction site.

Further, the quantitative research method allows the author to deal with a large number of respondents. A large amount of data can be produced in a short period for a fairly low cost. Moreover, the use of scientific methods for data collection and analysis also enables result generalization possible with a quantitative research approach. With the quantitative data, it is easier to draw results, graphs, and conclusions from the responses. Therefore, a quantitative research method is used in this research.

3.5.2 Instrument for Data Collection

A questionnaire survey is used to collect data. The questionnaire comprises three sections. Section A is regarding the respondent's profile, which including the name of the company, respondent's position, working experience, the total project involved by the respondents, and the type and size of the project currently involved by the respondents. Section B is regarding the respondents' perceptions of the critical safety factor causing poor safety performance on the construction site.

The Likert scale which ranges from '1' for 'least critical' to '5' for 'most critical' is adopted for the construction professional to rate the safety factors. Section C is regarding the respondents' perceptions of the relative importance of the critical safety measures to enhance safety performance on the construction site. Similarly, the Likert Scale, which ranges from '1' for 'least important' to '5' for 'most important is adopted for the construction professional to rate the critical safety measures.

3.5.3 Pilot Survey

A pilot survey is conducted before the actual data collection. This is crucial to ensure that the content of the questionnaire is clear, unambiguity, and comprehensible. It is important to ensure that the questions do make sense and would not lead to prejudiced answers. The respondents who participated in the pilot survey are the construction professionals including project architects, project engineers, project quantity surveyors, project managers, project supervisors, construction managers, and occupational safety and health officers. The trial questionnaire was designed and distributed to the construction professionals by hand-delivery and online survey method.

The respondents were asked to fill in the questionnaire and commented on the questionnaire whether it is very satisfactory, satisfactory, or unsatisfactory. A total of 30 sets of the trial questionnaire was distributed to the construction professionals and 28 of them have responded to the questionnaire. There are four project architects, five project engineers, five project quantity surveyors, four project managers, three project supervisors, three construction managers, and four occupational safety and health officer who had responded to the trial questionnaire.

35.72% of the respondents were very satisfied with the questionnaire, 53.57% of the respondents were satisfied with the questionnaire, and 10.71% of the respondents did not have a comment on the questionnaire. None of the respondents unsatisfied with the questionnaire. Therefore, since the majority of the respondents were satisfied with the trial questionnaire, the questionnaire was accepted. The result of the pilot survey is shown in Table 3.5.

Table 3.5: Result of Pilot Survey.

Construction Professionals	Unsatisfactory	Satisfactory	Very Satisfactory	No comment	Total
Project Architect	-	2	2	-	**4**
Project Engineer	-	3	2	-	**5**
Project Quantity Surveyor	-	3	1	1	**5**
Project Manager	-	2	1	1	**4**
Project Supervisor	-	2	1	-	**3**
Construction Manager	-	2	1	-	**3**
OSH Officer	-	1	2	1	**4**
Total	**0 (0.00%)**	**15 (53.57%)**	**10 (35.72%)**	**1 (10.71%)**	**28 (100%)**

3.5.4 Sampling Method

The statistic reported by the Department of Occupational Safety and Health (DOSH) shows that there are a total of 275 work-related accident cases, in which 72 cases were accidents causing death, 13 cases were accidents causing permanent disability and 13 cases were accidents causing non-permanent disability. In this research study, approximately 50% which is 130 respondents shall be taken as the sample size of this research study.

This research study covers the construction companies in Kuala Lumpur and Selangor as plotted from the Google Map as shown in Figure 3.1. The construction professionals, including project architects, project engineers, project quantity surveyors, project managers, project supervisors, construction managers, and occupational safety and health officer working in the respective construction companies are the targeted respondents of this research study.

Figure 3.1: Construction Companies Covered in this Research Study.

3.5.5 Data Collection Procedure

The questionnaires were distributed to the construction professionals working in Klang Valley through email as well as online survey methods. Google form was created and the link was shared to the respondents through email or social media, such as WhatsApp. To increase the rate of response to the questionnaire survey, a follow-up email or message was sent out to the construction professionals as a reminder if a reply email was not received after 3 working days

It was anticipated that 70% of the questionnaire would be returned. 130 sets of questionnaires were distributed to the construction professionals working in the respective construction companies. After a combination of 28 sets of trial questionnaires, there is a total of 92 sets of questionnaires have been returned. This provides a good response rate of 71%.

3.5.6 Data Analysis Method

The RII is used to determine the respondents' perception of the critical safety factors causing poor safety performance on the construction site, and the respondents' perception of the relative importance of the critical safety measures to enhance safety performance on the construction site. A Likert Scale of 1 to 5 is used to solicit the perception of the respondents with regards to the critical safety factors and the critical safety measures. '1' being 'least critical'/ 'least important', '2' being 'less critical'/ 'less important', '3' being 'critical'/ 'important', '4' being 'more critical'/ 'more important' and '5' being 'most critical'/ 'most important'. The equation for the relative importance index as given by Hatkar and Hedaoo (2016) is as follows:

$$RII = \frac{5n1+4n2+3n3+2n4+1n5}{5N} \quad (0 \leq RII \leq 1)$$

Where N = total number of respondents, 5 = highest weighted score (5,4,3,2,1), n1 = number of respondents (least critical/ least important), n2 = number of respondents (less critical/ less important), n3 = number of respondents (critical/ important), n4 = number of respondents (more critical/ more important) and n5 = number of respondents (most critical/ most important).

Cronbach's alpha reliability test is used to test the internal consistency or reliability of the safety factors and the critical safety measures in the questionnaire survey. According to Cronbach (1951), Cronbach's alpha reliability test is suitable to be used to multipoint-scaled items to test for internal consistency and reliability of the variables. The Cronbach's alpha is carried out in IBM-Statistical Package for the Social Sciences (SPSS) using Reliability Analysis.

Cronbach's alpha value ranges from 0 to 1. A higher alpha value indicates a strong relationship between the factors. In contrast, a lower alpha value indicates a weaker relationship between the factors (Tavakol and Dennick, 2011). The recommended Cronbach's alpha value and internal consistency reliability of the factors used in this research study are based on Cronbach's alpha rule of thumb (Cronbach, 1951), as shown in Figure 3.2.

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Figure 3.2: Cronbach's Alpha Rule of Thumb.

If the Cronbach's alpha is too low, which is under 0.60, the column of 'corrected item-total variation' (refer Figure 3.3) could be referred to find out which items would have to be removed from the questionnaire to increase the inter-item inconsistency. However, the removal out of any item must improve the reliability of the measure, otherwise would affect the validity of the measure negatively.

Item-total statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total variation	Cronbach's alpha if item deleted
Jobchar1	10,4393	7,143	,735	,777
Jobchar2	10,5318	7,483	,714	,788
Jobchar3	10,4104	7,639	,620	,828
Jobchar4	10,4971	7,554	,652	,814

Figure 3.3: Item-total statistics.

3.6 Methodological Flow Chart

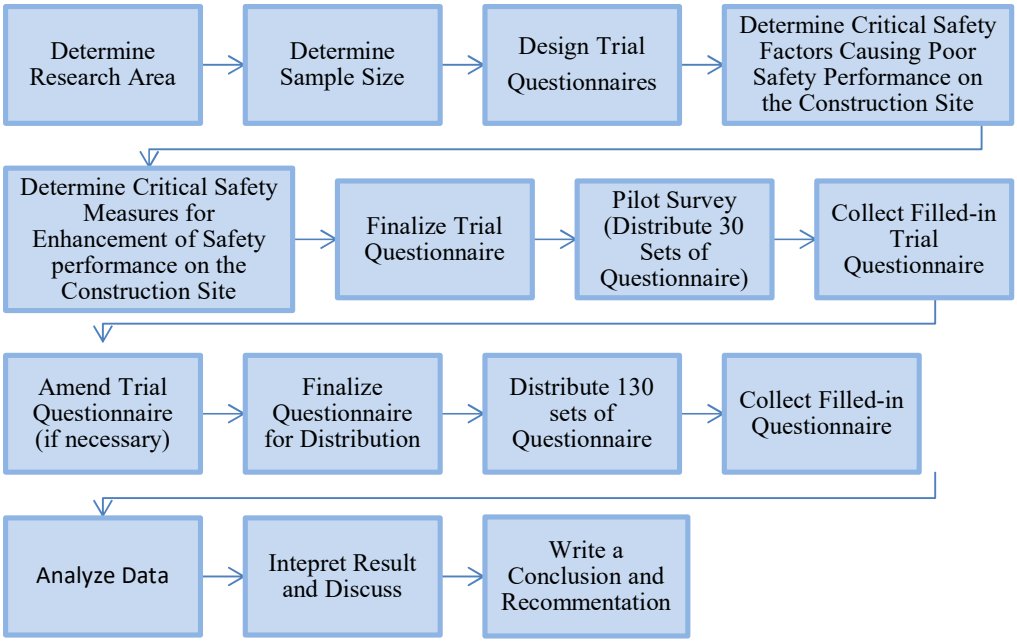

Figure 3.4: Methodological Flow Chart.

3.7 Conclusion

This chapter deals with the research methodology used by other researchers and the methodological procedure used in this research study. The research data obtained from the field survey shall be investigated, analysed, and interpreted. The results obtained shall then be analysed, tabulated, and presented in the next chapter for further analysis, evaluation, and interpretation.

CHAPTER 4
DATA COLLECTION

4.1 Introduction

The research results obtained from the field survey would be presented and elaborated on in this chapter. There is a total of 27 items in the questionnaire to be responded to by the respondents participating in the field survey, including 7 items for Section A (Respondent's Profile), 10 items for Section B (Critical Safety Factors Causing Poor Safety Performance on the Construction Site) and 10 items for Section C (Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site). The data were sorted using Microsoft Excel.

4.2 Field Survey Data

The data solicited from the respondents during the pilot and field survey for questionnaire Section A (Respondent's Profile), Section B (Critical Safety Factors Causing Poor Safety Performance on the Construction Site), and Section C (Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site) are shown in Table 4.1, 4.2 and 4.3 below:

Table 4.1: Respondent's Profile

Position	**Frequency (n)**	**Round (%)**
Project Manager	11	11.96
Construction Manager	11	11.96
Occupational Safety and Health Officer	12	13.03
Project Architect	13	14.13
Project Supervisor	13	14.13
Project Engineer	14	15.22
Project Quantity Surveyor	18	19.57
Total	**92**	**100.00**
How long have you been working in the construction industry?		
1-5 years	37	40.22
6-10 years	42	45.65
11-15 years	7	7.61
More than 15 years	6	6.52
Total	**92**	**100.00**
How many projects have you been involved in?		
1-5 projects	24	26.09
6-10 projects	50	54.35
11-15 projects	15	16.30
More than 15 projects	3	3.26
Total	**92**	**100.00**

	Frequency (n)	Round (%)
What is the type of projects that you are currently involved in?		
Condominium project	25	27.18
Condominium project, Infrastructure Project, Industrial building project	8	8.70
Condominium project, Institutional project	4	4.35
Condominium project, Mix housing development project	28	30.43
Industrial building project	5	5.43
Industrial building project, Mix housing development project	2	2.17
Infrastructure Project	8	8.70
Infrastructure Project, Mix housing development project	7	7.61
Mix housing development project	5	5.43
Total	**92**	**100.00**
What is the size of projects that you are currently involved in?		
Less than RM10 million	3	3.26
RM10-20 million	4	4.35
RM20-30 million	5	5.43
RM30-40 million	7	7.61
RM40-50 million	10	10.87
More than RM50 million	63	68.48
Total	**92**	**100.00**

Table 4.2: Critical Safety Factors Causing Poor Safety Performance on the construction Site

Please tick (√) the boxes below based on your perception of the critical safety factors causing poor safety performance on the construction site, from '1' for 'least critical' to '5' for 'most critical'.

