



THE FRAMEWORK FOR EFFECTIVE SAFETY CONTROL AND IMPLEMENTATION AT CONSTRUCTION PROJECT

Idris Othman ^{*1}, Hisham Mohamad ², Madzlan Napiah ³, Zain Hashim ⁴, Zuansi Cai ⁵

^{*1, 2, 3, 4} Civil Engineering Department, Universititekologi PETRONAS, Malaysia

⁵ Edinburgh Napier Universities, Merchiston Campus, EH105DT Edinburgh, United Kingdom

Abstract:

The Construction industry enhanced the growth of socio-economic of country as well as providing the necessary infrastructure and enhanced facilities for social comfort. However, it is stigmatized as the most hazardous industries due to high occupational risks and unsatisfactory state of occupational safety. Therefore, this study evaluates the factors affecting the successful implementation of safety control practices in construction project through structured questionnaire and case study of high rise construction project. The statistical techniques including Relative Importance Index (RII) and Average Index (AVI) are used to analyse the data gathered, while the statistical package for the social sciences (SPSS) is used to measure the Spearman's rank correlation between four different groups of respondents, the Cronbach's alpha (reliability test) and validity of the study. The high impact factors identified are then validated with the case study on contractors' practitioners' practices. Based on the highest impact factors identified, a framework of safety control management was proposed to improve the safety performance at construction project. The study concludes with the conclusion on the data obtained and recommendation for the improvement, thus more valid and reliable results can be obtained for the implementation of safety control practices in construction project.

Keywords: Integration Construction; Safety Control; Factors Implementing; RII; SPSS; Framework.

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1. Introduction

Nowadays, the construction sector is a very important and productive sector of the Malaysian economy. Since seventies, Malaysia has realized the vital role of the construction sector which is not only contributed on economic growth but also to enhance the quality of life and living standards of citizen. Construction industry is also an important industry that plays a vital role in the socio-economic growth of a country. Economically, it contributes in significant improvement in the overall GDP of a country. The industry has been consistently contributed approximately 3% to 5% of the national Gross Domestic Product (GDP) (Shari, 2000, Takim, 2005). There are increment in growth of construction which is from 6% to 15% since the seventies until middle nineties (Raftery et al, 1998, Shari, 2000). Besides, there many rapid execution of projects due to more advanced,

modernized and well equipped construction industry in Malaysia. The development of other sector such as tourism and manufacturing has also provided significant contribution to sustain growth momentum of the construction industry.

However, despite these contributions, construction industry has faced a wide range of challenges which is the frequent occurrences of accidents at the workplace. To be compared with another industry, the construction industry is five times more risky (Sorock et al., 1993; Sawacha et al., 1999). The safety of workers is a complex phenomenon since construction is always risky due to outdoor operations, work-at heights, complicated on-site plants and equipment operation coupled with workers attitudes and behaviors towards safety. Besides, (Wilson, 1989) state that the situation even worse due to the nature of the construction industry's rapidly changing conditions, associated work hazards, and the characteristics of construction organizations. Malaymail Online reported that construction sector generated the worst safety and health records with 89 fatalities in 2014 and 140 in 2015, hence contributed 21 percent fatalities in occupational hazard cases in 2015. Hinze (1997) reveals that according to OSHA (Occupational Safety and Health Administration), there five groups of accident consisting of falls, struck-by, electric shock, caught in or between, and other which consequently lead to fatalities.

The collaboration of Construction Industry Transformation Programme (CITP) with Works Ministry and Construction Industry Board (CIDB) was developed with the goal to transform Malaysia's construction sector by improving the overall quality, safety and professionalism of the industry. Therefore, to improve the effectiveness of managing resources for safety control in construction projects, better safety control management should be adopted by construction practitioners. Thus, safety performance at construction sites can be improved and indirectly, help to mitigate the construction safety risk.

1.1. Problem Statement

In the development process of a country, construction industry undoubtedly plays a significant role. Despite of the benefits it brings, it is known for high fatalities and accidents risk on the working place.

The construction industry has always been associated with chronic problems including poor safety awareness of top management, lack of training, low safety awareness among contractor, attitudes of management and workers and also reluctance to provide allocation of budget for safety. Thus, generate serious accident at the project, affecting others. A study done by C.M. Tam et al. (2004) reveals that the behavior of contractors on safety management are of grave concern, including the lack provision of personal protection equipment, regular safety meetings and safety training. Consequently, the most significant impacts of site accidents on construction firms are high cost, cause disturbance to schedule, give bad reputation to company and burden the workers and others.

