

Causes for Lack of Usage of Safety Harness Among Construction Workers in Malaysia: An Investigation

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Abstract: Most of the construction workers in Malaysia does not use a safety harness when working at height is, even the workers are constantly exposed to fall hazard and the use of safety harnesses is required by law such as OSHA 1994. Based on Surry's model, the main reason for the workers not using safety harnesses is identified as their personal decisions and behaviour not to do so. The objectives of this research are to investigate the causes for lack of usage of safety harness among construction workers using Theory of Planned Behaviour (TPB) and to suggest control measures to encourage construction workers for using a safety harness. A structured questionnaire was constructed according to the objectives that consist of four parts was used for data collection and the respondents were comprised of construction workers in construction sites at the southern part of Peninsular Malaysia which is Johor. The causes for the lack of usage of safety harness among construction workers were explored through theoretical analysis and empirical test. The methods that have been used to analyze the data were descriptive statistic and inferential statistic. As much as 86 construction workers from different sites in Johor completed the questionnaires developed based on TPB. Theory of Planned Behaviour shows that there are 28.5% changes in behaviour due to the changes in the intention of construction workers. The empirical test shows that the discomfort of using safety harness, the employer does not provide the safety harness, negative pressures from gangmasters, foreman and safety officers and lack of knowledge about how to use safety harness are the main causes of construction workers not using safety harness. According to the results of the empirical tests, 13 out of 14 construction workers suggested that the control measures to encourage the use of safety harnesses among construction workers is to provide more safety training.

Keywords: OSHA 1994, Theory of Planned Behaviour, Safety Harness, Fall from Height

1. Introduction

Construction industry contributes a lot to the economic growth in Malaysia. According to the 11th Malaysia Plan (11MP), construction sectors is one of the biggest contributors to the nation's Gross Domestic Product (GDP). In 2017, construction industry reported a growth of 6.7 per cent and contributed 5.9 per cent to the GDP [1]. The midterm review of 11MP, allocation for the development expenditure will be lowered by RM40 billion or 15% to RM 220 billion because the priority will be given to the people-centric project [2]. Due to the continuous adoption of new design such as green technology, the Industrialised Building System (IBS) and the modification made in a number of rules and regulations in the construction industry, the construction sector registered a productivity growth of 15.5% [3].

There are many job opportunities offered in this sector from management teams to suppliers' teams and all other necessary services that need to be linked to the industry including construction workers. Due to the nature of activities at the construction site, this sector has always been classified as one of the hazardous industry compared to other industries. From excavation works to structural and exterior works, workers are exposed to high risks of accidents involving fall from height, hit by falling objects lifting operations and electrocution [3].

Among all those accidents occur at the construction site, fall from height is one of the leading and serious accidents type on construction site in Malaysia. Fall from height will not only result in severe injuries, but it also imposes significant cost and lost work time [4]. According to the Occupational Safety and Health Act 1994, an employer must provide the workers with the appropriate personal protective equipment to protect their safety. So, fall protection is an essential part of preventing fall injuries. It is because the construction workers are constantly exposed to the fall from height hazards and that the use of safety harness is strictly required by law. It is reasonable to assume that construction workers should be willing to use safety harnesses in order to avoid accidents. Among of all fall protection measures, the last defense to use when working at height is safety harnesses that can avoid injuries due to fall from height and commonly relied on by construction workers.

Unsafe behaviour is recognized as a major cause of accidents among construction workers. When unsafe behaviour is produced, there will be failures in the cognition process that produced unexpected behaviour. Surry's (1969) model that has five cognitive stages is usually used to analyse the causes of unsafe behaviour. The five cognitive stages are detecting the hazard, recognizing hazards, perceiving responses, deciding a response and executing the decided response. The unsafe behaviour of the construction workers can lead to failure and accidents at the site.

2. Literature Review

Fall is defined as an injury to a person that occurs after landing on the ground after falling from a higher place such as the ladder, scaffold, building, roof or other work areas [5]. Fall from height is also known as falls from elevations such as falling from the ladders, scaffolding and other elevated structures [6]. However, the most common factors that lead to fall from height are risky activities, individual characteristics, site conditions, organizational characteristics and weather conditions [7].

Fall from height is not only caused severe injuries, but it also imposes significant cost and lost work time [8] According to DOSH, fall from height at construction site also can cause fatality and serious injuries of the workers. Research has revealed that fall from height causes approximately 48% of serious injuries and 30% of fatalities. For example, a Nepalese worker was killed after falling from a high-rise building at construction site in Precinct 7, Putrajaya on March 2017 [9].