1 = least critical 2 = less critical 3 = critical 4 = more critical 5 = most critical

	Level	Frequency (n)	Round up (%)
Lack of regular supervision	1	1	1.09
	2	1	1.09
	3	24	26.09
	4	31	33.70
	5	35	38.04
Total Respondents (n)		**92**	**100.00**
Under-reporting of work-related incident or accident	1	2	2.17
	2	4	4.35
	3	35	38.04
	4	39	42.39
	5	12	13.04
Total Respondents (n)		**92**	**100.00**

	Level	Frequency	Round up (%)
Construction workers under the influence of drugs and alcohol	1	2	2.17
	2	8	8.70
	3	37	40.22
	4	20	21.74
	5	25	27.17
Total Respondents (n)		**92**	**100.00**
Improper use or failure to use personal protective equipment (PPE)	1	0	0.00
	2	1	1.09
	3	21	22.83
	4	29	31.52
	5	41	44.57
Total Respondents (n)		**92**	**100.00**
Construction worker's negative attitude towards safety	1	0	0.00
	2	6	6.52
	3	23	25.00
	4	34	36.96
	5	29	31.52
Total Respondents (n)		**92**	**100.00**
Fatigue caused by working overtime	1	0	0.00
	2	6	6.52
	3	30	32.61
	4	27	29.35
	5	29	31.52
Total Respondents (n)		**92**	**100.00**
Lack of safety awareness among construction workers	1	0	0.00
	2	1	1.09
	3	32	34.78
	4	28	30.43
	5	31	33.70
Total Respondents (n)		**92**	**100.00**
Lack of safety signs at the construction site	1	2	2.17
	2	5	5.43
	3	31	33.70
	4	35	38.04
	5	19	20.65
Total Respondents (n)		**92**	**100.00**
Lack of training of construction workers	1	0	0.00
	2	3	3.26
	3	23	25.00
	4	38	41.30
	5	28	30.43
Total Respondents (n)		**92**	**100.00**

Table 4.3: Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site

Please tick (√) the boxes below based on your perception of the success factors to enhance safety performance on the construction site, from '1' for 'least important' to '5' for 'most important'. Please read the notes on page 3 for your better understanding of the factors before answering the questionnaire.

1 = least important 2 = less important 3 = important 4 = more important 5 = most important

	Level	Frequency (n)	Round up (%)
Close supervision by the safety supervisor	1	0	0.00
	2	2	2.17
	3	21	22.83
	4	29	31.52
	5	40	43.48
Total Respondents (n)		**92**	**100.00**
Reporting any work-related incident or accident immediately	1	0	0.00
	2	2	2.17
	3	34	36.96
	4	35	38.04
	5	21	22.83
Total Respondents (n)		**92**	**100.00**
Periodic checking to ensure construction workers follow safe work practices	1	0	0.00
	2	1	1.09
	3	19	20.65
	4	37	40.22
	5	35	38.04
Total Respondents (n)		**92**	**100.00**
Enforcing safety and health policy and regulation	1	0	0.00
	2	2	2.17
	3	22	23.91
	4	29	31.52
	5	39	42.39
Total Respondents (n)		**92**	**100.00**

	Level	Frequency (n)	Round up (%)
Correcting unsafe conditions and unsafe acts	1	0	0.00
	2	6	6.52
	3	18	19.57
	4	32	34.78
	5	36	39.13
Total Respondents (n)		**92**	**100.00**
Increase safety awareness among construction workers	1	0	0.00
	2	2	2.17
	3	19	20.65
	4	31	33.70
	5	40	43.48
Total Respondents (n)		**92**	**100.00**
Increase the number of health and safety signs	1	0	0.00
	2	9	9.78
	3	42	45.65
	4	16	17.39
	5	25	27.17
Total Respondents (n)		**92**	**100.00**
Conducting safety training for construction workers	1	0	0.00
	2	4	4.35
	3	23	25.00
	4	26	28.26
	5	39	42.39
Total Respondents (n)		**92**	**100.00**
Conducting regular toolbox safety meeting	1	1	0.00
	2	6	6.52
	3	31	33.70
	4	32	34.78
	5	22	23.91
Total Respondents (n)		**92**	**100.00**
Overcome language barriers among foreign workers in the workplace	1	0	0.00
	2	9	9.78
	3	31	33.70
	4	28	30.43
	5	24	26.09
Total Respondents (n)		**92**	**100.00**

4.3 Conclusion

The field survey data has been computed from the questionnaire answered by the respondents in this chapter. The collected data shall then be plotted in histograms and explained in detail in Chapter 5.

CHAPTER 5
DATA ANALYSIS

5.1 Introduction

The results based on the data obtained from the field survey in Chapter 4 are analysed and interpreted in this chapter. Each response made by the respondents in Section A, B, and C of the questionnaire is analysed and interpreted. There is a total of 2,484 inputs (27 x 92 respondents) to be dealt with. The sorting of data is conducted by using Microsoft Excel 2016 and IBM-SPSS. The tabulated data results are shown in Appendices C, D, and E.

5.2 Respondents' Profile

There is a total of 92 respondents who responded to the field survey. The distribution of a total of 92 respondents with various job positions is illustrated in Figure 5.1. The data reveals that most of the respondents who responded to the field survey are Project Quantity Surveyor (n=18, 19.57%), followed by the Project Engineer (n=14, 15.22%), Project Supervisor and Project Architect (n=13, 14.13%), and Occupational Safety and Health Officer (n=12, 13.04%). Construction Manager and Project Manager made up the lowest number of respondents (n=11, 11.96%).

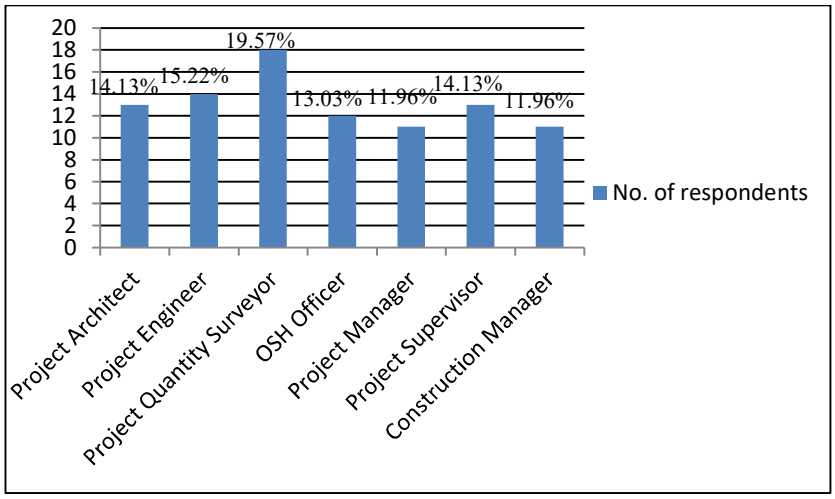

Figure 5.1: Job Position of Respondents.

Referring to Figure 5.2, most of the respondents who responded to the field survey have working experience of 6 to 10 years (n=50, 54.35%). 20.54% (n=19) of the respondents have 11 to 15 years of working experience, 18.48% (n=17) of the respondents have 1 to 5 years of working experience, while 6.52% (n=6) of the respondents have working experience more than 15 years.

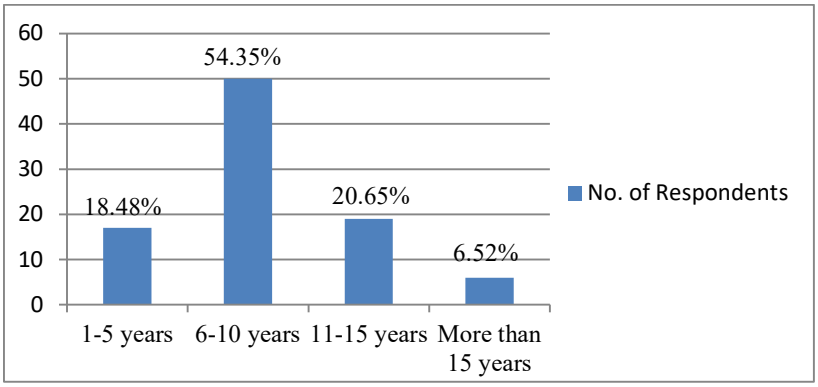

Figure 5.2: Respondents' Working Experience in the Construction Industry.

According to Figure 5.3, most of the respondents have been involved in 6-10 projects (n=24, 54.35%), followed by 1-5 projects (n=24, 26.09%), and 11-15 projects (n=15, 16.30%). The respondents who have been involved in more than 15 projects made up the least number of respondents.

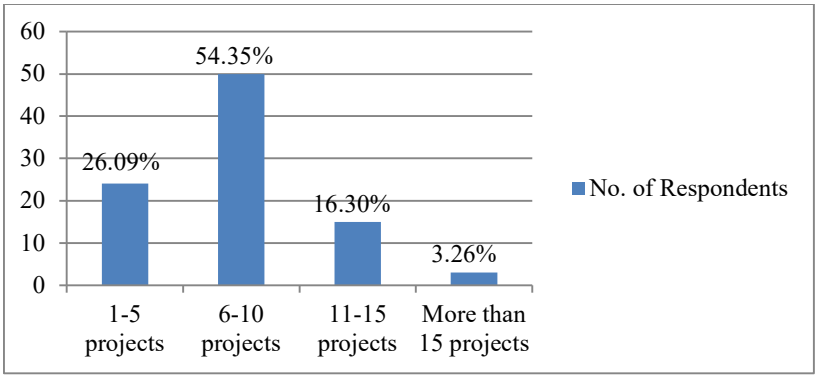

Figure 5.3: Number of Projects involved by Respondents.

The data obtained from the field survey shows that each of the respondents has been involved in various types of projects, including condominium projects, industrial building projects, infrastructure projects, mixed housing development projects, and institutional projects. Figure 5.4 shows that most of the respondents have been

involved in condominium projects (n=65), followed by a mixed housing development project (n=42), infrastructure project (n=23), industrial building project (n=15), and institutional project (n=4).

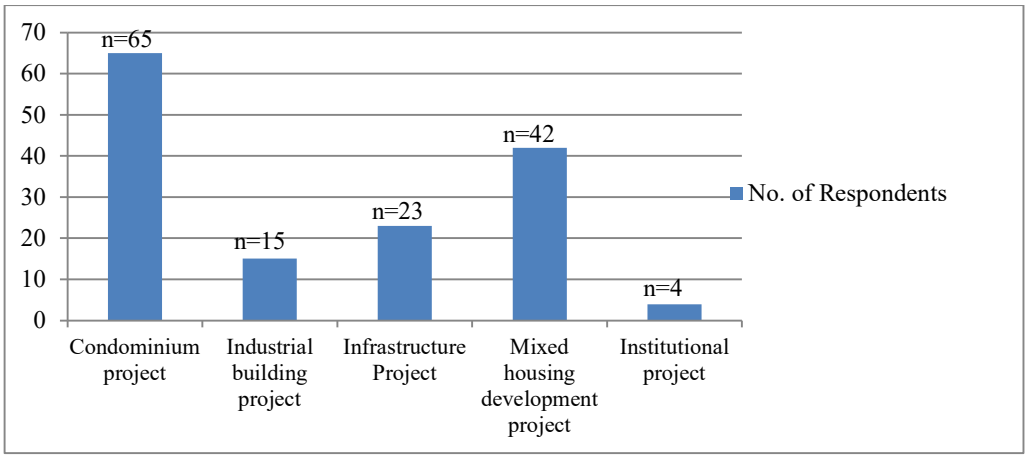

Figure 5.4: Types of Projects involved by Respondents.

The range of value of the projects that the respondents have been involved in is illustrated in Figure 5.5. Among the respondents who responded to the field survey, most of the respondents (n=63, 68.48%) have been involved in projects with a project value of more than RM50 million. Only a minority of the respondents have been involved in projects with project value ranging from project value less than RM10 million (n=3, 3.26%) to RM40-50 million (n=10, 10.87%).

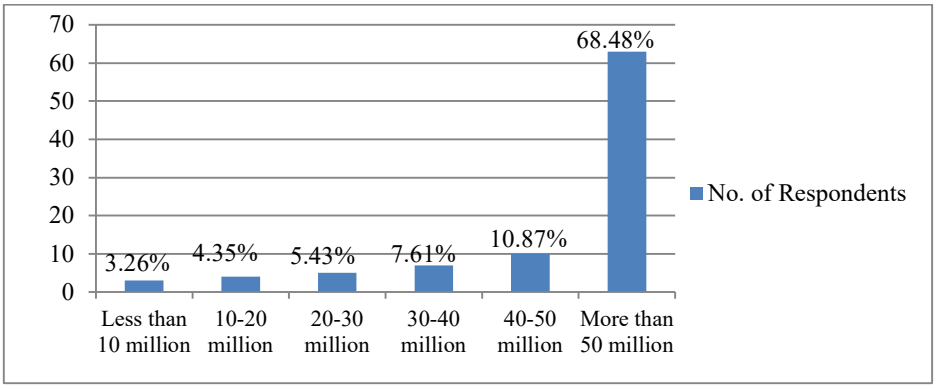

Figure 5.5: Size of Projects involved by Respondents.

The respondents' profile, i.e. job positions, working experience in the construction industry, projects that have been involved by the respondents (number, type, and size of the project) are taken into account in analysing the data because these variables determine the reliability of the data source. Referring to data in Table 5.1,

the respondents who responded to the field survey provides a good spread of respondents' job positions in the sample. The data would be reliable if the field survey involves construction professionals with a different job position.