Therefore, by identifying factor that affecting implementation safety control on resources such as worker, equipment and materials comprehensively and by practicing proper safety management, the construction safety risk can be reduced. This lead to better safety performance and successfulness of overall project

1.2. Objectives

The objectives of this research are explained as below:

- 1) To identify and rank the factors affecting the implementation of safety control towards resources during the construction phases which contribute largely to the safety performance and success of overall project based on relative importance index (RII) with correlation between construction practitioners.
- 2) To validate the factors and construction practitioners' practices influencing the implementation of safety control towards resources during the construction phases through the application of case study project.
- 3) To propose a suitable safety control framework for contractors' practitioners to enhance the implementation of safety control in construction project.

1.3. Scope of Study

This research is to identify, rank and analyse factors influencing the implementation of safety control towards resources based on the actual case studies of a high-rise building construction project. The study focuses on these contractors' practitioners including; (i) engineer, (ii) site supervisor, (iii) safety & health and (iv) others. The ranked factors are then further discussed and investigated through personal interview in order to obtain more information regarding the safety management and control system on real site condition.

2. Literature Review

2.1. Overview of Safety in Construction Project

Globally, the construction industry is contributed to the highest rates of casualties than other industries. HSE (2009) state that the construction industry brings significant contribution and benefit in facilities production which initiates various economic activities and enhance the social and environmental needs of a nation. Thus construction safety becomes one of the significant concerns.

In the construction industry, the hazards are difficult to be specified due to changing location for the group of workers and due to the work progress as construction proceeds. Thus, the risk that workers face also varies depends on their activity and location (McDonald et al., 2009). Low safety concern on construction sites influence workers and their relatives in term of physical and psychological which affect the project financially by increasing direct and indirect costs (Bansal 2011).

Safety performance was traditionally measure according to the record of accident or injury data (Choudhry et al. 2007). Focusing on safety results, the success of safety is indicated by levels of system failure (Choudhry et al., 2007). However, most of safety professionals and researchers agreed that delaying indicators at which that an accident at workplace or injuries of people must occur before a measure can be done. It may or may not provide the necessary awareness for to prevent future accidents (Grabowski et al., 2007).

As alternative, safety-related practices, for instance, unsafe behaviour and unsafe conditions can be measured during the construction phase (Hallowell et al., 2013). Thus, positive responses can be triggered before an unwanted incident occurs the behaviour sampling method also can be implemented. For this method, one or more trained observers are needed to do observation on workers at site to check either they are working safely or vice versa (Choudhry et al., 2007). This method is can be highly beneficial in measuring safety performance.

Besides the project management important element, consisting of time, cost, and quality, project personnel also should play vital role in managing safety risks in construction projects (Zou and Sunindijo,2013; Chi and Caldas,2011). Seo et al. (2015) state that the statistics of fatalities occurrence in the construction industry clearly indicate an immediate need to minimize the commonness both fatal and nonfatal injuries in construction Therefore, a continuous measurement of safety activities is required to assess the safety performance on construction sites.

2.2. Hazards in Construction Project

The construction industry continues to account for a disproportionate number of occupational fatal and nonfatal injuries (Findley et al., 2004; Ho et al., 2000). However, in the last decade, regardless the continuous safety efforts, the injury rates by construction sector have been increased.

According to National Safety Council (NSC; as cited in Mitropoulos, Abdelhamid& Howell, 2005), “an unsafe condition or activity that, if left uncontrolled, can contribute to an accident” is known as hazard. To prevent injuries, hazard recognition methods are introduced at which procedural or physical controls are being used, thus, workplace hazards can be identified and risk that associated with these hazards can be minimized.

Based on the knowledge of operations and past experience with similar work tasks, potential hazards can be identified. This usually involves brainstorming-type sessions among team members having familiarity with operational activities (Campbell, 2008).

Unidentified hazards will cause an underestimation of risk regarding the project which resulting in no necessary control measures was implemented to prevent exposure to specific hazards to prevent injuries. Furthermore, since in reality there is no adequate control to prevent injuries, workers may recognize the level of security wrongly, (Fleming, 2008). Thus, to have a good construction safety, a general understanding regarding the root factor of accident coupled with the ability to recognize the hazards, and safe behaviour are very vital to be practiced.

