

**COST OVERRUN OF CONSTRUCTION
PROJECT IN PAHANG: CAUSES AND
SOLUTION**

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ABSTRAK

Industri pembinaan memainkan peranan yang penting dalam membangunkan infrastruktur negara dan dianggap pra-syarat untuk pertumbuhan ekonomi yang pesat. Kebanyakan Pengurus projek akan meyakinkan pelanggan bahawa projek pembinaan akan siap dalam tempoh kos belanjawan dan pada masa yang ditetapkan. Walau bagaimanapun, kebanyakan projek pembinaan mengalami kos melebihi bajet yang menyebabkan beban kewangan yang besar ke atas pemilik projek atau pelanggan. Kos melebihi bajet berlaku apabila kos akhir pembinaan siap melebihi nilai kontrak asal. Oleh itu kajian ini dijalankan untuk mengenal pasti faktor-faktor yang paling berpengaruh menyebabkan kos yang berlebihan dan untuk menganalisis penyelesaian yang mungkin dapat mengurangkan atau mengawal kos melebihi bajet. Kajian ini adalah berdasarkan kajian literatur yang menyiasat punca dan penyelesaian kos yang berlebihan serta kaji selidik yang telah dijalankan di kalangan profesional dalam industri pembinaan di Pahang. Sebanyak 30 borang soal selidik telah diisi oleh pelanggan, perunding dan kontraktor. Responden diminta untuk menilai punca dan penyelesaian yang telah disenaraikan berdasarkan kebarangkalian kejadian dan kesannya terhadap projek pembinaan. Relative Important Index (RII) analisis digunakan untuk menganalisis data yang dikumpul dan menyenaraikan faktor yang paling berpengaruh terhadap kos ditakluki dan penyelesaian terbaik untuk kos melebihi bajet. Daripada keputusan analisis ia didapati bahawa faktor yang paling berpengaruh kos melebihi bajet ialah kesilapan dalam membuat anggaran kos dan penyelesaian yang paling terbaik ialah memilih kontraktor yang sesuai bukan sahaja atas dasar harga dan masa yang ditawarkan, tetapi juga pengalaman, kedudukan kewangan, keupayaan dan kepakaran. Berdasarkan penemuan utama penyelidikan, ia dicadangkan bahawa setiap pihak dalam industri pembinaan perlu mengambil kira faktor-faktor yang mempengaruhi kos melebihi bajet di setiap peringkat kitaran hayat dan mengambil langkah berjaga-jaga bagi mengelakkan masalah ini. Sebagai contoh, kontraktor disyorkan untuk mempunyai kakitangan teknikal yang berkecuali yang mempunyai pengalaman projek yang mencukupi, pemilik dinasihatkan supaya tidak bergantung kepada kontraktor harga paling rendah untuk melaksanakan projek dan perunding disyorkan untuk berterusan menyelaraskan aktiviti dan menyelia untuk memberi bimbingan, didikan sebagaimana yang dikehendaki supaya ia dilakukan mengikut kepentingan dengan tidak menghadapi sebarang konflik.

ABSTRACT

The construction industry plays a vital role in developing the country's infrastructure and was consider a pre-requisite for high levels of economic growth. Most of Project manager will reassure client that the construction project will be completed within budgetary cost and on time. However, most construction projects experience cost overrun and it put massive financial burden on the client or project owner. Cost overrun occurs when the final cost of the construction at the end of completion exceeded the original contract value. Therefore this research was carried out to identify the most influence factors in cost overruns and to analyze possible solutions to minimize or control cost overruns. The study is based on a literature review investigating causes and solution of cost overruns as well as a survey that was conducted among professionals in the construction industry in Pahang. A total of 30 filled questionnaires were collected from clients, consultants and contractors. The respondents were asked to rate the listed causes and solution on the basis of probability of occurrence and severity of impact. Relative Important Index (RII) analysis was used to analyze the data collected and to rank the most influence factor of cost overrun and the best possible solution of cost overrun. From the analysis of the result it found that the most influence factor of cost overrun is error in cost estimation and the most significant solution of cost overrun is select a suitable contractor not only on the basis of price and time offerings, but also on experience, financial standing, capacity and expertise. Based on the key findings of the research, it was recommended that each construction players in construction industry need to understand the factors that influence cost overrun in each stage of the life cycle of the projects and take a necessary precaution to avoid this problem. For instance, contractors are recommended to have qualified technical staff with appropriate experience of the project, owners are advised not to depend on the lowest price contractor to execute the project and consultants are recommended to continuously coordinating activities and supervising to provide guidance, and discipline as required so they are performed in accordance with their importance with a minimum of conflict.