2.1 Safety Harness

According to the Occupational Safety and Health Act (1994), fall protection such as safety harness shall be supplied and used in any place where an employee is at risk of a fall of 2 metres or more. The safety harness used at construction site must be a one-piece full-body harness or a seat harness used in conjunction with a chest harness that is firmly attached to the seat harness [10]. Based on the Arco Professional Safety Services, there are three main types of safety harnesses when working at height which are the two-point full-body harness, four-point full-body harness and five-point full-body harness. Two-point full body harness will have fall arrest attachment points on the front and back. It is a lightweight harness that can be used for fall arrest or work restraint. Four-point full-body harness has two works positioning attachment points on the waist and it is adjustable to fit a range of sizes. The harness that can be used for personal suspension, fall arrest, work restraint and work positioning techniques, climbing and rigging is five-point full-body harness.

However, most of the construction workers are reluctant to use safety harness although its use being a legal requirement and important to protect them from exposure to a fall. Reasons for such non-compliance have been found to be attributable to discomfort while wearing the harness and the restriction it places on movement [11]. Besides that, most of the construction workers also tend to have poor awareness and risk perception about the usage of safety harness. According to the study by Shamsuddin et al., [12] identified that most of the scaffolders decide not to use safety harness because it is inconvenience and discomfort of using safety harnesses, underestimating the risk of not using safety harnesses, negative pressures from gangmasters, foreman and safety officers and lack of safety lines [12].

2.2 Unsafe Behaviour

Human error or inappropriate operation is the unsafe behaviour of the construction workers that have been identified as the major risk factor behind most of the accidents and injuries that occur at construction sites [13]. These kind of human error is an inappropriate behaviour that affects safety during construction operations and also can affect the project cost and schedule performance. Figure 1 shows the factors that contribute to unsafe behaviour and accidents in the construction site.

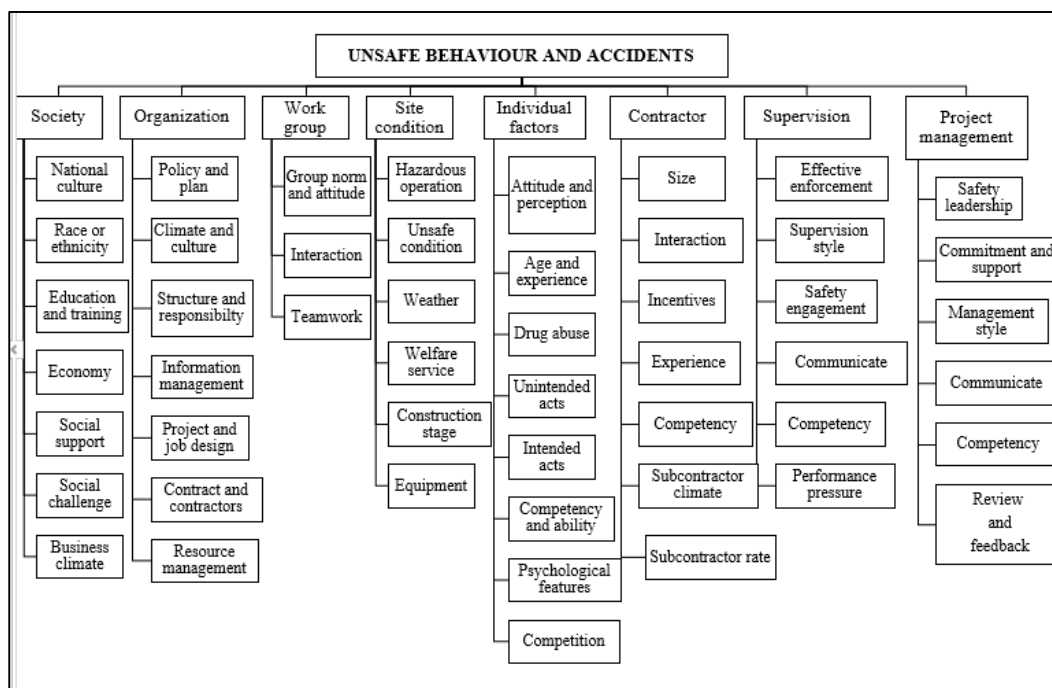


Figure 1: Factors that contribute to unsafe behaviour and accidents

Unsafe behaviour is generally analysed by using Surry's model which have five cognitive stages. The five cognitive stages are detecting hazards, recognizing hazards, perceiving responses, deciding a response and executing the decided response. Before a worker conducts a safe behaviour, they will detecting a surrounding hazard, realizing the possibility of injury due to hazard, retrieve a memory or looking at others to perceive safe response, select a safe response and execute the safe response correctly [14]. Cognitive failure in any of the stage can result from unsafe behaviour.