Based on Tam et al. (2004) the questionnaire in their study explores the perceived probability of serious accidents on construction sites, which will lead to fatalities. Falling from height is considered most risky (92%) (Larsson and Field, 2002). The other accidents in descending order of perceived probability are hit by falling materials, collapse of earthwork, use of heavy machine, and electrocution. Thus, it will cause the increase in cost, interrupted project timeline, affect reputation of firms and also cause burden to workers. Thus, appropriate safety control should be taken to mitigate construction safety and health risk, indirectly minimize the impacts towards the construction project.

2.3. Factor Affecting Implementation of Safety Control on Resources in Construction Project

In construction industry, improper safety control practices on resources known as one of the serious problems. The number of accidents in construction project is increasing proportionally with a vast development. Thus, it is needed to overcome the problems stated as well as to have well-managed resources and prevent fatalities either directly or indirectly. The factors that identified are (1) worker involvement factor, (2) material and equipment factor, (3) workplace factor and lastly, (4) management factor.

Worker Involvement

Firstly, for unsafe behaviour and attitudes, the workers tend to be ignorance and have poor working attitudes. The workers also unable to identify an unsafe condition that may exist or develop after a task was started Site workers' safety attitude can be shaped by norms of peer groups and can be directed by individual motivation in order to prevent unsafe act. Higher levels of motivation towards safety can be reinforced by the degree of their participation in safety-related activities (Coudhry& Fang, 2008; Aksorn&Hadikusumo, 2008)

Besides, poor communication affects the safety and also productivity of workers at which the commands and coordination are necessary in certain activity. To provide the possible solution for the poor communication problem such as technological solution, better safety procedures and improvement of the communication within main contractor and subcontractors.

According to (Hallowell & Gambatese,2009; Dabrowski,2015; Aksorn& Hadikusumo,2008; Tam et al., 2004; Choudhry & Fang,2008;Haslam et al., 2005) most of the workers receive little education and are unskilled, untrained and lack of experience. Low requirement for construction industry caused the increment of peasant workers. Lack of knowledge regarding safety leads to risk and hazards at work place Site workers should undergo proper training and education to increase their awareness regarding the safety issue.

Next, tiredness and fatigueness also have been including under this factor. The construction workers tend to work for long periods without a break due to overtime payment and also high work load. The consequences of tiredness and fatigue are reduced concentration, poor decision making and, it might be expected, compromised safety. The workers should follow the safety procedures and have concern towards their safety to prevent any injury to them (Choudhry & Fang, 2008; Haslam et al., 2005).

Material and Equipment

The effectiveness of safety program either in short term and long term goals depends largely on level of resources allocation. The shortcomings of equipment are due to haste and time regimes (tight deadlines) and also economic condition. The worker should be provided with adequate measure protection against hazards such as proper personal protective equipment in order to comply with requirements (Aksorn&Hadikusumo, 2008; Rollenhagen&Kahlbom, 2001; Tam et al., 2004)

According to Muhwezi et al. (2012), Haslam et al. (2005), a proper storage location, good storage techniques help to reduce the hazards such as fall or fire hazard. The materials should be stored according to the sequence of operations to ensure a minimum of movement and handling. Improperly handling and storing materials tend to expose the workers towards numerous accidents on site. The researchers also discussed on the need of training session in the planning and provision of the appropriate material storage and handling facilities on site.

Besides, numbers of the accidents are also due to the utilization of tools or equipment in poor condition. Poor condition is basically due to defective equipment and overloaded tools or equipment at which it will affect its performance. The tools should be inspected regularly and undergoes maintenance (Awolusi& Marks, 2017; Haslam et al., 2005).

Lastly, based on Mokhtar et al. (2011), poor configuration of tools such as scaffolding can cause serious incident at site. Poor configuration of tools is due to site constraints or equipment limitation which is cannot be placed flexibly. However, the alternatives for this problem did not been explored deeply.

Workplace

Poor housekeeping and problems with the site layout and space availability, contributed largely on the accident studies. Proper housekeeping should have proper access, walkways and traffic route. The constantly changing workplace and work activities that occur on construction sites leads to this problem. Thus, safety and risk management culture in the industry should be improved since tidy and well planned (layout) tend to provide a high level of safety performance. Meanwhile for site constraint, inadequate space or difficult access to perform a task contributes to fatalities. Site constraint is due to inadequate planning coupled with poor local assessment (Haslam et al., 2005; Choudhry & Fang, 2008).

