RISK MANAGEMENT IN CONSTRUCTION INDUSTRY

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RISK MANAGEMENT IN CONSTRUCTION INDUSTRY

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Thesis submitted in partial fulfillment of the requirements
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To my beloved husband, family, lecturers and friends who have always supported me,
Thank you very much.

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Thank You.

ABSTRACT

Managing risk during construction period is very important process in order to achieve the project objective in terms of safety and health, cost, time and quality. Four elements in managing the risk effectively are begun by establishing organizational structure, process and resources to enhance its performance. Therefore, this study is carried out to identify the risk that always occur in construction industry and also to determine the factor of risk in order to carried out the solution to prevent risk from occur. The study involved the G7 contractors registered with CIDB that have been involved in project area of Kuala Lumpur and also Kuantan. The total of 130 questionnaires was distributed and only 109 were returned answered which give a value of 84%. From the study, the risks that always occur in construction are machine and equipment problem and also manpower resources problem. Factor that contributes to the risk in construction industry are lack of site safety inspection and supervision, lack of adequate tool and equipment, lack of safety knowledge, lack of adequate lighting and also lack of compliance to governmental safety regulation. In order to minimize the risk and also to prevent the risk from occur, well planning of project process before project start should be done firstly follow by well manage machinery and equipment, established an efficient communication at the work place, assign a risk engineer and also develop the risk management workshop for employees.

ABSTRAK

Menguruskan risiko semasa tempoh pembinaan adalah proses yang sangat penting untuk mencapai objektif projek dari segi keselamatan dan kesihatan, kos, masa dan kualiti. Empat elemen dalam mengurus risiko yang berkesan adalah bermula dengan mewujudkan struktur organisasi, proses dan sumber untuk meningkatkan prestasinya. Oleh itu, kajian ini dijalankan untuk mengenal pasti risiko yang sentiasa berlaku dalam industri pembinaan dan juga untuk menentukan faktor risiko untuk dijalankan penyelesaian untuk mengelakkan risiko daripada berlaku. Kajian ini melibatkan kontraktor G7 yang berdaftar dengan CIDB yang telah terlibat dalam bidang projek Kuala Lumpur dan juga Kuantan. Jumlah 130 soal selidik telah diedarkan dan hanya 109 telah dikembalikan menjawab yang memberikan nilai 84%. Dari kajian itu, risiko yang sentiasa berlaku dalam pembinaan ialah mesin dan peralatan bermasalah dan juga masalah sumber tenaga manusia. Faktor yang menyumbang kepada risiko dalam industri pembinaan adalah kekurangan pemeriksaan keselamatan tapak dan pengawasan, kekurangan alat yang mencukupi dan peralatan, kekurangan pengetahuan keselamatan, kekurangan pencahayaan yang cukup dan juga kekurangan pematuhan kepada peraturan keselamatan kerajaan. Dalam usaha untuk mengurangkan risiko dan juga untuk mengelakkan risiko daripada berlaku, baik merancang proses projek sebelum permulaan projek perlu dilakukan pertama diikuti dengan baik menguruskan mesin dan peralatan, yang ditubuhkan komunikasi yang cekap di tempat kerja, menyerahhakkan jurutera risiko dan juga membangunkan bengkel pengurusan risiko untuk pekerja.

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LIST OF ABBREVIATIONS

CIDB	Construction Industry Development Board
DOSH	Department Occupational of Safety and Health
OSHA	Occupation Safety and Health Administration
AI	Average Index

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Risk can be defined as a situation involving to a danger or harm or a failure of the project. In other words, risk is the effect of uncertainty on objective but. In construction world, risk cannot be avoided but can reduce by proper risk management. Managing risk is an integral part of good management and fundamental in order to achieve good business and project outcomes and also the effective procurement of good and service. However, poor risk management may lead to negative implication for the achievement of the organization.

Construction industry is the most challenging industries in Malaysia due to its complex features. Malaysia already implemented the risk management since 1990. However, most of construction organizations in Malaysia still do not apply risk management in the project. Risk that occurred in construction will affect the ability of the organization to achieve the objective. Delays, cost overruns, and reduction of quality of projects are the negative effects. Failure to manage risks will result in financial loss, damage of reputation, and loss of future business

As an engineer, it is important to identify the risk and do a right decision in order to minimize the risk during project period. It is important to ensure the project can be done within the estimation time and cost to prevent any losses. Theodore Roosevelt point out that “risk is like fire, if controlled it will help you if uncontrolled it will rise up and destroy you”.

Managing risk during construction period is very important process in order to achieve the project objective in terms of safety and health, cost, time and quality. Four elements in managing the risk effectively are begun by establishing organizational structure, process and resources to enhance its performance. Then, Identify or analyzing the risk and developing plans to determine what could affect the objective of the organization and also the project. Then, allocate responsibility to the people by implementing new procedures. Finally, ensuring that the cost and objective of the project are achieved and benefits obtained.

1.2 PROBLEM STATEMENT

Construction sector is the most dangerous and hazardous place due to dangerous activities, equipment, and substances that easily affect physical and health condition. From the previous research in year 2011 by Department of Safety and Health (DOSH), occupational accident occur in Malaysia construction sector includes 66 death, 4 cases of permanent disability and 50 cases of non-permanent disability. Construction Industry Development Board (CIDB) stated that fatality rate that had been recorded since 2001 are over 25% per 100,000 workers.

Figure 1.1: Occupational accident for category of death until December 2010

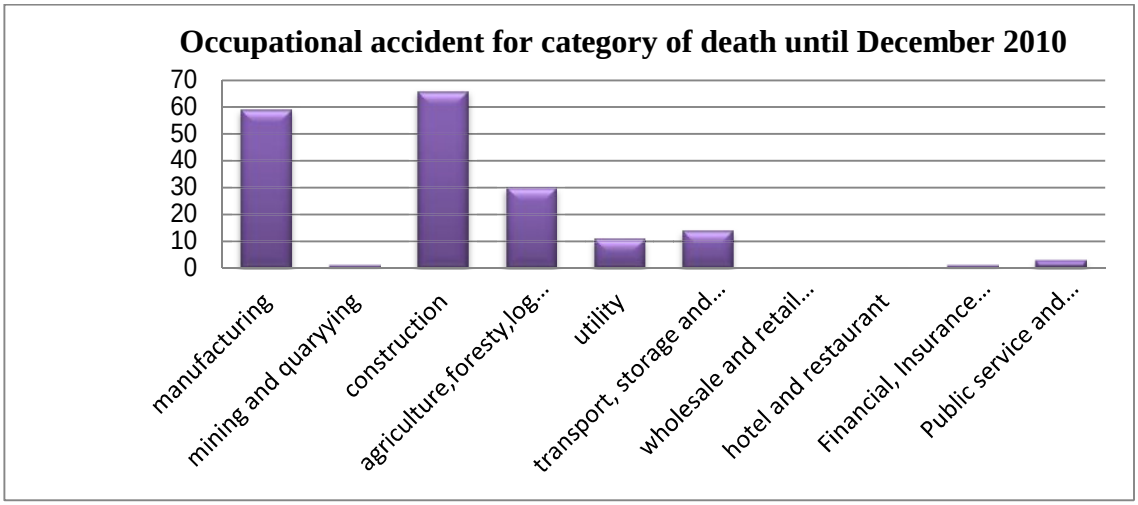


Table 1.1: Type of accident in construction industry until 2011

TYPE	FATAL ACCIDENT	NON-FATAL ACCIDENT	TOTAL ACCIDENT
Fall	34	16	50
Struck by falling object	14	12	26
Stepping on, striking against or struck by object	7	6	13
Caught in or between object	9	13	22
Overexertion to or strenuous movements	0	1	1
Exposure to or contact with extreme temperatures	1	2	3
Exposure to or contact with electric current	5	1	6
Exposure to or contact with harmful substances	11	22	33
Other type of accident N.E.C	0	2	2
Total	**81**	**76**	**152**