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LIST OF SYMBOLS

W	Scale for rating given by respondent range from 1-5
A	Highest weight of scale (5 in this case)
N	Total number of respondents
2D	2-Dimensional

LIST OF ABBREVIATIONS

RII	Relative Importance Index
PWD	Public Works Department
CIDB	Construction Industry Development Board
CM	Construction Management

CHAPTER 1

INTRODUCTION

1.1 Background

Construction industry involves a process of constructing a building and an infrastructure such construction of residential, bridge erection, paving of road, excavations and demolition. Construction is a hazardous industry that consists of many activities involving construction, alteration and repair. Thus, a successful construction project should be executed with an effective planning from the early stages of construction. Effective planning involves several stages of execution such as scheduling, budgeting, construction (site work) and completion. Usually for construction of new project or alteration of existing structure requires preparation of contract document. The document provides of pictorial representation of the construction work consists of working drawing, schedule of work, bill of quantities and specification.

Thus, it is vital for contractor to make sure that they abide the contact document until the completion date of project without any problem such as delay in works and overrun cost. Cost overrun was considered a big problem in construction industry, which hinders project's progress, since it decreases the contractor's profit leading to huge losses leaving the project in a big trouble. Cost overrun is defined as excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun." (Al-Najjar, 2008). Thus, this study will primarily focus on problem with cost estimation in a construction project to provide holistic understanding of cost overruns.

Accuracy in cost estimation is important because being able to make accurate estimates is the key to delivering a solid project plan since construction project is a complex project that prone to effect of risk and uncertainty. There are several factors that contribute to errors in cost estimation such as in conventional estimating techniques, the expected range of accuracy in construction is determined by the project plans and other specification provided to the cost estimator. Thus, the accuracy of the cost estimation basically depends on the details given. In addition, conventional costs estimations primarily rely on two-dimensional (2D) drawing measurement have high possibility for inefficiency, ambiguity and error. Thus, it is important to identify factors that contribute to errors during budgeting stages in construction project so that the possible solution can be adapted to overcome this problem. In order to curb excessive budget overruns in cost estimation the experiences of industrial worker were analyse.

1.2 Problem Statement

A construction project can be consider successful if the project have achieved the goals such as the construction project met the technical performance, maintained end date, complete without major safety issues and cost remained in budgetary cost. However, sometime circumstances occur and caused some project to go astray which caused problems such as cost overruns. The cost overruns as the difference between the original cost estimation of project and actual construction cost on completion of works of a commercial sector construction project defined by (Al-Najjar, 2008). Unexpected cost incurred in excess of budgeted cost due to underestimate actual amount of cost during early stage of construction can impact the future financial viability of the company or organization thus, it is vital for a construction project remained within budgetary cost until the completion date.

The increasing complexity of infrastructure projects and the environment within which they are constructed place greater demand on construction managers to deliver projects on time, within the planned budget and with high quality (Enshassi, Lisk, Sawalhi, & Radwan, 2003). Thus, cost overruns need a constructive analysis to analyse various reasons of cost overrun and possible solution to overcome this problem. The purpose of this study is to identify and analyse factors of cost overrun and the possible solutions for cost overrun in order to minimize these issues. The results will be obtained

by analysing the experience of experts in construction industry for better understanding of cost overruns.

1.3 Objective of Study

The objectives of this study are:

- i. To study factors of cost overrun and the possible solution of cost overrun in construction projects
- ii. To identify and analyse the most influence factors in cost overruns
- iii. To identify and analyse possible solutions to minimize or control cost overruns

1.4 Scope of Study

In this study, the scope of research have been limited to cost overrun that focused on factors of cost overrun, the most influence factors of cost overrun and solution to cost overrun. This research was conducted at Pahang only since it is not feasible for this study to survey every state in Malaysia within the provided span of time. To obtain more information for this research interview and questionnaire was distributed to client, consultants and construction contractor from Grade 6 to Grade 7 in Pahang. Besides analysing data of cost overrun that was gathered from experience of experts in industry through interview and questionnaire, data also was recorded by reviewed of articles and past research. These parameters are important in order to come out with more effective cost estimation in construction industry. All findings and recommendation from study may not represent researchers true view as researcher cannot cover all due to time and cost constraint.