Management

According to Haslam et al. (2005), elimination or reduction of risks can be applied through design or alternative methods of construction. Construction design and construction process are interlinked, with the process being dictated by the design and decisions from the design team. Many designers are still failing to acknowledge their influence on the safety of the construction process due to deep-seated custom and practice and an absence of safety education and training.

Deficiencies in project management and planning leads to problems with blurred responsibility and difficulties with communication between one contractor and another It also can lead to difficulties with the project schedule. Time pressure on all involved within a project, with subsequent problems such as trade overlap, crowded workspaces and reduced attention to detail. Management involvement and toolbox talks are the most effective site practices to enhance site safety. Other than that, management is responsible upon implementing the proper safety management systems including planning, organizing, providing safety policies and working procedures (Haslam et al., 2005; Choudhry & Fang, 2008).

In context of risk management, accidents invariably involve an inadequately controlled risk, indicative of a management failing. Operatives were well aware that they could be injured, become disabled or expose to the possibility of death. Perceptions of risk are very vital because lack of

knowledge or limited experience, then will lead to a greater risk (Haslam et al., 2005; Choudhry & Fang, 2008). Usually, the worker that lack of knowledge do not have a clear picture about the risk and do not know how to manage the risk. To ensure the safety at the project, management is required to set a positive standard of safety behavior for all employees. This is because employees usually imitate and will obey to the actions of management. The top management should set up appropriate environments for safety by defining the safety policy and allocating resources. The attitude of the top leaders plays an important role in cultivating a good safety culture. The establishment of realistic goals and objectives will guide all employees with a clearer picture, direction, and focus for performing day-to-day activities with the aim of reaching common goals. However, in practice, not all business leaders pay great attention to safety management because other business objectives such as profitability, schedule and quality are always competing for their time and resources (Tam et al., 2004; Aksorn&Hadikusumo, 2008).

3. Methodologies

Descriptive method which involved collecting data in order to answer the questions concerning the subject of the research was chosen as a method for this study. This is because as mentioned by Fraenkel and Wallen (1996), descriptive method is a method used to explain, analyze and classify something through various techniques, survey, interview, questionnaires, observation and text. This type of research is used to find the answers to who, what, where and how questions. It was designed to portray the characteristics of a population (Saunders et. Al.,2007).To find the factors affecting the implementation of safety control towards resources for successful completion of construction project; more than ten research, articles and journals being reviewed to get better understanding on the study. Based on the review done on the literatures, about 28 factors are identified. The factors then classified into four factors to be studied for which are; (1) worker involvement factors (2) material and equipment factors (3) workplace factors and (4) management factors.

A structured questionnaire survey was conducted to establish the highest impact factors influence the implementation of safety control practices in high rise construction project. The identified factors were grouped under the following categories: (1) worker involvement; (2) material & equipment; (3) workplace; (4) management. Based on Roscoe's Simple Rules Of Thumb, Roscoe (1975) in most research, samples of 30 or more are recommended whereas the use of statistical analyses with samples less than 10 is not recommended. Therefore, there are 30 respondents have been participated throughout the survey. This survey involves the contractor practitioners that have been experienced with this safety issues during construction phase. The questionnaire's questions are designed to achieve the objectives of the study. This survey is conducted to gain various perspectives regarding the highest impact factor that affecting the implementation of safety control on resources.

Table 1: Factors According ToGroup

FACTOR DESCRIPTION
WORKER INVOLVEMENT RELATED FACTORS
A.1 Unsafebehavior and attitudes
A.2 Poor communication
A.3 Lack of knowledge

A.4 Lack of experience
A.5 Tiredness and fatigue
A.6 Lack of coordination between the main contractor
A.7 Lack of teamwork spirit
MATERIAL AND EQUIPMENT RELATED FACTORS
B.1 Shortcomingswiththeequipment
B.2 Inappropriatestorage and handling of material
B.3 Poor condition of tools
B.4 Poor configuration of tools
B.5 Lack of supervision
B.6 Lack of protection in material transportation
B.7 Lack of personal protective equipment
WORKPLACE RELATED FACTORS
C.1 Poor housekeeping
C.2 Site constraint
C.3 Accidents due to negligence/ careless
C.4 Poor construction sequence
C.5 Impropersecurity of job site
C.6 Lack of worksite inspection
C.7 Reluctance to input resources for safety
MANAGEMENT RELATED FACTORS
D.1 Changes to design
D.2 Deficiencies in project management and planning
D.3 Deficiencies in risk management
D.4 Lack of awarenessfrom top management
D.5 Subcontractorselection and management
D.6 Performance pressure
D.7 Lack of organizationalcommitment

An interview guide was used to able the researcher and subject of case study (contractor practitioner) to have discussion regarding the current safety control practices and suggestion on future improvement. Interview session tends to allow a direct communication with the people from the industry, thus, details information are collected and the survey can be validated.