This is because construction professionals with different job positions could have different perceptions of the criticality of safety factors influencing safety performance and the critical safety measures enhancing safety performance on the construction site. More than half of the respondents who participated in the field survey have 6 to 10 years of working experience (n=50, 54.35%) in the construction industry and have been involved in 6 to 10 projects (n=50, 54.35%) with project value more than RM50 million (n=63, 68.48%).

Moreover, they have experience in various types of projects, i.e. condominium projects, industrial building projects, infrastructure projects, mix housing development projects, and institutional projects. Hence, the source of data provided by the respondents could be considered reasonably reliable.

5.3 Critical Safety Factors Causing Poor Safety Performance on the Construction Site

5.3.1 Relative Importance Index (RII)

Table 5.1: RII Ranking of Criticality of Factors Causing Poor Safety Performance on the Construction Site.

1 = Least critical 2 = Less critical 3 = Critical 4 = More critical 5 = Most critical

Critical Safety Factors Causing Poor Safety Performance at the Construction Site		**Level of Criticality**					**Relative Importance Index**	
	n_{1-5}	**n5**	**n4**	**n3**	**n2**	**n1**		
	Likert Scale	**1**	**2**	**3**	**4**	**5**		
		Frequency					**RII**	**Rank**
Lack of regular supervision		1	1	24	31	35	0.8130	2
Under-reporting of work-related incident or accident		2	4	35	39	12	0.7196	10
Construction workers under the influence of drugs and alcohol		2	8	37	20	25	0.7261	9
Improper use or failure to use personal protective equipment (PPE)		0	1	21	29	41	0.8391	1
Construction worker's negative attitude towards safety		0	6	23	34	29	0.7870	5
Fatigue caused by working overtime		0	6	30	27	29	0.7717	6
Lack of safety awareness among construction workers		0	1	32	28	31	0.7935	4
Lack of safety signs on the construction site		2	5	31	35	19	0.7391	7
Lack of training of construction workers		0	3	23	38	28	0.7978	3
Lack of toolbox safety meetings		0	7	39	30	16	0.7283	8

Research data of the respondents' perception with regards to the criticality of the safety factors causing poor safety performance on the construction site collected from the field survey is shown in Table 5.1. The respondents have given their perception of the level of criticality of each safety factor ranging from '1' for 'least critical' to '5' for 'most critical'. The RII for each critical factor is calculated based on the equation given by Hatkar and Hedaoo (2016) below:

$$\text{RII} = \frac{5n1+4n2+3n3+2n4+1n5}{5N} \qquad (0 \leq \text{RII} \leq 1)$$

Each factor is ranked according to the Relative Importance Index calculated. The factor with the highest RII indicates the most critical factors in influencing safety performance perceived by the respondents. In contrast, the factor with the lowest RII indicates the least critical factors in influencing safety performance perceived by the respondents. Referring to Table 5.1, 'improper use or failure to use PPE' has the highest relative importance index (RII=0.8130), where most of the respondents believed that this factor is the most critical factor influencing safety performance on the construction site.

Figure 5.6 shows that almost all of the respondents perceived that this factor is the most critical. Only 1 respondent (1.09%) perceived that this factor is less critical and none of the respondents perceived that this factor is the least critical. 44.57% (n=41), 31.52% (n=29), and 22.83% (n=21) of respondents have responded with 'most critical', 'more critical' and 'less critical' respectively. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(41)+4(29)+3(21)+2(1)+1(0)}}{\mathbf{5(92)}}$$

$$=0.8391$$

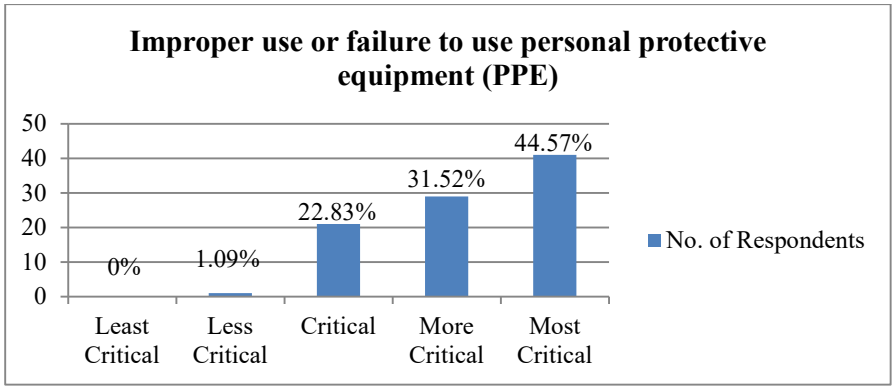

Figure 5.6: Respondent's Perception of Level of Criticality of 'Improper Use or Failure to Use Personal Protective Equipment (PPE)'.

Lack of regular supervision' has ranked the second most critical factor causing poor safety performance on the construction site perceived by respondents as shown in Table 5.1. It has a slightly lower RII of 0.8130. Referring to Figure 5.7, this factor is the critical factors perceived by most of the respondents, with 38.04% (n=35) of the

respondents said that it is 'critical', 33.70% (n=31) of the respondents said that it is 'more critical' and 26.09% (n=24) of the respondents said that it is 'critical'. Only 1.09% of the respondents said that it is 'less critical' and 'least critical' respectively. The research data collected from the field survey is displayed in Figure 5.7 and the RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(35)+4(31)+3(24)+2(1)+1(1)}}{\mathbf{5(92)}}$$

$$= 0.8130$$

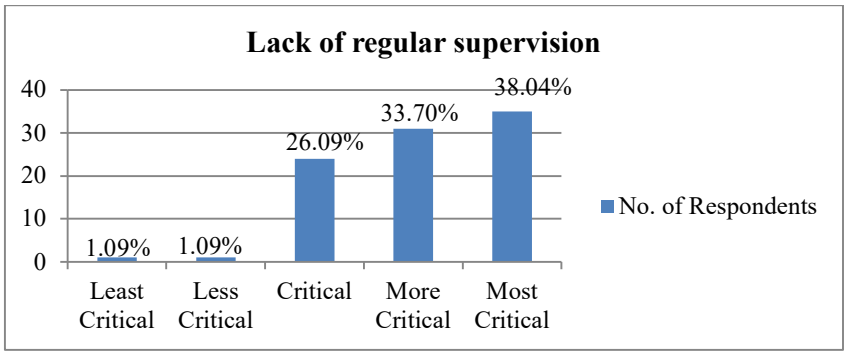

Figure 5.7: Respondent's Perception of Level of Criticality of 'Lack of Regular Supervision'.

Table 5.1 shows that 'lack of training of construction workers' has third-ranking among other factors. This factor has a lower RII = 0.7978. Although the respondents who responded with 'most critical' is lesser (30.43%, n=28), there are still many respondents who perceived that this factor is 'more critical' (41.30%, n=38) and 'critical' (25.00%, n=23). Only a minority of the respondents considered this factor as 'less critical' (3.26%, n=3) and none of them thought that this factor is 'least critical'. The research data obtained from the field survey is illustrated in Figure 5.8. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(28)+4(38)+3(23)+2(3)+1(0)}}{\mathbf{5(92)}}$$

$$= 0.7978$$

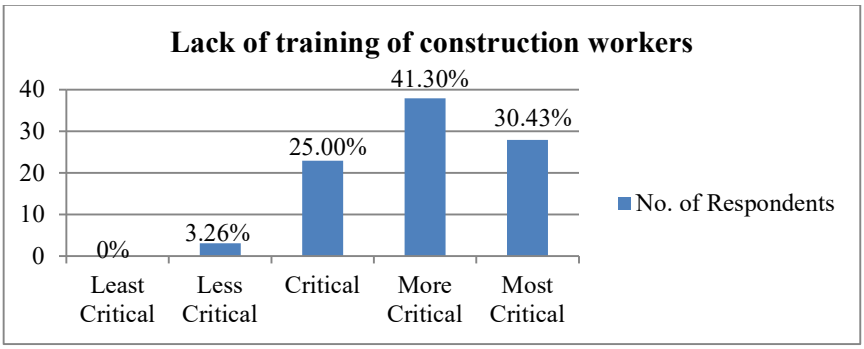

Figure 5.8: Respondent's Perception of Level of Criticality of 'Lack of Training of Construction Workers'.

Furthermore, based on Table 5.1, 'lack of safety awareness among construction workers' has ranked the fourth-highest critical factor with RII of 0.7935, which is slightly lower than 'lack of training of construction workers'. Referring to Figure 5.9, this factor is considered critical factors that need to be paying attention to as most of the respondents said that it is 'most critical'(33.70%, n=31), 'more critical' (30.43%, n=28) and 'critical'(34.78%, n=32), however, only 1.09% (n=1) of the respondents said that it is 'less critical'. None of the respondents said that this factor is 'least critical'. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(31)+4(28)+3(32)+2(1)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7935$$

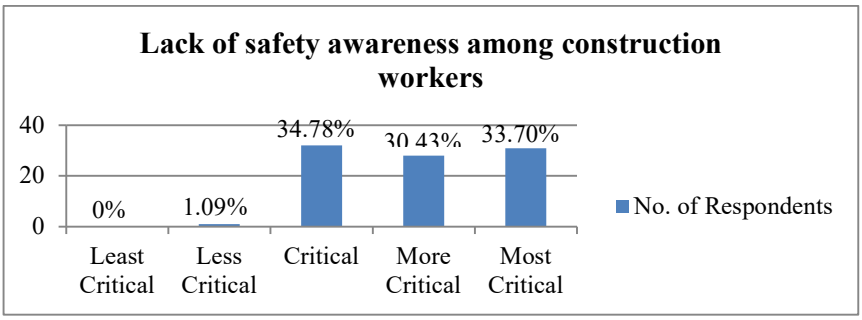

Figure 5.9: Respondent's Perception of Level of Criticality of 'Lack of Safety Awareness among Construction Workers'.

'Construction worker's negative attitude towards safety' has the fifth-highest RII=0.7870 based on the level of criticality of this factor perceived by the respondents as shown in Table 5.1. Referring to Figure 5.10, the highest percentage falls under 'more critical' (36.96%, n=34). The respondents responded with 'most critical' and 'critical' is lesser, which is 31.52% (n=29) and 25.00% (n=23) respectively. More respondents (6.52%, n=6) perceived that this factor is 'less critical' compared with other factors aforementioned, while none of the respondents perceived that this factor is 'least critical'. RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(29)+4(34)+3(23)+2(6)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7870$$

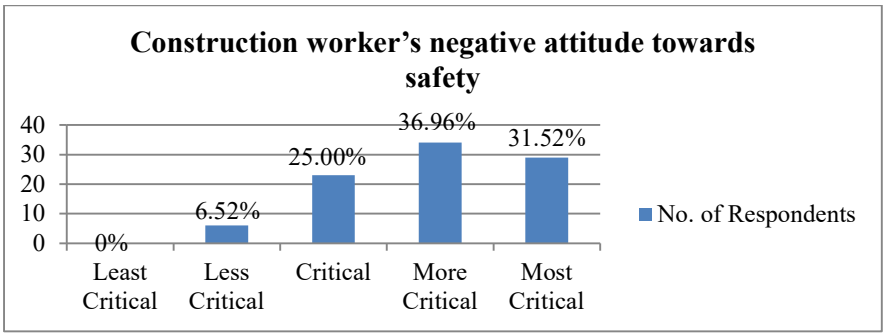

Figure 5.10: Respondent's Perception of Level of Criticality of 'Construction Worker's Negative Attitude towards Safety'.

Fatigue caused by working overtime has ranked the fifth-lowest critical factor with RII of 0.7717 referring to Table 5.1. Figure 5.11 shows that 31.52% (n=29) of the respondents perceived this factor as 'most critical', 29.35% (n=27) of the respondents perceived that this factor is 'more critical' and 32.61% (n=30) of the respondents perceived that this factor is 'critical'. Only 6.52% of the respondents considered this factor as 'less critical' and none of the respondents considered that this factor as 'least critical'. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(29)+4(27)+3(30)+2(6)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7717$$

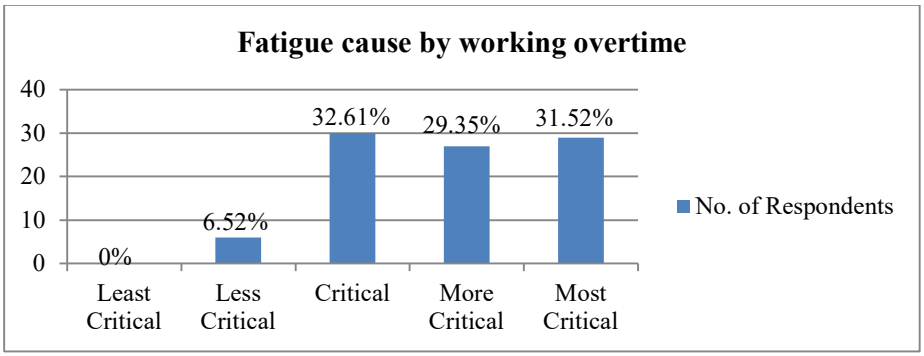

Figure 5.11: Respondent's Perception of Level of Criticality of 'Fatigue Caused by Working Overtime'.