Sources: Department of Occupational safety and health

Figure 1.1 and 1.2 shows the category of death by sector and type of accident in construction site that obtained from Department of Occupational safety and health (DOSH). The construction sector experienced the highest death compare to other sector. The most common type of accident in construction site are; falling (22.2%), stepping on the object (18.2%) and struck by falling object (17.1%). Falling recorded as the major type of accident that always happened in construction site.

In order to overcome and reduced the risk, DOSH already stated that risk management can help lessen the risk. Therefore, the risk analysis and management is very important feature in construction in order to deal with risk effectively and also to achieve project objective successfully.

1.3 OBJECTIVE OF STUDY

The objective of study is to evaluate how the risk management is used in the construction and also how organizations are managing risks during construction project. In order to achieve the objective, the following three (3) objectives have been formulated to support the study.

I. To identify type of risk that always occur during construction project
II. To determine the factor that contributes to the risk on construction site
III. To proposed the solution through proper risk management.

1.4 SCOPE OF STUDY

The research is focus on the construction organization and site at selected area which is in Kuantan Pahang. The reason of chosen area is because due to development within this area and also want to know the level of risk management among involved parties such as contractor during construction project.

1.5 SIGNIFICANT OF STUDY

I. To provide a better understanding about risk management in construction industry.
II. To guide organization in risk prevention and provide efficient solution to manage risk.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Literature review is very important process during research which is used as a guideline in the study and also to identify type of risk and risk management process used. There are many articles and studies conducted to identify the risk that exposed during construction and the prevention using proper risk management. So, it is very important and necessary to define the type of risk that involved during project construction in order to minimize the risk.

The purpose of risk management in project is to reduce uncertainty that may not achieve the objective of the project and also to help in identifying opportunities and advantages. Risk management assist all important process involved during project such as setting priorities, allocating resources and implementing action in order to get better outcomes. Risk provides a foundation for risk management and also project objectives. Risk should be identified as early as possible during the project appraisal phases. This is because once risk has been identified it is easy to determine the action that should be taken in order to deal with it.

Overall risk identification can be considered as risk classification. In order to manage risks it is necessary to classify risk because the risk elements involved are varied. The purpose of risk classification is to cope with risk effectively and classification is very helpful to identify the risks. Carruth (1977) and McNulty (1980) identified some risk elements inherent in construction projects, which include site security, health and welfare

requirements. Perry and Hayes (1985) and Mustafa and AI-Bahar (1991) identified a number of risk sources central to construction projects. These are environment, physical, design, financial, legal, political, construction and operation risk, etc.

2.2 DEFINITION

The construction industry has a high rate of work accidents and a poor reputation. Compared to other activities, construction is subject to more risks due to unique features such as long duration, complicated processes, unpredictable environment, financial intensity and dynamic organization structures. Risk plays important roles to determine the successful of the organization because risk can affect the productivity of the company, employers and even client. So, it is important to identify the risk properly.

2.2.1 Risk

Risk can be considered as threat or opportunity which will affects time, cost, quality, performance and productivity of the project**.** Based on the Oxford Dictionary, risk is "the possibility that something unpleasant will happen". Risk also can be theoretically described as situation involving unknown factor which can have pleasant or unpleasant or mostly unforeseen and unpredictable consequences. Based on ISO/IEC Guide 73 (BSI, 2002) risk is define as "the combination of probability of an event and its consequences". In some situation, risk arises from the possibilities of deviation from the unexpected outcome or event" but it "is generally used only when there is at least the possibility of negative consequences". Risk is involved in the nature of all projects in construction site and zero risk projects do not generate attraction to follow due to the fact that facing with risk is a major factor to earn desired benefits in return for ventured resources

2.2.2 Risk management

Risk management can be defined as a system which aims to identify and quantify all risks to which project is exposed so that a conscious decision can be taken. Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, and monitoring and control on a project. The objectives of Project Risk Management are to increase the probability and positive impact of positive events also decrease the probability and negative impact in the project. Thompson and Perry (1992) stated that the aim of applying risk management is not to remove all of the risks from the project, but it is to ensure that all risks are managed effectively. Tzvi Raz, Aaron Shenhar, and Dov Dvir stated that risk management practices on one hundred projects in a variety of industries. The results suggested about risk management practices:

I. Risk management is not widely used.
II. The projects that were most likely to have a risk management plan were those that were perceived to be high risk.
III. When risk management practices were applied to projects, they appeared to be positively related to the success of the project.
IV. The risk management approach influenced project schedules and cost goals but exerted less influence on project product quality.
V. Good risk management increases the likelihood of a successful project.

2.2.3 Accident

Occupational Safety and health defined accident as an unplanned event that results in personal injury or property damage. Accident is an indication of deficiency. In general, accident is unplanned, unexpected or undersigned event which occurs suddenly and causes injury or losses. It also will decrease value of resources or increase in liability. According to (article 3 of the act of 30 October 2002 on social insurance for accident at work and occupational diseases, Journal of Laws no. 199, item 1673) stated that accident at work is

considered to be sudden event caused by an external reason, resulting in injury or death, which took place in connection with work,

2.2.4 Hazard

A hazard is simply a condition or a set of circumstances that present a potential for harm. Hazard can categorized in two which is health hazards which is cause occupational illnesses and safety hazards that cause physical harm such as injuries. Hazards are the main cause of occupational health and safety problems. Eliminating and controlling the risk that contribute to hazard will help reducing workplace injuries and illness. To prevent health hazards at work, all possible health hazards that may be encountered should be identified before commencement of construction work. The health hazards at a construction site may come from the hazardous substances used or those already present on site. The environmental conditions may also create additional health hazards. These factors should also be identified, for example, heat and noise. The information for hazard identification can be obtained from the equipment and material supplier, site owner and principal contractor. If such information is not available, then a contractor should take actions to identify unknown substances or seek assistance from a specialist if necessary.

2.3 RISKS IN MANAGEMENT

In management, there are many type of risk identify such as time and delay, financial, material, labor and machine and equipment.

2.3.1 Time and delay

Time is very important factor in construction. Time associated with cost. Company will face financial losses due to improper time management. Bad time management in construction projects lead to serious consequences that may retard the development of the construction industry and influence the overall economic condition. Effective management

and the administration of the contract time and change provisions are central to the avoidance and mitigation extended time and cost overruns. To enhance the odds of a successful project outcome, it is essential for participants in the construction process to have a basic knowledge due to time management.