The data obtained are then ranked according to its RII value, the higher the RII, the higher the rank. The ranking is necessary to determine which factors have the highest impact towards the successful implementation of sustainable safety control practices in construction project. AVI is used to classify these ranked factors into its five different classes of impacts, very low to very high. The RII and AVI value is calculated based on the formula as shown in Table 2.

Table 2: The formula used to calculate RII and AVI

Relative Importance Index (RII)	$RII = \frac{\sum W}{A * N}$	W: Weighting given to each factor A: Highestweightage N: Total number of respondents
Average Index (AVI)	$AVI = \frac{\sum(\beta * n)}{N}$	β: Weighting given to each factor n: Frequency of respondents N: Total number of respondents

The correlation, reliability and validity of the data gathered are then analyzed through the application of Statistical Package for the Social Sciences (SPSS) software. The Cronbach's coefficient Alpha is used to measure the reliability and validity of the study where the nearest the value to +1 reflects the higher reliability.

4. Result and Discussion

A total of fifty (50) questionnaires were administered for this survey, of which (30) were returned with valid responses. The questionnaires were distributed through online form method. This showed a response rate of 60%. From the results obtained, it was observed that majority of the respondents were of the opinion that they are aware of the importance of safety control in construction project in order to improve safety performance and prevent occupational fatalities.

Table 3: The Demographic Characteristics of Respondents

Items	Description	Frequency	Percentage
AGE	20-29 yearsold	16	53.3
	30-39 yearsold	1	3.3
	40-49 yearsold	9	30.0
	More than 50 yearsold	4	13.3
GENDER	Male	20	66.7
	Female	10	33.3
QUALIFICATION	Doctor of Philosophy (PhD)	1	3.3
	Master Degree	1	3.3
	BachelorDegree	12	40.0
	Diploma	13	43.3
	SIJIL/STPM	3	10.0
DESIGNATION	Engineer	9	30.0
	Site Supervisor	6	20.0
	Safety and Health	5	16.7
	Others	10	33.3
WORKING DURATION	Lessthan 5 years	15	50.0
	Lessthan 10 years	1	3.3
	More than 10 years	14	46.7

Table 4: Summary of ranked factors according to group of respondents Summary of ranked factors according to group of

Rank/ Respondent	E	SS	S & H	O	Overall	Frequentrankedfactors
1	A.6	B.5	A.1	A.1	B.5	B.5
2	B.5	A.3	A.2	C.3	C.6	C.6
3	A.7	A.4	A.3	C.6	A.1	A.1
4	C.1	C.6	C.6	B.2	C.1	C.1
5	C.6	A.1	A.4	C.1	A.3	A.3

4.1. Top Five Highest Impact Factors Affecting Implementation of Safety Control on Resources in Construction Project

This section discusses the results which acquired based on analysis of the data. The factor was ranked based on the average index (AVI). Based on the analysis, the top five (5) highest impact factors affecting the successful implementation of safety control practices are; (i) Lack of supervision, (ii) Lack of worksite inspection, (iii) Unsafe behavior and attitudes, (iv) Poor housekeeping, (v) Lack of knowledge. Table 4 illustrates the highest impact factor affecting safety control in a high rise construction project among the engineers, site supervisor, safety & health and others and based on overall basis of respondents.

