Effectiveness of Safety Control and Implementation in Construction Project

by

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19324

Dissertation submitted in partial fulfilment of
the requirements for the
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CERTIFICATION OF APPROVAL

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Approved by,

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Ir. Dr. Idris Bin Othman

UNIVERSITI TEKNOLOGI PETRONAS
BANDAR SERI ISKANDAR, PERAK
SEPT 2017

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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(NUR ZAHIRAH BINTI ABD AZIZ)

ABSTRACT

Construction industry is a booming sector of Malaysian economy, which 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 the application of 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 analyze 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 are identified as follows: (i) Lack of supervision, (ii) Lack of worksite inspection, (iii) Unsafe behavior and attitudes, (iv) Poor housekeeping, (v) Lack of knowledge, which 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.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

In Malaysia, the construction industry has developed since independence and according to Lewis (1955), most of capital formation contribute by work in construction. Nowadays, the construction sector is a very important and productive sector of the Malaysian economy. Since seventies, Malaysia, a fast developing nation in Asian region, 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).According to Trading Economics, Gross Domestic Product (GDP) contributes by construction industry increased to 13398 MYR Million in the first quarter of 2017 from 12582 MYR Million in the fourth quarter of 2016. Based on the report, GDP from Construction in Malaysia averaged 9808.72 MYR Million from 2010 until 2017, achieve the highest value of 13398 MYR Million in the first quarter of 2017 and a record low of 6464 MYR Million in the first quarter of 2010.

Figure 1.1 (a): Malaysian GDP from construction

Nowadays, 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. Some of the major projects that completed by the Malaysian construction industry are the world tallest tower, PETRONAS Twin Towers (1992-1998); the Kuala Lumpur International Airport (1993-1998); North South Expressway in 1994; Maju Express Way; Penang Bridge; Storm Water Management and Road Tunnels constructed during 2003 to 2007; Commonwealth Games Village; Pavilion and Bangsar Apartments; Price Court Medical Centre and several other projects. Malaysian contractors have also completed worldwide projects outside the Malaysia like Burj-al-Arab (Dubai), International Circuit Bahrain, New Doha International Airport, Dukhan Highway in Qatar (Hasan, 2012).

Figure 1.1 (b): Examples of projects completed

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 because of 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. The most common of fatalities in the construction industry are fall from height, hit by falling materials, collapse of earth and stone work, use of heavy machine and electrocution (C.M. Tam et al., 2004). 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. While identifying root causes of construction injuries Hinze et al. (1998) suggested that these five groups can be classified into 20 possible categories. These categories include falls from elevation, falls from ground level, electrocution due to power lines, electrocution due to building power, electrocution due to faulty facility wiring, electrocution due to faulty construction tool/wiring, electrocution due to other, struck by equipment, struck by falling material, struck by material (other than falling material), caught in/between equipment, caught in/between material, cave-in, explosion, fire, explosion/fire, asphyxiation, drowning, natural causes and other. Therefore, to prevent accidents, Petersen (1971) stressed the need to improve inspection procedures, and training, make better assignment of responsibilities, and pre-task planning by supervisors.

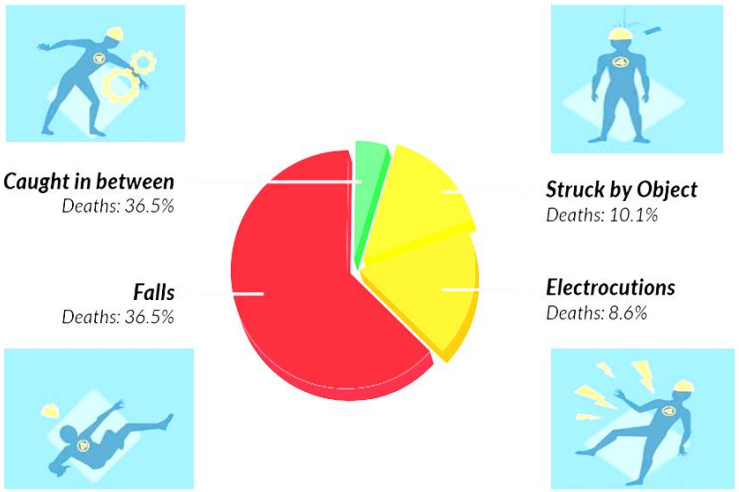

Figure 1.1 (c): Causes of construction injuries

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 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.

1.2 Problem Statement

In the development process of a country, construction industry undoubtedly plays a significant role, hence contributing towards employment and economic growth. This sector also provides the socio-economic infrastructure for industrial growth, production and basic amenities which is necessary for the country to develop and improve living standards of the society. 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 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.

1.3 Objectives

The purpose of this study is to establish the implementation of safety control for successful completion and mitigating hazards in construction projects by analyzing case study project and interviewing project team members. The objectives are outlined as below:

1. To identify and rank the factors affecting the implementation of safety control 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 during the construction phases through the application of case study project.
3. To propose a safety control framework suitable for contractors' practitioners to enhance the implementation of safety control in construction project.

1.4 Scope of Study

This research is to identify, rank and analyze factors influencing the implementation of safety control based on the actual case studies of a high-rise building construction project. The application of gap system in this research tends to improve the validity of it through identifying the relative factors that may have not been explored yet by past researches. 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.

1.5 Case Study

In order to validate the factors affecting the implementation of safety control, case study is conducted in this research. For this case study, it involves the contractor practitioners consisting engineer team, site supervisor team, safety & health team and others team. The case study took place at the high rise building construction project to further investigate the highest rank factors and to discuss on how these factors impact the cost, time, safety performance. Besides, to obtain the suggestion for improvement and to know the current practices at the project. So that the framework can be developed based on the case study and the study will tend to be more reliable as it compare with a real life context as well as establishing sources of evidences.

1.5.1 Project Details

Table 1.5.1(a) The details of the case study project

Contract Title	Cadangan Pembangunan Apartment Kos Rendah Taman Tunku Intan Safinaz (Fasa-1)
Construction Address	Lot PT4112, PT4138, PT4167 & PT4165 Bandar Darul Aman, Daerah Kubang Pasu, Kedah Darul Aman.
Client	BDB Land Sdn. Bhd.
Contractor	BDB Synergy Sdn. Bhd.
Contract Period	24 Months
Contract Sum	RM 20 000 000
Date Start	02 MAY 2015
Date Completion	01 MAY 2017
E.O.T	30 DECEMBER 2017

Table 1.5.1(b) The details of the consultants for the case study project

Consultants	Company
Project Management	APUDG
Architect	RUSHDAN MDSALLEH SDN. BHD.
Civil & Structural	PERUNDING TIMUR (K) SDN. BHD.
Mechanical & Electrical	SARJANA JURUTERA PERUNDING SDN. BHD.
Quantity Surveyor	JUB IKATAN SEPAKAT SDN. BHD.

1.5.2 The Location of Project

Figure 1.5.2: Taman Tunku Intan Safinaz (Fasa-1) Low Cost Apartment in Jitra, Kedah,

1.6 The Relevancy of Project

Currently, construction industry is one of the thriving sectors, thus contributing a great impact towards the growth of economy of one country. According to Construction Industry Development Board (2017), this industry is known as major contribution towards booming development. In 2016, the construction sector grew by 7.4% to RM166.4 billion from RM140 billion in 2015, which was up 8.2%. It also generates income towards another sector such as tourism, manufacturing and others.

However, construction work environment has been stigmatized as one of the most hazardous jobs. The construction labors often exposed to safety and also health risks throughout the construction process. The various forms of development in Malaysia especially high rise project have led to the various forms of fatalities and accidents at construction site such as falls, struck by objects, electrocutions, caught between object and others. Thus, indicating poor safety performance. Poor safety performance might be due to poor safety control including low safety awareness among contractor, attitude of management and workers and also reluctance to provide allocation of budget for safety program. These problems then will lead to disturbance in term of cost, time, reputation of construction company and affect the workers as well.

In conclusion, it is vital for the industry to enhance the implementation of safety control to improve safety performance at construction project. Thus, accidental injuries and losses in workplace can be reduced. This is referring to integrate safety aspect as one of the construction management dimension, thus cause less harm to the contractors' practitioner. The identification of the factors and construction practitioners' practices that influence the implementation of safety control and its analysis outcome could be relevant and useful for the successful completion of the construction project and safe working place throughout construction phase.

CHAPTER 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 (Brunette, 2004; Bansal, 2011; HKOSH, 2013; HSE, 2014; BLS, 2015). HSE (2009) state that the construction industry brings significant contribution and benefit in facilities production which initiate 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). Hallowell et al. (2013) stated that actions being taken in response to adverse trends in injuries. Measures regarding rate of accidents and compensation costs can either be forthcoming or after the event and are relatively uncommon (Cooper and Phillips 2004). 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).

According to Hallowell et al. (2013) as alternative, safety-related practices, for instance, unsafe behaviors and unsafe conditions can be measured during the construction phase. Thus, positive responses can be triggered before an unwanted incident occurs. The behavior 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. Thus, for the continuous collection and analysis of safety activities, a systematic approach is required to be adopted in order to prevent injuries and fatalities.

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 the Bureau of Labor statistics (2012), the U.S. construction sector has experienced for more than 1,000 fatal injuries every year between 1995 and 2008. In 2011, construction workers accounted for a fatality rate of 9.1 per 100,000 full-time equivalent (FTE) workers, as opposed to the all-worker fatality rate of 3.5 per 100,000 FTE workers (BLS, 2011). These injury

statistics clearly prove that construction workers are more likely to lose their lives or injured as compared to workers from other industries.

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. Hazards that can be detected during assessment may have less control in place; consequently, it may lead to severe threat to both safety of workers and the environment. Thus, it is very crucial to execute an organized effort to identify and evaluate processes and activities for potential hazards. Those kind of both informal and formal methods provide important information. From the information obtained, the safety problems can be addressed and operational risks can be managed.

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 behavior are very vital to be practiced.

Construction sites exhibit unique hazardous characteristics; for example, workers are crowded together on sites, operating at height and outdoors, with the use of heavy machine and equipment. 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. Such site accidents 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 in Construction Project

In construction industry, improper safety control known as one of the serious problems. The number of accidents in construction project is increasing proportionally with a vast development of this industry which then will affect the safety performance. Therefore, it is very vital to identify the factors and construction practitioners' practices that influence the safety control in construction project in order to overcome the problems stated 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.

2.3.1 Worker Involvement Factor

Firstly, for unsafe behavior 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).

2.3.2 Material and Equipment Factor

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 been 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.

2.3.3 Workplace Factor

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).

2.3.4 Management Factor

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).

Table 2.3.1 The worker involvement factors influence the implementation of safety control in construction project

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
WORKER INVOLVEMENT	**Unsafe behavior and attitudes**	• **Coudhry & Fang (2008)** • **Aksorn & Hadikusumo (2008)**	• 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.	• How to cultivate the interest of workers to participate in safety program? • How to ensure that the site worker can have positive group norms?
	Poor communication	• **Coudhry & Fang (2008)** • **Haslam et al. (2005)**	• To raise concern on the importance of having good communication within the work teams. • Poor communication affects the safety and also productivity of workers at which the commands and coordination are necessary in construction 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.	• What should be included in safety procedures to improve the communication problem? • How to improve the communication within main contractor and subcontractors?

Table 2.3.1 The worker involvement factors influence the implementation safety control in construction project (continued)

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
WORKER INVOLVEMENT	**Lack of knowledge**	• **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 of safety issues.	• How to ensure the contractor company gives the necessary education to the site labors in order to mitigate the occupational hazards at construction site?
	Tiredness and fatigue	• **Choudhry & Fang (2008)** • **Haslam et al. (2005)**	• The construction workers tend to work for long periods without a break due to overtime payment and also a 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.	• What are the necessary measures needs to be taken to ensure that the workers follow the correct safety procedure? • What alternatives can be done in high work load condition instead of making workers work continuously without sufficient rest?

Table 2.3.2 The material and equipment factors influence the implementation safety control in construction project

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
MATERIAL AND EQUIPMENT	**Shortcomings with equipment**	• **Aksorn & Hadikusumo (2008)** • **Rollenhagen & Kahlbom (2001)** • **Tam et al.(2004)**	• 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.	• What can be implemented to prevent the contractor company from using the old and obsolete equipment or sharing the equipment during carry out the construction activities?
	Inappropriate storage and handling of material	• **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 necessity of materials to 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 need of training session in the planning and provision of the appropriate material storage and handling facilities on site.	• How to successfully implement the storage technique following the sequence of operations on site? • What are the necessary conditions to be considered in placing an appropriate storage location? • The researchers did not discuss about how to give the simplest instruction to handle the materials. • Who, in the first place should provide the training session on material management for workers?

Table 2.3.2 The material and equipment factors influence the implementation of safety control in construction project (continued)

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
MATERIAL AND EQUIPMENT	**Poor condition of tools**	• **Awolusi & Marks (2017)** • **Haslam et al.(2005)**	• A number of the accidents are 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 been inspected regularly and undergoes maintenance.	• The researchers did not discuss on how to ensure the tools been inspected and undergoes maintenance time by time.
	Poor configuration of tools	• **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. • The alternatives for this problem should be explored.	• What are the alternatives for improvement of this problem? The researchers did not explored in details.

Table 2.3.3 The workplace factors influence the implementation safety control in construction project

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
WORKPLACE	**Poor housekeeping**	• **Haslam et al. (2005)** • **Choudhry & Fang (2008)**	• 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.	• How to improve safety and risk management culture in the construction industry? • The researchers do not mentioned the responsible party to overcome the poor housekeeping problem.
	Site constraint	• **Haslam et al. (2005)**	• Inadequate space or difficult access to perform a task contributes to fatalities. • Site constraint is due to inadequate planning coupled with poor local assessment.	• What are the alternatives that can be implemented to overcome this problem? • How to have adequate planning for this problem and how to improve?