Construction industry has a very poor reputation in coping with delays. Construction duration was defined as the elapsed period from the commencement of foundation works on-site to the practical completion and handover of the building to the client (Albert and Chan, 1996). In Malaysia, many contractors faced a problem to complete the project on time. This is because of several causes that are contributed to time delay. SM Ahmed stated that, "time delays actually had become a construction phenomenon and these created an effect towards the owner, consultants, and contractor based on their relationships, distrust, litigation, arbitration, cash-flow problems, and their impression based on work progress". W. Alaghbari (2007) ranked the factors that caused delay based on contractor-related. Financial problems in the highest ranked followed by the shortage of materials on site, poor site management construction mistakes and defective work, delay in delivery of materials to site, coordination problems with others, shortage of site labor, low labor productivity. Delay will affect financials of the company because company will face losses due to delay. Proper planning is very important at the early phases of construction in order to minimize or prevent delay.

2.3.2 Financial

Financial issues in construction projects lead to serious consequences that may retard the progress and development of a project and can influence the construction organization and industries. According to Ahmed et al. (2003), the possible financial-related factors that lead to delays in Malaysian construction projects are financial problems of client such as delayed payments, financial difficulties and economic problems; financial and cash flow problems of contractor, and external factor of poor economic conditions, such as currency and inflation rate. There are many financial related causes such as

payment failure, cash flow issued, financial resources and also market issues. Table 2.1 shows the categorized of financial problem.

Table 2.1: Categorized Of Financial Problem

Category	Causes
Payment issues	• Client's poor financial and business management • Withhold of payment by client Contractor's invalid claim • Delay in valuation and certification of interim payment by consultant • Inaccuracy of valuation for work done • Insufficient documentation and information for valuation • Involvement of too many parties in the process of honoring certificates • Heavy work load of consultant to do evaluation for variation order
Cash flow issues	• Contractor handles too many projects at the same time • Contractor's instable financial background Unqualified contractor underbidding the project cost • Lack of regularly cash flow forecasting • Poor credit arrangement with creditors and debtors Capital lock-up
Financial resource	• Difficulties in getting loan from financiers • Allocation of government budget not in place
Market issues	• Increment of interest rate in repayment of loan • Inflation (material prices, labor wages, transportation costs) • Increment of foreign exchange rate (imported materials and plants)

2.3.3 Material

An important problem that adversely affects the performance of construction projects is the improper handling of materials during site activities. The inappropriate handling and management of materials on construction sites has the potential to severely hamper project performance (Ogunlana el 01,. 1996). There are major issues which affect materials management activities such as constraints on storage areas, sites logistics with regards to materials handling and distribution and also ordering and delivery of materials to the construction site**.** Previous research has also highlighted materials management issues such as; improper storage (Canter, 1993), requirement for large storage capacity (Agapiou el aI. 1998), transportation difficulties and inappropriate materials delivery (Zakeri el al., 1996). Other issues include; manual processes, and non-compliance with specifications (Dey, 2001), late delivery (Aibinu and Odeyinka, 2006), shortage of materials (Abdul-Rahman el al. 2006). So, there are many factors that contribute to material management that give impact to overall project during construction.

2.3.4 Labor

Labor play important roles in the construction industries. Proper labor management in construction can make the profit on project that bidding on. Time management will determine the total payout that need to invest on the labor salary due to overtime in order to complete the project. But, if construction organization doesn't have enough workers, it also could lead to construction delays which will give impact to profit margin.. Labor productivity can define as output per labor hour. Labor performing task is susceptible in order to influence management. Labor productivity is very important and it shown the overall effectiveness of management. In construction, the hire workers are divided into two categories which are skill and unskilled workers. Both are play important roles to finish the project and make profit from bidding project.

2.3.5 Equipment and machineries

Construction equipment may affect the time, energy and productivity of the project during construction. Appropriate selection based on type and usage will make the work become easier. It is important for workers that involve in project construction to be familiar with machineries and equipment that commonly used during construction work. Risk control must be applied to the hazards to prevents or reduces the risk of injury or harm. Health and safety laws require the highest order control be applied so far as is reasonably practicable. Higher order machinery and equipment risk controls are preventative by nature, are effective and durable for the environment it is used in, and deal directly with the hazard at its source. Base on Health and safety law, there are three orders for equipment risk control which is lower order machinery and equipment control, Administrative control and higher control. For Lower order machinery and equipment risk controls, such as personal protective equipment (PPE), can prevent injuries, but are generally not as effective as higher order controls, as they rely more on employee behavior, maintenance programs and supervision. Administrative controls use systems of work to reduce risk by providing a framework of expected behaviors. Examples are rotation of staff to reduce exposure to a hazard, or a documented safe system of work, such as ‘lock out-tag out’. These types of controls rely on extensive instruction, information, training and supervision. In terms of time and ongoing administration by managers and employers to ensure the desired behavior occurs, administrative controls can be the most expensive and least effective form of hazard control.

2.4 RISKS ON CONSTRUCTION SITE

Construction industry accident fatality rate stands at more than double that of the all sector average. Minor accidents are almost incalculably. Construction sites are a health and safety nightmare which is almost every conceivable hazard exists within this constantly changing working environment but the hazards associated with construction sites are well known. Most responsible employers are aware of their duty of care to employees, visitors,

and those that may be affected by their activities, and will manage the site effectively by implementing appropriate accident prevention measures. Risk assessments are carried out by management to identify hazards and risks posed.

2.4.1 Falls

A fall is defined as an event which results in a person coming to rest *i*nadvertently on the ground or floor or other lower level. Employers must set up the work place to prevent employees from falling off of overhead platforms, elevated work stations or into holes in the floor and walls. OSHA requires that fall protection be provided at elevations of four feet in general industry workplaces, five feet in shipyards, six feet in the construction industry and eight feet in long shoring operations. In addition, OSHA requires that fall protection be provided when working over dangerous equipment and machinery, regardless of the fall distance."(OSHA,2009). Falls are one of the most common causes of work related injuries and deaths. Overall, about half of victims die at the scene, and a total of 70% die before they reach the hospital. The median height leading to death is about 49 feet and 100% of victims die after falling 85 feet or more. (Crit Care Med, 2005) Fall hazards include overhead platforms, elevated work stations, holes in the floors and walls, dangerous equipment and machinery and others. Basic fall protection would include guardrails, mid rails and toe boards. Openings must be properly barricaded or covered. Open sides, floors or platforms must be equipped with standard railings.

2.4.2 Electrocutions

Electrocution still provides a very real and often deadly risk although it is not common as other injuries in site. According to the National Institute for Occupational Safety and Health, around 400 fatalities occur every year from electrocution on construction sites. In addition to these fatalities, many nonfatal electrical accidents occur on construction sites every year. Most of these accidents are avoidable, often caused by the negligence of the party responsible for the property. The Occupational Safety and Health Administration (OSHA) recognizes four types of electrical injuries which is burn, electric

shock, fall caused by electrical shock and fata electrocution. Electric shock can damage both external skin and internal organs. Some shocks may seem to leave only a minor external wound, when it has actually caused major damage to internal tissues.