Table 5.2 shows that 'lack of safety signs on the construction site' has the fourth lowest ranking among other factors with RII of 0.7391. The data collected from the figure survey are revealed in Figure 5.12. The data shows that the respondents who perceived that 'lack of safety signs on the construction site' is 'least critical and less critical consist of 2.17% (n=2) and 5.43% (n=5) respectively. Some respondents perceived that this factor is 'critical', 'more critical', and 'most critical'. There are 33.70% (n=31), 38.04% (n=35), and 20.65% (n=19) of them. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(19)+4(35)+3(31)+2(5)+1(2)}}{\mathbf{5(92)}}$$
$$= 0.7391$$

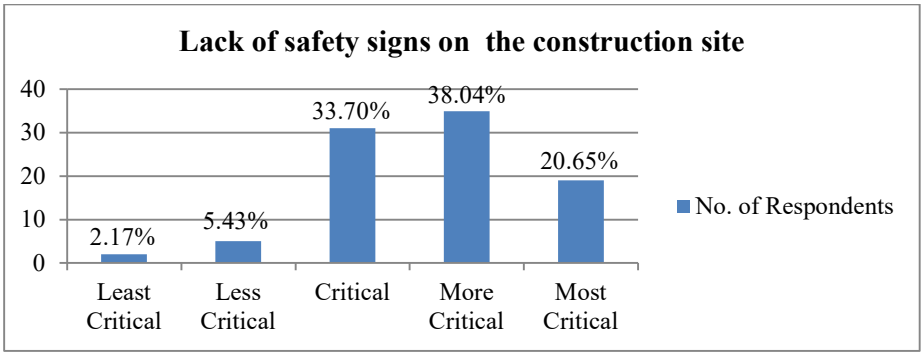

Figure 5.12: Respondent's Perception of Level of Criticality of 'Lack of Safety Signs on the Construction Site'.

Further, the lack of toolbox safety meetings has RII of 0.7283, which was ranked as the third-lowest critical factor as shown in Table 5.1. Refer to Figure 5.13, only 17.39% (n=16) of the respondents said that 'lack of toolbox safety meetings' is 'most critical', however, there is 36.96% (n=34) and 38.04% (n=35) of them said that this factor is 'more critical' and 'critical'. Only 7.61% (n=7) of them said that this factor is 'less critical' and none of them said that it is 'least critical'. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(16)+4(34)+3(35)+2(7)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7283$$

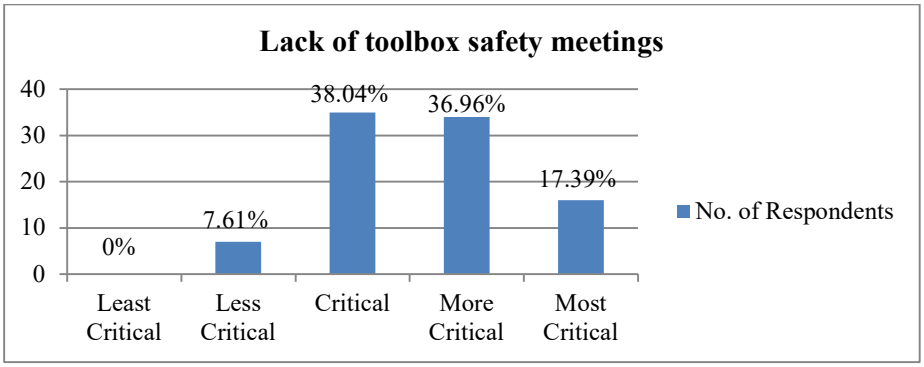

Figure 5.13: Respondent's Perception of Level of Criticality of 'Lack of Toolbox Safety Meetings'.

Referring to Table 5.1, 'Construction workers under the influence of drugs and alcohol' has ranked the second-lowest critical factor as the critical factors causing poor safety performance on the construction site. As shown in Figure 5.14, most of the respondents responded with 'critical', which is 40.22% (n=37) of them, followed by 27.17% (n=25) and 21.74% (n=20) of them who responded with 'most critical' and 'more critical' respectively. More respondents responded with 'less critical' and 'least critical' compared with other factors, which consist of 8.70% (n=8) and 2.17% (n=2) of them respectively. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(25)+4(20)+3(37)+2(8)+1(2)}}{\mathbf{5(92)}}$$
$$= 0.7261$$

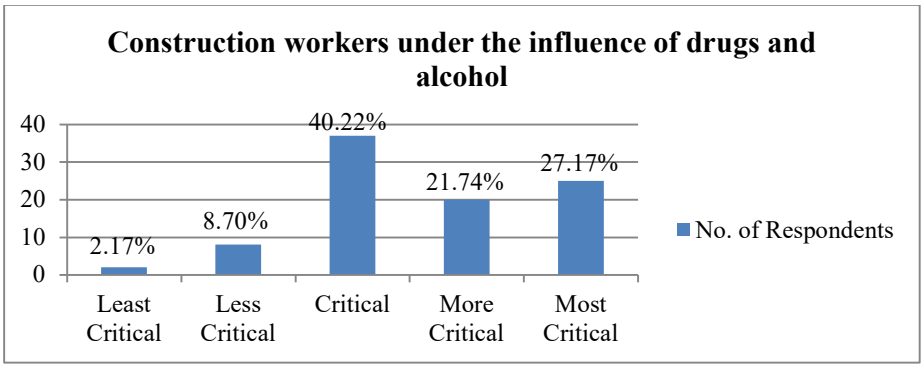

Figure 5.14: Respondent's Perception of Level of Criticality of 'Construction Workers under the Influence of Drugs and Alcohol'.

'Under-reporting of work-related incident or accident' has the lowest ranking with RII of 0.7196 according to Table 5.1. The data collected from the field survey are illustrated in Figure 5.15. The respondents who opined that 'under-reporting of work-related incident or accident' is 'most critical', 'more critical' and 'critical' are consist of 13.04% (n=12), 42.39% (n=39), and 38.04% (n=35). 4.35% (n=4) and 2.17% (n=2) of the respondents are in the opinion that this factor is 'less critical' and 'least critical'. The RII is calculated based on the level of criticality of this factor perceived by the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(12)+4(39)+3(35)+2(4)+1(2)}}{\mathbf{5(92)}}$$

$$= 0.7196$$

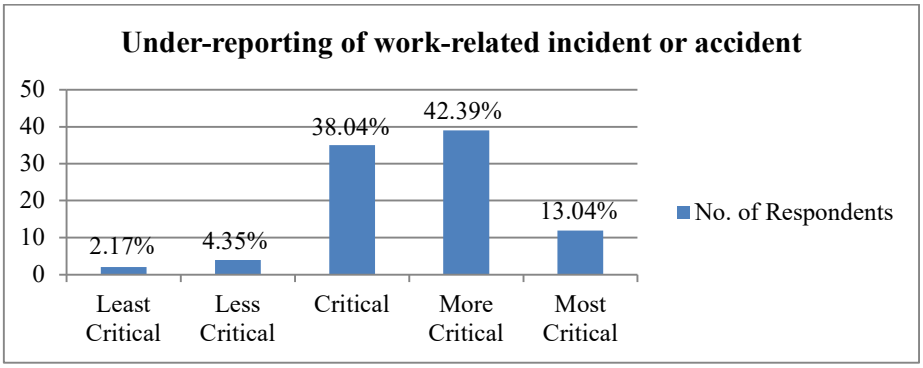

Figure 5.15: Respondent's Perception of Level of Criticality of 'Under-Reporting of Work-Related Incident or Accident'.

In summary, the data in Table 5.1 shows that the RII for all the critical factors is close to each other. This indicates that each factor aforementioned should be considered by the construction professionals as the critical factor in causing poor safety performance on the construction site.

5.3.2 Reliability Test

Reliability analysis was carried out on the critical factors comprising of 10 items. The Cronbach's Alpha value, $\alpha = 0.987$ based on Figure .16. This reflects the high reliability of the questionnaire. Moreover, Cronbach's Alpha value of more than 0.9 indicates excellent internal consistency of the questionnaire according to Cronbach's alpha rule of thumb (Cronbach, 1951).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.987	.987	10

Figure 5.16: Reliability Statistics.

The mean and deviation appear to be fairly close to each other without any critical safety factor that has a lot higher or lower than others referring to Figure 5.17. Moreover, as shown in Figure 5.19, there is a list of 1.000 across the diagonal from top left to bottom right. This shows the strong correlation between each safety factor. The scores are identical making the correlation to be perfect (r=1).

All the critical safety factors have fairly similar correlations without any factor that has consistently low or high correlations across the board. Further, the Corrected Item - Total Correlation column in Figure 5.18 shows that all the correlations of the safety factors are very close to each other. This reveals that the questionnaire is reliable and thus no safety factor would be removed from Section C of the questionnaire.

Item Statistics

	Mean	Std. Deviation	N
lack_of_regular_supervision	4.0652	.88708	92
under_reporting_of_work_related_incident_or_accident	3.5978	.85240	92
construction_workers_under_the_influence_of_drugs_and_alcohol	3.6304	1.04532	92
improper_use_or_failure_to_use_PPE	4.1957	.82860	92
construction_worker_negative_attitude_towards_safety	3.9348	.91152	92
fatigue_caused_by_working_overtime	3.8587	.94441	92
lack_of_safety_awareness_among_construction_workers	3.9674	.85743	92
lack_of_safety_signs_at_the_construction_site	3.6957	.93455	92
lack_of_training_of_construction_workers	3.9891	.83198	92
lack_of_toolbox_safety_meetings	3.6413	.85910	92

Figure 5.17: Reliability Statistics.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
lack_of_regular_supervision	34.5109	58.626	.933	.939	.986
under_reporting_of_work_related_incident_or_accident	34.9783	59.384	.912	.913	.986
construction_workers_under_the_influence_of_drugs_and_alcohol	34.9457	56.250	.941	.893	.986
improper_use_or_failure_to_use_PPE	34.3804	59.799	.906	.875	.986
construction_worker_negative_attitude_towards_safety	34.6413	57.991	.956	.955	.985
fatigue_caused_by_working_overtime	34.7174	57.414	.963	.961	.985
lack_of_safety_awareness_among_construction_workers	34.6087	59.032	.935	.923	.986
lack_of_safety_signs_at_the_construction_site	34.8804	57.843	.941	.932	.985
lack_of_training_of_construction_workers	34.5870	59.322	.942	.941	.985
lack_of_toolbox_safety_meetings	34.9348	59.139	.925	.931	.986

Figure 5.18: Total Statistics.

Inter-Item Correlation Matrix

	lack_of_regular_supervision	under_reporting_of_work_related_incident_or_accident	construction_workers_under_the_influence_of_drugs_and_alcohol	improper_use_or_failure_to_use_PPE	construction_worker_negative_attitude_towards_safety	fatigue_caused_by_working_overtime	lack_of_safety_awareness_among_construction_workers	lack_of_safety_signs_at_the_construction_site	lack_of_training_of_construction_workers	lack_of_toolbox_safety_meetings
lack_of_regular_supervision	1.000	.834	.880	.924	.916	.890	.913	.859	.939	.824
under_reporting_of_work_related_incident_or_accident	.834	1.000	.880	.813	.857	.884	.824	.934	.831	.941
construction_workers_under_the_influence_of_drugs_and_alcohol	.880	.880	1.000	.871	.897	.915	.881	.907	.892	.903
improper_use_or_failure_to_use_PPE	.924	.813	.871	1.000	.876	.864	.875	.830	.880	.825
construction_worker_negative_attitude_towards_safety	.916	.857	.897	.876	1.000	.959	.925	.892	.955	.868
fatigue_caused_by_working_overtime	.890	.884	.915	.864	.959	1.000	.944	.922	.921	.898
lack_of_safety_awareness_among_construction_workers	.913	.824	.881	.875	.925	.944	1.000	.865	.908	.849
lack_of_safety_signs_at_the_construction_site	.859	.934	.907	.830	.892	.922	.865	1.000	.872	.944
lack_of_training_of_construction_workers	.939	.831	.892	.880	.955	.921	.908	.872	1.000	.840
lack_of_toolbox_safety_meetings	.824	.941	.903	.825	.868	.898	.849	.944	.840	1.000

Figure 5.19: Inter-Item Correlation Matrix.

