

## ORIGINAL ARTICLE

## THE PERFORMANCE OF SAFETY IMPLEMENTATION TOWARDS ACCIDENT OCCURRENCE IN MALAYSIA CONSTRUCTION INDUSTRY

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## ABSTRACT

*Reported fatal accidents in Malaysia construction industry contributed the highest number among other industries since 2009 until 2018. These statistics are alarming and elucidate the need to conduct scientific research to find the solution to solve the problem. Safety and health issues remain critical to the construction industry due to its working environment and the complexity of working practices. To prevent an accident, hazard identification is essential to construction safety management because unidentified hazards present the most unmanageable risks. Therefore, this research is conducted to help in reducing occupational accidents in the construction industry, and it can be considered worthy. This study aims to understand the triggering events, and their factors leading to fatal accidents are of significant input. The obtained data were analyzed using a statistical analysis program. Data collections of 139 numbers of respondents have been conducted in six different construction sites in east Malaysia. The result showed that there is a correlation between worker's perspective on safety management in the construction site and accident that can lead to a more fatality rate compared to other sectors. The corresponding recommendations are ultimately put forward as fatal accident prevention in construction activities. The patterns found in this paper can contribute valuable direction for formulating accident prevention strategies. In future research, reporting of an accident and near misses are essential to be further explored.*

**Keywords:** Construction safety, Construction industry, Accident, Fatality

## INTRODUCTION

In Malaysia, construction is a high-risk industry. The construction sector is vital for the country's economy and played an important aspect in satisfying the development of national infrastructure<sup>1,2</sup>. Besides, the construction industry nowadays becomes progressive, modernized, and well equipped. It has the possibility to bring complex, massive infrastructure, and high-rise building projects by using highly sophisticated mechanized methods<sup>3</sup>. Researches showed that although there is a significant enhancement in Occupational Safety and Health (OSH), the construction industry maintained as a high-risk industry with a considerable amount of injury and fatality globally<sup>4,5,6</sup>. The vast number of injury and fatality in the industry not only affects construction firms and their staff, it also has a negative effect on society and the national economy<sup>7</sup>. In having a safer work environment at construction industries, safety performances and implementations shall not be neglected. Also, the need for more innovative strategies and solutions are required to overcome the problems.

Fatal accidents in the construction industry is continuing to register the highest sector than the other areas of the world economy; hence will undertake a range of work to understand and overcome the underlying causes<sup>8,9,10</sup>. In recent years, building works and construction industries in Malaysia have made excellent progress and the

growth in their activities has affected the safety and health of the general community. There are several risk factors that have been recognized to influence on general workplace safety which is containing safety culture, organizational structure, codes and standards, communication, clear instructions, training, leadership, and responsibility<sup>11</sup>.

Persistent endeavors have been set up to promote occupational safety and health matters in the construction industry, but fatalities remain to bother the industry. Recently, the variability of research in construction safety has been a concentrate on several issues, including accident statistics, competency, safety design, and safety culture, to assist as the base of progressing construction safety management. Hence a systematic study of analysis in construction safety is essential for the leading investors to share advanced findings and predict the trends of construction safety in future<sup>12</sup>.

To have a better understanding on the issue of occupational fatalities in the construction industry, the Ishikawa model diagram is used to describe the possible cause of the accident. An Ishikawa diagram or also known as cause and effect diagram, which was developed by a Japanese scientist Kauro Ishikawa<sup>13</sup> shows the roots of a specific event. Its development is based on the 5M + E method, which represents the first letters of the factors: methods, machinery, materials, manpower, management, and

environment. These factors are acknowledged as the leading factors of accident and are placed on the oblique axes of the diagram as shown in Figure 1<sup>14</sup>. This tool is particularly helpful for enabling teams to group possible causes of a problem and ultimately analyse the root causes<sup>13</sup>.