2.4.3 Falling debris, materials or objects

Unnecessary injuries from falling objects on construction sites are common. When tools, building materials, debris and other relatively heavy objects accelerate to high speeds in the process of falling, they can cause potentially fatal injuries to construction workers below. Even an object as small as a bolt can cause serious injury if drop from a number of stories above a worksite onto a construction worker. Heavy winds can cause unsecured construction materials or equipment to fall and strike workers

2.4.4 Overexertion

Common types of overexertion occur when a worker pushes, pulls, carries, and lifts, heavy objects for an extended period. This creates stress on the joints and muscles in the body. Other ways overexertion injuries happen is because of repeated bending at the waist and poor posture. These strains happen and can result in stretched or torn muscles. A common serious form of overexertion is overheating and dehydration. Construction workers are very susceptible to this type of overexertion, especially when they work outside on days that are hot and humid. Overexertion can be avoided, by taking breaks, staying hydrated, and using proper lifting and other techniques to reduce body stress. There are many sign of overexertion such as Fatigue, dizziness, significant sweating, irregular heartbeat, chest pain, weakness, burning sensation, nausea and etc.

2.4.5 Machinery accidents

Construction workers often are exposed to dangerous and heavy machinery. Depending on a person’s job and the size of a job site, this could happen on a daily basis, or even more frequently. It comes as no surprise then that machinery accidents occur too

often on construction sites. These huge machines can cause catastrophic and even fatal injuries to workers. Injuries from machinery can affect the quality of a person's life, his or her health, or even the financial stability of a family. Accidents involving machinery come in many forms such as loader accidents, crane accidents, as well as accidents with skid steers, back loaders, bulldozers, etc. The effects of a machinery accident can cause many of the same injuries that affect the limbs, face, head, and other parts of the body. Broken bones, cuts, scrapes, amputations, paralysis, traumatic brain injury, disfigurement, and other terrible injuries or death can occur on a construction job site due to machinery

2.5 METHOD TO PREVENT RISK AT CONSTRUCTION SITE

"The optimal method of preventing occupational illnesses, injuries, and fatalities is to "design out" the hazards and risks; thereby, eliminating the need to control them during work operations."(Corbett, 2007). Every year millions of people in the European Union (EU) are injured at work or have their health seriously harmed in the workplace. Occupational accidents and diseases cause great human suffering and loss and the economic cost is also high. Prevention is the guiding principle for occupational safety and health (OSH).

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Selecting an appropriate research methodology is crucial and depends on the study objectives and resource limitations, such as time and funds. To obtain valid and reliable data, it is imperative to select a methodology that serves the research objectives. This chapter describes in detail the research design, strategy and data collection. Philliber et al. (1980) state that research design provides guidelines of the research. It also provides responses and solutions to areas of research questions, appropriate information, and method of collecting and analyzing the content. In this study, two (2) method that have been decided to used which is literature review and questionnaire survey . Literature review Literature review has been done in order to collect data and information related to study. Other than that, Questionnaire surveys also chosen as a mechanism for obtained information and opinion. Questionnaires are very efficient collection of certain kinds of information. This method used in order to get the data and the feedback from organization which is related to my study.

3.2 LITERATURE REVIEW

The investigation began by reviewing the relevant literature to collect the primary data and in order to determine the gaps in research related to the proposed topic, and to critically review the issues related to the study. The literature review stage also helped to

identify the related factors, and their classification helped to determine the most appropriate techniques to be applied in order to achieve the research aim. Literature review done by reading related books, journals, thesis, magazine, newspaper and other resources which is also can be obtained from the internet. Most of sources can be obtained from the library.

3.3 QUESTIONNAIRE SURVEY

Kindrick (2003) stated that the format of a risk assessment questionnaire should be reviewed to select only the risks relevant to the type of project, with simple responses offered. Thus, the number of risk factors was kept to a minimum and the questions were reevaluated in order to maximize the usefulness of the survey, to design an effective questionnaire, and to ensure the reliability of the risk factors. The questionnaire was designed to suit the local environment and bring out the key local issues faced by the clients, consultants and contractors (CCCs) during the construction phase

3.3.1 Section A: Respondent Profiles

Section A is a respondent profiles which is information from the respondent can be obtain. The questionnaire includes the following:

I. Company the respondent represented
II. The position of respondent in the company
III. The working experiences of respondent in construction industry
IV. The experiences of company in construction industry.

3.3.2 Section B: Type of risk in construction site

In this section is to identify the type of risk on construction site. The respondents was asked to rank the type of risk based on the own judgments and working experiences.

The questionnaire used Likert's scale of five (5) ordinal measures from one (1) to five (5) according to the level of frequent. Each scale represented the following rating:

(5) = Always occur
(4) = Mostly occur
(3) = Sometimes occur
(2) = Seldom occur
(1) = Never occur

3.3.3 Section C: Factor that contributes to the risk on construction site

This section focused on factor that contributed to the risks on the construction site. There are a lot of factors that have been identified and the construct into a structured question. The questionnaire also based on Likert's scale of five (5) ordinal measures from five (5) to one (1) according to level of contribution. Each of scale will represent the following rating:

(5) = Very high contributing
(4) = High contributing
(3) = Medium contributing
(2) = Low contributing
(1) = Very low contributing

3.3.4 Section D: Solution on how to manage a risk at construction site

This section is to obtain the information about application of risk management in construction site. The respondent will be asked about prevention that should be taken. The questionnaire is based on Likert's Scale of five (5) ordinal measures from five (5) to one (1). Each scale represents the following rating:

(5) = Highly agree

(4) = Agree

(3) = Neutral

(2) = Disagree

(1) = Very disagree

3.4 INTERVIEW

The most appropriate way to collect data from the very beginning, without depending on questionnaires developed by other researchers, is to collect data using face-to-face interaction with the practitioners Belson (1981). Creswell (2009) stated that qualitative study helps in collecting data from face-to-face interaction with participants who have experienced the problems in the field or on site. It also assists in collecting data from multiple sources, such as interviews and documents, then reviewing all the data to make sense of it and organize it. In designing the interview questions several aspects were taken in consideration, such as the exact information it was necessary to gather, and what type of questions – open or closed – would best serve the purpose of the interview Belson (1986). Furthermore, sending information to respondents ahead of time with an assurance of confidentiality was another way of improving the interview process.

3.5 DATA ANALYSIS

All data taken as a result will be sorted, organized and distributed based on the questions. In order to achieve the objectives, data analysis of the information gathered will be divided into two parts of analysis which is initial and detailed analysis. Preliminary analysis conducted on the data about respondent's background and general information whereas the detailed analysis involved the analysis of the data necessitate for the purpose of reaching the research objectives.

In general, the data collected from the questionnaire distributed was analyzed using "Average Index" (AI). This technique has been used by Al-Hammad *et.al.* (1997). AI was calculated using the following formula in Figure 3.1.