5.4 Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site

5.4.1 Relative Importance Index (RII)

Table 5.2: Ranking Order of Relative Importance of the Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site.

1 = Least Important 2 = Less Important 3 = Important 4 = More Important 5 = Most Important

Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site		**Level of Criticality**					**Relative Importance Index**	
	n_{1-5}	**n5**	**n4**	**n3**	**n2**	**n1**		
	Likert Scale	**1**	**2**	**3**	**4**	**5**		
		Frequency					**RII**	**Rank**
Close supervision by the safety supervisor		0	2	30	32	28	0.8326	2
Reporting any work-related incident or accident immediately		0	2	34	35	21	0.7630	7
Periodic checking to ensure construction workers follow safe work practices		0	1	19	37	35	0.8304	3
Enforcing safety and health policy and regulation		0	2	22	29	39	0.8283	4
Correcting unsafe conditions and unsafe acts		0	6	18	32	36	0.8130	6
Increase safety awareness among construction workers		2	2	19	31	40	0.8370	1
Increase the number of health and safety signs		0	9	42	16	25	0.7239	10
Conducting safety training for construction workers		0	4	23	26	39	0.8174	5
Conducting regular toolbox safety meeting		1	6	31	32	22	0.7478	8
Overcome language barriers among foreign workers in the workplace		0	9	31	28	24	0.7457	9

Table 5.2 shows the research data of the respondents' perception of the relative importance of the critical safety measures enhancing safety performance on the construction site. The respondents have given their perception of the relative importance of the critical safety measures ranging from '1' for 'least important' to '5' for 'most important'. The RII for each critical safety measure is calculated based on the equation given by Hatkar and Hedaoo (2016) below:

$$RII = \frac{5n1+4n2+3n3+2n4+1n5}{5N} \quad (0 \leq RII \leq 1)$$

The relative importance of each of the factors to enhance safety performance on the construction site is ranked according to the RII calculated. The factor with the highest RII indicates the most important factors in enhancing safety performance on the construction site perceived by the respondents. The lowest RII indicates the least important factors in enhancing safety performance on the construction site perceived by the respondents.

Referring to Table 5.2, 'increase safety awareness among construction workers' has ranked the most important safety measure among other factors. It has the highest RII of 0.8370. Referring to Figure 5.20, most of the respondents (43.48%, n=-40) have perceived that this factor is the most important safety measure to enhance safety performance on the construction site, followed by 33.70% (n=31) for 'more important', 20.65% (n=19) for 'important'. Only 2.17% (n=2) of the respondents thought that it is 'less important' and none of the respondents thought that it is 'least important'. The RII is calculated based on the perceptions of respondents as follows:

$$RII = \frac{\mathbf{5(40)+4(31)+3(19)+2(2)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.8370$$

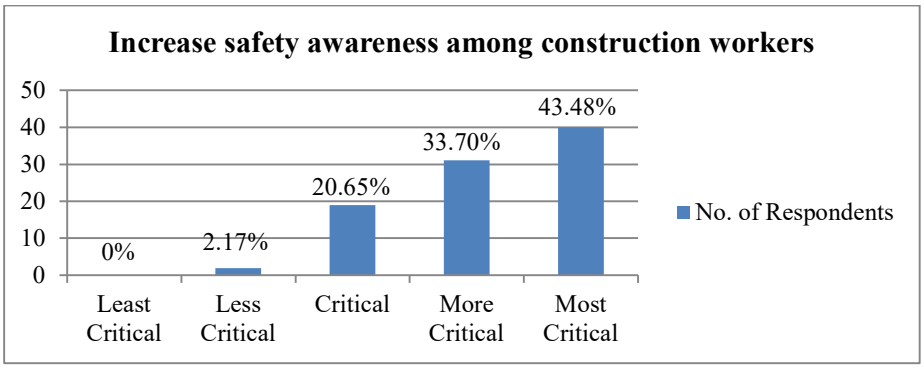

Figure 5.20: Respondent's Perception of Importance of 'Increase Safety Awareness Among Construction Workers'.

'Close supervision by the safety supervisor' has ranked the second important safety measure in enhancing safety performance on the construction site with a slightly lower RII of 0.8326 as shown in Table 5.2. Figure 5.21 shows that the majority of the respondents have said that this factor is important with 43.48% (n=40) of them said that it is 'most important', 31.52% (n=29) of them said that it is 'more important 'and 22.83% (n=21) said that it is 'important'. Only 2.17% (n=2) of them said that this factor is 'less important', and none of them said that it is 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(40)+4(29)+3(21)+2(2)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.8326$$

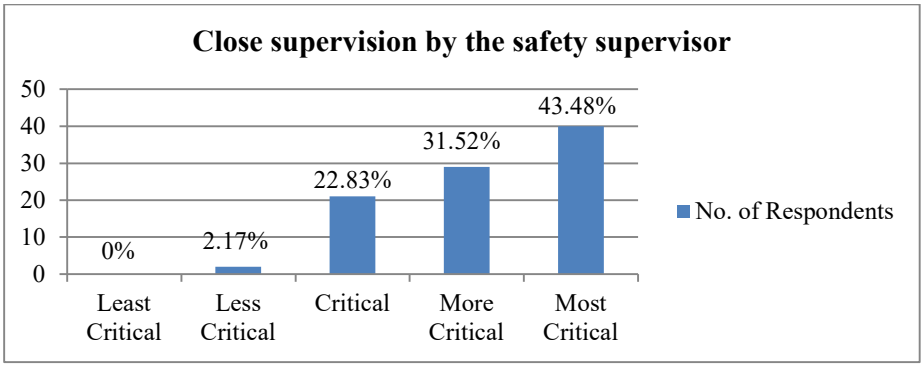

Figure 5.21: Respondent's Perception of Importance of 'Close Supervision by the Safety Supervisor'.

According to Table 5.2, 'Periodic checking to ensure construction workers follow safe work practices' has ranked the third important safety measure in improving safety performance on the construction site. It has the third-highest RII of 0.8304, which is slightly lower than the second-highest-ranking factor. Referring to Figure 5.22, this factor is 'most important', 'more important' and 'important' perceived by 38.04% (n=35), 40.22% (n=37), and 20.65% (n=19) of the respondents respectively. Only one respondent (1.09%) perceived that it is less important and none of them perceived that it is 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(35)+4(37)+3(19)+2(1)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.8304$$

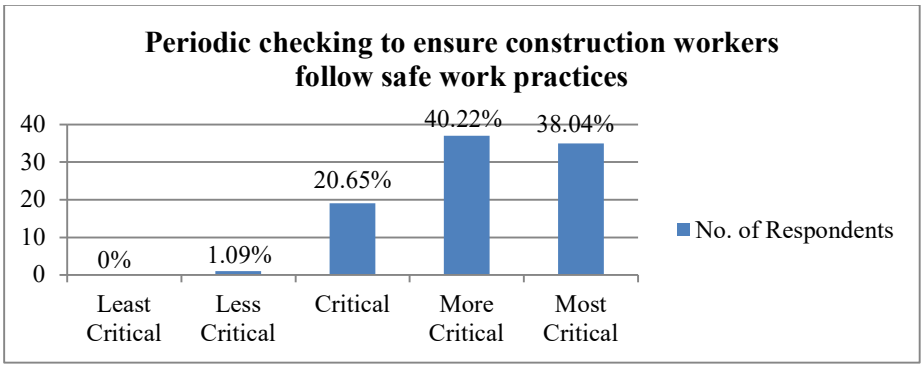

Figure 5.22: Respondent's Perception of Importance of 'Periodic Checking to Ensure Construction Workers Follow Safe Work Practices'.

Based on Table 5.2, 'enforcing safety and health policy and regulation' has the fourth-highest RII of 0.8283, which has ranked the fourth important safety measure in enhancing safety performance on the construction site. Figure 5.23 shows that among the respondents, 42.39% (n=39) of them said that it is 'most important', 31.52% (n=29) of them said that it is 'more important 'and 23.91% (n=22) of them said that it is 'important'. Meanwhile, 2.17% (n=2) of them said that it is 'less important' and none of them said that it is 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(39)+4(29)+3(22)+2(2)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.8283$$

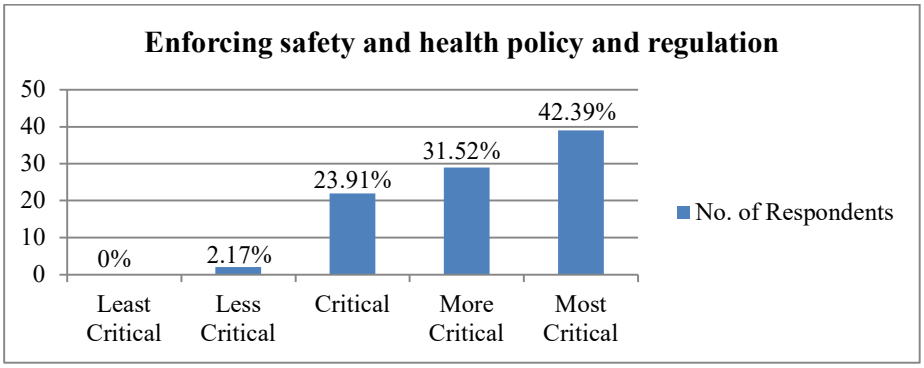

Figure 5.23: Respondent's Perception of Importance of 'Enforcing Safety and Health Policy and Regulation'.

As shown in Table 5.2, 'conducting safety training for construction workers' has ranked the fifth-highest important safety measure with RII of 0.8174. Figure 5.24 shows the response of the respondents on this factor. The respondents who responded with 'most important', 'more important' and 'important' consist of 42.39% (n=39), 28.26% (n=26), and 25.00% (n=23). However, only 4.35% (n=4) of the respondents responded with 'less important' and none of them responded with 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(39)+4(26)+3(23)+2(4)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.8174$$

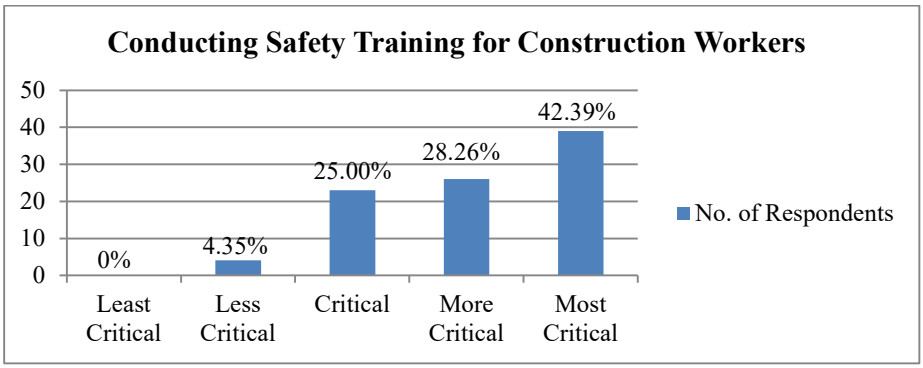

Figure 5.24: Respondent's Perception of Importance of 'Conducting Safety Training for Construction Workers'.

As shown in Table 5.2, the safety measure which has ranked the fifth-lowest is 'correcting unsafe conditions and unsafe acts' with RII of 0.8130. Referring to Figure 5.25, the respondents who perceived that this factor is 'most important', 'more important' and 'important' consist of 39.13% (n=36), 34.78% (n=32), and 19.57% (n=18) respectively. 6.52% (n=6) of them are in the perception that this factor is 'less important', however, none of them are in the perception that this factor is 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(36)+4(32)+3(18)+2(6)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.8130$$

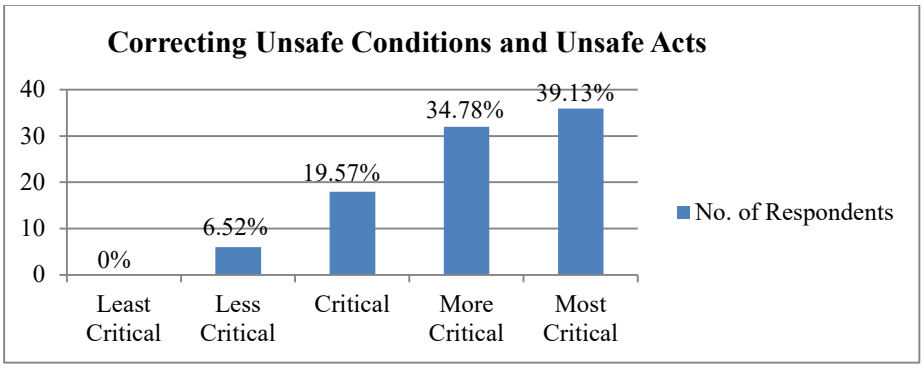

Figure 5.25: Respondent's Perception of Importance of 'Correcting Unsafe Conditions and Unsafe Acts'.