Table 2.3.4 The management factors influence the implementation safety control in construction project

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
MANAGEMENT	**Changes to Design**	• **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.	• What kind of changes can be done on design? • What should be done before changing the design?
	Deficiencies in project management and planning	• **Haslam et al.(2005)** • **Choudhry & Fang (2008)**	• This leads to problems with blurred responsibility and difficulties with communication between one contractor and another. • Deficiencies in project management and planning 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. Thus, it can induce an accident to occur. • Management involvement and toolbox talks are the most effective factors for site safety. • Management is responsible for implementing the safety management systems including planning, organizing, providing safety policies and working procedures.	• How project scheduling problems affects the safety?

Table 2.3.4 The management factors influence the implementation safety control in construction project (continued)

	FACTOR	RESEARCHER	KEY STATEMENT	GAP
MANAGEMENT	**Deficiencies in risk management**	• **Choudhry & Fang (2008)** • **Haslam et al.(2005)**	• Accidents invariably involve an inadequately controlled risk, indicative of a management failing. • Operatives were well aware that they could be injured, become disabled or experience the possibility of death. • Perceptions of risk are important. Lack of knowledge or limited experience, then lead to a greater risk.	• How to improve risk management in construction project? • What kind of risks that are faced by construction worker and what are the suitable ways to reduce the risks. The researchers do not explain more about risk management.
	Lack of awareness from top management	• **Aksorn & Hadikusumo (2008)** • **Tam et al. (2004)**	• Employees usually imitate and follow the actions of management thus management is required to set a positive standard of safety behavior for all employees. • The top management sets 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.	• How to cultivate the interest regarding safety within the top management?

CHAPTER 3

METHODOLOGY

3.1 Research Methodology

In this chapter, the approach of methodological to this study will be discussed and outlined. Firstly, the research purpose and approach will be provided. Next, research strategy which consists of data collection (literature review, documentation, survey and interview), sample selection (respondent, case study), data analysis (Average Index, Relative Important Index (RII)) and Statistical package for the social sciences (SPSS) **(**correlation test, reliability test, validity test) is to be discussed. Lastly, a flowchart summarizing the research methodology and Gantt chart for this project will be provided.

3.2 Research Purpose

Descriptive method which involved collecting data in order to answer the questions concerning the subject of the research was chosen to be the research purpose 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).

There are four methodology phases of this research; literature review, case studies, empirical and evaluation. The purpose of this study is to identify factors affecting the implementation of safety control and rank them. While mainly looking into construction industry in Malaysia, the researcher is trying to understand better of the industry by describing the current performance of the Malaysian construction sector through study. Those will help the researcher to identify the areas of problems and try to provide corrective

measures towards the safety problem. Thus, this study can be explained as descriptive.

3.2.1 Literature Review

A literature review is an evaluative report of information obtained through literature that is related to the selected field of study. Literature review is done through further readings from journals, educational books and also from internet. The purpose of this phase is to provide an excellent starting point for researches to begin the research in a new area and most importantly, to ensure that researches do not duplicate work that has been done. Besides, to find the gap from the past research.

3.2.2 Case Study

In this research, case study concept is applied in order to analyze the causes and impacts of construction activities on safety and thus, make a comparison on application of safety practices in construction projects. The case study is chosen based on the following criteria mentioned as below:

- The project must be a high-rise building construction.
- The project must an on-going construction for practicality and feasibility of the research.
- The current practice for safety control.
- Applied to contractor practitioners only.

3.2.3 Empirical

The second phase which is to gather data and information related to the objective of this research.

3.2.4 Evaluation

This is the phase where gathered data were being processed and analyzed as results. The findings based on analysis that has been done, are then evaluated, discussed and summarized. Next, conclusion is made through the interpretation, evaluation and discussion of the findings. There are few recommendations proposed based on the conclusion in order to make an

improvement of the research. Thus, the results obtained, is much more reliable and valid.

3.3 Research Approach

A study that investigates the quality of relationships, activities, situations, or materials is frequently referred to as qualitative researches (Fraenkel & Wallen, 2012) which related to statement by Sugiyono (2013), qualitative method is focused on a natural object. Meaning that the main points brought by researcher, the data obtained are inductive, and the result focuses on meaning rather than generalization.

Regarding the explanation above, Maxwell (1996) proposed five purposes of qualitative research which are as follows:

1. To understand the given meaning of the participants in the research of the events, situations, and action involved based on their experience.
2. To understand the particular context regarding the participants action and the effect of this context towards their actions
3. To identify unanticipated phenomena and influences, and generating new grounded theories.
4. To understand the process by which events and actions take place.
5. To develop reasoning explanation.

The research approach was chosen due to the purpose of study. Therefore, the researcher has chosen qualitative as her research approach in order to get better understanding on the purpose.

3.4 Research Strategy

Survey and case study will be used as the research strategy of this study. Table below will show how Yin (1994) correlates each situation to the five alternative strategies.

Table 3.4: Different Research Strategies for Different Situation (Yin, 1994, p.6)

Strategy	Form of research Question	Requires control Over behavioural Event?	Focuses on Contemporary Events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, How many, how much	No	Yes
Archival analysis	Who, what, where How many, how much	No	yes/no
History	How, why	No	No
Case Study	How, why	No	Yes

This study purpose is to get clearer understanding of the factors which lead to successful implementation of safety control in the Malaysia construction sector. For this study, there are four kind of strategies been used including survey, archival analysis, history and case study. The intention of stating research questions is to avoid questions which would not cover broader understanding than the purpose of the study itself. Thus, survey and case study research strategy will help to cater the "how" and "what" research questions by focusing on the current events without requires control over the behavioral event. For archival analysis and history strategies, mostly used to know the condition of one issue time by time. As for example, the Gross Domestic Product (GDP) and accident rate for the construction project.

3.5 Data Collection

In this research, four sources of evidence used are literature review, documentation, survey and interview. The data were gathered through searching from journal papers, proceeding papers and also, internet. To find the factors affecting the implementation of safety control 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.

Documentation is also involved in the data collection process. According to Yin (1994, p.80) documentation strengths are stable, unobtrusive, exact and broad coverage. This means that data collection through documentation; could repeatedly be reviewed, not created from the case, details and reference of the event, contains real names and longer time span. Many events making document as a good source of evidence despite the weaknesses of retrievable, possibility of bias reporting and possibility of blockage to access.

The next data is the distribution of questionnaire survey to construction's professional including engineer, safety and health, site supervisor and others which have been involved in construction project. According to Martin and Bateson (1986) state that by increasing the sample size, more data collected, the statistical power is improved. 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.

Lastly, according to Yin (1994), in a case study data collection interviews are the most important source. Indeed McNamara (1999) mentioned that

interviews may be handful as follow-up to certain respondents to questionnaires such as to further investigate their responses. An interview guide was used to able the researcher and subject of case study 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. In conclusion, literature review, documentation, survey and interview are used as data collection strategy.

3.6 Sample Selection

A single case study on the factors affecting the successful implementation for safety control was chosen for sample selection. Based on Holme & Solvang (1997) the respondents' selection is crucial. The research may turn out to be invalid or worthless if the wrong persons are interviewed. First, the sample companies were notified via email, the intention of this study explained. In order to fulfill the research purpose, it was necessary to reach the person who possessed the most experience and knowledge of the research area, in this case engineers, site supervisor, safety & health and others. Therefore, the respondents were limited to contractor practitioners only.

3.7 Data Analysis

The next logical step after collecting information was to analyze the available data obtained from the respondents through questionnaire survey and interview. To analyze the data collected, Statistical Package for Social Science (SPSS) software will be used. SPSS is a comprehensive system for analyzing data; it could generate tabulated reports, charts, descriptive statistics, plots of distributions and complex statistical analysis from any type of data file (Chandler, M. 2016). Average Index (AI), Relative Importance Index (RII), correlation test, reliability test and validity test will be conducted in analyzing the data.

3.7.1 Average Index (AVI)

The factors were ranked based on their average; a factor with high score means that it has a high influence on the accidents rate and on the implementation of safety control in construction project. The ranges of each class are determined to ease the classification of the factors according to their importance (Al-rifai and Amoudi, 2016).

$$AVI = \frac{\sum(\beta * n)}{N}$$

Equation 3.7.1 Average index

Where,

β: Weighing given to each factor by the respondents (ranging from 1 to 5)

n: Frequency of the respondents

N: Total number of respondents

Based on the Likert scale, one (1) represents very low or strongly disagree and five (5) represents high impact or strongly agree. The range between the maximum and minimum values is 4. The range is divided by 5 to represent the five classes shown in the Likert scale (strongly disagree, disagree, neutral, agree, and disagree). The calculated interval for each class is 0.8 as shown in the table below:

Table 3.7.1 Average index rating scale

Average index (AVI)	Internal consistency

1.00 < x < 1.80	Very low
1.80 < x < 2.60	Low
2.60 < x < 3.40	Medium
3.40 < x < 4.20	High
4.20 < x < 5.00	Very High

The application of ranking obtained from the calculation is then used to cross-compare the average index of the factors as perceived four (4) selected group of construction practitioners including engineer, safety and supervisor. Based on ranking, identification of the most influence factors affecting the implementation of safety control in construction project can be done.

3.7.2 Relative Importance Index (RII)

The gathered data are analyzed through Relative Importance Index (RII) method in order, to determine the relative importance of various factors affect the implementation of safety control in construction project.

$$RII = \frac{\sum W}{A * N}$$

Equation 3.7.2 Relative importance index.

Where,

W: Weighting given to each factor by the respondents (ranging from 1 to 5)

A: Highest weight

N: Total number of respondents

The Relative Important Index value is within a range of 0 to 1. The higher the weight, the greater the factors influence the implementation of safety control in construction project.

3.8 Statistical Package for The Social Sciences (SPSS)

Statistical Package for the Social Sciences is a windows based program that can be used to perform data entry and analysis, also to create tables and graphs. It is known as one of the top statistical software for the ability to handle large amounts of data and can perform various form of analysis. SPSS is capable to generate various type of statistical analysis including descriptive statistics, prediction of numerical outcomes and also prediction of identifying groups.

3.8.1 Spearman's Correlation Test

Correlation is a statistical technique that shows how strongly two variables are related to each other or the degree of association between the two. It is a technique to measure how closely the number/possibilities related to each other. In a simple meaning, Spearman's rank correlation coefficient is a nonparametric measurement between 2 variables. Spearman's rank evaluate how closely a relationship between the variables. For this study, the correlation test was being done on the perspectives of the construction practitioners to identify the relation between one group's perspective to another group perspectives. A perfect Spearman correlation of +1 or −1 occurs when each of the variables is a perfect monotone function of the other. If there are no repeated data values, 0 values will occurs. The coefficient of Spearman's is suitable for discrete and continuous variables. The definition of Spearman correlation is shown below.

$$\rho = 1 - \frac{6\Sigma d_i^2}{n\,(n^2-1)}$$

Equation 3.8.1 Spearman's Coefficient.

Interpretation;

a. Close to -1 - Negative correlation.
b. Close to 0 - No linear correlation.
c. Close to 1 - Positive correlation.

3.8.2 Cronbach's Alpha Reliability test

In a general sense reliability is defined as the consistency of measurement (Linn and Gronlund, 2000) or the precision of measurement (Carlota, 1987). The higher the value obtained, the greater the reliability. In statistics, Cronbach's alpha (Reliability Test) is a coefficient of internal consistency. It is commonly used as an estimate of the reliability of a psychometric test for a sample of examinees. It is commonly used as an estimation of the reliability of a psychometric test for a sample of examinees. A "high" value for alpha does not imply that the measure is unidimensional. Cronbach's alpha is not a statistical test - it is a coefficient of reliability (or consistency). This test is to be computed using SPSS software. The Cronbach alpha coefficient value above 0.6 indicates that the measurement procedure is reliable (Toke et al., 2012).

Table 3.8.2 Cronbach's Alpha Consistency.

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.7 \leq \alpha \leq 0.9$	Good
$0.6 \leq \alpha \leq 0.7$	Acceptable
$0.5 \leq \alpha \leq 0.6$	Poor
$\alpha \leq 0.5$	Unacceptable

Equation 3.8.2 Cronbach's Alpha Coefficient.

Equation 3.8.2 Cronbach's Alpha Coefficient.

3.8.3 Validity test

Validity of an assessment is the degree to which it measures what it is supposed to measure. The validness of study is defined through the number of sources used as reference and absence of logical errors in drawing conclusions from the data (Agyekum, 2012; Yin, 2003; Garson, 2002). The data has been gathered from reliable sources of respondents who act as an important role in related department. The research questions were designed based on literature review that was drawn from the discussed theories. When a measure is both valid and reliable, the results will appear as in the image to the right. Though, just because a measure is reliable, it is not necessarily valid (and vice-versa). Validity is also dependent on the measurement measuring what it was designed to measure and not something else instead.

$$S = \sqrt{Reliability}$$

Equation 3.8.3 Validity

3.9 Flowchart of Methodology

Figure 3.9 will summarize the design methodology of this research from Research Purpose, Research Approach, Research Strategy, Data Collection, Sample Selection, Data Analysis and lastly Statistical Package for the Social Sciences (SPSS)