Figure 3.1: Average Method Formula

Average Index = $\left[\frac{\sum_{i=1}^{5} a_i x_i}{\sum_{i=1}^{5} x_i}\right]$ **for five scale rating**

Where,

a_i = Constant expressing the weight given to I,

x_i = Variable expressing the frequency of the response for;

I = 1, 2, 3, 4, 5 and illustrated as follow:

x_1 = frequency of the 'very rare' response and corresponding to a_i=1

x_2 = frequency of the 'rare' response and corresponding to a_i=2

x_3 = frequency of the 'slightly frequently' response and corresponding to a_i=3

x_4 = frequency of the 'frequently' response and corresponding to a_i=4

x_5 = frequency of the 'very frequently' response and corresponding to a_i=5

To determine the degree of importance in this study the classification of the rating scales the classifications of the rating scales have been used are as follows:

Table 3.1: Category scale in priority

Scales	Categories	Average Index (x)
1	Strongly Disagree	$1.00 \leq X < 1.50$
2	Disagree	$1.50 \leq X < 2.50$
3	Neutral	$2.50 \leq X < 3.50$
4	Agree	$3.50 \leq X < 4.50$
5	Strongly Agree	$4.50 \leq X \leq 5.00$

The data collected from the questionnaire that also called quantitative data were analyzed using Microsoft Excel. As a spreadsheet, Excel can be used for data entry, manipulation and presentation but it also offers a suite of statistical analysis functions and other tools that

can be used to run descriptive statistics and to perform several different and useful inferential statistical tests that are widely used in research. Finally, the final analysis can be presented in the form of graphs, tables, pie charts etc. so that it is more attractive and easily to understand.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

This chapter will explain the finding of data collecting and all also data analysis in order to achieve all three objectives. All of the data is collected; the final and essential step is data analysis. It involves treating, managing, and analyzing of all information gathered in previous phases particularly in data collection. The data was collected through the questionnaire that conducted based on the objective of study

4.2 RESPONSES TO QUESTIONNAIRE

The structured questionnaire based on the data obtained from the literature review where the final questionnaire from is presented in Appendix. Table 4.1 below shows the questionnaire distribution and responses. One hundred and thirty (130) sets of questionnaire were distributed to the contractors and only 109 were returned completed. The percentages of the response rate were 84 %.

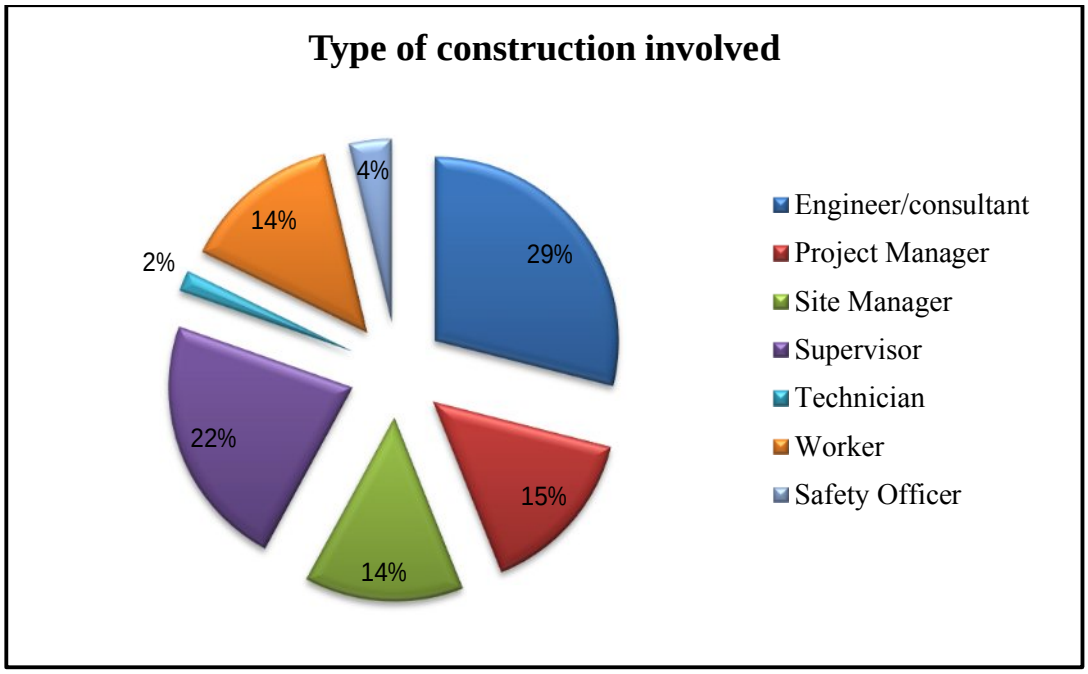
Table 4.1: Number of questionnaire distributed

Category	Number of distributed questionnaires	Number of respondents	Percentage, %
Contractors	130	109	84

4.2.1 Type of construction involved

Figure 3 represented the types of construction work involved by the contractors as indicated by the respondents. The figure shows that 47% of the contractors involved with building project, followed by various type of project which is 34% project. After that, industrial project takes third place which at 8% while highway projects at 6%. For infrastructure works only 5% of the respondent company's involved.

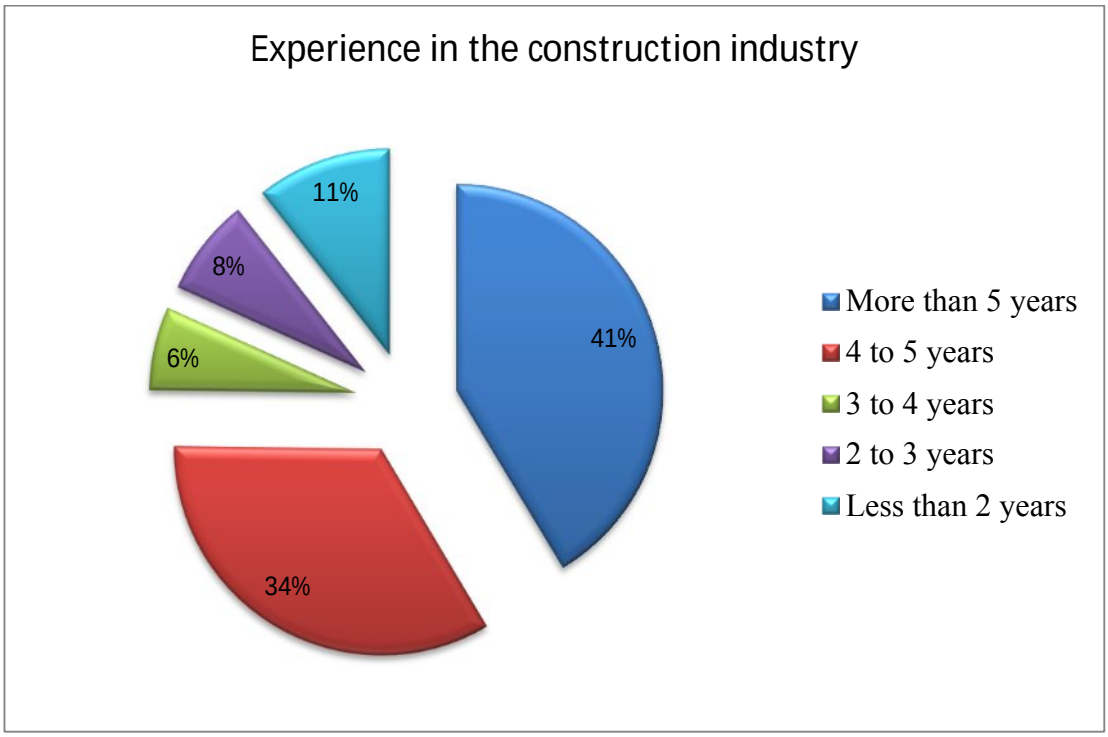
Figure 4.1: Type of construction involved



4.2.2 Experience in the Construction Industry

Figure 4.2 show the years of experience of the contractor in construction industry. First, 41% of the contractors experienced more than 5 years in construction industry followed by 4 to 5 years of experience which is 34%. After that, 3 to 4 years of experience third place which at 11% while 2 to 3 years and less than 2 years contractor experience in construction industry each at 8% and 6%.