'Reporting any work-related incident or accident immediately' is the safety measure that has ranked the fourth-lowest with the RII of 0.7630 as shown in Table 5.2. As illustrated in Figure 5.26, the respondents who responded with 'most important' are lesser which consists of 22.83% (n=21). Nevertheless, many respondents responded with 'more important' and 'important', which consist of 38.04% (n=35) and 36.96% (n=34) respectively. The respondents who responded with 'less important' consist of 2.17% (n=2) and none of them responded with 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(21)+4(35)+3(34)+2(2)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7630$$

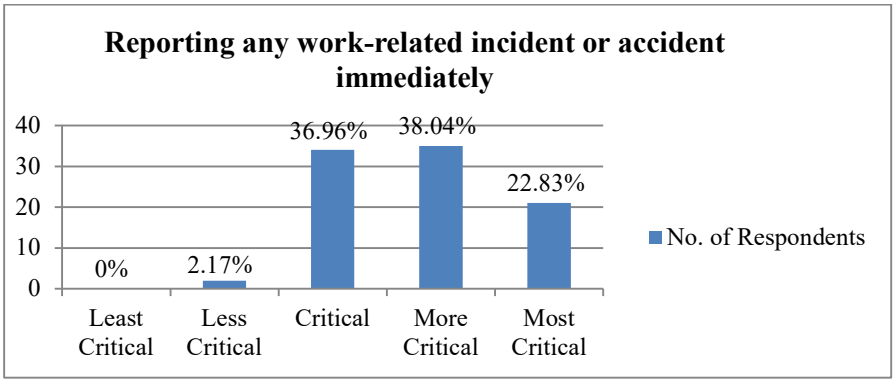

Figure 5.26: Respondent's Perception of Importance of 'Reporting Any Work-Related Incident or Accident Immediately'.

'Conducting Regular Toolbox Safety Meeting' has the third-lowest RII of 0.7478 and has ranked the second-lowest important factor in enhancing safety performance on the construction site as shown in Table 5.2. Figure 5.27 shows that most of the respondents perceived that 'conducting regular toolbox safety meeting' is 'more important' (n=32), followed by 'important' (n=31) and 'most important' (n=22). The respondents who perceived that it is 'less important' consist of 6.52% (n=6), followed by 'least important' consist of 1.09% (n=1). The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(22)+4(32)+3(31)+2(6)+1(1)}}{\mathbf{5(92)}}$$
$$= 0.7478$$

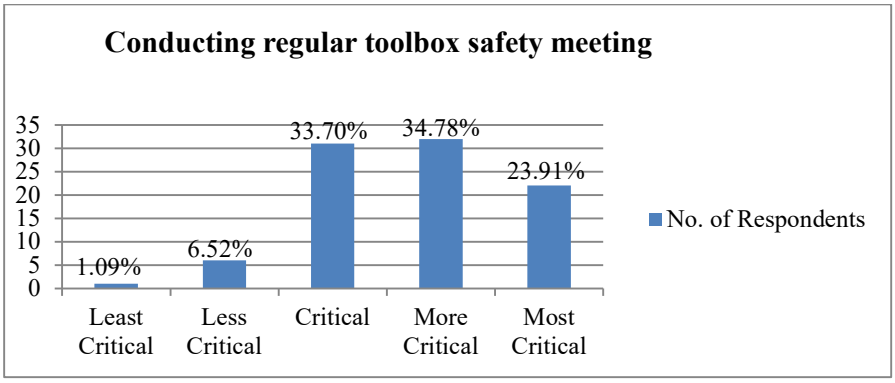

Figure 5.27: Respondent's Perception of Importance of 'Conducting Regular Toolbox Safety Meeting'.

The safety measure which has the second-lowest RII is 'overcome language barriers among foreign workers in the workplace'. It has ranked the second-lowest important safety measure as shown in Table 5.2. As illustrated in Figure 5.28, the respondents who perceived that this factor is 'important' made up of the most number of respondents (33.70%, n=31), followed by 'most important' (26.09%, n=24) and 'more important' (30.43%, n=28). The respondents who responded with 'less important' consist of 9.78% (n=9) and none of the respondents who responded with 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(24)+4(28)+3(31)+2(9)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7457$$

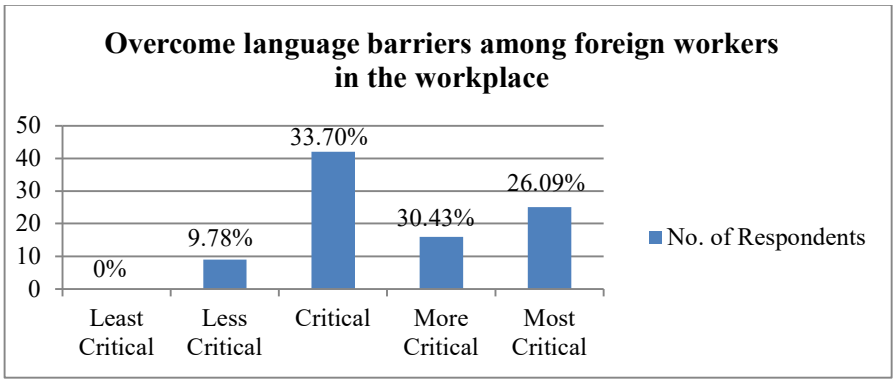

Figure 5.28: Respondent's Perception of Importance of 'Overcome Language Barriers among Foreign Workers in the Workplace.

Referring to Table 5.2, 'increase the number of health and safety signs' has ranked the lowest important safety measure in enhancing safety performance at the construction. It has the lowest RII of 0.7239. As shown in Figure 5.29, the respondents who perceived that this factor is 'important' made by the highest percentage of respondents, followed by 'most important', 'more important', and' less important'. None of the respondents perceived that this factor is 'least important'. The RII is calculated based on the perceptions of the respondents as follows:

$$\text{RII} = \frac{\mathbf{5(25)+4(16)+3(42)+2(9)+1(0)}}{\mathbf{5(92)}}$$
$$= 0.7239$$

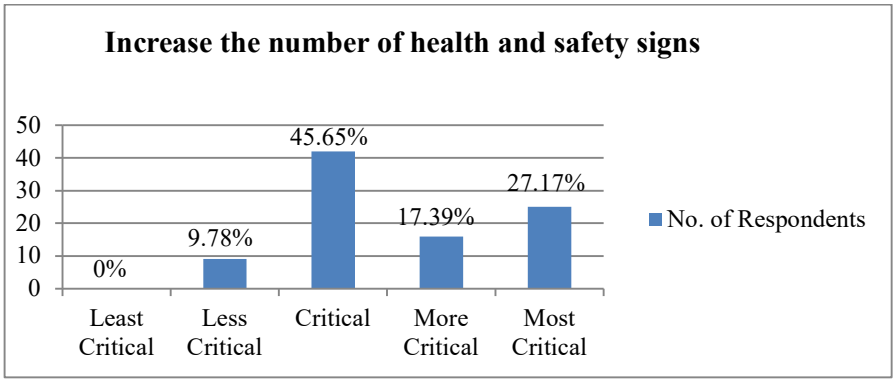

Figure 5.29: Respondent's Perception of Importance of 'Increase the Number of Health and Safety Signs'.

5.4.2 Reliability Test

Reliability analysis was carried out on the values scale of safety measures comprising of 10 items. Figure 5.30 shows that Cronbach's Alpha value, $\alpha = 0.988$, which is above 0.9. This indicates the high reliability of the measuring instrument. Further, it reflects excellent internal consistency for the specific sample according to Cronbach's alpha rule of thumb (Cronbach, 1951).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.988	.988	10

Figure 5.30: Reliability Statistics.

The mean and deviation shown in Figure 5.31 appear to be fairly close to each other without any safety measure that has a lot higher or lower than others. Moreover, referring to Figure 5.33, there is a list of 1.000 across the diagonal from top left to bottom right. This indicates that all the items have been correlated with each other. Due to the scores are identical, the correlation is perfect (r=1).

All the items have fairly similar correlations without any safety measure that have consistently low correlations across the board. Further, the Corrected Item - Total Correlation column in Figure 5.32 reveals that all the correlations of the critical safety measure are very close to each other. This shows that the questionnaire is reliable and thus none of the safety measures would be removed from the overall questionnaire.

Item Statistics

	Mean	Std. Deviation	N
close_supervision_by_the_safety_supervisor	4.1630	.85520	92
reporting_any_work_related_incident_or_accident_immediately	3.8152	.81104	92
preiodic_checking	4.1522	.78355	92
enforcing_health_and_safety_policies_and_regulations	4.1413	.85910	92
correcting_unsafe_conditions_and_unsafe_acts	4.0652	.92349	92
increase_safety_awareness_among_construction_workers	4.1848	.83770	92
increase_the_number_of_health_and_safety_signs	3.6196	.99275	92
conducting_safety_training_for_construction_workers	4.0870	.92168	92
conducting_regular_toolbox_safety_meeting	3.7391	.93608	92
overcome_language_barriers_among_foreign_workers	3.7283	.96195	92

Figure 5.31: Reliability Statistics.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
close_supervision_by_the_safety_supervisor	35.5326	58.208	.958	.986	.986
reporting_any_work_related_incident_or_accident_immediately	35.8804	59.513	.901	.921	.987
preiodic_checking	35.5435	59.482	.939	.932	.987
enforcing_health_and_safety_policies_and_regulations	35.5543	58.118	.961	.982	.986
correcting_unsafe_conditions_and_unsafe_acts	35.6304	57.269	.953	.956	.986
increase_safety_awareness_among_construction_workers	35.5109	58.516	.954	.979	.986
increase_the_number_of_health_and_safety_signs	36.0761	56.708	.920	.897	.987
conducting_safety_training_for_construction_workers	35.6087	57.274	.955	.950	.986
conducting_regular_toolbox_safety_meeting	35.9565	57.427	.926	.954	.987
overcome_language_barriers_among_foreign_workers	35.9674	56.977	.933	.950	.987

Figure 5.32: Total Statistics.

Inter-Item Correlation Matrix

	close_supervision_by_the_safety_supervisor	reporting_any_work_related_incident_or_accident_immediately	preiodic_checking	enforcing_health_and_safety_policies_and_regulations	correcting_unsafe_conditions_and_unsafe_acts	increase_safety_awareness_among_construction_workers	increase_the_number_of_health_and_safety_signs	conducting_safety_training_for_construction_workers	conducting_regular_toolbox_safety_meeting	overcome_language_barriers_among_foreign_workers
close_supervision_by_the_safety_supervisor	1.000	.836	.930	.985	.946	.985	.863	.958	.850	.856
reporting_any_work_related_incident_or_accident_immediately	.836	1.000	.823	.842	.823	.827	.867	.845	.949	.921
preiodic_checking	.930	.823	1.000	.931	.943	.944	.866	.910	.849	.857
enforcing_health_and_safety_policies_and_regulations	.985	.842	.931	1.000	.958	.971	.863	.970	.853	.858
correcting_unsafe_conditions_and_unsafe_acts	.946	.823	.943	.958	1.000	.936	.866	.949	.872	.874
increase_safety_awareness_among_construction_workers	.985	.827	.944	.971	.936	1.000	.865	.947	.847	.854
increase_the_number_of_health_and_safety_signs	.863	.867	.866	.863	.866	.865	1.000	.865	.897	.938
conducting_safety_training_for_construction_workers	.958	.845	.910	.970	.949	.947	.865	1.000	.867	.870
conducting_regular_toolbox_safety_meeting	.850	.949	.849	.853	.872	.847	.897	.867	1.000	.958
overcome_language_barriers_among_foreign_workers	.856	.921	.857	.858	.874	.854	.938	.870	.958	1.000

Figure 5.33: Inter-Item Correlation Matrix.

5.5 Conclusion

The research data obtained from the field survey are investigated, analysed, and interpreted in this chapter. The data were sorted using Microsoft Excel. The RII method was then used to determine the perception of the respondents with regards to the criticality of the safety factors influencing safety performance on the construction site and the relative importance of the critical safety measures to enhance safety performance on the construction site. Further, the reliability analysis was adopted to test the internal consistency of the measurement scale of the questionnaire survey.

The research findings and the implication of the research study shall be discussed in the final chapter, chapter 5. Chapter 5 shall also conclude with some propositions that shall be able to address the concerns as stated in the problem statement in sub-section 1.2 of this research study.

CHAPTER 6

RESEARCH FINDINGS AND CONCLUSION

6.1 Research Findings

6.1.1 Research Objective 1: To determine the perceptions of the construction professionals with regards to the most critical safety factor causing poor safety performance on the construction site

Table 6.1: Critical Safety Factor Causing Poor Safety Performance on the Construction Site.