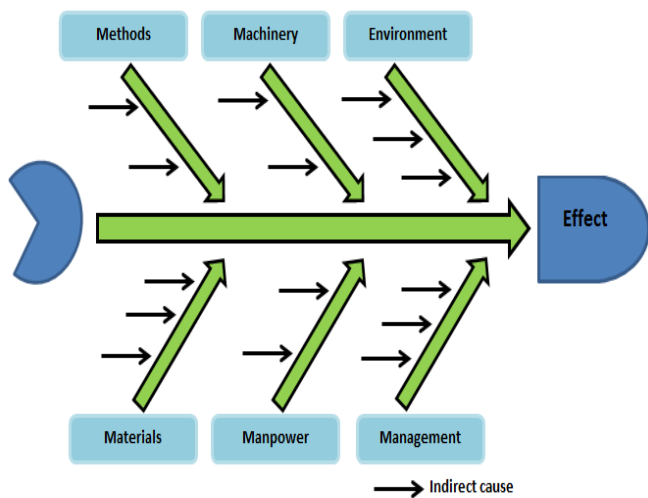


Figure 1: The Ishikawa model diagram

**PROBLEM**

According to the Department of Occupational Safety and Health (DOSH) Malaysia, the fatality rate in Malaysia construction industry is the highest between 2009 and 2018<sup>15,16</sup>. The numbers of occupational fatality in construction industry was stated as the highest number of fatal work investigated out of any Malaysia industry sector in year 2018, as mentioned in Figure 2. Also, the construction sector contributed a total of 118 cases (45.4%) of fatalities<sup>16</sup>. Awareness about the trends which are noticeable in accidents is needed to determine the level of security and also directions of changes<sup>17</sup>.

Table 1 and Figure 3 show the statistic of the accident in the Malaysia construction industry from 2012 to 2018<sup>18,19</sup>. These statistics are alarming and elucidate the need to conduct scientific research to find the best way to reduce the problem. Poor safety performances in the construction industry considered as one of the causal factors to work-related accidents and diseases<sup>20</sup>. The construction industry remains one of the most hazardous working places in which to work compared to other industries<sup>21, 22, 23</sup>, and being one of the highest shares of fatal occupational accidents for many countries, including Malaysia<sup>24, 25, 26</sup>.

Due to the complex condition and activities involved in the construction site, safety work becomes more challenging<sup>27, 28</sup>. In addition, its complexity is due to the use of a multidisciplinary workforce and the challenge of managing the boundaries between the disciplines<sup>29</sup> and the characteristics of worker behaviours, which are

not as consistent as those in manufacturing industries<sup>30</sup>.

Safety should be emphasized from the design phase, along with downstream activities, such as the construction phase, and devices to enhance the focus on protection beyond the site level would be a practical tool for managers<sup>31</sup>. Accidents may take place caused by unsafe acts of the workers, which very challenging to monitor and control<sup>27</sup>.