1.5 Methodology

The research of this thesis largely adopts a quantitative approach with some elements of qualitative approach especially in the last stages of the research. Quantitative approach is used to gather factual data and to study relationships between facts and how such facts and relationships accord with theories and the findings of any

research executed previously, but the qualitative approach seek to gain insights and to understand people's perception of "the world" whether as individuals or groups.

First of all, before research can begin, the area for research was determined to minimize the scope of research in Pahang. After the location was specified, problem involving construction industries was identified to come out with the problem statement of research. Then, the aims and objectives of this research should be defined clearly for next procedure can be proceeds and title was proposed as Cost Overrun on Construction Industries in Pahang: Causes and Solution. Basically, the information gathered for the early stages of this study was by extensive review and critique of existing literature and theories on the cost overrun phenomenon.

Methodology for this study was divided into two phases which are phase 1 and phase 2. In phase 1, factors and solutions for cost overrun was identified by the interview session with the construction companies in Pahang during the first industrial visit and by extensive review of literature from past research. Data collected from phase 1 was used to design questionnaires to provide the framework for data collection, analyses and verification.

In phase 2, several sets of questionnaires were distributed to different respondents in construction companies in order to determine the most significant factor of cost overrun and solution of cost overrun. Data collected from phase 2 enable objective 2 and 3 of this research which are to identify and analyse the most influence factors and solutions of cost overrun to be achieved. Relative Importance Index (RII) was used in data analysis to rank the most influences factors and solutions of cost overrun. The results were then discussed before reaching conclusions and recommendations for achieving more reliable cost estimation.

1.6 Significant of Study

Research on cost estimation was extremely important for researchers to come out with the best solution to decrease consumption of cost in order to prevent common problem in construction industry such as cost overruns. Minimizing the cost overrun in construction also helps to increase the profits and development of construction industry in Malaysia. With such high levels of capital investment and considering said role construction plays in Malaysian economics, the industry faces two recurrent problems which are slippage of project-schedules and project cost overrun (Shehu, Endut, & Akintoye, 2014). Despite as a guide for preventing cost overrun, a study on cost estimation can be an additional guide for future planning for study area development especially in project management and construction. Thus, this study can motivate others to do more research on this study area.

1.7 Expected Outcome

From a comprehensive analysis on the topic of cost overrun, the outcome was expected to be able to rank the most influence factors and solutions of cost overrun. All factors that contribute to cost overrun will be identified and analysed. This research also was expected to come out with possible solution to minimize cost overrun in construction project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Cost overruns in construction industry in developing country have attracted many researchers all around the world. The cost overrun in construction industry statistics have been well documented in literature, media and official government publications. Cost overrun is especially a problem for Malaysia's construction industry and its broader developing economy. Thus, many researchers have attempted to find the possible solution for cost overrun because cost is arguably one of the most fundamental criteria for measuring the success of any project (Baloyi & Bekker, 2010).

However, controlling cost from exceeding the budget over the time span was not an easy task as it required contribution from many aspects. Projects can be delivered on budget but that requires a good starting estimate, project management discipline and an awareness of factors that can cause cost escalation. In the competitive environment of today's construction industry, the difference of a single percentage point can be the difference between winning and losing a bid, making a profit, or bankruptcy. Hence, the only way to remain competitive is to have a good strategy on how to control and decrease cost without jeopardizing the quality of the products or services. It is important to identify the factors that contribute to cost overrun to avoid and reduce the problems (Kamaruzzaman & Ali, 2010). Identifying the reasons is usually the first step when addressing problems, and then corrective action can be taken.

2.2 Definition of Cost Overrun

Cost is the budgeted expenditure, which the client has agreed to commit for creating or acquiring the desired construction facility (Chitkara, 2011). Cost overrun is defined as the difference between the actual and estimated costs as a percentage of the estimated cost, with all costs calculated in constant prices. Actual costs are defined as the accounted costs actually spent, as determined at the time of project completion. Estimated costs are defined as the budgeted or forecasted costs at the time of project approval, which are typically similar to costs presented in the business case for a project (Le-Hoai, Lee, & Lee, 2008).

Cost overrun occurs when the final cost of the project exceeds the original contract value at the time of completion and (Flyvbjerg, Mette Skamris Holm, & Soren Buhl, 2002) established that it is common to find 9 out of every 10 construction projects globally with cost overruns of 50 to 100 percent. Cost overrun in construction is a worldwide phenomenon, and its effects are normally a source of friction between owners, project managers, and contractors (Creedy, et al., 2010). Therefore, to ensure successful projects, it is essential to find the solution for effective project cost control as recommended by previous researchers.