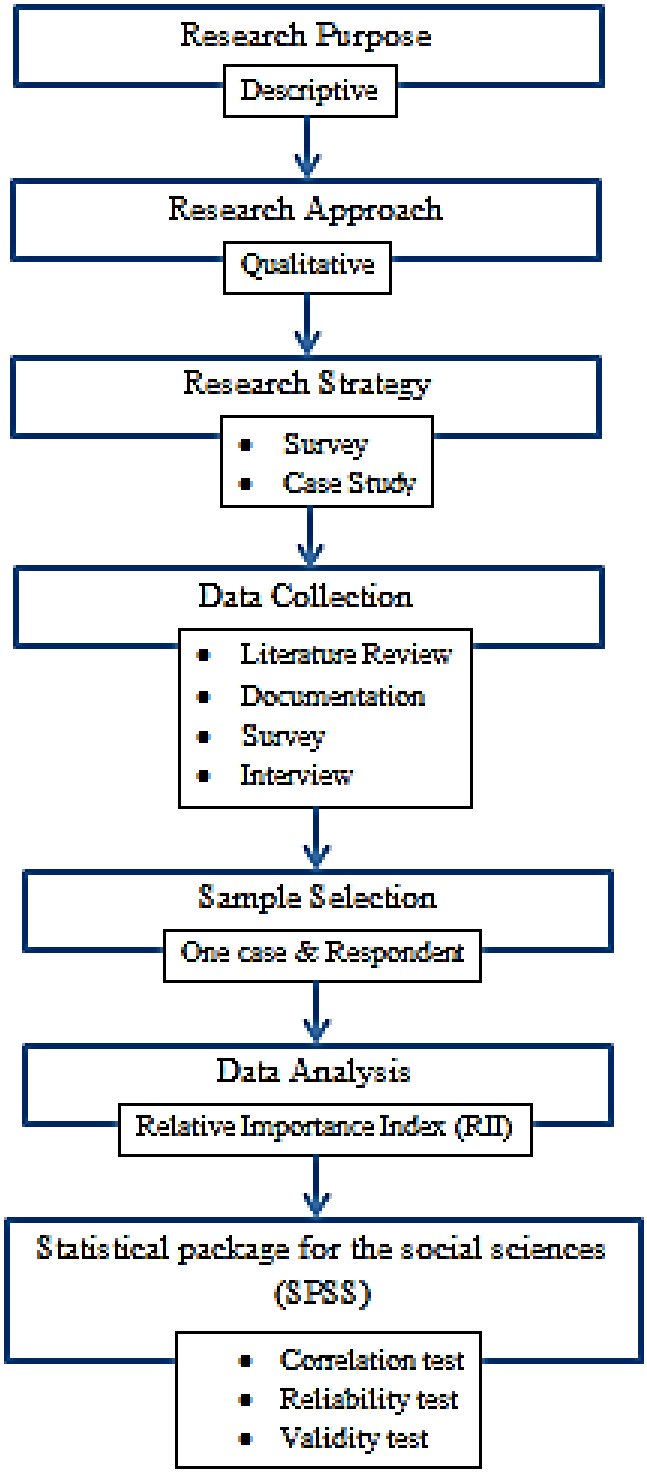

Figure 3.9: Flowchart of Research Methodology

3.10 Gantt Chart

3.10.1 Final Year Project I

Table 3.10.1 Final Year Project I

EFFECTIVENESS OF MANAGING RESOURCES FOR SAFETY CONTROL AND IMPLEMENTATION IN CONSTRUCTION PROJECT																												
ITEMS	**2017**														**2017**													
	MAY			**JUNE**			**JULY**					**AUG**			**SEPT**		**OCT**				**NOV**				**DEC**			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Task 1: Selection of project title																												
Task 2: Preliminary research work																												
Task 3: Preparation of research grant Proposal																												
Task 4: Submission of research grant Proposal																												
Task 5: CO-SV verification																												
Task 6: Preparation of extended proposal																												
Task 7: Submission of extended proposal																												
Task 8: Preparation of project defense Proposal																												
Task 9: Proposal defense																												
Task 10: Preparation of questionnaire																												
Task 11: Preparation of draft report																												
Task 12: Submission of draft report & Questionnaire																												
Task 13: Handling survey (questionnaire)																												
Task 14: Submission of final report (FYP I)																												

3.10.2 Final Year Project II

Table 3.10.2 Final Year Project II

EFFECTIVENESS OF MANAGING RESOURCES FOR SAFETY CONTROL AND IMPLEMENTATION IN CONSTRUCTION PROJECT																											
ITEMS	**2017**														**2017**												
	MAY			**JUNE**				**JULY**				**AUG**			**SEPT**		**OCT**				**NOV**				**DEC**			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Task 15: Site visit &conducting interviews																												
Task 16: Analysis on the data collected																												
Task 17: Submission of progress report																												
Task 18: PRE-SEDEX																												
Task 19: Submission of draft final report																												
Task 20 :Submission of project dissertation (soft bound)																												
Task 21: Submission of technical paper																												
Task 22: VIVA (Oral presentation)																												
Task 23: Submission of project Dissertation (hard bound)																												

3.11 Key Milestone

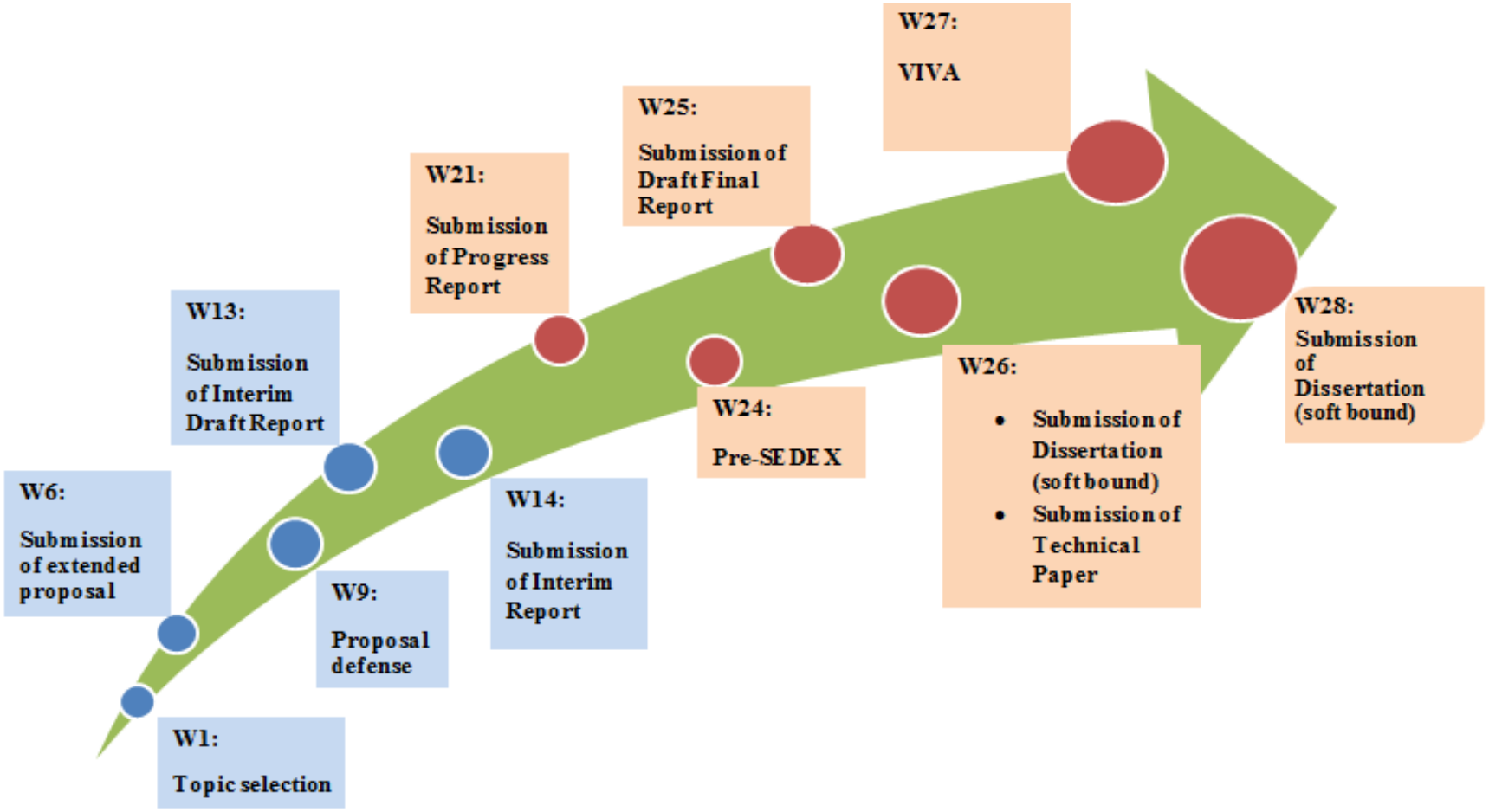

Figure 3.11 Key Milestones for FYP 1 and FYP 2

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter aims to analyze and further discuss on the findings of this study. The data gathered are interpreted and certain relation between the results is highlighted to address the objectives of the research. The quantitative study findings are outlined both in table and text form. The questionnaire is categories into three (3) sections as stated in previous chapter, focuses on construction practitioners including engineer, safety and supervisor.

4.2 Feedback on The Questionnaire

A total of twenty three (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 obseMrved 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.

The data shows that all of respondent (100%) claimed that their current companies were implementing safety control practices on site. **Table 4.2(d)** shows the general information that represents the first section of questionnaire. It demonstrates that most of the respondents approximately 53.3% were in the range of age between twenty to twenty nine years old followed by range of age between forty to forty nine years old with second highest percentage which is 30% of respondents. Then, 13.3% of respondents were more than fifty years old and the least percentage, 3.3% is contributed by respondent in the age between thirty to thirty nine years old. The gender shown that most of the respondents are male which is about 66.7% and for female is 33.3%. The qualification of respondent ranging from Doctor of Philosophy, PhD (3.3%), followed by Master Degree (3.3%), Bachelor Degree (40%), Diploma (43.3%) and SIJIL/STPM (10%). The data also

shows that about 30% of respondents hold positions as an engineer (project manager, site engineer and project engineer), 20% of respondents are site supervisor while the rest are 16.7% of safety & health and 33.3% of others (quantity surveyor, government officer, executive director, owner of contractor company, QAQC team). For this survey, majority of respondent, 50%t of them have working experience less than five (5) years. Besides, 46.7% of respondents were contributed by more than ten (10) years of working experience and the least number of respondent contributing 3.3% have working experience less than ten (10) years.

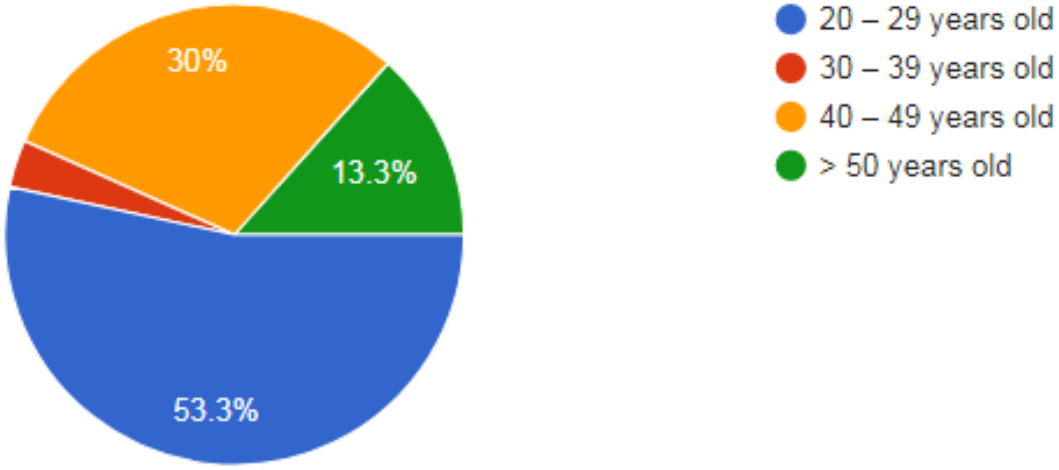

Figure: 4.2(a): Age of Respondents

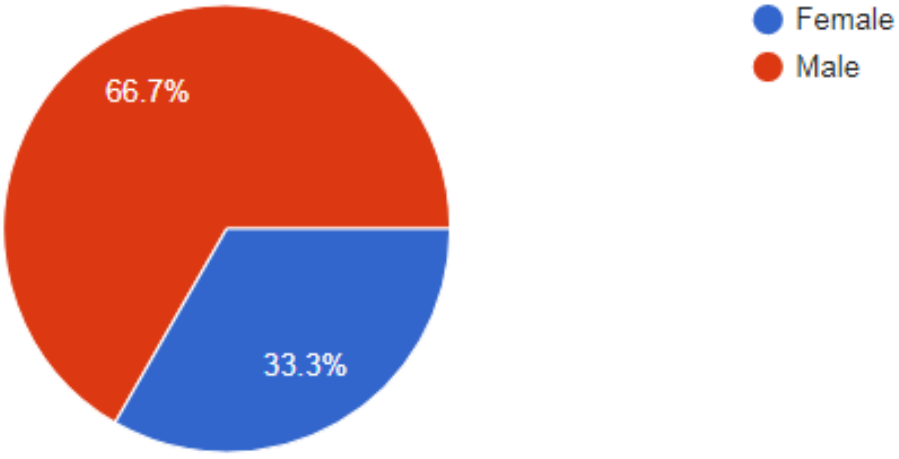

Figure 4.2(b): Gender of respondents

Table 4.2(a): Qualification of respondents

QUALIFICATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	PHD	1	3.3	3.3	3.3
	Master	1	3.3	3.3	6.7
	Degree	12	40.0	40.0	46.7
	Diploma	13	43.3	43.3	90.0
	SIJIL/STPM	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

Table 4.2(b): Designation of respondents

DESIGNATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Engineer	9	30.0	30.0	30.0
	Site Supervisor	6	20.0	20.0	50.0
	Safety & Health	5	16.7	16.7	66.7
	Others	10	33.3	33.3	100.0
	Total	30	100.0	100.0	

Table 4.2(c): Working duration of respondents

WORKING_DURATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	15	50.0	50.0	50.0
	Less than 10 years	1	3.3	3.3	53.3
	More than 10 years	14	46.7	46.7	100.0
	Total	30	100.0	100.0	

Table 4.2(d): The demographic characteristics of respondents

Items	Description	Frequency	Percentage
AGE	20-29 years old	16	53.3
	30-39 years old	1	3.3
	40-49 years old	9	30.0
	More than 50 years old	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
	Bachelor Degree	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	Less than 5 years	15	50.0
	Less than 10 years	1	3.3
	More than 10 years	14	46.7

4.3 Factors Affecting The Implementation of Safety Control in Construction Project

4.3.1 Worker Involvement Related Factors

Table 4.3.1 The rank of worker involvement related factors affects the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	CLASS	RII	RANK
A.1	Unsafe behavior and attitudes	4.000	High	0.800	1
A.3	Lack of knowledge	3.867		0.773	2
A.6	Lack of coordination between the main contractor and subcontractor	3.800		0.760	3
A.4	Lack of experience	3.700		0.740	4
A.7	Lack of teamwork spirit	3.700		0.740	5
A.2	Poor communication	3.667		0.733	6
A.5	Tiredness and fatigue	3.433		0.687	7

As shown in **Table 4.3.1** above, the highest rank factors of worker involvement related factors are “A.1: unsafe behavior and attitudes” with RII (0.800) while “A.3: lack of knowledge” ranked as the second most important factors with RII (0.773). Then, followed by “A.6: lack of coordination

between the main contractor and subcontractor" with RII (0.760). "A.4: lack of experience" and "A.7: lack of teamwork spirit" factors shared the same RII (0.740). Next, followed by "A.2: poor communication" have RII (0.733) and the lowest RII (0.687) is contributed by "A.5: tiredness and fatigue". For average index (AVI), all of the factors in this "worker involvement related factors" fall in the ranges ($3.4 < x < 4.2$) and classified as high impact factor towards the factors affect the effectiveness implementation of safety control in construction project.