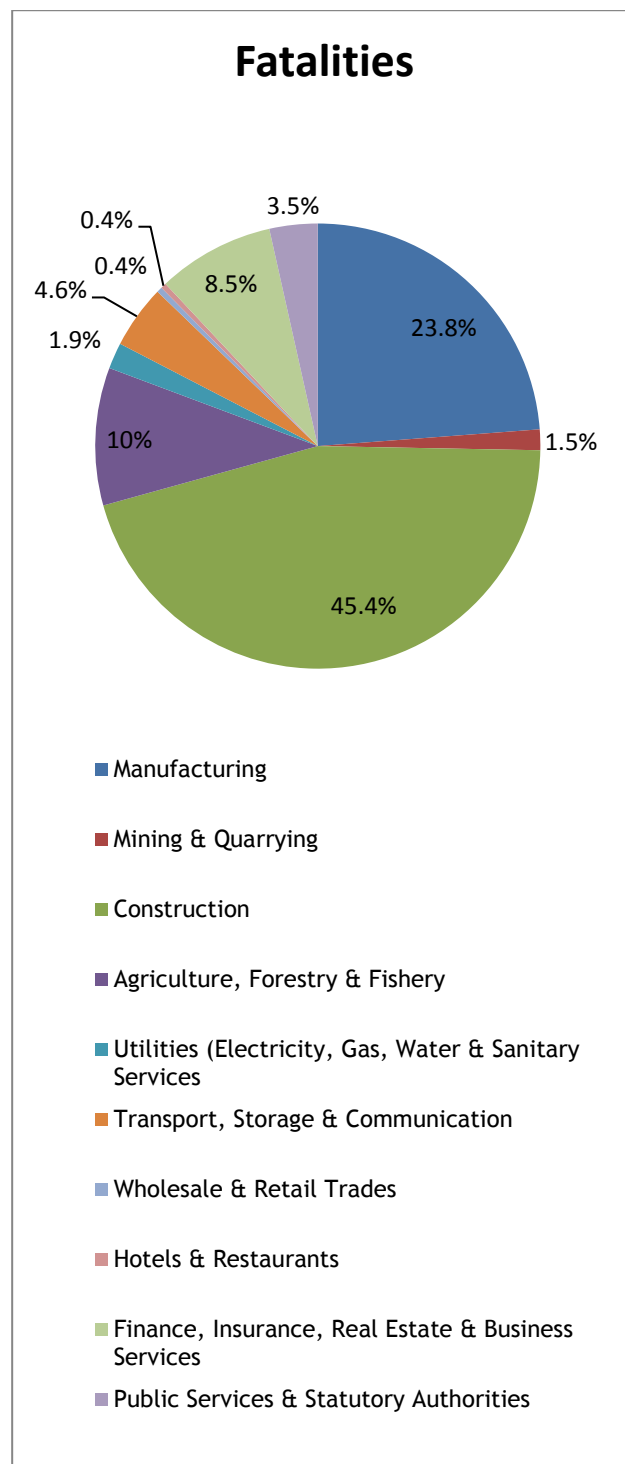
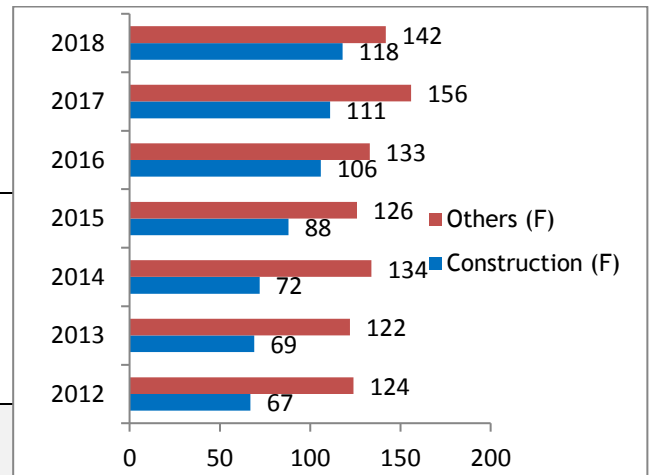


Figure 2: Occupational Accidents Statistics by Sector in 2018 (Investigated)

**Table 1: Comparison of accidents recorded in the construction industry and other industries (Number of Accident) in Malaysia**

Category Years	Fatalities (F)		Permanent disability (PD)		Non-permanent disability (NPD)	
	Construction	Others	Construction	Others	Construction	Others
2012	67	124	12	195	98	2285
2013	69	122	12	153	83	2393
2014	72	134	6	139	94	2362
2015	88	126	11	111	138	2871
2016	106	133	6	114	135	3256
2017	111	156	6	150	123	3089
2018	118	142	8	226	106	4431