Figure 4.2: Years of Experiences



4.3 Objective No. 1: To identify type of risk that always occurs during construction project

Figure 4.3 shows the type of risk that always occurs in contractor organization. According to that figures, type of risk 'Machine and equipment problem' is the most significant factor which have the value of 4.21 of AI. This factor has to be heavily influences the contractors because all equipment has potential to cause great problem in during construction activities. If workers fail to manage the risks associated with the use of work equipment, it could be putting the person using that piece of equipment and others at risk whether injury or death. It is followed by the 'manpower resources problem' which has a value of AI is equal to 4.11. Manpower will contribute to productivity and also risk. The biggest obstacle in case of manpower is the fact that the industries in general are not making optimum use of their manpower. Other than that the increase of absenteeism among manpower has been increase will lead to less of productivity and increase the risk to

organization in term of management. Beside than that the skill of manpower hired and risk knowledge among worker also could expose to the risk.

The third and fourth significant factor was ‘accident during lifting materials’ and ‘falling during work at height’ which has a value of AI is equal to 2.51 and 2.10. A lifting operation is an operation concerned with the lifting and lowering of a load. A load might be items or person. The physical load from manual lifting in the construction industry has been reported extensively. Jobs in the construction industry with manual lifting tasks are scaffolding, bricklaying and processing plasterboard. Manual lifting tasks with high loads or frequencies may induce musculoskeletal disorders (MSD that lead to back pain. According to the European Working Conditions Survey 36.5% of the construction workers reported work related back aches. In addition, acute trauma such as cuts or fractures due to accidents may occur from manual lifting task. Other than that falling during work at height are responsible for many serious injuries and even death. Fall from height two meters will sustain serious injury.

The fifth significant factor of is ‘Accident during excavation and trenching’ which has a value of AI is equal to 1.98. Occupational Safety and Health Department stated that excavating is recognized as one of the most hazardous construction operations. A trench is defined as a narrow underground excavation that is deeper than it is wide, and is no wider than 15 feet (4.5 meters). Trench collapsed recorded dozens of fatalities and hundreds of injuries each year. In addition, the ranking of ‘type of risk in construction’ was summarized in Table 4.2.

Figure 4.3: Types of risk

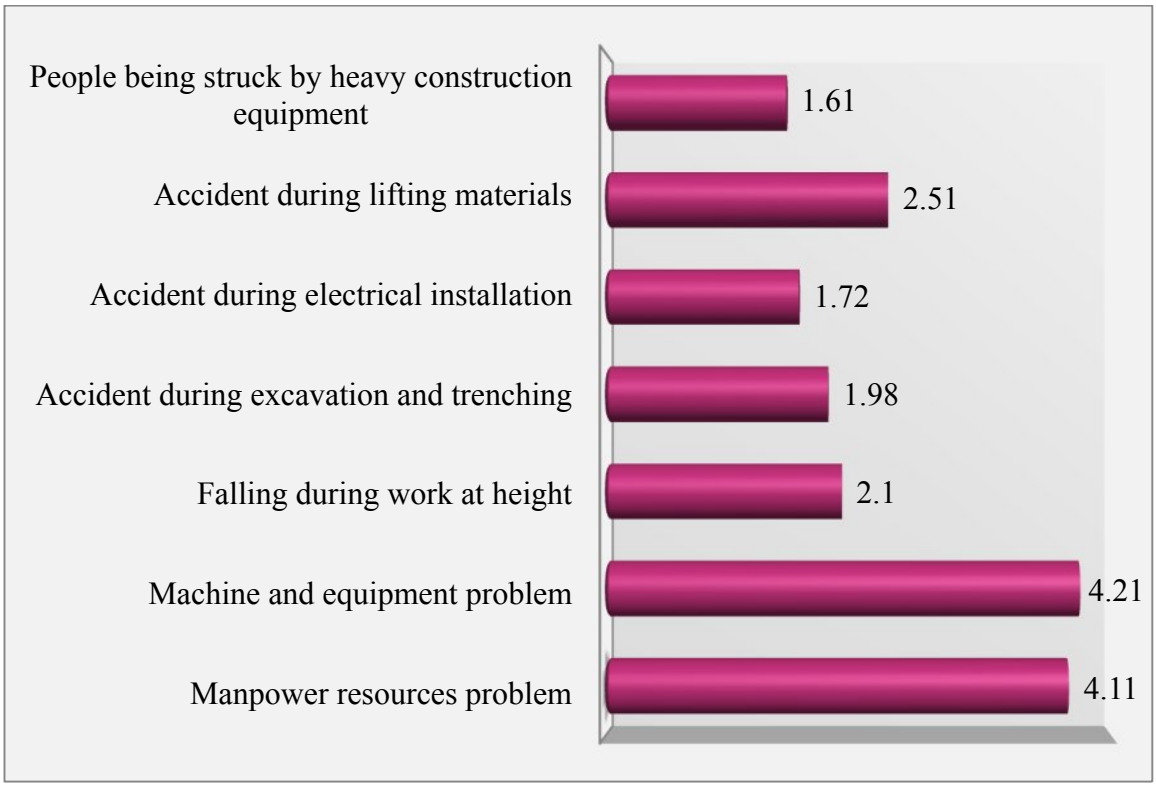


Table 4.2: Ranking of type of risk in construction site

No.	Type of risk in construction site	Total Respondents	AI	Rank
1.	Machine and equipment problem	109	4.21	**1**
2.	Manpower resources problem	109	4.11	**2**
3.	Accident during lifting materials	109	2.51	**3**
4.	Falling during work at height	109	2.10	**4**
5.	Accident during excavation and trenching	109	1.98	**5**
6.	Accident during electrical installation	109	1.72	**6**
7.	People being struck by heavy construction equipment	109	1.61	**7**

4.4 Objective No. 2: To identify the factor that contributes to the risk on construction industry

Figure 4.4 shows Factor that contributes to the risk on construction site. Based on the data obtained, the most significant factors that contributed to the risk 'lack of site safety inspection and supervision' is the higher factor which give value of AI equals to 4.81. Lack of inspection and supervision give advantage to the workers to do something which is supposed not to do in construction site. With the tight supervision will ensure the employees do their job properly and follow the safety. Plus, it will make it possible for employees to cut corners to get their work done faster that could lead to all kind of risk and hazard. Secondly, it was followed by 'Lack of adequate tools and equipment' which has a value of AI equals to 4.77. Selecting correct equipment that suitable with its intended purpose is very important. Correctly selecting equipment will reduce the chances of damage or injury to plant, equipment and people and also reduce chances of losses.