Critical Safety Factors Causing Poor Safety Performance on the Construction Site	Relative Importance Index (RII)	Order of Criticality (Rank)
Improper use or failure to use personal protective equipment (PPE)	0.8391	1
Lack of regular supervision	0.8130	2
Lack of training of construction workers	0.7978	3
Lack of safety awareness among construction workers	0.7935	4
Construction worker's negative attitude towards safety	0.7870	5
Fatigue caused by working overtime	0.7717	6
Lack of safety signs on the construction site	0.7391	7
Lack of toolbox safety meetings	0.7283	8
Construction workers under the influence of drugs and alcohol	0.7261	9
Under-reporting of work-related incident or accident	0.7196	10

The responses of the construction professionals on the factors collected from the field survey are analysed and ranked by using the RII as shown in Table 6.1. All the critical safety factors are highly correlated as all of the factors have Cronbach's Alpha value of above 0.9 as shown in Figure 5.15. Among the ten (10) factors in Table 6.1, 'improper use or failure to use PPE' was perceived by the construction professionals as the most critical safety factor causing poor safety performance on the construction site as it has the highest RII. This is not surprising because falling from height was the most frequent case that occurred due to construction workers' inappropriate usage or failure to wear PPE (DOSH, 2020)

Further, this research finding is aligned with the previous research study carried out by Kasuma, et al. (2019), Ahmed (2020), Pipitsupaphol and Watanabe (2000),

Zerguine, Tamrin and Jalaludin (2018), O'Toole (2002), and Alinaitwe, Mwakali and Hansson (2007), who believe that failure to use PPE by construction workers was one of the causes of poor safety performance on the construction site. The usage of PPE on the construction site would prevent and minimize the construction accident. This is supported by the research study carried out by Hashim and May (2018). Most of the respondents agreed that the rate of accidents had been reduced due to the usage of PPE.

However, the PPE was not worn by many construction workers on the construction site (Elavarasan and Kamal, 2017). This undermines their safety and leads to work-related injuries. Most of them are not aware of the importance of PPE as safety protection (Shamsuddin, et al., 2015). Ulang, et al. (2014) found that some of the workers do not know about PPE. They wore the PPE only when instructed by their supervisor. However, when supervision does not carry out, they indiscriminately violate the instructions and not wearing PPE during working at the job site.

6.1.2 Research Objective 2: To determine the perceptions of the construction professionals with regards to the relative importance of the critical safety measures to enhance safety performance on the construction site

Table 6.2: Critical Safety Measures for the Enhancement Safety Performance on the Construction Site.

Critical Factors Influencing Safety Performance at Construction Site	Relative Importance Index (RII)	Order of Criticality (Rank)
Increase safety awareness among construction workers	0.8370	1
Close supervision by the safety supervisor	0.8326	2
Periodic checking to ensure construction workers follow safe work practices	0.8304	3
Enforcing safety and health policy and regulation	0.8283	4
Conducting Safety Training for Construction Workers	0.8174	5
Correcting unsafe conditions and unsafe acts	0.8130	6
Reporting any work-related incident or accident immediately	0.7630	7
Conducting regular toolbox safety meeting	0.7478	8
Overcome language barriers among foreign workers in the workplace	0.7457	9
Increase the number of health and safety signs	0.7239	10

The Cronbach's Alpha value of above 0.9 as shown in Figure 5.30 reflects the inter-consistency between the factors is excellent and all the factors are correlated with one another. Among the ten (10) critical safety measures being asked in the questionnaire, 'increase safety awareness among construction workers' was perceived by the construction professionals as the most critical safety measure to enhance safety performance on the construction site as it has the highest RII as shown in Table 6.2.

This is supported by the previous study conducted by Shafii, Bin-Shahna and Meryam (2019) who found that improving safety awareness of the construction workers enhanced the safety performance on the construction site. The construction workers who have safety awareness would be aware of the potential factors and knowledge of how to minimize the risk factors (Vitharana, De Silva and De Silva, 2015). The construction workers who have safety awareness would change in their safety behaviour (Huang and Yang, 2019) and tend to address safety concerns and follow safety practices (Roshanira and Nur Atiqah, 2008).

In contrast, the construction workers with a lack of awareness have often underestimated the risk as they do not have the knowledge and awareness (Trotto, 2016). This would cause the construction workers to expose themselves to the risk of illness, injury, and death (Nawi, et al., 2016).

6.1.3 Research Objective 3: To establish how to improve safety performance on the construction sites

The responses of the construction professionals from the field survey reflected that lack of improper use or failure to use PPE is the most critical safety factors causing poor safety performances on the construction site. Hence, an effective way to improve safety performance on the construction site is to increase compliance of construction workers to wear PPE on the job site. Safety helmets, safety glasses, safety shoes, and hand protection are the basic protection for the construction workers against health and safety risks on the job.

To encourage greater PPE compliance, the top strategy is to educate the workers on the importance of PPE as safety protection during work. This could be done by providing the construction workers with training on using PPE. The

construction workers should be taught how to select an appropriate PPE based on the job tasks given on site. They should be trained on why the PPE is being worn. On top of that, the construction workers should be taught how to recognize deficiencies of the PPE by regularly inspecting the PPE.

For instance, the helmets that are cracked are required to be replaced. The construction workers must ensure that the PPE is in good condition before being used on the construction site. The construction workers after attending the training should be equipped with knowledge on how to perform the work on the construction site with minimum safety risks and realized the importance of PPE. Moreover, close supervision by the safety supervisor is required to ensure that PPE is correctly worn by the construction workers. A punishment rule on PPE practice should also be practiced to ensure compliance with PPE by the construction workers.

Further, the responses of the construction professionals from the field survey also revealed that the safety performance on the construction site could be improved by increasing safety awareness among the construction workers. Construction workers' safety awareness can contribute to preventing accidents on the construction site. The construction workers with safety awareness would aware of the danger present on the construction site. For example, the effectiveness of PPE usage would be enhanced with the construction workers have safety awareness among themselves.

The construction workers who aware of the importance of safety would change their safety behaviours. They tend to address safety concerns and follow safe work practices. The safety awareness among the construction workers could be enhanced through weekly or monthly safety meetings where the construction workers are given chance to discuss issues relating to safety matters and participate in safety planning. They would be more aware of the potential risks to occur on the job site.

Safety awareness among the construction workers could also be enhanced by providing safety training to the construction workers. Through safety training, the construction workers are equipped with the skills required to identify and control hazards. A lot of similar accidents on the construction site could be prevented if proper safety training is provided to the construction workers. It is vital that safety training to be conducted regularly to keep safety on the minds of the construction workers.

If every construction worker has safety awareness and take safety as a priority, the safety performance on the construction site could be improved. In summary, the safety performance on the construction site could be enhanced by increasing compliance of construction workers to wear PPE on the job site and promoting safety awareness among the construction workers.

6.2 The implication of Research Findings

It is a fact that most of the accidents that occurred on the construction site were due to improper use or failure to use PPE on the construction site. Therefore, awareness of the PPE application and the importance of PPE as safety protection should be constantly stressed to the construction workers by the top management. Effective action needs to be planned and implemented to ensure that the construction workers comply with wearing PPE during work. The wearing of PPE should become the main priority to protect the construction workers from work-related injuries.

Moreover, it is crucial to increase safety awareness among construction workers at all times. The safety performance on the construction site can be improved if the construction workers have awareness of the potential risk factors and knowledge on how to minimize those risk factors. Regular safety meetings and safety training that helps to raise safety awareness among the construction workers can be conducted. The training could incorporate the reason being the safety procedures during the training sessions rather than just train the construction workers on how to operate them.

6.3 Contribution of Research Study

The research study would contribute to the construction industry with regards to the responses of construction professionals to field surveys on the critical factor causing poor safety performance on the construction site. This could put an alarm on the construction industry that the poor safety performance on the construction site was arising from improper use or failure to use PPE. To improve safety performance on the construction site, various efficient and effective actions could be planned and implemented to ensure that wearing PPE becomes the safety practice among the construction workers.

In addition, the research study would contribute to the construction industry for the perception of the construction professional on the critical safety measures to enhance safety performance on the construction site. To improve the safety performance on the construction site, the construction industry could focus on implementing effective plans to raise safety awareness among the construction workers. Rather than just asking the construction workers to follow the safety procedures, the top management would educate the construction workers on the importance of complying with safety regulations.

6.4 Conclusion

6.4.1 Summary of Research Study

This research study reviews the literature related to the research objectives. This includes the literature about the safety performance in the Malaysian construction industry, the critical safety factor causing poor safety performance on the construction site, and the critical safety measures to enhance safety performance on the construction site. To achieve the research objectives, the questionnaire has been distributed to the construction professionals working in respective construction companies located in Klang Valley. The construction professionals including project architects, project engineers, project quantity surveyors, project managers, project supervisors, construction managers, and occupational safety and health officers are the targeted respondents in the field survey.

Their perceptions concerning the critical safety factors causing poor safety performance on the construction site and critical safety measures to enhance safety performance on the construction site have been asked in the field survey. A Likert Scale was used in the field survey to solicit the perceptions of the construction professionals concerning the criticality of the safety factors causing poor safety performance on the construction site, and the relative importance of the critical safety measures to enhance safety performance on the construction site.

A trial questionnaire was designed and distributed to the construction professionals before the actual field survey. Out of 30 sets of the trial questionnaire distributed, 28 respondents have responded to the questionnaire.35.72% of the respondents were very satisfied with the questionnaire, 53.57% of the respondents

were satisfied with the questionnaire, and 10.71% of the respondents did not have a comment on the questionnaire. None of the respondents unsatisfied with the questionnaire. Since the majority of the respondents were satisfied with the trial questionnaire, the questionnaire was accepted.

130 sets of questionnaires were distributed including the trial questionnaire. There is a total of 92 sets of questionnaires that have been returned. This provides a good response rate of 71%. The collected data was analysed by using the RII and IBM-SPSS. The criticality of the safety factors and the relative importance of the critical safety measures perceived by the construction professionals was ranked based on the RII calculated. Cronbach's Alpha test was conducted using SPSS to measure the reliability of the questionnaire.

The Cronbach's Alpha of more than 0.9 shows that the inter-consistency of the safety factors and the critical safety measures in the questionnaire are excellent. All the factors are correlated with each other. The research findings show that 'improper use or failure to use PPE' was the most critical factor perceived by the construction professional to cause poor safety performance on the construction site. Meanwhile, 'increase safety awareness among construction workers' was the most important safety measures to enhance safety performance on the construction site perceived by the construction professionals.

Hence, the effective way to improve the safety performance on the construction site is to increase the compliance of the construction workers to wear PPE on the job site. Training on PPE should be provided to the construction workers to equip the construction workers with the knowledge on how to wear the PPE correctly and perform the work on the construction site with minimum safety risks. Furthermore, to improve safety performance on the construction site, safety awareness among the construction workers must be enhanced. Regular safety meetings and safety training could be conducted to raise safety awareness among construction workers.

6.4.2 Critique of Research Objectives

There were few limitations encounter in this research study especially time constraints. Due to time constraints, limited safety factors, and critical safety measures are covered in this research study. There was a time constraint to cover all aspects of safety factors and safety measures in the research study. Furthermore, the research study only covered a limited number of respondents from the construction companies located in Klang Valley due to the limited time frame in accomplishing this research study. Further, it was found that there is a lack of research studies relating to the effective way to improve safety performance on the construction site. Other than that, this research study has only covered safety. The health of the workers is not covered in this research study. Hence, there are always recommendations at the end of a research study for further researches.

6.5 Recommendations for Further Research Study

In concluding this research study, the author keenly hopes that the future academic researchers who are concerned with the issues relating to poor safety performance on the construction site to embark on carrying out the research study relating to critical safety factors and the critical safety measures which are not covered in this research study. Besides the critical safety factors covered in this research study, other researchers could look into other safety factors such as inadequate safety policy, poor education of construction workers, lack of emergency measures, lack of teamwork and coordination, lack of technical guidance, etc.

Furthermore, other researchers could look into other critical safety measures to enhance safety performance on the construction site such as regular maintenance of plant and equipment, the involvement of construction workers in safety decisions, implementation of the safety program, management commitment, etc. and other effective ways to improve safety performance on the construction sites other than the safety measures that are being discussed in this research studies, i.e. increasing PPE compliance and safety awareness among the construction workers, which are not covered in this research study.

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APPENDICES

APPENDIX A: Trial Questionnaire

Academic Survey Questionnaire

Section A: Respondent's Profile

Please fill in all the fields and tick (√) in the appropriate box.