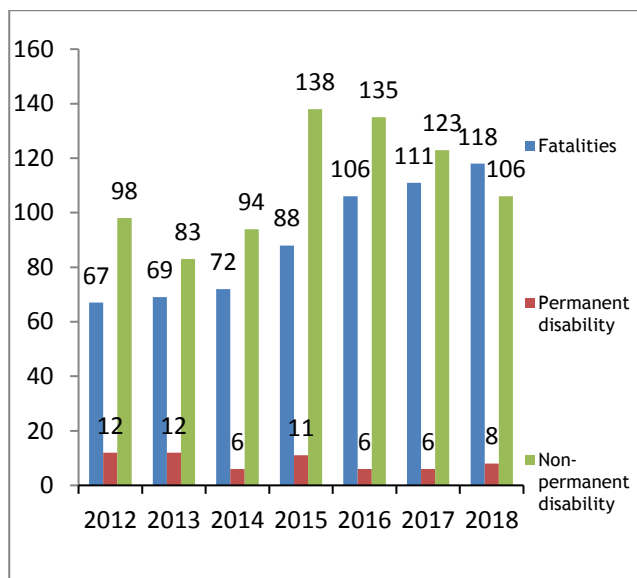


**Figure 4: Statistic of fatality cases in Construction industry vs. other industries in Malaysia**

A well-made safety management system (SMS) can contribute to the practical application of a safety management system in the workplace<sup>28</sup>. SMS can be described as a system used to manage and control safety, or it is a management system intended explicitly at safety<sup>32</sup>. A well-planned platform for safety management can promote well-organized information communication between multiple stakeholders, supporting the adoption of a more effective safety management system<sup>33</sup>. For example, subjective data are produced in conventional safety inspections, where the data were influenced by the person who conducts the inspection with standard method using the simple tool for site observations, which generally used in Finnish construction companies, as well as in other EU countries<sup>34</sup>.

Unsatisfactory Occupational Safety and Health (OSH) in the construction industry has been highlighted to be a subject matter as it is the most hazardous industry with complex and vigorous method<sup>35</sup>, hence provide huge figures of incidents and death to the construction workers and public<sup>36,24</sup>. OSH issues can be considered as the most significant to the project development as it may influence the work quality and time<sup>37</sup>. As efforts to promote safe working conditions in Malaysia, the Factories and Machinery Act (FMA) 1967 and Occupational Safety and Health Act (OSHA) 1994 were introduced to ensure all preventive measures to job-related accident and illnesses.

As known, hazard identification is a fundamental basis for construction safety management as accident prevention; to dig out the unidentified hazards as it may present the most uncontrollable risks. Any involvement in assisting in reducing occupational accidents in the construction industry can be considered worthy<sup>38</sup>. Before the hazard identification process can be successfully conducted, safety awareness among workers must have existed. Wong et al.<sup>39</sup> may lead us to the technique on how to improve perceived risk



**Figure 3: Comparison of accidents recorded in the construction industry and other industries (Number of Accident) in Malaysia**

among workers. As stated in Wong et al.<sup>39</sup>, the improvement of safety awareness in the Hong Kong construction industry was significant and associated with the trainees' educational background after receiving necessary safety training. Hence there is no specific method to stop accidents from happening, but rather efforts or strategies to cover several areas of work. Therefore, identifying the best-performing arrangements of practices or approaches for different dimensions of companies with different requirements is a promising field; this is the point of departure of this research<sup>38</sup>.

Workers' safety is always a complex phenomenon. Construction is continuously hazardous and risky due to its regular practices such as outdoor work operations, complex on-site plants, equipment operation, work at heights plus with workers' attitudes, and behaviors towards safety. The nature of the construction growth rapidly, associated work hazards and the characteristics of construction organizations further worsen the condition<sup>40</sup>.

This study aims to explore the safety management system that has been practiced to achieve high safety performances in construction safety; hence the significance and comprehensive improvements can be made for accident prevention in the future.

**METHOD**

**Data collections**

Data collection was conducted in six (6) different construction sites located in East Malaysia. A total number of 139 respondents among construction workers from various job position were voluntarily participated in this study. All respondents have been given a briefing before they start answering the questionnaire.