2.3 Cost Overrun in Construction Industry of Malaysia

All construction company in Malaysia was compulsory registered their company to CIDB as CIDB was assigned as the highest regulatory body for construction industry from 1 December 1994. In Malaysia, projects costing less than RM10 million are normally constructed by small contractors (CIDB, 2005). According to (Takim & Akintoye, 2002) small contractors perform worse than large contractors and especially in terms of planning and coordination which often leads to cost overrun in this cost range. There are two main sector for construction projects in Malaysia; public and private sector. Most of the public sector projects are handled by Public Works Department (PWD) (Endut, Akintoye, & Kelly, 2005).

Cost overrun in construction industry gives significant impact to the development of Malaysia. There are many factors that contribute to cost overrun in

Malaysia's construction projects and the factors might become risky and lead to adverse effects on the project if not controlled (Kamaruzzaman & Ali, 2010). Time and cost overrun can affect delay in construction projects in Malaysia. This is because time overrun may lead to cost overrun due to delay will consume more time for construction works results in increase of cost for payment of additional labor salaries and utility bills.

(Endut et al., 2005) studied time and cost performances of 359 projects, which comprise of 301 new constructions and 58 refurbishment projects in Malaysia. Of these 301 projects, 250 were public projects and 51 private projects. The study found that only 18.2% of public sector projects and 29.45% of private sector projects were completed on time and more than 50% of projects face cost overrun. Since completion of projects on time and staying within budget are fundamental criteria of successful construction, it is vital to evaluate time and cost performance at the early stage and take necessary corrective actions.

In addition, the latest issue related to time and cost overrun that happen in Malaysia is construction of Kuala Lumpur International Airport 2, or known as KLIA2. It was targeted to open in September 2011, but the opening was then moved to June 28 2013. Because of the delay, they expect the project to face some RM500 million in cost overruns. This problem happens due to frequent design changes in construction. Hence, this case shows that time and cost overrun is a serious issue in construction in Malaysia (Ismail, Rahman, & Memon, 2013).

2.4 Cost Overrun Based on Project Sector

The final cost of public works is often considerably higher than the price at which the contract is awarded in the tendering process. Usually private projects performed better than public projects (Flyvbjerg, Mette Skamris Holm, & Soren Buhl, 2002). However, from the recent research by (Shehu, Rohani, Akintoye, & Holt, 2014) the mean overall frequency, public sector projects (1.37%) performed better than private sector ones (6.43%).

2.5 Cost Overrun Based on Tendering Method

There are three types of tendering method have been practiced in Malaysia which are open tender, selective and negotiate whereas open tender is the most common method used by both public and private sector. However, from the research conducted by (Shehu, Rohani, et al., 2014) about cost overrun in Malaysia, in term of best-cost performance selective tendering is the best option as it recorded 52% of projects were completed within the budget whereas only 46% and 39% of projects were completed at or below contract sum for negotiated and open tender method respectively.

2.6 Cost Overrun Based on Type of Project

From the research conducted by (Shehu, Rohani, et al., 2014) to analyses the cost variance based on types of project it can be seen that both new build projects and refurbishment projects have similar statistics of percentage projects complete at or below the contract sum. Hence, it can be conclude that new build projects was not a strong discriminator of cost variance as both types of projects share the similar trend (John & John Mansfield, 2001). Earlier observation shown that refurbishment projects are more prone to cost variance as compared with new build project because refurbishment project have high tendency of cost variance due to increase in complexity (Baccarini, 1996).

2.7 Factors of Cost Overrun

Findings from previous research by (Morris, 1990), (Kaming , Olomolaiye , Holt , & Harris, 1997) and (Chimwaso, 2001) discovered that there are four main factors that influence cost overruns. These are; inadequate planning from the early stage, design changes, unpredictable weather conditions and fluctuations in the cost of building materials. (Kaming , Olomolaiye , Holt , & Harris, 1997) furthered explained that the prime variables of cost overruns have been commonly identified as: unpredictable weather, inflationary material cost, inaccurate materials estimates, complexity of project, contractor's lack of geographical experience, contractor's lack of project type experience, non-familiarity with local regulations.