Third significant factor that contributes to the risk in construction industry is 'Lack of safety knowledge' which has the value of AI is equal to 4.73. Knowledge about safety and health are very important in order to minimize the risk. When workers are aware of the health and safety risks in their workplace, they can address health and safety concerns and follow safe work practices. The ranking of factor that contributes to the risk on construction site was summarized in Table 4.3.

Figure 4.4: Factor that contributes to the risk on construction site

Table 4.3: Ranking of factor that contributes to the risk on construction site

No.	Factor that contributes to the risk on construction site	Total Respondents	AI	Rank
1	Lack of site safety inspection and supervision	109	4.81	**1**
2	Lack of adequate tools and equipment	109	4.77	**2**
3	Lack of safety knowledge	109	4.73	**3**
4	Lack of adequate lighting	109	4.69	**4**
5	Lack of compliance to governmental safety regulations	109	4.64	**5**
6	Lack of adequate safety training	109	4.62	**6**
7	Lack of adequate resources to safety	109	4.60	**7**
8	Lack of adequate job experience	109	4.59	**8**
9	Incorrectly using tools and equipment, hand tools, power tools, and machinery	109	4.46	**9**
10.	Failure to use personal protective equipment	109	3.99	**10**

4.5 Objective No. 3: To purpose the solution through proper risk management

Figure 4.5 shows the solution on how to manage a risk at construction site. Based on the data obtained, the most significant factors that contributed to the risk 'Well planning of a project process before project start' is the higher factor which give value of AI equals to 4.56. Well planning project can prevent many possible problems. Before project begin identification of potential risk and the evaluation of the potential impact of risk that will face during construction activities should be done. Secondly, it was followed by 'Well manage machinery and equipment' which has a value of AI equals to 4.52. Machinery and equipment should not use by unauthorized, unqualified or untrained people. Supervisor need to check the machine in order to ensure the machine is well maintained and fit to use.

Workers also need to ensure that machinery and equipment are appropriate for the job and working properly and all the safety measures are in place.

Third significant factor that contributes to the risk in construction industry is 'Establish an efficient communication at the work place' which has the value of AI is equal to 4.50. Employees in the organization that communicate effectively have more successful project and also successful in risk prevention. The ranking of solution on how to manage a risk at construction site was summarized in Table 4.4.

Figure 4.5: Solution on how to manage a risk at construction site

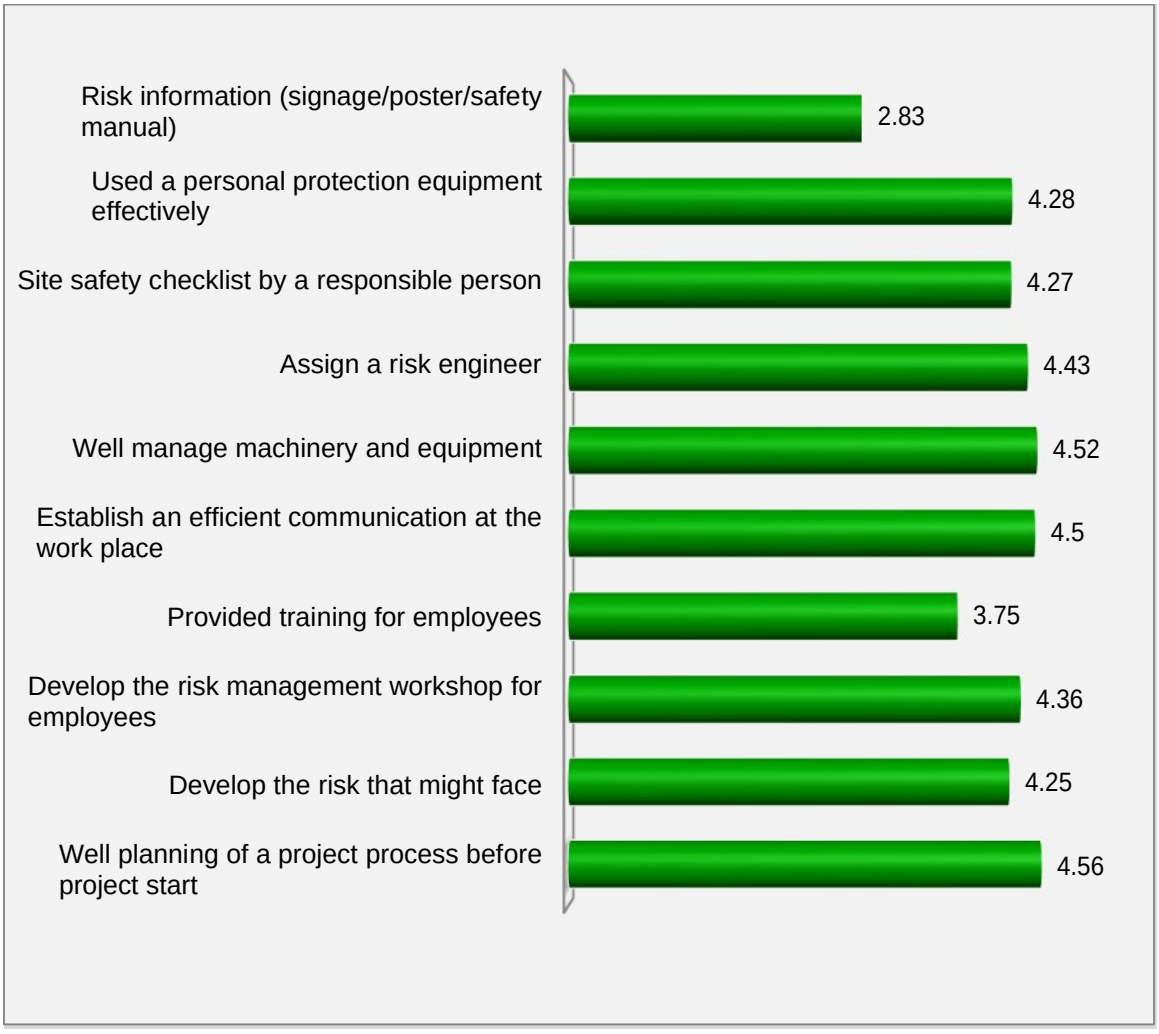


Table 4.4: Ranking of Solution on how to manage a risk at construction site

No.	Solution on how to manage a risk at construction site	Total Respondents	AI	Rank
1	Well planning of a project process before project start	109	4.56	**1**
2	Well manage machinery and equipment	109	4.52	**2**
3	Establish an efficient communication at the work place	109	4.50	**3**
4	Assign a risk engineer	109	4.43	**4**
5	Develop the risk management workshop for employees	109	4.36	**5**
6	Used a personal protection equipment effectively	109	4.28	**6**
7	Site safety checklist by a responsible person	109	4.27	**7**
8	Develop the risk that might face	109	4.25	**8**
9	Provided training for employees	109	3.75	**9**
10.	Risk information (signage/poster/safety manual)	109	2.83	**10**

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter will conclude the overall study regarding to risk management in construction industry. The objective of this study was based on the outcomes and analysis from previous chapter. In summary, the study of the risk management in construction industry was achieved by questionnaires distributed. Some research limitation also will be discussed together with the suggestion and recommendations for the future study.