**Questionnaire**

The study questionnaire comprises questions on safety management at construction site. It consists of five sections, which include:

- i. Section 1: Background of the organization
- ii. Section 2: personal particulars
- iii. Section 3: training and experiences
- iv. Section 4: safety management at the workplace
- v. Section 5: risk management.

The Likert scale of five-point scale (1= strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree) were used to respond the questions in Section 3, 4, and 5. The questionnaire has been translated into dual language which are English and Malay Language to suit the respondent.

**Statistical analysis**

The obtained data were analysed using statistical analysis (IBM SPSS Statistic) program. As each completed questionnaire was received, the data contained was extracted, coded, and entered onto IBM SPSS Statistics version 24.

**RESULTS**

From the finding, as stated in Table 2, 83.4% of the total respondents are general workers, 2.9% are safety representatives, and 13.7% are management teams from several job positions. The majorities of the respondents are male (97.1%) and age between 20-40 years (84.9%). All of the general workers are foreigners from different countries, and 59% of them had lower education from primary to secondary level.

*Table 2: Statistical Analysis of Demographic Data*

Variables	Frequency (n)	Percentage (%)	Variables	Frequency (n)	Percentage (%)
<b>Job position</b>			<b>Education</b>		
General workers (Labour)	116	83.4	Certificate	39	27.3
Safety representatives	4	2.9	Diploma	11	7.9
Management team	19	13.7	Degree	8	5.8
			Others	82	59
<b>Status</b>			<b>Experience</b>		
Permanent	30	21.6	<1 year	30	21.6
Temporary	9	6.5	1-5 years	52	37.4
Contract	100	71.9	6-10 years	32	23.0
			>10 years	25	18.0
<b>Age</b>			<b>Gender</b>		
<20	2	1.4	Male	135	97.1
20-25	24	17.3	Female	4	2.9
26-30	37	26.6	<b>MC</b>		
31-35	34	24.5	<5 days	96	69.1
36-40	23	16.5	5-10 days	6	4.3
>40	19	13.7	>10 days	1	0.7
			Not applicable	36	25.9
<b>Race</b>			<b>CIDB Green Card</b>		
Malay	24	17.3	Yes	66	47.5
Bangladesh	64	46.0	No	73	52.5
Indonesian	43	30.9	<b>Training</b>		
Others	8	5.7	Formal course	13	9.4
			On the job	104	74.8
<b>Working hour</b>			Previous experience	20	14.4
<5 hours	4	2.9	All above	2	1.4
<5 hours	89	64			
5-10 hours	46	33.1			
>10 hours					

Although all construction personnel in Malaysia are compulsory to be registered with Construction Industry Development Board (CIDB), the result indicated that 52.5% of the respondents do not have CIDB Green Card and 74.8% received informal training through the job done at the workplace. All construction workers in Malaysia are required to be a Registered Construction Personnel as stipulated in section 33, Act 520 effective on 1<sup>st</sup>

June 2015. Malaysia Act 520 has been gazetted in 1994 to establish the CIDB, as well as to provide for its functions and for matters connected relating to the construction industry. The amended Act 520 focused on construction quality and safety which require the construction personnel to be registered with CIDB<sup>41</sup>.

For those who were found guilty working without proper registration and accreditation papers, will be fined of not exceeding RM5000. Likewise, the same penalty will also be obligated on employers of workers who are not accredited to carry out construction work<sup>41</sup>.

The data presented in Table 3 shows an employee’s satisfaction with the implementation of the safety management system at the workplace, as demonstrated in Section 4. For the result of each category, it was computed by averaging all the implementations within the category. “You have been involved in a repetitive accident at the workplace” was ranked as the highest mean of the whole finding for workers “knowledge” (mean 4.2 ; SD 1.12). It followed by “There had a fatal accident at your workplace” and “You have been involved in an accident at the workplace”. Meanwhile, for the question “You think safety at the workplace is the responsibility of all parties,” which pre-assume as the most significant implementation for worker’s knowledge category, only receiving the mean value of 1.45 with a standard deviation of 0.85.