Research findings from (Chimwaso, 2001) stated that seven out of ten projects that were evaluated based on the cost performance had reported cost overruns. Thus, the factors that have been identified to give significance influence to cost overrun were ranked in order of significance. (Frimpongs , Oluwoye , & Crawford , 2003) had identified 26 factors that cause cost overruns in construction projects in Ghana by distributed questionnaires to owners, contractors and Consultant. Results of the survey ranking indicates that major factors that can cause project overruns in developing countries are poor contractor management, monthly payment difficulties from agencies, material procurement, poor technical performances, escalation of material prices according to their degree of influence.

2.7.1 Cost Overrun due to contractor's responsibilities

From past research by several researchers such as (D., Akan G., & Gurdamar S., 1985), (Assaf & Al-hejji, 2006), (Daniel & Kumaraswamy Mohan M, 1996), (Kaming , Olomolaiye , Holt , & Harris, 1997), (Kumaraswamy & Chan, 1998), (Odeh & Battaineh, 2002), (Enshassi, Lisk, Sawalhi, & Radwan, 2003), and (Alaghbari, Kadir, & Salim, 2001) found that poor site management and safety could hinder the progress of construction. Findings from the past research proved that poor site management can interrupted the work flow of construction project and lead to delay and cost overrun. Next, findings from (Daniel & Kumaraswamy Mohan M, 1996), (Odeh & Battaineh, 2002) and (Enshassi, Lisk, Sawalhi, & Radwan, 2003) stated that inadequate contractor experience give significant effect on the cost and time overrun. This is because contractor with enough experience in construction project will have higher possibility to execute work with more professionalism and in short time, rather than the contractor executing the project for the first time.

Equipment and tools shortage was ranked quite high to causes delay and cost overrun from past research by (Enshassi, Lisk, Sawalhi, & Radwan, 2003). However, equipment and tools shortage does not consider as the main problem in construction industry for developed country such as Malaysia, Hong Kong, Jordan and Saudi Arabia. This is because finding from by (Enshassi, Lisk, Sawalhi, & Radwan, 2003) with severe political and economic situation country such as Gaza did not coincide with other

researchers findings from developed country such as (Assaf & Al-hejji, 2006), (Kaming , Olomolaiye , Holt , & Harris, 1997), (Alwi, Sugiharto and Hampson, & Keith, 2003), (Odeh & Battaineh, 2002), and (Alaghbari et al., 2001).

Non-performance subcontractor also caused cost over because contractors usually award smaller works to subcontractors not based on technical qualifications. Thus, subcontractors may not have sufficient experience to efficiently do the work based on research done by researcher such as (T.Subramani, 2014). Other than that, researcher such as (Yakubu & Sun, 2010) that study on United Kingdom's construction industry have identified 21 factors that caused cost overrun including the factors non-performance of subcontractor.

Findings from research by (Odeh & Battaineh, 2002) and (Alaghbari et al., 2001) explained that mistakes during construction causes the delay in construction work and lead to more cost to be incurred for the construction project. Mistakes during construction occurred due to contractor's error during exaction of construction project and caused rework to be done and consume more time. Other than that, finding (Ogunlana , promkuntong , & Jearkjirm, 1996) explained that the unethical behavior used by contractor to achieve the highest possible level of profit also lead to construction cost overrun.

This is because unethical behaviors of several parties in construction project can causes disputes between the two parties for example disputes between contractors and supervision staff that can lead to mistrust. Results from (Morris, 1990) stated that one of factors that lead to cost overruns is the delay in the construction supply of raw materials and equipment by contractors. This finding was furthered explained as each day delay to supply material cost the contractor additional losses such as overhead, cost of subcontractors and penalty. Lack of communication between parties ranked high as the factors affecting cost overrun by (Abdul et al., 2014) because it may results in poor management, selection of proper material and problem between the contractor and other parties.

2.7.2 Cost Overrun due to consultant's responsibilities

Research done by several researchers such as (Daniel & Kumaraswamy Mohan M, 1996), (Ogunlana , promkuntong , & Jearkjirm, 1996), (Kaming , Olomolaiye , Holt , & Harris, 1997), (Alwi, Sugiharto and Hampson, & Keith, 2003), (Chan & Kumaraswamy, 2002), (Odeh & Battaineh, 2002) stated that variations such as design changes and addition of extra work was one the factors caused delay and lead to cost overrun. The research findings by (Sambasivan & Yau, 2007)and (Alaghbari et al., 2001)show a result that the delay of materials approval by consultant is one of important factors of delay. This is because delay in approving material due to staff hired was lack of experience will lead to suspend of work and consume more money. Thus, based on the results of research by (Ogunlana , promkuntong , & Jearkjirm, 1996) and (Fong , Wong, & Wong , 2006) consultants with enough experience such as consultants in Hong Kong and Thailand able to approve the construction materials in short time help to avoid cost and time overruns.