4.3.2 Material and Equipment Related Factors

Table 4.3.2 The rank of material and equipment related factors affects the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	CLASS	RII	RANK
B.5	Lack of supervision	4.033	High	0.807	1
B.2	Inappropriate storage and handling of material	3.700		0.740	2
B.7	Lack of personal protective equipment	3.700		0.740	3
B.3	Poor condition of tools	3.633		0.727	4
B.1	Shortcomings with equipment	3.567		0.713	5
B.4	Poor configuration of tools	3.500		0.700	6
B.6	Lack of protection in material transportation	3.167	Medium	0.633	7

Based on the ranking shown as **Table 4.3.2** above, the highest rank factors of material and equipment related factors are"B.5: lack of supervision" with RII (0.807). Then, "B.2: inappropriate storage and handling of material" and "B.7: lack of personal protective equipment" ranked as the second and third most important factors respectively with the same RII (0.740). Next, followed by "B.3: poor condition of tools" with RII (0.727), "B.1: shortcomings with equipment" with RII (0.713) and "B.4: Poor configuration of tools" with RII (0.700). Lastly, the lowest RII (0.633) is contributed by "B.6: lack of protection in material transportation" and it considers as medium impact towards the factors affect the effectiveness implementation of safety control in construction project since the AVI (3.167) which is within the range ($3.4 < x < 4.2$). About 86 % of the factors' including "B.5: lack of supervision",

"B.2: inappropriate storage and handling of material", "B.7: lack of personal protective equipment", "B.3: poor condition of tools", "B.1: shortcomings with equipment" and "B.4: Poor configuration of tools" have an average index (AVI) of 4.033, 3.700, 3.700, 3.633, 3.567 and 3.500 respectively falls in the range within ($3.4 < x < 4.2$) which is classified as high impact factors while "B.6: lack of protection in material transportation" consider as medium impact towards the factors affect the effectiveness implementation of safety control in construction project.

4.3.3 Workplace Related Factors

Table 4.3.3 The rank of workplace related factors affects the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	CLASS	RII	RANK
C.6	Lack of worksite inspection	4.003	High	0.807	1
C.1	Poor housekeeping	3.900		0.780	2
C.3	Accidents due to negligence/ careless	3.867		0.773	3
C.7	Reluctance to input resources for safety	3.767		0.753	4
C.4	Poor construction sequence	3.467		0.693	5
C.5	Improper security of job site	3.433		0.687	6
C.2	Site constraint	3.400		0.680	7

Based on the ranking shown as **Table 4.3.3** above, the highest rank factors of workplace related factors are "C.6: lack of worksite inspection" with RII (0.807) while "C.1: poor housekeeping" and "C.3: accidents due to negligence/ careless" ranked as the second and third most important factors with RII (0.780) and RII (0.773) respectively. Next, followed by "C.7: reluctance to input resources for safety" with RII (0.753) and "C.4: poor construction sequence" with RII (0.693). For "C.5: improper security of job site", the factor contributes RII (0.687) and the lowest value for RII is obtained by "C.2: site constraint" at RII (0.680). All of the factors which are "C.6: lack of worksite inspection", "C.1: poor housekeeping", "C.3: accidents due to negligence/ careless", "C.7: reluctance to input resources for safety", "C.4: poor construction sequence", "C.5: improper security of job site" and "C.2: site constraint", have an average index (AVI) of 4.033, 3.900, 3.867, 3.767, 3.467, 3.433 and 3.400 respectively. The AVI are in the range within

(3.4 < x < 4.2) which is classified as high impact towards the factors affect the effectiveness implementation of safety control in construction project.

4.3.4 Design Related Factors

Table 4.3.4 The rank of management related factors affects the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	CLASS	RII	RANK
D.4	Lack of awareness from top management	3.667	High	0.733	1
D.5	Subcontractor selection and management	3.533		0.707	2
D.7	Lack of organizational commitment	3.500		0.700	3
D.3	Deficiencies in risk management	3.433		0.687	4
D.6	Performance pressure	3.333	Medium	0.667	5
D.2	Deficiencies in project management and planning	3.167		0.633	6
D.1	Changes to design	2.800		0.560	7

Based on the ranking shown as **Table 4.3.4** above, the highest rank factors of design related factors are "D.4: lack of awareness from top management" with RII (0.733) and second most highest is "D.5: subcontractor selection and management" with RII (0.707). Next, followed by "D.7: lack of organizational commitment", "D.3: deficiencies in risk management", "D.6: performance pressure" and "D.2: deficiencies in project management and planning" ranked as the third, fourth, fifth and sixth most important factors with the RII 0.700, 0.687, 0.667 and 0.633 respectively. Then the least important factor is "D.1: changes to design" with RII (0.560). About 57% of the factors including "D.4: lack of awareness from top management", "D.5: subcontractor selection and management", "D.7: lack of organizational commitment" and "D.3: deficiencies in risk management" have an average index (AVI) of 3.667, 3.533, 3.500and 3.433 respectively falls in the range within (3.4 < x < 4.2) which is classified as high impact factors while another 43% of the factors consisting of "D.6: performance pressure", "D.2: deficiencies in project management and planning" and "D.1: changes to design" are considered as medium impact towards the factors affect the effectiveness implementation of safety control in construction project.

4.4 Contractors Practitioners' Perspective

4.4.1 Engineer's Perspectives

Table 4.4.1 The engineer's rank of factors affect the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
WORKER INVOLVEMENT RELATED FACTORS					
A.1	Unsafe behavior and attitudes	3.556	0.711	1.130	11
A.2	Poor communication	3.444	0.689	1.130	19
A.3	Lack of knowledge	3.556	0.711	0.882	12
A.4	Lack of experience	3.556	0.711	0.726	13
A.5	Tiredness and fatigue	3.556	0.711	1.130	14
A.6	Lack of coordination between the main contractor and subcontractor	3.889	0.778	0.928	1
A.7	Lack of teamwork spirit	3.778	0.756	0.833	3
MATERIAL AND EQUIPMENT RELATED FACTORS					
B.1	Shortcomings with equipment	3.667	0.733	0.866	6
B.2	Inappropriate storage and handling of material	3.667	0.733	1.000	7
B.3	Poor condition of tools	3.556	0.711	0.882	15
B.4	Poor configuration of tools	3.556	0.711	1.130	16
B.5	Lack of supervision	3.889	0.778	0.782	2
B.6	Lack of protection in material transportation	3.111	0.622	1.364	26
B.7	Lack of personal protective equipment	3.444	0.689	1.130	20
WORKPLACE RELATED FACTORS					
C.1	Poor housekeeping	3.778	0.756	1.302	4
C.2	Site constraint	3.667	0.733	0.866	8
C.3	Accidents due to negligence/ careless	3.556	0.711	1.130	17
C.4	Poor construction sequence	3.444	0.689	1.130	21
C.5	Improper security of job site	3.444	0.689	1.014	22
C.6	Lack of worksite inspection	3.778	0.756	0.833	5
C.7	Reluctance to input resources for safety	3.556	0.711	1.130	18
MANAGEMENT RELATED FACTORS					
D.1	Changes to design	2.556	0.511	0.527	28
D.2	Deficiencies in project management and planning	3.111	0.622	1.167	27
D.3	Deficiencies in risk management	3.444	0.689	1.130	23
D.4	Lack of awareness from top management	3.667	0.733	1.000	9
D.5	Subcontractor selection and management	3.667	0.733	0.866	10
D.6	Performance pressure	3.222	0.644	0.833	24
D.7	Lack of organizational commitment	3.222	0.644	0.972	25

AVI

Very high	**(4.2 < X < 5.0)**
High	**(3.4 < X < 4.2)**
Medium	**(2.6 < X < 3.4)**
Low	**(1.8 < X < 2.6)**
Very low	**(1.0 < X < 1.8)**

N = 30
FC: Factor code
AVI: Average index
SD: Standard deviation
RII: Relative importance index

The data obtained on engineer's perspective of the total of twenty eight factors affecting the implementation of safety control in construction project is presented in table 4.3.2.1. The data demonstrated, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). Based on the table 4.3.2.1, Relative Importance Index (RII) of the factors affect the successful implementation of safety control in construction project ranges between 0.511 and 0.778.

Based on the analysis of the results, the engineer's team selected "A.6: lack of coordination between the main contractor and subcontractor" as the highest rank factor with RII (0.778), AVI (3.889) and SD (0.928) as shown in the table above, while "B.5: lack of supervision" contributed to the second most important factor with the same RII (0.778) and AVI (3.889) but different SD (0.782). "A.6: lack of coordination between the main contractor and subcontractor" is classified as high impact factors with average index value (AVI) within (3.4 < x < 4.2). The respondents indicate that most of "material and equipment related factors" are within the top seven highest ranks as compared to the other group of factors. It can be observed that three (3) out of seven (7) for "material and equipment related factors" are within the highest rank.

This indicates that the most important factors which gives the highest impact on the effectiveness implementation of safety control according to engineer's perspective are "A.6:lack of coordination between the main contractor and subcontractor" and "B.5: lack of supervision" while "changes to design" is the least considered with lowest RII (0.511) and AVI (2.556) as shown in table above. This shows that most of respondent under engineer's category agree that "material and equipment related factors" affect the successful

implementation of safety control. It can be seen that the "material and equipment related factors" covering "B.1: shortcomings with equipment", "B.2: inappropriate storage and handling of material", "B.5: lack of supervision" which are relevant to workers and contractors, have the highest contribution to low safety performance. This is due to poor material and equipment management. Most of the engineers individually are agreed that contractor are less aware about the importance of safety and tend to neglect the safety control. This is because to them, the implementation of 100% safety or risk free at site is costly and the budget for safety is not included during tendering phase. Thus, possibly, they would prefer to avoid from complying the control measure. In order to address this issue, the detail and comprehensive safety and health provision should be provided and made as mandatory inside the contract document. Therefore, the contractor will strictly bounded to all the requirements that have been written inside the Bill of Quantities (BQ), increasing the level of awareness of the contractor towards the safety requirement and help to plan, as well as mitigating the construction safety issues.

4.4.2 Site Supervisor's Perspectives

Table 4.4.2 The site supervisor's rank of factors affect the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
WORKER INVOLVEMENT RELATED FACTORS					
A.1	Unsafe behavior and attitudes	**3.500**	0.700	1.378	5
A.2	Poor communication	**3.500**	0.700	1.941	6
A.3	Lack of knowledge	**3.833**	0.767	1.169	2
A.4	Lack of experience	**3.667**	0.733	1.033	3
A.5	Tiredness and fatigue	**2.833**	0.567	1.169	24
A.6	Lack of coordination between the main contractor and subcontractor	**3.333**	0.667	1.211	14
A.7	Lack of teamwork spirit	**3.500**	0.700	1.225	7
MATERIAL AND EQUIPMENT RELATED FACTORS					
B.1	Shortcomings with equipment	**3.500**	0.700	1.049	8
B.2	Inappropriate storage and handling of material	**3.333**	0.667	1.211	15

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
B.3	Poor condition of tools	3.500	0.700	1.049	9
B.4	Poor configuration of tools	3.167	0.633	0.983	18
B.5	Lack of supervision	4.167	0.833	1.169	1
B.6	Lack of protection in material transportation	2.833	0.567	0.983	25
B.7	Lack of personal protective equipment	3.500	0.700	0.837	10
WORKPLACE RELATED FACTORS					
C.1	Poor housekeeping	3.500	0.700	0.548	11
C.2	Site constraint	3.000	0.600	0.632	22
C.3	Accidents due to negligence/ careless	3.333	0.667	1.211	16
C.4	Poor construction sequence	2.833	0.567	0.983	26
C.5	Improper security of job site	3.167	0.633	0.753	19
C.6	Lack of worksite inspection	3.667	0.733	1.033	4
C.7	Reluctance to input resources for safety	3.500	0.700	0.837	12
MANAGEMENT RELATED FACTORS					
D.1	Changes to design	2.833	0.567	1.329	27
D.2	Deficiencies in project management and planning	3.000	0.600	1.265	23
D.3	Deficiencies in risk management	3.167	0.633	1.472	20
D.4	Lack of awareness from top management	3.500	0.700	1.049	13
D.5	Subcontractor selection and management	3.333	0.667	0.816	17
D.6	Performance pressure	2.833	0.567	0.983	28
D.7	Lack of organizational commitment	3.167	0.633	1.472	21

AVI

- Very high **(4.2 < X < 5.0)**
- High **(3.4 < X < 4.2)**
- Medium **(2.6 < X < 3.4)**
- Low **(1.8 < X < 2.6)**
- Very low **(1.0 < X < 1.8)**

N = 30
FC: Factor code
AVI: Average index
SD: Standard deviation
RII: Relative importance index

The data obtained on site supervisor's perspective of the selected factors affecting the implementation of safety control is presented in table 4.3.2.2. The data demonstrates top seven (7) out of twenty eight (28) factors imposed the higher impact towards the successful implementation of safety control in construction project. It is shown that the relative importance index (RII) of the causative factors of the poor safety performance ranges between 0.567 to 0.833. Based on the analysis of the results, the site supervisor team selected "B.5: lack of supervision" as the highest rank factors with RII (0.833), mean

score (4.17) and SD (1.169) as shown in table above, while "A.3: lack of knowledge" represents the second most important factor with RII (0.767), mean score (3.83) and SD (1.169).