Under “attitude” category, “You are aware of the importance of using personal protective equipment” and “You are afraid to report an accident at the workplace. ” were found to be the highest mean value. For “practice” category, “You make a report for near-miss incident at the workplace ” which receiving a mean value of 2.21. This implied the positive impact of the implementation of SMS for hazard control and accident reduction<sup>42</sup>.

**Table 3: Worker’s Knowledge, Attitude and Practice in their Construction Site.**

Implementation Question Number	Questions	Min	Max	Mean	Standard Deviation
Knowledge	1 Your work does affect your safety and health.	1	5	1.65	0.98
	2 Your work is considered as high risk	1	5	1.89	1.13
	3 You have basic knowledge about safety and health at the workplace.	1	4	1.55	0.63

Attitude	4 You can identify the classification of hazard exist at the workplace.	1	5	1.83	0.93
	5 You think safety at the workplace is the responsibility of all parties.	1	5	1.45	0.85
	6 You have been involved in an accident at the workplace.	1	5	3.63	1.52
	7 You have been involved in repetitive accident at the workplace.	1	5	4.22	1.12
	8 There had a fatal accident at your workplace.	1	5	3.69	1.61
	9 Construction site is considered as one of the most hazardous place of work.	1	5	1.82	1.25
	10 The training(s) you attended/ received cover any safety aspects of your job.	1	5	1.56	.86
	1 You are aware about the safety policy at the workplace.	1	5	1.84	1.01
	2 You are feeling comfort using personal protective equipment while working.	1	5	1.72	0.99
	3 You are aware of the importance using personal protective equipment.	1	4	1.37	0.65
4 You are afraid to report an accident at the workplace.	1	5	2.91	1.65	
5 You think the behaviour affect the safety and health at the workplace.	1	5	1.45	0.85	
6 You are aware about the risk of accidents and injuries at the workplace.	1	5	1.43	0.67	
7 You are willing to change the work practices when you notice it does not meet the procedure	1	5	1.94	1.17	

	8	You are willing to participate in safety awareness program at the workplace.	1	5	1.42	0.73
	9	You think the provision of safety training by employer is very important.	1	4	1.37	0.63
	10	You think accident at the workplace is normal.	1	5	2.68	1.54
	11	You are willing to cooperate with employer to control the risk of accident at the workplace.	1	5	1.39	0.73
	12	You feel comfortable working in a group.	1	5	1.46	0.79
	13	You have no problem when directed to work overtime.	1	5	1.73	1.0
	14	You feel motivated when there is reward for your hard work.	1	5	1.55	1.00
<b>Practice</b>	1	You are trained / competent worker to do the task.	1	5	1.98	1.13
	2	You are practicing safe work procedure.	1	5	1.50	0.77
	3	You are always use personal protective equipment while working.	1	4	1.30	0.55
	4	All accident at workplace will be informed to the employer.	1	5	1.40	0.74
	5	You make a report for near miss incident at the workplace.	1	5	2.21	1.41
	6	You need minimum supervision while working.	1	5	1.82	1.09

Table 4 shows the result of Worker’s Perception on Safety Management Commitment in their Construction Site. The data illustrated in Table 4 shows “Employer ensures that all employees are adequately trained for high risk work” was ranked as the highest mean value (1.85) with a standard deviation of 1.09. It followed by the question of “Employer provides the employee with training opportunity” with mean and standard deviation values are 1.83 and 1.06 respectively. Meanwhile, “Employer ensures that all employees are responsible for the safety of

themselves and others in the workplace,” receiving the mean value of 1.19 with standard deviation values is 0.53.