5.2 CONCLUSION

The three objectives of this study have been successfully achieved. The findings can be summarized as follows:

5.2.1 Objective No 1: To identify type of risk that always occurs during construction project

From the study, it was found that types of risk that always occur during construction project are as follows:

I. Machine and equipment problem
II. Manpower resources problem

5.2.2 Objective No 2: To determine the factor that contributes to the risk on construction industry

From the study, the factor that contributes to the risk on construction industry is as follows:

I. Lack of site safety inspection and supervision
II. Lack of adequate tools and equipment
III. Lack of safety knowledge
IV. Lack of adequate lighting
V. Lack of compliance to governmental safety regulations

5.2.3 Objective No 3: To purpose the solution through appropriate risk management

I. Well planning of a project process before project start
II. Well manage machinery and equipment
III. Establish an efficient communication at the work place
IV. Assign a risk engineer
V. Develop the risk management workshop for employees

5.3 DISCUSSION

Overall, the objectives of the study were has been achieved in the time assigned. The objectives of this study were achieved by questionnaires conducted. Since the well planning of a project process before project start and well manage machinery got highest rank in managing risk, it shows that managing project at the beginning will prevent and minimizing any risk from occur. Moreover it will increase profit and productivity in the organization.

Established an efficient communication at work place and assign a risk engineer also can minimize the risk during construction activities. Through the active communication and proper supervision from risk engineer will increase the level of safety during construction project. Other than that, by develop the risk management workshop for employees will increase the safety knowledge and risk prevention during construction activities.

5.4 RECOMMENDATION FOR FUTURE STUDIES

Since the study only covered a limited scope in Kuantan and Kuala Lumpur, it is proposed that the further study can be conducted in other state in Malaysia so that it can contribute more significantly to the organization in Malaysia.

This study was only based on the opinion of G7 contractors. In the future, it is recommended that the research can be expanding the domain of study for all grades of contractor to develop efficiency risk management. Also, more through and extensive study can be conducted to develop an efficient solution through risk management.

5.5 SUMMARY

This study had successful provided an overview on the risk management in the local contractor's organization. Accordingly, it is hope that this study can truly support and motivate future studies on the subject matter according to the recommendation suggested.

REFERENCES

[1] Willey (2014). Project Risk Management Guideline,second Edition. Broadleaf Capital

[2] J. Smith, T. Merna, P.l Jobling (2006). Managing risk in construction project, second edition. Retrieved from https://www.researchgate.net/file.PostFileLoader.html?id...assetKey

[3] Y.C Heap & S.L Thuan (2014). Accidents in Malaysian Construction Industry Statistical Data and Court Cases, Thesis. Retrieved from http://archiwum.ciop.pl/65487

[4] J. Irizarry, S. Zolfagharian, M. Nourbakhsh (2011). Risk Assessment of Common Construction Hazards among Different Countries. Retrieved from http://igtplus.mcut.edu.tw/assets/attached/1494/original/Risk

[5] A. Ibrahim Salleh (2014). Risk Management For Safety Improvement On Building Construction Sites In Qatar. Retrieved from http://qspace.qu.edu.qa/bitstream/handle/10576/3280/Al%20Abbadi,%20Ibrahim%20Saleh.pdf?sequence=1

[6] M. Yakubu Danasabe. & I. Mohammad Bakri (2014). A Study Of Fatal And Non-Fatal Accidents in Construction Sector [Abstract]. Retrieved from http://civil.utm.my/mjce/files/2014/04/Paper-10-251.pdf

[7] H.Y. Chong & T.S. Low (2014) . Accidents in Malaysian Construction Industry: Statistical Data and Court Cases [Abstract]. Retrieved from http://archiwum.ciop.pl/65487

[8] J. Cavignac (2009) Managing risk in a construction company [Internet]. Retrieved from http://www.constructionbusinessowner.com/topics/insurance/constructioninsurance/managing-risk-construction-company

[9] P. Goodrum and M.Gangwar (2004). Safety incentive. Professional Safety. Retrieved from http://www.asse.org/foundation/research/docs/foungrnt_july04_goodrum.pdf

[10] S. Martin (2006) Risk management in construction project management, Journal of Business Economics and Management Retrieved from http://www.tandfonline.com/doi/pdf/10.1080/16111699.2006.9636126

FACULTY OF CIVIL ENGINEERING & EARTH RESOURCES

QUESTIONNAIRE

Title: Risk Management in Construction Industry

Prepared by:

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Supervisor

Dr. Doh Shu Ing

All the provided information from your respond will be treated as strictest confidence and will be used in this research only. Your participation in this survey is very much appreciated.

Thank You.

Section A: General Information

Please (√) on the appropriate choices that best suits you

1. Company Name: _____

2. Type of construction work involved (you may tick more than one)

☐	Building
☐	Highway
☐	Industrial Project
☐	Infrastructure

☐ Others, specify:_____

4. Number of year respondent has experience in construction industry

☐ Less than 2 years
☐ 2 - 3 years
☐ 3 – 4 years
☐ 4 – 5 years
☐ More than 5 years

Section B: Type of risk in construction site

Objective 1: To identify type of risk that always occurs during construction project

1	2	3	4	5
Never occur	**Seldom occur**	**Sometimes occur**	**Mostly occur**	**Always occur**

Type of risk in construction site	**1**	**2**	**3**	**4**	**5**
Manpower resources problem					
Machine and equipment problem					
Falling during work at height					
Accident during excavation and trenching					
Accident during electrical installation					
Accident during lifting materials					
People being struck by heavy construction equipment					

Section C: Factor that contributes to the risk on construction site

Objective 2: To determine the factor that contributed to the risk on construction industry

1	2	3	4	5
Very low contributing	**Low contributing**	**Medium contributing**	**High contributing**	**Very high contributing**

Factor that contributes to the risk on construction site:	**1**	**2**	**3**	**4**	**5**
Lack of site safety inspection and supervision					
Lack of adequate resources to safety.					
Lack of adequate safety training.					
Lack of compliance to governmental safety regulations					
Lack of safety knowledge					
Lack of adequate job experience					
Failure to use personal protective equipment					
Incorrectly using tools and equipment, hand tools, power tools, and machinery					
Lack of adequate tools and equipment					
Lack of adequate lighting					

Section D : Solution on how to manage a risk at construction site

Objective 3: To purpose the solution through appropriate risk management

1	2	3	4	5
Very disagree	**Disagree**	**Neutral**	**Agree**	**Highly agree**

Solution on how to manage a risk at construction site	**1**	**2**	**3**	**4**	**5**
Well planning of a project process before project start					
Develop the risk that might face					
Develop the risk management workshop for employees					
Provided training for employees					
Establish an efficient communication at the work place					
Well manage machinery and equipment					
Assign a risk engineer					
Site safety checklist by a responsible person					
Used a personal protection equipment effectively					
Risk information (signage/poster/safety manual)					