3. Materials & Methods

This study was conducted at construction site at the southern part of Peninsular Malaysia which is Johor. However, only the construction involving contractor from Grade 7 were analyzed and investigated in this study. Basically, there is about 689 Grade 7 contractor in Johor according to Construction Industry Development Board (CIDB). The questionnaires were distributed to the general worker at construction site who involve with working at height during the construction process.

Quantitative research for Theory of Planned Behaviour (TPB) was also used to quantify the problem by generating numerical data or data that can be transformed into usable statistics. This quantitative research was used to quantify attitudes, opinions, behaviours and other defined variables and it is suitable for a large sample population [15].

A set of questionnaire was design based on the objectives of the study which are to investigate the causes for lack of usage of safety harness among construction workers using TPB and to suggest a control measures to encourage construction workers using safety harness. The number of questions and the suggestions of elements that should be included in this questionnaire were based on the information gained from the literature review and Theory of Planned Behaviour. This questionnaire was constructed based on the Theory of Planned Behaviour which is by using Likert scale and open-ended question. The set of questionnaire was divided into four parts included the background of respondents, direct measures of attitude, subjective norm, perceived behavioural control, intention and behaviour as well as measures of behavioural beliefs, normative beliefs and control beliefs. Besides, the questionnaire also included the factor that might interfere construction workers from wearing safety harness which consists of belief strength, motivation to comply and control power. An open ended question was used to ask the workers' suggestions about the best control measures to promote the usage of safety harness.

The data obtained were then analyzed by using descriptive analysis. The statistical measures of descriptive analysis were used to compute further statistical testing which are to measure of central tendency, measures of variability, measures divergence and measures of probability. The mean, standard deviation and frequency distribution of each variables in the questionnaire were calculated and path analysis was used to test the validity of TPB based on the direct measures of the constructs in TPB. Finally, the workers' suggestion on the best control measures to promote the usage of safety harness at construction site were analyzed according to the frequency distribution and ranking.

4. Result & Discussion

A total of 86 respondents were selected to answer the questionnaire that will contribute to this study. The respondents that have been selected is the construction worker who works at the construction sites in Johor. That range of years that have been selected were from less than 5 years, 5 to 10 years, 11 to 15 years and more than 15 years. Besides that, the percentage of respondents who have encounter accidents while working at construction sites is about 28%. The respondents' who have experience in construction site accidents are mostly from the workers who have served for more than 11 years in this field.

4.1 Descriptive statistic of direct measures

Based on the Table 1, the main reason for the lack of usage of safety harness is the workers perceived behavioural control compared to other variables. The workers does not feel comfortable to wear safety harness when working at height have the highest mean value which is 3.47 that indicate strongly agree as selected by the respondents. The lowest mean value for this part is 2.10 which most of the respondents disagree with the questions that said the workers did not know how to use safety harness.

Besides that, the workers had a highly positive attitudes to the use of safety harness when working at height and high normative pressure from the people who are important to them. The perception of control about the usage of safety harness among construction worker is moderately high and the workers also have intend to use safety harness when working at height. According to the workers' past behaviour, the percentage of the workers that never use safety harness when working at height (> 3) is about 11% out of 86 respondents. Meanwhile, 66% of the respondents have experience in using safety harness while working at height (< 3).