1. Name: _____

2. Company's name: _____

3. Position:
   - ☐ Project Architect
   - ☐ Project Manager
   - ☐ Project Engineer
   - ☐ Project Supervisor
   - ☐ Project Quantity Surveyor
   - ☐ Construction Manager
   - ☐ Occupational Safety and Health Officer

4. How long have you been working in the construction industry?
   - ☐ 1-5 years
   - ☐ 11-15 years
   - ☐ 6-10 years
   - ☐ More than 15 years

5. How many projects have you been involved in?
   - ☐ 1-5 projects
   - ☐ 11-15 projects
   - ☐ 6-10 projects
   - ☐ More than 15 projects

6. What is the type of projects that you are currently involved in?
   - ☐ Mix housing development project
   - ☐ Industrial building project
   - ☐ Condominium project
   - ☐ Infrastructure Project

7. What is the size of projects that you are currently involved in?
   - ☐ Less than RM10 million
   - ☐ RM30-40 million
   - ☐ RM10-20 million
   - ☐ RM40-50 million
   - ☐ RM20-30 million
   - ☐ More than RM50 million

Section B: Critical Safety Factors Causing Poor Safety Performance on the Construction Site

Please tick (√) the boxes below based on your perception of the critical factors influencing Safety Performance at the Construction Site, from '1' for 'least critical' to '5' for 'most critical'. Please read the notes below for your better understanding of the critical safety factors before answering the questionnaire.

1 = least critical 2 = less critical 3 = critical 4 = more critical 5 = most critical

		1	2	3	4	5
1.	Lack of Regular Supervision	☐	☐	☐	☐	☐
2.	Under-reporting of work-related incident or accident	☐	☐	☐	☐	☐
3.	Construction workers under the influence of drugs and alcohol	☐	☐	☐	☐	☐
4.	Improper use or failure to use personal protective equipment (PPE)	☐	☐	☐	☐	☐
5.	Construction worker's negative attitude towards safety	☐	☐	☐	☐	☐
6.	Fatigue caused by working overtime	☐	☐	☐	☐	☐
7.	Lack of safety awareness among construction workers	☐	☐	☐	☐	☐
8.	Lack of safety signs at the construction site	☐	☐	☐	☐	☐
9.	Lack of training of construction workers	☐	☐	☐	☐	☐
10.	Lack of toolbox safety meetings	☐	☐	☐	☐	☐

Notes:

1. Lack of regular supervision at the job site would cause hazardous conditions and unsafe work practices to become uncovered and cannot be eliminated or minimized before the workers get injured or killed.
2. Under-reporting of incidents or accidents may cause threats to safety to go unnoticed and unresolved.
3. The workers who are under the influence of drugs and alcohol will become short-tempered and illogical, which may cause danger to themselves and also their coworkers.
4. Most of the work-related injuries at the job site were due to failure and the incorrect wearing of PPE, e.g. eye injuries due to failure of wearing eye protection at the time of an accident or wearing the wrong kind of eye protection for the job.
5. The workers with a negative attitude complain about everything, including having to practice safety. They tend to ignore safety precautions, thus putting themselves and coworkers at risk.
6. Fatigued workers are less attentive, less concentration, less dexterity, and more prone to make mistakes that can lead to serious injury or fatal accidents.
7. The workers with a lack of safety awareness may not be able to recognize hazards when operating at work.
8. The workers may not alert of the possible hazards and precautionary measures need to be taken by them without safety signs at the workplace.
9. The workers with a lack of training may have a lack of knowledge and skills to perform their work safely and may create hazards that could place themselves or their coworkers at risk.
10. Without regular toolbox safety meetings, the workers may forget about what they have learned from training months ago. Toolbox safety meetings could be a great tool to remind the workers about potential hazards and safe work practices that they have learned during the meeting.

Section C: Success Factors for Enhancing Safety Performance at the Construction Site

Please tick (√) the boxes below based on your perception of the critical success factors for enhancing safety performance at the construction site, from '1' for 'least important' to '5' for 'most important'. Please read the notes below for your better understanding of the success factors before answering the questionnaire.

1 = least important 2 = less important 3 = important 4 = more important 5 = most important

		1	2	3	4	5
1.	Close supervision by the safety supervisor	☐	☐	☐	☐	☐
2.	Reporting any work-related incident or accident immediately	☐	☐	☐	☐	☐
3.	Period checking to ensure construction workers follow safe work practices	☐	☐	☐	☐	☐
4.	Enforcing health and safety policies and regulations	☐	☐	☐	☐	☐
5.	Correcting unsafe conditions and unsafe acts	☐	☐	☐	☐	☐
6.	Increase safety awareness among construction workers	☐	☐	☐	☐	☐
7.	Increase the number of health and safety signs	☐	☐	☐	☐	☐
8.	Conducting safety training for construction workers	☐	☐	☐	☐	☐
9.	Conducting regular toolbox safety meeting	☐	☐	☐	☐	☐
10.	Overcome language barriers among foreign workers in the workplace	☐	☐	☐	☐	☐

Notes:

1. Regular supervision at the job site helps to uncover, eliminate and minimize the hazardous conditions and unsafe work practices to ensure the safety of workers
2. By reporting the work-related incidents or accidents, the root cause of accidents can be investigated so that preventive or corrective actions can be taken promptly.
3. Periodic checking helps to ensure that all the workers follow safe work practices and procedures while performing the task at the job site.
4. Health and safety policies and regulations act as a guideline to control the safety of the construction workers performing tasks in the workplace, e.g. disciplinary action can be taken to the workers who violate the established health and safety regulations at the construction site.
5. A safe workplace starts with workers follow safe work practices while performing the task at the job site and working in safe conditions.
6. The workers with safety awareness are more prone to recognize hazards when operating at the workplace. This helps to mitigate work-related injuries at the construction site.
7. Increase the number of health and safety signs at the appropriate place to remind the workers of hazardous conditions and ways to protect themselves from injury.
8. Safety training helps to ensure that the workers are equipped with knowledge and skills to perform their work safely and prevent creating hazards that could place themselves or their coworkers at risk.
9. The workers can be reminded of the importance of safety during the toolbox safety meeting.
10. The safety issues can be improved by overcoming language barriers among foreign workers in the workplace. This is because most of the foreign workers cannot understand the instructions, safety rules, and interpreting warning signs in English or Malay.

Comment:

This questionnaire is:

☐ Very satisfactory

☐ Satisfactory

☐ Unsatisfactory

Additional comments:

APPENDIX B: Questionnaire

Academic Survey Questionnaire

Section A: Respondent's Profile

Please fill in all the fields and tick (√) in the appropriate box.

1. Name: _____

2. Company's name: _____

3. Position:
   - ☐ Project Architect
   - ☐ Project Manager
   - ☐ Project Engineer
   - ☐ Project Supervisor
   - ☐ Project Quantity Surveyor
   - ☐ Construction Manager
   - ☐ Occupational Safety and Health Officer

4. How long have you been working in the construction industry?
   - ☐ 1-5 years
   - ☐ 11-15 years
   - ☐ 6-10 years
   - ☐ More than 15 years

5. How many projects have you been involved in?
   - ☐ 1-5 projects
   - ☐ 11-15 projects
   - ☐ 6-10 projects
   - ☐ More than 15 projects

6. What is the type of projects that you are currently involved in?
   - ☐ Mix housing development project
   - ☐ Industrial building project
   - ☐ Condominium project
   - ☐ Infrastructure Project

7. What is the size of projects that you are currently involved in?
   - ☐ Less than RM10 million
   - ☐ RM30-40 million
   - ☐ RM10-20 million
   - ☐ RM40-50 million
   - ☐ RM20-30 million
   - ☐ More than RM50 million

Section B: Critical Safety Factors Causing Poor Safety Performance on the Construction Site

Please tick (√) the boxes below based on your perception of the critical factors influencing Safety Performance at the Construction Site, from '1' for 'least critical' to '5' for 'most critical'. Please read the notes below for your better understanding of the critical safety factors before answering the questionnaire.

1 = least critical 2 = less critical 3 = critical 4 = more critical 5 = most critical

		1	2	3	4	5
1.	Lack of Regular Supervision	☐	☐	☐	☐	☐
2.	Under-reporting of work-related incident or accident	☐	☐	☐	☐	☐
3.	Construction workers under the influence of drugs and alcohol	☐	☐	☐	☐	☐
4.	Improper use or failure to use personal protective equipment (PPE)	☐	☐	☐	☐	☐
5.	Construction worker's negative attitude towards safety	☐	☐	☐	☐	☐
6.	Fatigue caused by working overtime	☐	☐	☐	☐	☐
7.	Lack of safety awareness among construction workers	☐	☐	☐	☐	☐
8.	Lack of safety signs at the construction site	☐	☐	☐	☐	☐
9.	Lack of training of construction workers	☐	☐	☐	☐	☐
10.	Lack of toolbox safety meetings	☐	☐	☐	☐	☐

Notes:

1. Lack of regular supervision at the job site would cause hazardous conditions and unsafe work practices to become uncovered and cannot be eliminated or minimized before the workers get injured or killed.
2. Under-reporting of incidents or accidents may cause threats to safety to go unnoticed and unresolved.
3. The workers who are under the influence of drugs and alcohol will become short-tempered and illogical, which may cause danger to themselves and also their coworkers.
4. Most of the work-related injuries at the job site were due to failure and the incorrect wearing of PPE, e.g. eye injuries due to failure of wearing eye protection at the time of an accident or wearing the wrong kind of eye protection for the job.
5. The workers with a negative attitude complain about everything, including having to practice safety. They tend to ignore safety precautions, thus putting themselves and coworkers at risk.
6. Fatigued workers are less attentive, less concentration, less dexterity, and more prone to make mistakes that can lead to serious injury or fatal accidents.
7. The workers with a lack of safety awareness may not be able to recognize hazards when operating at work.
8. The workers may not alert of the possible hazards and precautionary measures need to be taken by them without safety signs at the workplace.
9. The workers with a lack of training may have a lack of knowledge and skills to perform their work safely and may create hazards that could place themselves or their coworkers at risk.
10. Without regular toolbox safety meetings, the workers may forget about what they have learned from training months ago. Toolbox safety meetings could be a great tool to remind the workers about potential hazards and safe work practices that they have learned during the meeting.

Section C: Critical Safety Measures for the Enhancement of Safety Performance on the Construction Site

Please tick (√) the boxes below based on your perception of the critical safety measures for the enhancement of safety performance on the construction site, from '1' for 'least important' to '5' for 'most important'. Please read the notes below for your better understanding of the success factors before answering the questionnaire.

1 = least important 2 = less important 3 = important 4 = more important 5 = most important

		1	2	3	4	5
1.	Close supervision by the safety supervisor	☐	☐	☐	☐	☐
2.	Reporting any work-related incident or accident immediately	☐	☐	☐	☐	☐
3.	Period checking to ensure construction workers follow safe work practices	☐	☐	☐	☐	☐
4.	Enforcing health and safety policies and regulations	☐	☐	☐	☐	☐
5.	Correcting unsafe conditions and unsafe acts	☐	☐	☐	☐	☐
6.	Increase safety awareness among construction workers	☐	☐	☐	☐	☐
7.	Increase the number of health and safety signs	☐	☐	☐	☐	☐
8.	Conducting safety training for construction workers	☐	☐	☐	☐	☐
9.	Conducting regular toolbox safety meeting	☐	☐	☐	☐	☐
10.	Overcome language barriers among foreign workers in the workplace	☐	☐	☐	☐	☐

Notes:

1. Regular supervision at the job site helps to uncover, eliminate and minimize the hazardous conditions and unsafe work practices to ensure the safety of workers
2. By reporting the work-related incidents or accidents, the root cause of accidents can be investigated so that preventive or corrective actions can be taken promptly.
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4. Health and safety policies and regulations act as a guideline to control the safety of the construction workers performing tasks in the workplace, e.g. disciplinary action can be taken to the workers who violate the established health and safety regulations at the construction site.
5. A safe workplace starts with workers follow safe work practices while performing the task at the job site and working in safe conditions.
6. The workers with safety awareness are more prone to recognize hazards when operating at the workplace. This helps to mitigate work-related injuries at the construction site.
7. Increase the number of health and safety signs at the appropriate place to remind the workers of hazardous conditions and ways to protect themselves from injury.
8. Safety training helps to ensure that the workers are equipped with knowledge and skills to perform their work safely and prevent creating hazards that could place themselves or their coworkers at risk.
9. The workers can be reminded of the importance of safety during the toolbox safety meeting.
10. The safety issues can be improved by overcoming language barriers among foreign workers in the workplace. This is because most of the foreign workers cannot understand the instructions, safety rules, and interpreting warning signs in English or Malay.