About 46 % of factors are categorized as high impact factors affect the successful implementation of safety control in construction project while the remaining 54 % of factors classified as medium class. The respondents indicate that most of "worker involvement related factors" are within the top seven highest ranks compared to the other group of factors. As the results shown, the five (5) "worker involvement related factors" which are "A.1: unsafe behavior and attitudes", "A.2: poor communication", "A.3 : lack of knowledge", "A.4: lack of experience" and "A.7: lack of teamwork spirit" have dominated the top seven ranking.

According to site supervisor's perspective, the most important factor that dominates the highest impact on the effectiveness implementation of safety control is "B.5: lack of supervision" whereas "D.6: performance pressure" is the least considered as shown in table 4.3.2.2. Despite the highest rank which falls under "material and equipment related factors" category, the data obtained shows that most of respondents under site supervisor team agree that majority of the factors under "worker involvement related factors" category influenced the safety performance at construction project the most. It can be seen that the top ranking factors in "worker involvement related factors" is due to inexperienced or limited safety knowledge of fresh manpower. These weaknesses will then lead to reckless and unsafe behavior of the worker, hence increasing the fatalities at risky construction site.

4.4.3 Safety & Health's Perspectives

Table 4.4.3 The safety & health's' rank of factors affect the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
WORKER INVOLVEMENT RELATED FACTORS					
A.1	Unsafe behavior and attitudes	**4.000**	0.800	0.707	1
A.2	Poor communication	**4.000**	0.800	0.707	2

A.3	Lack of knowledge	4.000	0.800	0.707	3
A.4	Lack of experience	3.800	0.760	0.837	5
A.5	Tiredness and fatigue	3.600	0.720	0.894	11
A.6	Lack of coordination between the main contractor and subcontractor	3.800	0.760	0.837	6
A.7	Lack of teamwork spirit	3.200	0.640	1.095	17
MATERIAL AND EQUIPMENT RELATED FACTORS					
B.1	Shortcomings with equipment	3.200	0.640	0.837	18
B.2	Inappropriate storage and handling of material	3.000	0.600	1.000	22
B.3	Poor condition of tools	3.800	0.760	0.447	7
B.4	Poor configuration of tools	3.200	0.640	0.837	19
B.5	Lack of supervision	3.200	0.640	0.548	20
B.6	Lack of protection in material transportation	3.000	0.600	0.707	23
B.7	Lack of personal protective equipment	3.800	0.760	1.095	8
WORKPLACE RELATED FACTORS					
C.1	Poor housekeeping	3.800	0.760	0.837	9
C.2	Site constraint	3.000	0.600	0.707	24
C.3	Accidents due to negligence/ careless	3.800	0.760	0.447	10
C.4	Poor construction sequence	3.200	0.640	0.837	21
C.5	Improper security of job site	2.800	0.560	0.837	27
C.6	Lack of worksite inspection	4.000	0.800	0.707	4
C.7	Reluctance to input resources for safety	3.600	0.720	1.140	12
MANAGEMENT RELATED FACTORS					
D.1	Changes to design	2.600	0.520	0.894	28
D.2	Deficiencies in project management and planning	3.000	0.600	1.000	25
D.3	Deficiencies in risk management	3.000	0.600	1.000	26
D.4	Lack of awareness from top management	3.400	0.680	0.894	15
D.5	Subcontractor selection and management	3.400	0.680	1.342	16
D.6	Performance pressure	3.600	0.720	1.140	13
D.7	Lack of organizational commitment	3.600	0.720	0.548	14

AVI

- Very high **(4.2 < X < 5.0)**
- High **(3.4 < X < 4.2)**
- Medium **(2.6 < X < 3.4)**
- Low **(1.8 < X < 2.6)**
- Very low **(1.0 < X < 1.8)**

N = 30
FC: Factor code
AVI: Average index
SD: Standard deviation
RII: Relative importance index

The data obtained on safety & health perspective of the selected factors influencing the safety control at construction project is indicated as shown in table 4.3.2.3. The data displayed top seven (7) out of twenty eight (28) factors triggered the high impact towards the implementation of safety control in construction project. Referring to table 4.3.2.3, all of the factors are important though their degree of importance varies. It is shown that the relative importance index (RII) of the contributory factors of the poor safety performance ranges between 0.520 and 0.800.

Analysis of the results shown that the safety & health's team selected four (4) factors as the highest rank factor with the same RII (0.800), AVI (4.000) and SD (0.707). The highest rank factors are "A.1: unsafe behavior and attitudes", "A.2: poor communication", "A.3: lack of knowledge" from "worker involvement related factor" and "C6: lack worksite inspection" from "workplace related factor". The remaining top seven (7) rank which are "A.4: lack of experience", "A.6: lack of coordination between the main contractor and subcontractor" and "B3: poor condition of tools' represent the second most important factor with common RII (0.760) and AVI (3.800) but different SD. Most of the contributory factors are contributed by "worker involvement related factor" category at which five (5) out of seven (7) factors are within the highest rank.

This implies that the most important factor which poses the highest impact on the effectiveness implementation of safety control according to safety & health's perspective is under "worker involvement related factor" category while "D.1: changes to design" under "management related factor" is the least considered with lowest RII (0.520) and AVI (2.600) with SD (0.894). According to safety & health's point of view, the attitude of the workers is the main root of the safety problem at construction site. Lack of knowledge, poor communication and lack of worksite inspection has worsened the safety performance. As to this team, every construction labor has to play the role at site by continuously complying the safety rules and one should be prevent reckless operation in doing their job. So that, safety & health team has

recommended to each construction project to place at least a full time safety & health to control and manage general workers through their safety knowledge with assessment prior engagement to any site work. This is to ensure the manpower are able to identify and mitigate the construction risk, thus contributing to the successful of safety control implementation at construction project.

4.4.4 Others' Perspectives

Table 4.4.4 The others' rank of factors affect the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
WORKER INVOLVEMENT RELATED FACTORS					
A.1	Unsafe behavior and attitudes	**4.700**	0.940	0.483	1
A.2	Poor communication	**3.800**	0.760	0.422	16
A.3	Lack of knowledge	**4.100**	0.820	0.568	7
A.4	Lack of experience	**3.800**	0.760	0.632	17
A.5	Tiredness and fatigue	**3.600**	0.720	0.843	22
A.6	Lack of coordination between the main contractor and subcontractor	**4.000**	0.800	0.816	8
A.7	Lack of teamwork spirit	**4.000**	0.800	0.943	9
MATERIAL AND EQUIPMENT RELATED FACTORS					
B.1	Shortcomings with equipment	**3.700**	0.740	0.823	20
B.2	Inappropriate storage and handling of material	**4.300**	0.860	0.675	4
B.3	Poor condition of tools	**3.700**	0.740	1.059	21
B.4	Poor configuration of tools	**3.800**	0.760	1.033	18
B.5	Lack of supervision	**3.900**	0.780	0.876	12
B.6	Lack of protection in material transportation	**3.500**	0.700	0.972	26
B.7	Lack of personal protective equipment	**4.000**	0.800	0.943	10
WORKPLACE RELATED FACTORS					
C.1	Poor housekeeping	**4.300**	0.860	0.823	5
C.2	Site constraint	**3.600**	0.720	0.843	23
C.3	Accidents due to negligence/ careless	**4.500**	0.900	0.707	2
C.4	Poor construction sequence	**4.000**	0.800	1.054	11
C.5	Improper security of job site	**3.900**	0.780	1.197	13
C.6	Lack of worksite inspection	**4.500**	0.900	0.707	3
C.7	Reluctance to input resources for safety	**4.200**	0.840	0.919	6
MANAGEMENT RELATED FACTORS					

D.1	Changes to design	3.100	0.620	1.287	28
D.2	Deficiencies in project management and planning	3.400	0.680	0.699	27
D.3	Deficiencies in risk management	3.800	0.760	0.789	19
D.4	Lack of awareness from top management	3.900	0.780	0.876	14
D.5	Subcontractor selection and management	3.600	0.720	1.075	24
D.6	Performance pressure	3.600	0.720	1.075	25
D.7	Lack of organizational commitment	3.900	0.780	0.738	15

AVI

- Very high **(4.2 < X < 5.0)**
- High **(3.4 < X < 4.2)**
- Medium **(2.6 < X < 3.4)**
- Low **(1.8 < X < 2.6)**
- Very low **(1.0 < X < 1.8)**

N = 30
FC: Factor code
AVI: Average index
SD: Standard deviation
RII: Relative importance index

The data obtained on others' (comprised of quantity surveyor, government officer, executive director, owner of contractor company, QAQC team) perspective of the selected factors affecting the implementation of safety control is presented in table 4.3.2.4. The data demonstrated, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). Based on the table 4.3.2.4, relative importance index (RII) of the contributory factors influencing the successful implementation of safety control in construction project ranges between 0.680 to 0.940.

Based on the analysis of the results, the others' team selected "A.1: unsafe behavior and attitude" from "worker involvement related factor" category as the highest rank factor with RII (0.940), AVI (4.700) and SD (0.483) as shown in the table above, whereas "C.3: accidents due to negligence/ careless" and " C.6: lack of worksite inspection" form "workplace related factor" category represents the second most important factor with RII (0.900), AVI (4.500) and SD (0.707). The respondents indicate that most of "workplace related factors" are within the top seven (7) highest ranks compared to the other group of factors. It can be observed that four (4) out of seven (7) "workplace related factors" are within the highest rank.

This implies that the most important factor which poses the highest impact on the effectiveness implementation of safety control according to others' perspective is "A.1: unsafe behavior and attitude" while " is "D.1: changes to design" is the least considered with the lowest RII (0.680) and AVI (3.100) with SD (0.699) as shown in the table above. Based on the analysis, majority of respondent agree that "workplace related factor" affect the successful implementation of safety control. It can be seen that the factors including "C.1: poor housekeeping", "C.3: accidents due to negligence/ careless", "C.6: lack of worksite inspection" and "C.7: reluctance to input resources for safety". In this analysis, there are five (5) factors which are classified as very high impact factor which is ranged (4.2 < X < 5.0) on the effectiveness implementation of safety control. The factors are "A.1: unsafe behavior and attitudes", "B.2: Inappropriate storage and handling of material", "C.3: poor housekeeping", "C.3: accidents to negligence/ careless" and "C.6: lack of worksite inspection" which are relevant to workers and contractors, have the highest contribution for poor safety performance due to poor working culture.

4.4.5 Overall perspective

Table 4.4.5 The overall rank of factors affect the implementation of safety control.

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
WORKER INVOLVEMENT RELATED FACTORS					
A.1	Unsafe behavior and attitudes	**4.000**	0.800	1.050	3
A.2	Poor communication	**3.667**	0.733	0.922	13
A.3	Lack of knowledge	**3.867**	0.773	0.819	5
A.4	Lack of experience	**3.700**	0.740	0.750	9
A.5	Tiredness and fatigue	**3.433**	0.687	1.006	22
A.6	Lack of coordination between the main contractor and subcontractor	**3.800**	0.760	0.925	7
A.7	Lack of teamwork spirit	**3.700**	0.740	0.988	10
MATERIAL AND EQUIPMENT RELATED FACTORS					
B.1	Shortcomings with equipment	**3.567**	0.713	0.858	16
B.2	Inappropriate storage and handling of material	**3.700**	0.740	1.022	11
B.3	Poor condition of tools	**3.633**	0.727	0.890	15

FC	FACTOR DESCRIPTION	AVI	RII	SD	RANK
B.4	Poor configuration of tools	3.500	0.700	1.009	19
B.5	Lack of supervision	4.033	0.807	0.850	1
B.6	Lack of protection in material transportation	3.167	0.633	1.053	26
B.7	Lack of personal protective equipment	3.700	0.740	0.988	12
WORKPLACE RELATED FACTORS					
C.1	Poor housekeeping	3.900	0.780	0.960	4
C.2	Site constraint	3.400	0.680	0.814	25
C.3	Accidents due to negligence/ careless	3.867	0.773	1.008	6
C.4	Poor construction sequence	3.467	0.693	1.074	21
C.5	Improper security of job site	3.433	0.687	1.040	23
C.6	Lack of worksite inspection	4.033	0.807	0.850	2
C.7	Reluctance to input resources for safety	3.767	0.753	1.006	8
MANAGEMENT RELATED FACTORS					
D.1	Changes to design	2.800	0.560	1.031	28
D.2	Deficiencies in project management and planning	3.167	0.633	0.986	27
D.3	Deficiencies in risk management	3.433	0.687	1.073	24
D.4	Lack of awareness from top management	3.667	0.733	0.922	14
D.5	Subcontractor selection and management	3.533	0.707	0.973	17
D.6	Performance pressure	3.333	0.667	0.994	18
D.7	Lack of organizational commitment	3.500	0.700	0.974	20

Very high **(4.2 < X < 5.0)**
High **(3.4 < X < 4.2)**
Medium **(2.6 < X < 3.4)**
Low **(1.8 < X < 2.6)**
Very low **(1.0 < X < 1.8)**

N = 30
FC: Factor code
AVI: Average index
SD: Standard deviation
RII: Relative importance index

The data obtained on overall view of the selected factors affecting the generation of construction waste is presented in table 4.3.2.5. The data demonstrates top seven (7) out of twenty eight (28) factors imposed the higher impact towards effectiveness implementation of safety control in construction project. Table 4.3.2.5 also reveals that 28 factors were considered important though their degree of importance varies as revealed through analysis. According to the analysis, the relative importance index

(RII) of the contributory factors affect the implementation of safety control is between 0.560 to 0.807.

About 85.7 % of factors are categorized as high impact factors affect the successful implementation of safety control in construction project while the remaining 14.3 % of factors are classified as medium class. The respondents indicate that most of “worker involvement related factors” and “workplace related factor” are within the top seven (7) highest ranks compared to the other group of factors. It can be seen that the three (3) “worker involvement related factors” and three (3) “workplace related factors” have monopolized the top seven ranking.