Table 1: Minimum, maximum, mean, standard deviation and frequency distribution of attitude, subjective norm, perceived behavioural control, intention and behaviour

Causes	Min	Max	Mean	S.D	< 3 (%)	= 3 (%)	> 3 (%)	Rank
It is not comfortable to wear while doing other construction works.	1.00	5.00	3.47	1.07	26	7	67	1
It is difficult for me to use a safety harness when I am working at height.	1.00	5.00	3.34	1.06	27	13	60	2
Wearing a safety harness is time consuming.	1.00	5.00	2.98	0.98	35	29	36	3
I have the freedom to decide whether to use a safety harness while working at height.	1.00	5.00	2.79	0.96	34	46	20	4
I do not pleased to use safety harness when I am working at height.	1.00	5.00	2.76	1.26	49	9	42	5
Most people who are important to me does not use safety harness when they are working at height.	1.00	4.00	2.42	0.85	65	20	15	6
I don't intend to use safety harnesses when I am working at height	1.00	4.00	2.42	0.90	65	17	18	7
Most people who are important to me do not care whether I use safety harness or not when working at height.	1.00	4.00	2.35	0.86	63	26	11	8
I don't like follow safety rules to	1.00	4.00	2.31	1.10	59	21	20	9

use safety harness when I am working at height.

I never use safety harness when I was working at height. 1.00 4.00 2.17 0.95 66 23 11 10

Nobody have ever teach me how to use safety harness. 1.00 4.00 2.13 1.34 77 11 12 11

I don't know how to use safety harness. 1.00 4.00 2.10 0.99 78 6 16 12

4.2 Validity of TPB to explain the causes of not using safety harness

Based on Figure 1 below, subjective norm gave the greatest effect on the intention and behavior of the construction workers. Subjective norm in this study was indicate based on the workers' important person and front line management such as safety officer, gangmaster and foreman. Besides, direct relationship between perceived behavioural control and behaviour was demonstrated. The results shows that there are 9.6% changes in behaviour due to the changes in the construction workers' perceived behavioural control. When working at height, the construction workers may give up to wear safety harness due to uncomfortable and time consuming. On the construction site, this kind of phenomenon can often be seen. This results can be related to the incidents that had happened in Johor in 2016 where a worker fell from 11th floor while he was performing a construction works. It is because the worker fails to wear safety harness while working at height even it is provided by the company [16]. Despite the discomfort, the workers should wear safety harness if they believe that it is necessary to wear when working at height.

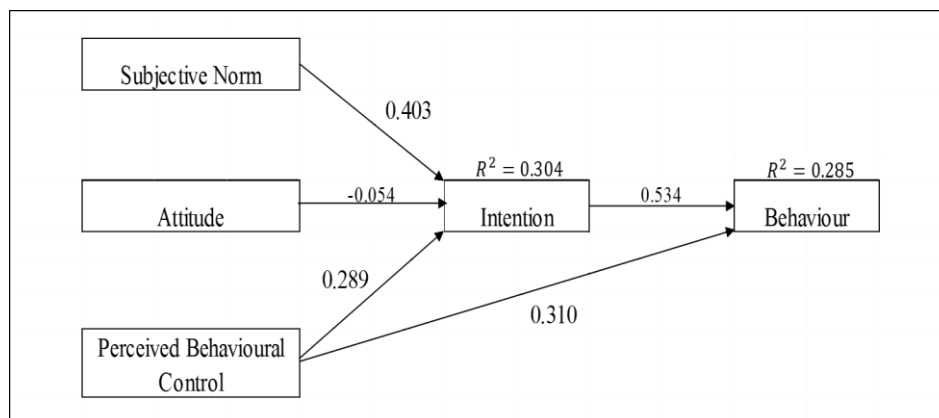


Figure 2: Theory of planned behavior analysis

4.3 Behavioral beliefs, Normative beliefs & control beliefs

Table 2 below shows the descriptive statistic and frequency distributions of the three kinds of underlying belief. Based on the three variables, behavioural beliefs has the highest mean which is 3.69 while control beliefs has the lowest mean which is 3.27. However, according to each items, most of the workers beliefs that using safety harness can avoid injuries and it has the highest mean value which is 4.37 that indicate the workers' are strongly agree. The lowest mean value for this part is 2.53 because most of the employer does not provided safety harness for their employees that involved with working at height at the construction sites.

According to behavioural beliefs, 93% out of 86 respondents for the value of more than three indicate that most of the construction workers believe that using safety harnesses can avoid injuries. Besides that, more than half workers agree (>3) that it is convenience to use safety harness and the percentage is 80% out of 86 respondents. However, 53% of the construction feels uncomfortable wearing a safety harness when working at height (< 3).

Normative beliefs consist of the beliefs about the normative pressure from gangmasters, foremans, safety officers and pressure from co-workers. Most of the construction workers beliefs that the normative pressure from foreman and safety officers with the highest mean which is 3.87 compared to pressure from gangmaster and co-workers that have the average mean of 3.62 and 3.53 respectively.