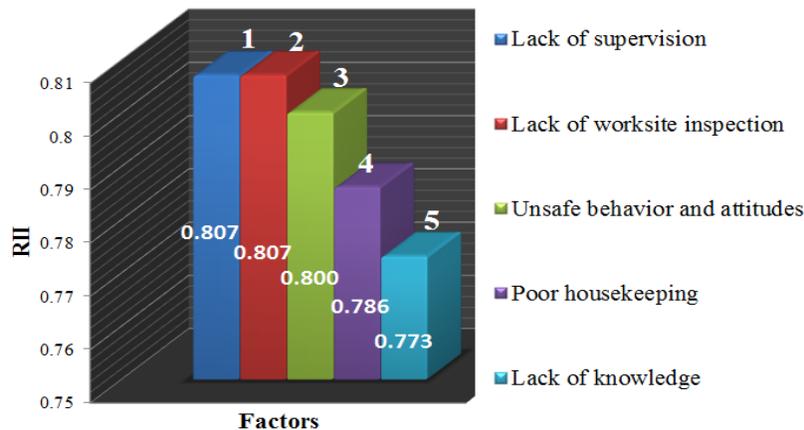


Figure 1: Top rank factor

Table 5: Top rank factor with AVI and RII

Rank	Factor	AVI	RII
1	Lack of Supervision (B.5)	4.033	0.807
2	Lack of Worksite Inspection (C.6)	4.033	0.807
3	Unsafe behavior and attitudes (A.1)	4.000	0.800
4	Poor housekeeping (C.1)	3.900	0.786
5	Lack of knowledge (A.3)	3.867	0.773

Lack of Supervision (B.5)

Lack of supervision was ranked as first highest impact factor with highest AVI and RII. Lack of supervision which is from material and equipment related factor is might be due to lack of safety

awareness among the contractor practitioner. This problem then led to the unsafe attitude and behavior towards the material and equipment handling. There is no proper guidance to the worker regarding their work. Therefore it is needed for the worker to have briefing and the supervisor should be responsible in monitoring the worker. This is because not all of the workers have holistic knowledge regarding safety control practices and they tend to do their work with the wrong sequence and also method. Based on the problem, it is advisable to the contractor company to enhance the safety knowledge of the worker by giving internal training, regular briefing and also provide the safety booklets that can be understand easily by the worker.

Lack of Worksite Inspection (C.6)

The second highest impact factor for the implementation of safety control on resources is lack of worksite inspection which is categorized under workplace related factor. Lack worksite inspection is might be occurred due to irresponsible contractor practitioner, therefore safety awareness should be developed among them, importantly to top management. Lack of worksite inspection is also might be due to lack of budget provided to hire fulltime safety personnel. However, worksite inspection is very crucial to provide safety controls since the construction worker are exposed to hazards more than other industry. The workers are involved in concreting work, plastering work and others which is very risky due to the changing condition and also risky area. Since the worksite inspection was rarely been done, the worker tend to disobey the rules in construction project, as for example they tend to not wearing proper PPE and perform their task in unsafe way. Besides, the critical surrounding such as the void area will not be properly covered or secured and also the scaffolding will not be inspected. So, it is needed to have site assessment and implement fine to the wrong action, so the potential hazards can be identified and can be addressed before any unwanted incidents occur.

Unsafe behavior and attitudes (A.1)

With the third highest AVI (4.000), unsafe behavior and attitude has been categorized under the high impact factor. This problem occurs might be due to the lack of knowledge among the worker. The worker tend to act based on their own way, which is opposed to the correct method. Besides, this problem also happens because the workers receive minimum guidance for safety control practices. Therefore, it is really important for the worker contractor to provide safety education program and training to the worker. Besides, for the implementation of the safety program, full commitment from top management is required.

Poor housekeeping (C.1)

Housekeeping is one of the significant ways to keep the site's environment in the satisfying state. To improve the housekeeping, the site should be inspected by safety & health. Besides, the site should be cleaned to have a proper access to the construction site and to smoothen the construction work. Poor housekeeping will lead to various unsatisfying condition such as the stagnant water in the walkway area leading to breeding ground for mosquito and also can cause electrocution if the electrical appliance was exposed to the water. Besides, the poor housekeeping also caused the construction site to be exposed with the abundance of wastes in the site, causing site constraint to worker. This can led to serious accident such as fall from height. Therefore, regular inspection should be done and supervisor should monitor the site condition.

Lack of knowledge (A.3)

Another top five highest impact factors affecting the implementation of safety control on resources in construction project are lack of knowledge. This lack of knowledge led to various problems. Without adequate knowledge, the worker will exhibit unsafe behavior upon their work and they also would have poor housekeeping. The contractor would have low safety awareness towards the hazards. However, it is very vital for the worker to be provided with proper education and training regarding the safety. The worker should be monitored by providing the adequate input to enhance their daily work routine. Thus, reducing the risk at workplace.