Based on the analysis of the results, most of respondents selected “B.5: lack of supervision” from “material and equipment related factors” category and “C.6: lack of worksite inspection” from “workplace related factors” category as the highest rank factors with RII (0.807), AVI (4.033) and SD (0.850). Meanwhile, “A.1: unsafe behavior and attitudes” from “worker involvement related factors” category represents the second most important factor with RII (0.800), AVI (4.000) and SD (1.050). Statically, “worker involvement related factors” and “workplace related factors” categories are the most frequent within the top seven (7) highest ranks compared to the other group of factors as shown in table 4.3.2.5. Therefore, this implies that the most important factor that poses the highest impact on the safety control practices are due to lack of knowledge regarding safety, lack of coordination between the main contractor and subcontractor to improve the safety control, lack of supervision on site labors, negligence and lack of worksite inspection on safety performance. This then will lead to unsafe behavior and attitudes of worker and poor housekeeping. Contradict with those factor, changes to design is the least considered by most respondents. This is because changes to design are not importantly significant during the construction phase and it is more to pre-construction phase.

4.5 Correlation Between Contractor Practitioners' Perspective

The Spearman rank-order correlation coefficient is a nonparametric measure of the strength and direction of association that exists between two variables measured on at least an ordinal scale. For this project, the correlation test is done to determine the relationship or connection between the construction practitioners including i) engineer, ii) site supervisor, iii) safety & health and iv) others (comprised of quantity surveyor, government officer, executive director, owner of contractor company, QAQC team). The test is conducted through Statistical Package for the Social Sciences (SPSS) as mentioned in chapter 3.

Table 4.5 (a) Correlation test result on SPSS

			E	**SS**	**S&H**	**O**
Spearman's rho	**E**	Correlation Coefficient	1.000	0.583**	0.247	0.446*
		Sig. (2-tailed)	.	0.001	0.204	0.017
		N	28	28	28	28
	SS	Correlation Coefficient	0.583**	1.000	**0.592****	0.547**
		Sig. (2-tailed)	0.001	.	0.001	0.003
		N	28	28	28	28
	S&H	Correlation Coefficient	0.247	**0.592****	1.000	0.513**
		Sig. (2-tailed)	0.204	0.001	.	0.005
		N	28	28	28	28
	O	Correlation Coefficient	0.446*	0.547**	0.513**	1.000
		Sig. (2-tailed)	0.017	0.003	0.005	.
		N	28	28	28	28

E:Engineer

SS: Site Supervisor

S& H: Safety & Health

O: Others

Correlation:

E with **SS, SP, O**

SS with **E, SP, O**

SP with **E, SS, O**

O with **E, SS, SP**

Table 4.5 (b) Reliability test result on SPSS

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.956	.956	28

Table 4.5 (c) Reliability and validity test results

Reliability	Validity
0.956	0.9778

Based on the data obtained, it is notified that the relationship between Engineer (E) and Safety & Health (S&H) group are more correlated compared to the other three (3) relationships. There was a strong, positive correlation between SS and SP rate, at which Spearman's correlation coefficient, r_s, is 0.592 which is close to 1, thus this is statistically significant (p = 0.001).

The value of correlation between site supervisor and safety& health group is the highest compared to the other relationship. This is because these two teams are doing common duties at which both of the team are responsible on managing construction labors, inspecting ongoing work, ensuring adherence to state and local codes, arranging for necessary equipment and monitoring construction project costs. The least correlation is identified between engineer and safety & health. This is both of the teams are due to different parts of their working area, where the engineer are focusing on monitoring technical matter of the construction site such as structural, electrical and architectural, while the safety & health were focusing on monitoring safety matter and involved with the management of construction labors, workplace and material and equipment.

4.6 Top Five Highest Impact Factors Affecting The Implementation of Safety Control 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 4.6 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.

Table 4.6: Summary of ranked factors according to group of respondents

Rank/ Respondent	Engineer	Site Supervisor	Safety & Health	Others	Overall	Frequent ranked factors
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

4.6.1 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.

4.6.2 Lack of Worksite Inspection (C.6)

The second highest impact factor for the implementation of safety control 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 been 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.

4.6.3 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.

4.6.4 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.

4.6.5 Lack of knowledge (A.3)

Another top five highest impact factors affecting the implementation of safety control in construction project is 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 wok routine. Thus, reducing the rick at workplace.

4.7 Current Practices on Safety Control

4.7.1 Survey questionnaire

Based on the Section C which is open ended of the questionnaire, majority of the respondents claimed that they are aware regarding the importance of

safety control in construction project. Safety control refers to workplace procedures adopted to minimize injury, reduce adverse health effects and control damage to plant or equipment. Safety control practices are often standardized and taught to managers and safety & health in construction industry. Through analysis of the results, it is observed that most of the respondents agreed that safety control is necessary to eliminate fatalities and protect life, to avoid and reduce any accidents in a workplace or construction sites.

Majority of the construction's practitioners stated that their current company do apply safety control practices on site. For example, EOSH and OHSAS 18001:2007. Besides that, the respondents also stated that they implement the safety briefing (tool box talk) every morning and make sure all the workers wear the proper personal protective equipment (PPE) during the construction work. They also have safety meeting, training and also site inspection every month. Site and Health Officer (SHO) also been hired to conduct and manage all the safety in site.

Nowadays, the construction safety still being the crucial problem faced in construction industry. From the point of view of respondents, there are a few factors contributing to this problem stated. Based on their experience of working in construction industry, these are the different factors stated that affected the safety control in construction project:

1. Costing.
2. Less understanding from the contractor about the safety of their workers.
3. Lack of supervision, lack of communication, lack of safety training and human behavior
4. Inexperienced or many fresh general worker with no or limited safety knowledge.
5. Lacking of Tool Box Briefing at site.
6. No awareness from top management such as poor planning and poor commitment.

7. There are no mandatory provisions inside the bill of quantity (BQ) that covered the safety and health requirements. Hence, the issues is not taken seriously by the parties involve.

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Suggestion for improvement are needed for the betterment of safety performance in construction project. Based on questionnaire, the respondents suggested to include costing for safety in contract document. Then, make sure the workers wear personal protective equipment (PPE) during the construction works and take action for abandoning that rules. They also suggest to conduct frequent session of safety awareness program. Besides, control and manage general workers through safety knowledge with assessment prior engagement to any site work in order to ensure these group able to identify risk and how to escalate the issue. They also suggest to provide full time safety personnel on site and have at least one Site Safety Supervisor (SSS) at every site. In Quantity Surveyor's point of view, they suggest to provide detail and comprehensive safety and health provision inside contract document. Therefore, contractor will strictly bound to all the requirements that have been written inside the Bill of Quantity (BQ). This will increase the level of awareness of the contractors towards the safety requirement and help to plan and as well as reduce the issues.

To be concluded, through the section C of questionnaire, the author would be able to know the level of awareness of construction practitioners, the current practices at their current company. Besides that, the author also would be able to identify the factor affecting safety control based on respondents' point of view. Lastly, the author also can get the suggestion towards enhancing the safety control practices in construction site and can be included in the framework.

4.7.2 Interview

To validate the questionnaire survey results regarding the highest impact factor affecting the implementation of safety control , the interview have been conducted upon a group of engineers. Based on the interview, the

interviewees have given their opinion regarding the current safety practices that most mentioned in questionnaire survey which are “hiring fulltime safety personnel and having toolbox briefing” and also the suggestion for safety control.

Based on the interview, most of the engineers agreed that by “hiring fulltime safety personnel and having toolbox briefing”, it will provide awareness among the workers since they would be remind about the importance of safety regularly, they tend to be alert to the risk. Even, it will only provide minimum effect to the worker since it cannot mitigate 100 per cent of risk; at least it will minimize the construction risk. Besides, those interviewees provide additional input for these practices at which they suggest to have micro briefing about hazards and risk for each specific job with their respective team leader and safety personnel should provide constant training at site.

For safety control, most of the interviewees suggest that construction project should have proper safety management system which covered:

1. Provision of safety awareness among all.
2. Cost for proper safety management must be included in contract.
3. Provide constant training/talks to the workers.
4. Implementing compound/summons to workers who does not abide by safety rules and regulations.
5. Every construction site must have safety personnel from DOSH to control the safety application on site and documents control.
6. Every person involve in construction site must attend a proper course to widen the knowledge regarding safety.

4.8 Proposed Safety Control Management Framework

Safety control management is a system used in construction industry to minimize or eliminate exposure to hazards by considering various practices and any model or framework that have been developed for the successful

implementation safety control in a construction company. A comprehensive approach is needed to be done in the one management since the various practices might be interrelated and cooperated to each other and very crucial for the safety control management.

Framework is a popular output which serves as a medium of delivering concepts, ideas and plans in a non-prescriptive manner (Dale, 2003). It is provided with starting point consisting problem identification and specific course of actions and priorities to create an individual dimension of safety control management which is related to the highest impact factor affecting the implementation of safety control . Therefore, the proposed framework should be designed to represent operations of the organization and the system could enhance the activities that been conducted to enhance the safety performance.

The proposed framework as mentioned above is graphically depicted in **Figure 4.8(c)**. 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 be 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.

Besides, the idea for the proposed framework also gathered from existing frameworks (**Figure 4.8(a)** and **Figure 4.8(b)** which have to be improved. For **Figure 4.8(a)**, the framework was developed by considering the critical success factors, CSFs in the context of project management. Based on the existing framework, the new framework was proposed by considering the safety control related factor consisting of worker involvement related factor, material and equipment related factor and workplace related factor. For **Figure 4.8(b)**, the existing framework was referred to generate the stages in

the proposed framework. For the new proposed framework, there are five stages used which are what, related factor, problem, control measure and outcome as compared to the existing framework with only three stages consisting of input variables (moderators), practice and health and safety performance (effective dimension) .

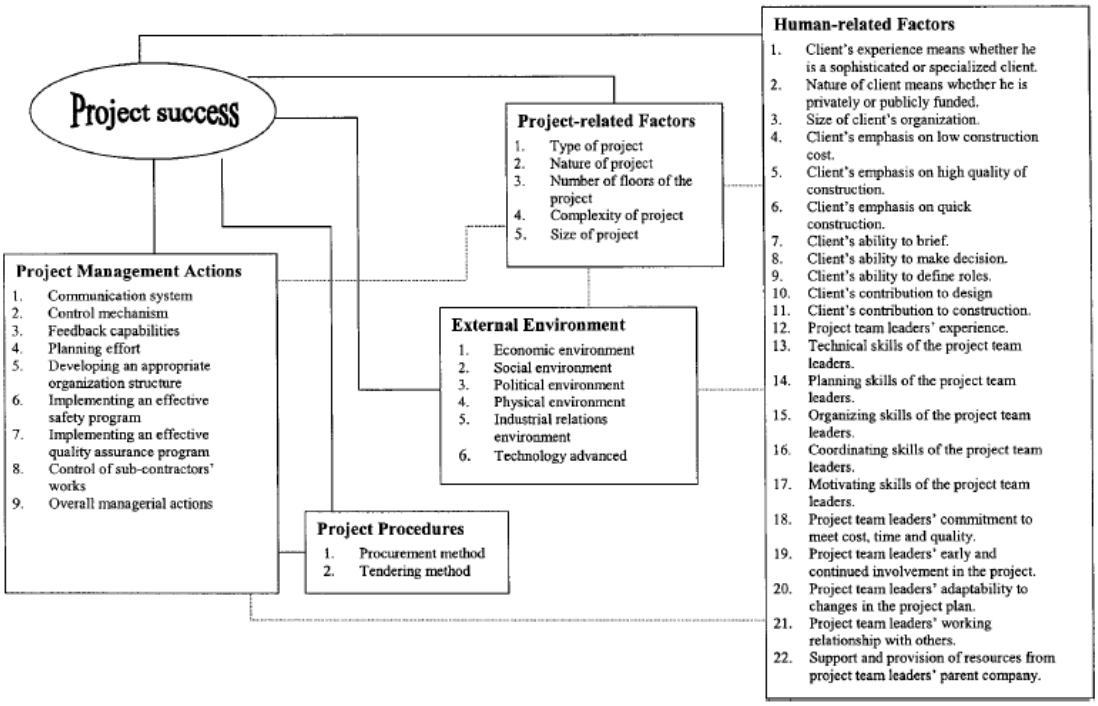

Figure 4.8(a): A conceptual framework for factor affecting project success (Chan et al., 2004