Control beliefs have the lowest mean which is 3.27 compared to behavioural belief and normative belief with the mean of 3.58 and 3.69 respectively. Control beliefs were analyze according to the workers knowledge to use safety harnesses and it environmental condition that can support the workers to use safety harness. According to the workers knowledge, 80% of the construction workers know how to use safety harness and 85% know in which situations the safety harness should be wear. However, the construction workers thought that the environmental conditions to support the workers using safety harness must be ensured. 71% of the respondents thought that safety harness should be provided and 65% thought that the safety lines should be supplied in order to hang the safety harness. 43% of 86 respondents agree that it is convenient to get a safety harness (>3).

Table 2: Minimum, maximum, mean, standard deviation and frequency distribution of behavioural belief, normative belief and control belief

Causes	Min	Max	Mean	S.D	< 3 (%)	= 3 (%)	> 3 (%)	Rank
Using safety harness can avoid injuries	2.00	5.00	4.37	0.69	2	5	93	1
I know in which situations I need to wear safety harnesses.	2.00	5.00	4.03	0.82	8	7	85	2
Foreman and safety officers will criticize me if I do not use safety harness.	2.00	5.00	4.03	0.74	1	22	77	3
I feel it convenient	2.00	5.00	3.95	0.80	7	13	80	4
I know how to use a safety harnesses.	1.00	5.00	3.93	0.99	13	7	80	5
Gangmasters will criticize me if I do not use safety harness	2.00	5.00	3.86	0.80	6	22	72	6
Gangmasters will not blame me if I waste time in using a safety harness	2.00	5.00	3.80	0.88	8	26	66	7
Foreman and safety officers will not blame if I waste time in using safety harness.	1.00	5.00	3.70	0.83	6	28	66	8
Co-workers will not laugh at my timidity if I use a safety harness.	1.00	5.00	3.58	0.93	8	37	55	9
Co-workers will not blame me if I waste my time in using safety harness.	1.00	5.00	3.57	0.94	12	33	55	10
Co-workers will remind me to use safety	2.00	5.00	3.43	0.96	24	17	59	11

harnesses if I did not use it.

Gangmasters use safety harness	1.00	5.00	3.19	1.11	36	23	41	12
It is convenient to get safety harnesses.	1.00	5.00	3.14	1.22	36	21	43	13
Co-workers use safety harnesses.	1.00	5.00	3.10	1.17	45	13	42	14
I feel comfortable to use safety harness	1.00	5.00	2.74	1.04	56	17	27	15
There are safety lines to hang safety harnesses.	1.00	5.00	2.72	1.33	65	6	29	16
Safety harnesses are provided to us.	1.00	5.00	2.53	1.12	71	6	23	17

4.4 Factors that interfere from wearing a safety harness

Descriptive statistics and frequency distributions of belief strength, motivation to comply and control power were analyzed in Table 3 below. Based on the three variables, motivation to comply and control power shared the same value of mean which is 3.82 while belief strength has the lowest mean which is 4.36. However, according to each items, most of the workers beliefs that safety is the first priority when working at construction site and it has the highest mean value which is 4.49 that indicate the workers' are strongly agree. The lowest mean value for this part is 3.65 because most of the employer thought that safety harness cannot be used when the workers itself does not have the knowledge on how to use safety harness.

According to belief strength, more than half construction workers agree that convenience and comfort of using safety harness is important which are 94% and 90% respectively for the values that is more than three. Besides that, almost all of the construction workers concerned about the safety at construction site where the values for more than three is 94%.

According to motivation to comply, 68% of the workers have high motivation to comply with the normative pressure from gangmasters, foremans, safety officers and co-workers with average mean of 3.82. The value of agreement of the construction workers with the motivation to comply with normative pressure from gangmasters, foremans and safety officers and co-workers is more than 60% which are 66%, 65% and 73% respectively.

For control power, more than half of the construction workers thought that it is important for the workers to have knowledge regarding the usage of safety harness which is 64% out of 86 respondents. Lack of supply of safety harness and the inconvenience to get the safety harnesses, more than half construction workers could not deals with this two barriers which are 78% and 77%. However, there are only 12% of the workers thought that the lack of safety lines at construction site can be overcome.