4.2. Correlation Test, Validity Test, Reliability Test

Table 6: Correlation test results

RESPONDENT	E	SS	S&H	O
E	1.000	0.583**	0.247	0.446*
SS	0.583**	1.000	0.592**	0.547**
S&H	0.247	0.592**	1.000	0.513**
O	0.446*	0.547**	0.513**	1.000

Table 7: Reliability and validity test results

Reliability	Validity
0.956	0.9778

4.3. Proposed Safety Control Management Framework

The proposed framework as mentioned above is graphically depicted in Figure 2. A framework of safety control management that emerged through the literature review has been developed in this research. To fill the gap that has not been mentioned by previous researchers, the idea from conducted interviews and survey questionnaires have been included in the new safety control management framework. This is to enhance the contractor practitioners to improve the safety performance at construction project. Therefore, all of the objectives for this research can be achieved.

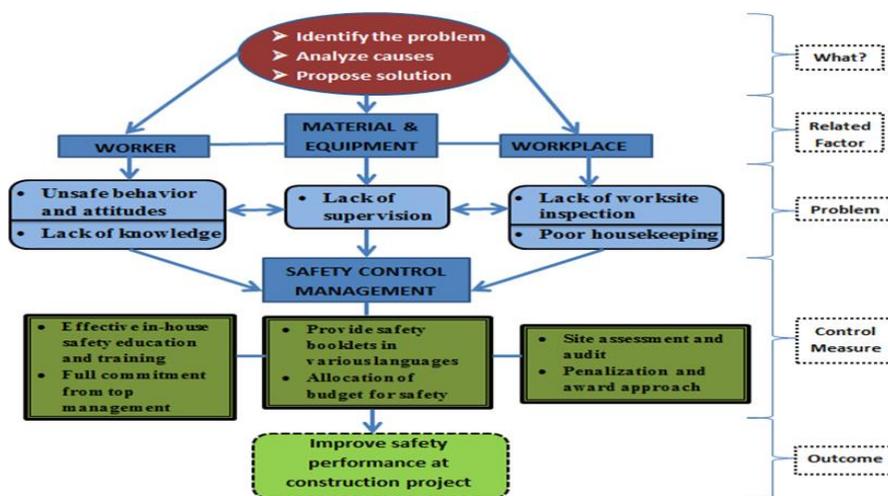


Figure 2: Framework for Safety Control

5. Conclusion and Future Works

5.1. Conclusion

This study has identified the high impact factors affecting the successful implementation of safety control practices in construction project from the perspective of contractors' practitioners. The level contribution of groups of factors is different according to each team of respondents. "Site Supervisor" and "Safety & Health" has rated "worker involvement related factors" as the highest impact compared to other group of factors. Engineer has chosen most of "material and equipment related factors" following with "worker involvement related factors" and also "workplace related factors". According to the contractors' practitioners, the least importance factor is "design related factors". This is because the factor is more related to consultant's job scope.

Based on the analysis, the top five (5) highest impact factors influencing the successful implementation of safety control practices are; (i) Lack of supervision, (ii) Lack of worksite inspection, (iii) Unsafe behaviour and attitudes, (iv) Poor housekeeping, (v) Lack of knowledge. The framework on safety control management is developed, the highest impact factors affecting the successful implementation of safety control practices in construction project (problems) can be determined and several control measures are suggested in order to overcome the highest rank problems

5.2. Recommendations

To make this study to be more significant in the future, there are several recommendations need to be considered as below:

1) Greater Number of Respondents

To increase the reliability and validity of the data that obtained from the survey questionnaire, the number of respondent should be greater than 30 respondents.

2) Increase the Number of Case Study Application

To add the number of case studies therefore the results can be compared and to ensure the data acquired through the studies is more reliable and accurate. Furthermore, the different construction projects would have the dissimilar environment and also safety issue at the construction project. Thus, more challenges can be explored through each case study.

3) Respondent with High Level of Education

To increase the correlation between the different group of respondent, reliability and validity of the data, the respondent for survey questionnaire should have high level of education such as degree holder (professional employee). The respondent with high level of education will answer carefully and more detail to the survey.

4) More Respondent from Safety & Health Group

To obtain more information regarding safety control management, the number of respondent from Safety & Health group should be increased. They are more familiar with safety management and issues.

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*Corresponding author.

E-mail address: idris_othman@ utp.edu.my