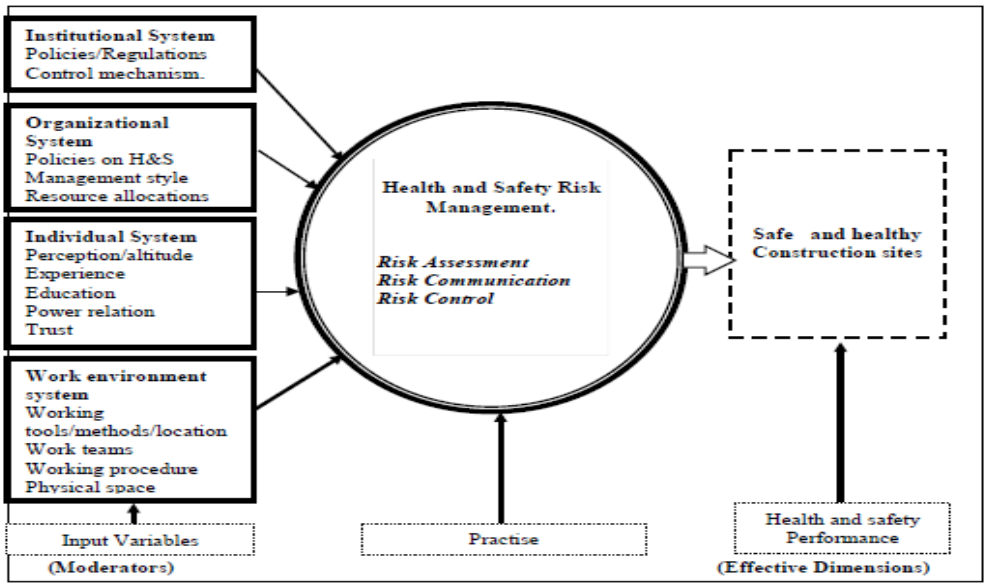

Figure 4.8 (b): Research conceptual framework

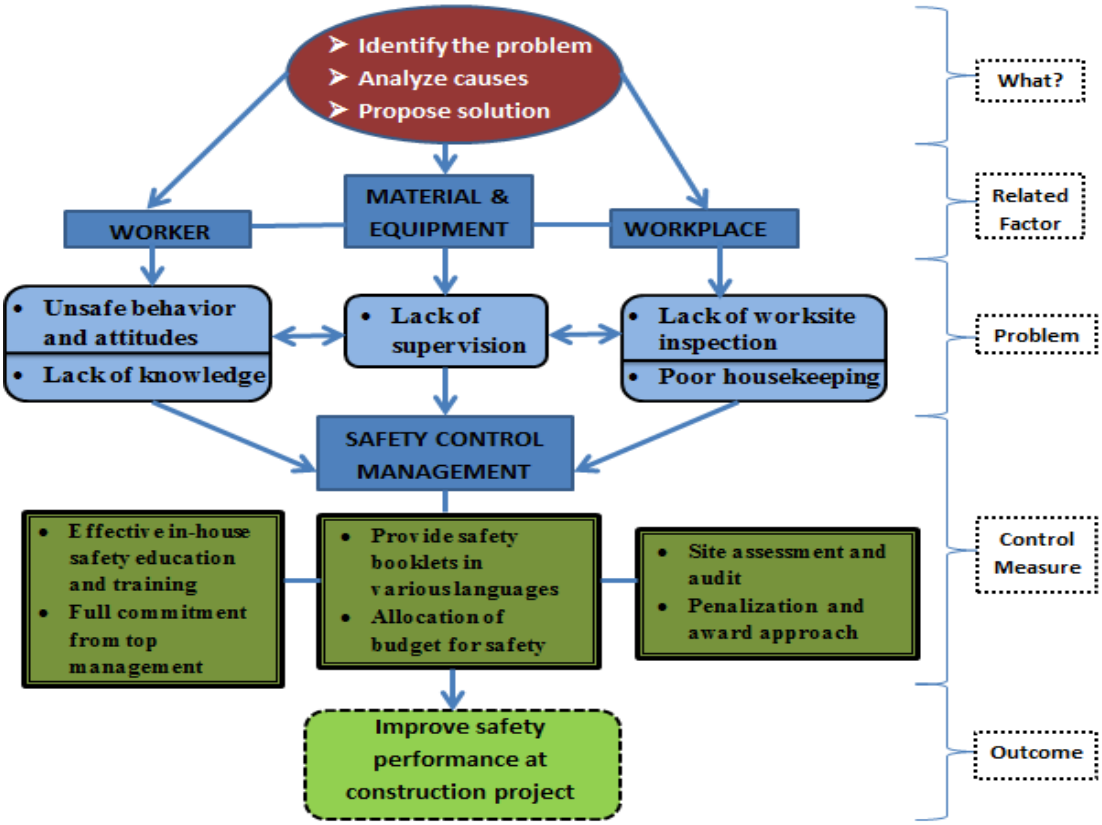

Figure 4.8 (c): Framework for safety control

CHAPTER 5

CONCLUSION AND RECOMMENDATION

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 behavior 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

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5.2 Recommendation

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

5.2.1 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.

5.2.2 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.

5.2.3 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.

5.2.4 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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APPENDIX A: QUESTIONNAIRE SURVEY

QUESTIONNAIRE SURVEY

EFFECTIVENESS OF SAFETY CONTROL AND IMPLEMENTATION IN CONSTRUCTION PROJECT

Disclaimer:

I am a final year final semester Bachelor of Engineering (Hons) Civil Engineering, student of Universiti Teknologi PETRONAS (UTP). In partial fulfilment of the requirements of this degree, I am required to complete final year project (FYP). The questionnaire is intended to gather information to further study the factors influencing the implementation of safety control in construction project.

Objectives:

To identify and rank its factors influencing the implementation of safety control and resource efficiency during the construction phases which affect successful completion construction project based on relative index (RII) with correlation between construction practitioners.

Instructions:

1. Please answer ALL the following questions.
2. Please fill in the blank and tick ✓ in the respective box.
3. All information treated as CONFIDENTIAL and shall be used for academic purpose only.
4. All the data will be on aggregated basis and no individual data will be published

SECTION A
PERSONAL DETAIL

Q1 **Name** : .....

Q2 **Gender** :

- ☐ Male
- ☐ Female

Q3 **Age** :

- ☐ 20 – 29 years old
- ☐ 30 – 39 years old
- ☐ 40 – 49 years old
- ☐ > 50 years old

Q4 **Qualification** :

Q5 **Designation** :

- ☐ Project director
- ☐ Project manager
- ☐ Project engineer
- ☐ Site engineer
- ☐ Planning engineer
- ☐ Scheduler
- ☐ Quantity surveyor
- ☐ Site Supervisor
- ☐ Safety & Health
- ☐ Others: .....

Q6 **Working duration** :

- ☐ Less than 5 years
- ☐ Less than 10 years
- ☐ More than 10 years

SECTION B

THE IMPLEMENTATION OF SAFETY CONTROL IN CONSTRUCTION PROJECT

Factors affect the performance of safety at construction project

Please answer the questions below based on undergoing project.

1 : Strongly disagree 2 : Disagree 3 : Moderately 4 : Agree 5 : Strongly agree

WORKER INVOLVEMENT RELATED FACTORS

Factor code	Factors description	1	2	3	4	5
A.1	Unsafe behavior 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 and subcontractor	☐	☐	☐	☐	☐
A.7	Lack of teamwork spirit	☐	☐	☐	☐	☐

MATERIAL AND EQUIPMENT RELATED FACTORS

Factor code	Factors description	1	2	3	4	5
B.1	Shortcomings with equipment	☐	☐	☐	☐	☐
B.2	Inappropriate storage 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						
Factor code	**Factors description**	**1**	**2**	**3**	**4**	**5**
C.1	Poor housekeeping	☐	☐	☐	☐	☐
C.2	Site constraint	☐	☐	☐	☐	☐
C.3	Accidents due to negligence/ careless	☐	☐	☐	☐	☐
C.4	Poor construction sequence	☐	☐	☐	☐	☐
C.5	Improper security of job site	☐	☐	☐	☐	☐
C.6	Lack of worksite inspection	☐	☐	☐	☐	☐
C.7	Reluctance to input resources for safety	☐	☐	☐	☐	☐

MANAGEMENT RELATED FACTORS						
Factor code	**Factors description**	**1**	**2**	**3**	**4**	**5**
D.1	Changes to design	☐	☐	☐	☐	☐
D.2	Deficiencies in project management and planning	☐	☐	☐	☐	☐
D.3	Deficiencies in risk management	☐	☐	☐	☐	☐
D.4	Lack of awareness from top management	☐	☐	☐	☐	☐
D.5	Subcontractor selection and management	☐	☐	☐	☐	☐
D.6	Performance pressure	☐	☐	☐	☐	☐
D.7	Lack of organizational commitment	☐	☐	☐	☐	☐

SECTION C
CURRENT PRACTICES ON SAFETY CONTROL

1. Do you aware the importance of safety control in construction project? Reason.

2. Do your current company apply any safety control practices on site? If yes, state the practices.

3. Nowadays, the construction safety still being the crucial problem faced in construction industry. From your point of view, what are the factors contributing to this problem?

4. What are your suggestions towards enhancing the safety control practices in construction site?

SECTION D
PILOT SURVEY FEEDBACK

1. Suggestion on the improvement of the survey. Give opinion.

2. May I contact you again for future involvement in another questionnaire form regarding the implementation of safety control practices in your company?

APPENDIX B: INTERVIEW (QUESTION)

UNIVERSITI TEKNOLOGI PETRONAS

INTERVIEW

EFFECTIVENESS OF SAFETY CONTROL AND IMPLEMENTATION IN CONSTRUCTION PROJECT

Disclaimer:

I am a final year final semester Bachelor of Engineering (Hons) Civil Engineering, student of Universiti Teknologi PETRONAS (UTP). In partial fulfilment of the requirements of this degree, I am required to complete final year project (FYP). The questionnaire is intended to gather information to further study the factors influencing the implementation of safety control in construction project.

Objectives:

To validate the factors and construction practitioners' practices influencing the implementation of safety control during the construction phases through the application of case study project.

Instructions:

1. Please answer ALL the following questions.
2. Please fill in the blank and tick ✓ in the respective box.
3. All information treated as CONFIDENTIAL and shall be used for academic purpose only.
4. All the data will be on aggregated basis and no individual data will be published.
5.

SECTION A
PERSONAL DETAIL

Q1 Gender :

☐ Male

☐ Female

Q2 Age :

☐ 20 – 29 years old

☐ 30 – 39 years old

☐ 40 – 49 years old

☐ > 50 years old

Q3 Qualification :

Q4 Designation :

☐ Project director

☐ Project manager

☐ Project engineer

☐ Site engineer

☐ Planning engineer

☐ Scheduler

☐ Quantity surveyor

☐ Others:

.....

Q5 Working duration :

☐ Less than 5 years

☐ Less than 10 years

☐ More than 10 years

SECTION B
QUESTIONS

Q1 What is your view on current situation: the safety performance at construction project?

Q2 How does safety problem affect cost and time of the project?

Q3 Do you think the current practice, which are “hiring fulltime safety personnel and having toolbox briefing” will mitigate the construction risk? Why?

Q4 In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Q5 Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision

(b) Lack of worksite inspection

(c) Unsafe behaviour and attitudes

(d) Poor housekeeping

(e) Lack of knowledge

Q6 Based on your choice on the previous question, state the reason.

Q7 Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Q8 Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

APPENDIX C: INTERVIEW (ANSWERS)

Interview transcript (1)

Duration: 39 minutes
Date: 10/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 4 years.

Interviewer: Please state your designation.

Interviewee: Civil Engineer (Site).

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: As I work in oil and gas construction project, everyone will practice safety work procedure as per permit to work and site safety supervisor is required to supervise whole working process. However, construction project for others type project I am really not sure.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: Minor incident/accident would not really affect much cost and time. If major incident/accident would lead closure of site project due to investigation of case with DOSH. Which directly impact to cost and time of the project.

Interviewer: Do you think the current practice, which are “hiring fulltime safety personnel and having toolbox briefing” will mitigate the construction risk? Why?

Interviewee: Depending to the hiring safety personnel, sometime safety personnel don't even have knowledge about working process. Toolbox briefing could have minimized the construction risk. It'll be more effective if there be a micro briefing about hazard and risk for each specific job with their team leader.

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: Safety awareness among all. Management, executive, professional, team leaders, and workers.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision

(b) Lack of worksite inspection

(c) Unsafe behaviour and attitudes

(d) Poor housekeeping

(e) Lack of knowledge

Interviewee: Lack of supervision.

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: Good supervision would overcome other factors.

Interviewer: Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Interviewee: Safety awareness among all. Management, executive, professional, team leaders, and workers. Better awareness, better supervision.

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Lack of knowledge. No knowledge no supervision. Add safety awareness subject as compulsory subject for relevant construction certificate, diplomas, and degrees.

Interview transcript (2)

Duration: 29 minutes
Date: 14/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 17 years.

Interviewer: Please state your designation.

Interviewee: Site engineer.

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: Improve continuously.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: Project stop in certain time due to safety issue.

Interviewer: Do you think the current practice, which are "hiring fulltime safety personnel and having toolbox briefing" will mitigate the construction risk? Why?

Interviewee: Yes. Those current practices make all workers always alert with the risk

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: To implement safety management system at site. Safety works will be more organized.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision
(b) Lack of worksite inspection
(c) Unsafe behaviour and attitudes
(d) Poor housekeeping
(e) Lack of knowledge

Interviewee: Unsafe behaviour and attitudes

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: Ignorance to work hazard without safety control

Interviewer: Based on your opinions, what is the control measure that needed to be taken in order to address this problem?

Interviewee: Cost for proper safety management must be included in contract. With enough cost provision, it is possible to enhance the safety control.

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Everybody in the site must work as a team to achieve good safety practice.

Interview transcript (3)

Duration: 33 minutes
Date: 15/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 26 years.

Interviewer: Please state your designation.

Interviewee: Construction Manager.

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: Improving, more safety officer deployed for the works.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: Stop work order due to safety noncompliance..

Interviewer: Do you think the current practice, which are "hiring fulltime safety personnel and having toolbox briefing" will mitigate the construction risk? Why?

Interviewee: Safety officer for certain amount of contract / tool box / safety committee is mandatory.

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: Safety walkabout and tool box. Message can be convey direct to workers.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision
(b) Lack of worksite inspection
(c) Unsafe behaviour and attitudes
(d) Poor housekeeping
(e) Lack of knowledge

Interviewee: Unsafe behaviour and attitudes.

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: Safety is related to attitude and awareness.

Interviewer: Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Interviewee: Tool box

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Lack of supervision.

Interview transcript (4)

Duration: 50 minutes
Date: 19/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 4.5 years

Interviewer: Please state your designation.

Interviewee: Project Engineer cum Traffic Management Officer cum Authorized Gas Tester

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: Based on my observation, most projects nowadays only provide minimal safety measures/resources as it cost a lot to ensure 100% of implementation. Contractors only adhere to PPE issuance for their workers. They tend to turn a blind eye over small matters because it is tedious and time consuming.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: It's very related actually and sometimes costs a fortune to certain projects. Take a high rise project for example; an accident occurred that costs a life of a worker. Investigation shows that the contractor had failed to provide guard rail with safety net for void area/opening space that resulted the worker to slip and fall down to the bottom floor. The project will be temporary shut down for JKKP to investigate further and this indirectly will cost the contractor time and money. Due to this, the progress of the project will be delayed.

Interviewer: Do you think the current practice, which are "hiring fulltime safety personnel and having toolbox briefing" will mitigate the construction risk? Why?

Interviewee: Yes, but not 100% will mitigate the risk. The keyword here is knowledge. If the employee and workers understand the importance of safety implementation and safety knowledge at site, the possibility of risks/accidents can be lowered down. Safety personnel should provide constant training at site, employee should send the workers to safety

courses that are related to their work, and JKKP should do more inspection at construction projects in Malaysia.