Table 3: Minimum, maximum, mean, standard deviation and frequency distribution of belief strength, motivation to comply and control power

Factors	Min	Max	Mean	S.D	< 3 (%)	= 3 (%)	> 3 (%)	Rank
Safety is the first priority	3.00	5.00	4.49	0.61	0	6	94	1
Convenience of using safety harnesses is important.	2.00	5.00	4.31	0.62	1	5	94	2
Comfort of using safety harnesses is important	3.00	5.00	4.29	0.65	0	10	90	3
I will not use a safety harness unless it is easy to get.	1.00	5.00	3.95	0.80	4	20	76	4

I will not use a safety harness unless it is provided.	1.00	5.00	3.90	0.95	7	15	78	5
I care about co-workers views on my behaviour.	2.00	5.00	3.87	0.82	7	20	73	6
I care about gangmasters' view on my behaviour.	2.00	5.00	3.84	0.85	6	28	66	7
I will not use a safety harness unless there is a safety line.	1.00	5.00	3.78	1.04	12	11	77	8
I care about foreman and safety officers' view on my behaviour.	2.00	5.00	3.74	0.75	5	30	65	9
I cannot use a safety harness unless I have the knowledge.	2.00	5.00	3.65	1.03	20	16	64	10

4.5 Control measures

Table 4 below shows the control measures that have been suggested by 40 out of 86 construction workers that have been selected to answer the questionnaires. Based on Table 4 below, 13 workers out of 40 suggest that safety training is an effective method to modify the workers negative attitude and behaviour. It is because the workers may not be able to recognize and avoid the potential hazard associated with the task that the workers performed when a worker was not exposed with proper safety training. According to OSHA Malaysia (2016), the training that can be provided to workers is to provide an awareness training program that can train the workers in their specific roles at construction sites. The program will help provide exposure to all workers, such as monitoring when injuries occur and providing information about on-site safety and health hazards and controls for those hazards. Therefore, it will increase the awareness of the workers to always wear personal protective equipment once the workers learn about the risk and danger at the construction site.

In addition, 11 construction workers indicated the need for the employer to provide the safety harness supply for those who are working at height. It is necessary for the employer to provide a complete personal protective equipment for the workers in order to ensure the workers safety. Based on the observation and questionnaires, most workers agree that they intend to wear safety harness when working at height, but it is not provided by the employer. According to Guidelines for Falls Prevention by DOSH, workers should wear personal protective equipment when there is a risk that failure to wear those equipment could lead to serious injury. Furthermore, for fall protection such as safety harness shall be supplied and used in any place where an employee is at risk of a fall of 2 metres or more.

Seven workers have also argued that it is necessary to raise the concerns of the gangmasters about the use of safety harness among construction workers. It is because the gangmaster is a person that organizes the work of laborers and act as a leader at the construction site. Therefore, gangmasters need to be aware of their responsibility to concerns with the workers' safety, for example, by enforcing penalties on employees who do not wear safety harness while working at height. Meanwhile, 5 out of 40 respondents pointed out the need to reinforce safety supervision of the unsafe behaviour of the construction workers. In order to reduce the inconvenience and discomfort of using safety harness, four construction workers proposed that the design of the safety harness should be improve.

Table 4: Construction workers’ view on control measures to encourage using safety harness

Measures	Frequencies	Ranking
Safety training	13	1
Ensuring equipment supplies	11	2
Raising gangmasters’ concerns on the use of safety harness	7	3
Safety supervision	5	4
Improving the design of safety harness	4	5
Total	40	-

5. Conclusion

There are many possible causes for the lack of usage of safety harnesses among construction workers in Johor and some relevant control measures have been suggested according to the specific causes to encourage the construction workers using safety harnesses. In order to minimize the impression of the workers of the difficulty and discomfort of using safety harness when working at height, the safety harness design should be considered to be enhanced.

Besides that, the management should provide the construction workers with a safety report on accidents caused by non-use of safety harness. It is important to make the workers aware and will not underestimate the risk of not using safety harness. Thus, it also can raise awareness and improve the workers behaviour. It is also necessary to let managers like gangmasters, foreman and safety officers know their influence to the workers if the managers exerted negative normative pressure on the use of safety harness.

In conclusion, the causes for lack of usage of safety harness among construction workers are mostly caused by unsafe behaviour among the workers. Besides that, when working at height, the employer must take the responsibility of supplying and educating the workers to wear a safety harness. Therefore, both objectives have been fulfilled and it can help to reduce the number of construction sites accidents especially fall from heights.

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