**Table 4: Worker’s Perception on Safety Management Commitment by their Employers.**

Implementation	Question Number	Questions	Min	Max	Mean	Standard Deviation
<b>Management Compliance</b>	1	Employer ensures that all workers are given accurate information regarding the risks at the workplace.	1	4	1.27	0.53
	2	Employer ensures that employees comply with the safety rules set at the workplace.	1	4	1.26	0.50
	3	Employer gives priority to safety element than productivity.	1	5	1.53	0.85
	4	Employer ensures that all problems related to safety are corrected immediately.	1	3	1.29	0.52
	5	Employer ensures that all employees are responsible for the safety of themselves and others in the workplace.	1	3	1.19	0.42
	6	Employer ensures that all employees are adequately trained for high risk work.	1	5	1.85	1.09
	7	Employer always encourages employees to provide recommendations on risk-related improvements in the workplace.	1	5	1.55	0.78
	8	Employer involved employees in making decisions about safety.	1	3	1.61	0.74
	9	Employer provides employees with personal protective equipment.	1	4	1.52	0.83
	10	Employer provides employee with training opportunity.	1	5	1.83	1.06

## DISCUSSION

Based on the data from 2012 to 2018, the number of accidents increased each year. The highest accident rate in construction projects was in 2018, which contributed 118 fatality cases. This study explored the knowledge, attitude and practices of 139 construction workers. At the same time, *worker's perception on safety management commitment by their employers also been investigated.*

Lack of training also can be considered as one of the items that need to look into. Despite all construction personnel in Malaysia are compulsory to be Registered Construction Personnel with Construction Industry Development Board (CIDB) as stipulated in section 33, Act 52, data shown 52.5% of the respondent do not have CIDB Green card. Workers who are undergoing the training sessions under CIDB are provided with basic knowledge about safety practice at the construction work. However, it is believed the effectiveness of the training is needed to be revisited. This issue is vital, as can be seen in the results of how workers experienced the accident at the workplace and how they think as accidents happen to become a norm at their place work.

Worker's safety practices can be considered as low (results showed the highest mean value is only 2.21 for the question about near misses reporting practice). The points that can be highlighted based on the finding are workers still feel that they are not competent to do the task, and they agreed to have close monitoring by their supervisors. By lacking supervision, workers not wearing PPE at all required times and not reporting all accidents that happened at the workplace. It is in line with the study of Man, Chan and Alabdulkarim<sup>43</sup>, besides the requirements to have safety training or retraining program, it really needs to ensure that frequent regular safety inspection and supervision need to be provided to prevent workers from taking risks at work. Based on the obtained results, it is yes; employers provided training to the workers. However, it can be seen that employees still need more proper training design for their specific needs.

## CONCLUSION

A good practice in implementation of safety management system is playing an important role to minimize an accident at the workplace hence a high performance in construction safety can be achieved. Many researchers tried to find the significant safety factors for successful accident prevent in construction. Therefore, the decision-makers can implement a phased implementation approach to certify realistic execution of safety programs under the constraints of available resources. Based on the data collected, most of the construction workers are aware of the

importance of wearing personal protective equipment during working hours. It shows the positive impact of safety management system implementation at site. Moreover, to emphasis and encourage the level of safety performance, general workers and safety personnel must be carefully designated and managed in order to ensure the implementation of safety procedures are at the top priority. Active involvement of employees in safety-related activities could enhance their motivation and strengthen their safety awareness.

## LIMITATIONS AND FUTURE RESEARCH

The limitation of the data collection is not representing the whole study area which only covers six construction sites with number of respondent is relatively low (N=139). Another limitation is lacking of type of work data to represent the hazards exposure contribute to an accident. During data collection, language was a main constraint due to nationality of the general workers. In addition, some of the management at construction not allowed outsiders to collect the data due to management issues. Future research should be conducted to identify how accidents are related to the type of work factors in order to get the best solution to reduce the number of occupational fatalities.

## Acknowledgment

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