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: 1) Provide constant training/talks to the workers. Give them exposures on how importance of safety knowledge and relate to their daily work life. Give insights about the Hazard Identification Risk Assessment and Risk Control (HIRARC).

2) Tighten the supervision of safety personnel and every supervisors including higher up positions at site by implementing compound/summons to workers who does not abide by safety rules & regulations. By this, workers get the idea of the importance of safety that can affect their lives as well as contributing to the progress at site.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision

(b) Lack of worksite inspection

(c) Unsafe behaviour and attitudes

(d) Poor housekeeping

(e) Lack of knowledge

Interviewee: Lack of knowledge

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: Knowledge is the key of success. We need to educate the workers about the danger that might fall before them should they neglect the importance of safety in a working environment. The company must instill safety values and urge the workers to practice while working so that it will become habits for them. Therefore, eventually improve their perspective regarding safety.

Interviewer: Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Interviewee: 1) Everyone have to play their part. It has come from the top management. The management must take safety issues seriously and fully implement it at every project. The reason why some management takes safety for granted is because it costs a lot to provide the resources

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2) Whenever workers did not comply with safety regulations, summons should imposed on them. As for the company who does not comply, authority should take serious action by imposing hefty fine on them.

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Supervision from respective company such as safety personnel as well as other safety committee members must play their part. This is crucial as they became role model for their workers. To set an example, the safety personnel and committee members must first abide by safety rules and regulations at site. They are the ones who must follow the safety rules and supervise the workers accordingly. Summons must be issued to those who does not comply with safety without biased and prejudice. On the other hand, local authority should provide more training on safety courses to invite public to involved in this industry. To date, projects registered under JKKP/DOSH is estimated around 130,000 ++ however, there is only 3000-4000 active Safety & Health Officer in Malaysia. Companies should also send their employee to attend the safety courses to generate more Safety & Health Officer, (SHO) in the future.

Interview transcript (5)

Duration: 31 minutes
Date: 19/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 5 years.

Interviewer: Please state your designation.

Interviewee: Safety officer

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: Still need a lot of improvement especially commitment from contractors and management.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: Delay in progress in term of: 1) Investigation, 2) Compensation 3) Damage of properties, 4) Legal battle, 5) Reputation of company

Interviewer: Do you think the current practice, which are "hiring fulltime safety personnel and having toolbox briefing" will mitigate the construction risk? Why?

Interviewee: For a minimum effect as it creates awareness among the workers.

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: Safety campaigns and management involvement.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision

(b) Lack of worksite inspection

(c) Unsafe behaviour and attitudes

(d) Poor housekeeping

(e) Lack of knowledge

Interviewee: Unsafe behaviour and attitudes

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: Unsafe acts include basis of workers attitude. Safety starts from one's mind.

Interviewer: Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Interviewee: Educate contractors. Penalize adamant contractors. Change mindset from top level to bottom.

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Lack of knowledge in supervisors and safety practitioners.

Interview transcript (6)

Duration: 36 minutes
Date: 19/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 1 year.

Interviewer: Please state your designation.

Interviewee: Assistant Resident Engineer.

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: Most of contractors are taking lightly on this matter.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: Safety problem may lead to stop work order, which will delay the project progress.

Interviewer: Do you think the current practice, which are "hiring fulltime safety personnel and having toolbox briefing" will mitigate the construction risk? Why?

Interviewee: No, because most of in house safety personnel have restricted authorization due to their employer's instructions.

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: Every construction site must have safety personnel from DOSH to control the safety application on site and documents control.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision

(b) Lack of worksite inspection

(c) Unsafe behaviour and attitudes

(d) Poor housekeeping

(e) Lack of knowledge

Interviewee: Lack of knowledge

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: Without knowledge in safety on site, no one can implement a proper safety application.

Interviewer: Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Interviewee: Every person involve in construction site must attend a proper course to widen the knowledge regarding safety.

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Lack of supervision. A site must have more safety personnel to control the safety implementation so that more supervision can be done.

Interview transcript (7)

Duration: 27 minutes
Date: 21/10/2017

Interviewer: How long have you been in this industry?

Interviewee: 2 years.

Interviewer: Please state your designation.

Interviewee: Engineer.

Interviewer: What is your view on current situation: the safety performance at construction project?

Interviewee: Safety performance nowadays is very good because of a lot of workers already have a basic knowledge about the importance of safety to their life.

Interviewer: How does safety problem affect cost and time of the project?

Interviewee: Because if accident happens, the legal authority must go to that site and check every detail about that accidents and the every work progress must stop.

Interviewer: Do you think the current practice, which are "hiring fulltime safety personnel and having toolbox briefing" will mitigate the construction risk? Why?

Interviewee: Yes. It is because the workers must be remind about the important of safety at site every day.

Interviewer: In your point of view, what is the effective safety control practice that can be implemented at construction project? State your reason.

Interviewee: The workers must wear complete PPE while working at site.

Interviewer: Which factors do you think has the highest impact towards successfulness implementation of safety control practices in construction project?

(a) Lack of supervision

(b) Lack of worksite inspection

(c) Unsafe behaviour and attitudes

(d) Poor housekeeping

(e) Lack of knowledge

Interviewee: Unsafe behaviour and attitudes.

Interviewer: Based on your choice on the previous question, state the reason.

Interviewee: It is everything about attitudes. The workers must know the importance of their life.

Interviewer: Based on your opinions, what are the control measure that needed to be taken in order to address this problem?

Interviewee: Fine the workers who don't wear PPE.

Interviewer: Lastly, what factors will you choose as the second highest impact towards successfulness implementation of safety control practices? State the reason for your opinion and what is your suggestion for further improvement?

Interviewee: Supervise the site properly.

APPENDIX D: AVERAGE INDEX (AVI) AND RELATIVE IMPORTANCE INDEX (RII) CALCULATION

- **Overall**

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	5	5	5	5	2	5
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RII	0.8	0.7333	0.7733	0.74	0.6867	0.76	0.74	0.7133	0.74	0.7267	0.7	0.8067	0.6333	0.74	0.78	0.68	0.7733	0.6933	0.6867	0.8067	0.7533	0.56	0.6333	0.6867	0.7333	0.7067	0.6667	0.7
AVI	4	3.6667	3.8667	3.7	3.4333	3.8	3.7	3.5667	3.7	3.6333	3.5	4.0333	3.1667	3.7	3.9	3.4	3.8667	3.4667	3.4333	4.0333	3.7667	2.8	3.1667	3.4333	3.6667	3.5333	3.3333	3.5

- **Engineer**

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
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AVI	3.5556	3.4444	3.5556	3.5556	3.5556	3.8889	3.7778	3.6667	3.6667	3.5556	3.5556	3.8889	3.1111	3.4444	3.7778	3.6667	3.5556	3.4444	3.4444	3.7778	3.5556	2.5556	3.1111	3.4444	3.6667	3.6667	3.2222	3.2222
RII	0.7111	0.6889	0.7111	0.7111	0.7111	0.7778	0.7556	0.7333	0.7333	0.7111	0.7111	0.7778	0.6222	0.6889	0.7556	0.7333	0.7111	0.6889	0.6889	0.7556	0.7111	0.5111	0.6222	0.6889	0.7333	0.7333	0.6444	0.6444

- **Site Supervisor**

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
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	5	4	5	4	2	4	5	4	5	4	3	4	2	3	3	2	3	3	3	5	3	4	5	5	5	4	4	5
	1	1	2	2	1	1	2	2	2	2	2	2	2	2	3	3	1	1	2	2	2	1	2	2	2	2	2	1
	3	3	3	3	3	3	3	4	4	4	4	4	4	4	3	3	4	3	4	3	4	4	3	3	4	3	3	4
	4	5	4	4	3	4	3	3	3	3	4	5	2	4	4	3	4	3	3	4	4	2	2	2	3	4	2	2
	4	4	4	4	4	4	3	3	2	3	2	5	3	4	4	3	4	3	3	4	4	2	2	2	3	3	2	3
AVI	3.5	3.5	3.8333	3.6667	2.8333	3.3333	3.5	3.5	3.3333	3.5	3.1667	4.1667	2.8333	3.5	3.5	3	3.3333	2.8333	3.1667	3.6667	3.5	2.8333	3	3.1667	3.5	3.3333	2.8333	3.1667
RII	0.7	0.7	0.7667	0.7333	0.5667	0.6667	0.7	0.7	0.6667	0.7	0.6333	0.8333	0.5667	0.7	0.7	0.6	0.6667	0.5667	0.6333	0.7333	0.7	0.5667	0.6	0.6333	0.7	0.6667	0.5667	0.6333

- **Safety & Health**

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
	5	5	5	5	5	5	2	3	3	4	3	5	3	5	5	3	4	3	2	4	3	2	3	4	4	4	5	4
	4	4	4	3	3	3	5	4	4	4	4	4	3	2	3	3	3	4	3	3	2	3	4	3	2	1	4	4
	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	4	4	4	4	4	4	3	3	2	4	3	5	2	4	4	3	4	3	3	5	5	2	2	2	3	4	2	3
	4	4	4	4	3	4	3	2	2	3	2	4	3	4	3	2	4	2	2	4	4	2	2	2	4	4	3	3
AVI	4	4	4	3.8	3.6	3.8	3.2	3.2	3	3.8	3.2	4.4	3	3.8	3.8	3	3.8	3.2	2.8	4	3.6	2.6	3	3	3.4	3.4	3.6	3.6
RII	0.8	0.8	0.8	0.76	0.72	0.76	0.64	0.64	0.6	0.76	0.64	0.88	0.6	0.76	0.76	0.6	0.76	0.64	0.56	0.8	0.72	0.52	0.6	0.6	0.68	0.68	0.72	0.72

- **Others**

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
	5	4	4	4	3	4	4	2	4	3	3	5	3	4	5	4	5	4	5	5	4	2	3	3	4	2	2	3
	5	4	4	4	3	3	3	4	4	5	4	3	3	3	3	4	4	3	3	5	4	2	3	4	3	3	3	3
	4	4	4	3	2	3	3	3	3	2	2	3	2	2	3	3	4	2	2	3	2	4	2	2	2	3	2	3
	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	5	4	4	4
	5	3	5	5	5	4	5	4	5	5	5	3	3	5	4	4	5	5	4	5	5	3	3	4	4	4	5	5
	5	4	3	3	3	4	4	4	5	5	4	5	5	5	5	5	5	5	5	4	4	3	4	5	5	4	3	4
	4	3	4	4	4	5	5	5	5	3	5	5	5	5	5	3	5	5	5	5	5	5	4	4	4	5	4	4
	5	4	5	3	4	5	5	4	4	4	5	4	4	4	4	4	5	5	5	5	5	3	4	4	4	4	4	4
	5	4	4	4	4	3	3	4	5	3	3	4	3	4	5	3	5	4	4	5	5	1	3	4	4	2	4	4
	5	4	4	4	4	5	5	3	4	3	3	3	3	4	5	2	3	3	2	4	4	5	4	4	4	5	5	5
AVI	4.7	3.8	4.1	3.8	3.6	4	4	3.7	4.3	3.7	3.8	3.9	3.5	4	4.3	3.6	4.5	4	3.9	4.5	4.2	3.1	3.4	3.8	3.9	3.6	3.6	3.9
RII	0.94	0.76	0.82	0.76	0.72	0.8	0.8	0.74	0.86	0.74	0.76	0.78	0.7	0.8	0.86	0.72	0.9	0.8	0.78	0.9	0.84	0.62	0.68	0.76	0.78	0.72	0.72	0.78

APPENDIX E: STANDARD DEVIATION (SD) CALCULATION

- **Overall**

Statistics

		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
N	Valid	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		1.050	.922	.819	.750	1.006	.925	.988	.858	1.022	.890	1.009	.850	1.053	.988

		C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
N	Valid	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		.960	.814	1.008	1.074	1.040	.850	1.006	1.031	.986	1.073	.922	.973	.994	.974

- **Engineer**

Statistics

		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
N	Valid	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		1.130	1.130	.882	.726	1.130	.928	.833	.866	1.000	.882	1.130	.782	1.364	1.130

		C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
N	Valid	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		1.302	.866	1.130	1.130	1.014	.833	1.130	.527	1.167	1.130	1.000	.866	.833	.972

- **Site Supervisor**

Statistics

		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
N	Valid	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		1.378	1.378	1.169	1.033	1.169	1.211	1.225	1.049	1.211	1.049	.983	1.169	.983	.837

		C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
N	Valid	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		.548	.632	1.211	.983	.753	1.033	.837	1.329	1.265	1.472	1.049	.816	.983	1.472

- **Safety & Health**

Statistics

		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
N	Valid	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		.707	.707	.707	.837	.894	.837	1.095	.837	1.000	.447	.837	.548	.707	1.095

		C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
N	Valid	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		.837	.707	.447	.837	.837	.707	1.140	.894	1.000	1.000	.894	1.342	1.140	.548

- **Others**

Statistics

		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
N	Valid	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		.483	.422	.568	.632	.843	.816	.943	.823	.675	1.059	1.033	.876	.972	.943

		C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6	D7
N	Valid	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std. Deviation		.823	.843	.707	1.054	1.197	.707	.919	1.287	.699	.789	.876	1.075	1.075	.738

APPENDIX F: TEST ON SPSS

Correlations

			ENGINEER	SITE_SUPERVISOR	SAFETY_AND_HEALTH	OTHERS
Spearman's rho	ENGINEER	Correlation Coefficient	1.000	.583**	.247	.446*
		Sig. (2-tailed)	.	.001	.204	.017
		N	28	28	28	28
	SITE_SUPERVISOR	Correlation Coefficient	.583**	1.000	.592**	.547**
		Sig. (2-tailed)	.001	.	.001	.003
		N	28	28	28	28
	SAFETY_AND_HEALTH	Correlation Coefficient	.247	.592**	1.000	.513**
		Sig. (2-tailed)	.204	.001	.	.005
		N	28	28	28	28
	OTHERS	Correlation Coefficient	.446*	.547**	.513**	1.000
		Sig. (2-tailed)	.017	.003	.005	.
		N	28	28	28	28

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.956	.956	28