Another problem caused by consultant that caused delay and lead to cost overrun is they consume more time to approve test and also poor inspection. Some of the consultants tend to postpone certain activities and does not have enough experience to follow up these activities which will hinder project progress. This factor of cost overrun was proven by (Alaghbari et al., 2001), (Fong , Wong, & Wong , 2006) and (Sambasivan & Yau, 2007). (Alwi, Sugiharto and Hampson, & Keith, 2003)and (Alaghbari et al., 2001) also stated that slowness in giving instruction by consultants is one of the major causes of delay thus, as a consultant they should have sufficient experience to perform all their work immediately. Lack of project management during execution such as changes in scope of works can cause cost overrun (Chitkara, 2011). Other than that, research from (Le-Hoai, Lee, & Lee, 2008) also stated that poor project management in construction project such as design changes during construction works can lead to problem such as rework that consume more cost.

Little periodical session to address work problem was explained as one of the factor of cost overrun by researchers. However, from the research findings by (Albatsh, 2015) shows that the periodic meetings to resolve problem related to work does not affect the time consume for project construction to complete. The periodic meeting is helpful to solve the problem related to work but if there is failure to find the solution of the problem will lead to delay of the construction project and consume more costs. From the research also shows that centralization of decision making process from consultant party will affect the progress of construction project. This is because the site engineers and other lower positions resort to managers to deal with the matters of work.

2.7.3 Cost Overrun due to owner's responsibilities

(Chan & Kumarswamy, 2002), (Odeh & Battaineh, 2002), (Enshassi, Lisk, Sawalhi, & Radwan, 2003), (Fong , Wong, & Wong , 2006), (Sambasivan & Yau, 2007), and (Alaghbari et al., 2001) stated in their research findings that owner delay in freeing the contractor financial payments is one of the factors that hinder the project progress in construction project. This is because delay in freeing the financial by owner will affect the financial of contractor such as wages of labours and cost to purchase materials. Thus, for construction project, payments were considered as one of the most important factors for a project to complete within the required time.

Next, research findings by (Alaghbari et al., 2001) explained about the effect of contract modification such as replacement or addition of new work or any changes in specifications on the construction projects. Any modification in bill of quantities, change in specification and any alteration or replacement in current working work in construction project will caused disputes between contractor and owner. (Odeh & Battaineh, 2002), (Fong , Wong, & Wong , 2006) and (Sambasivan & Yau, 2007)stated that determination of the duration of project precisely with realistic in term of type, volume and location by owner is important to avoid problem in construction project. Thus, unrealistic contract duration imposed by owner can be considered as one of the most important The earlier research work done by (Azhar, Farooqui , & Ahmed, 2008), (Kaliba, Muya, & Mumba, 2009) and (Ameh, Soyngbe, & Odusami, 2010) confirms this case.

The professionals have no total control over what the client wants; if he was involved during the design stage it could have been managed. As a result, their approach has to be reactive to the problem as it arises as they are never allowed enough time to prepare for handling such problems. The lack of preparation in the design phase exerts a major influence on how the professionals will be able to handle causes of cost overrun appearing in the construction phase. Research done by (Kaliba, 2009) previously stated additional work request by client can caused problem in construction phase due to not enough time to execute the work within the time limit. Research done by (Nega, 2008) that study on predominant factors for cost overrun in public building construction projects in Ethiopia have identified change orders due to enhancement required by clients as the main caused of cost overrun in construction project.

2.7.4 Cost Overrun due to design and documentation

(Ogunlana , promkuntong , & Jearkjirm, 1996) stated that construction project will encounter problem if drawing still incomplete when the site is handed over to contractor. Design team should make sure to complete the drawing before the tendering phase to avoid delay in works and cost overrun. However, from some cases design team may gradually according to the priorities of activities. Other factor that affect cost overrun was identified as poor documentation and no detailed written procedures based on the results of research conducted by (Alwi, Sugiharto and Hampson, & Keith, 2003), (Fong , Wong, & Wong , 2006), (Abudul-Rahman, Berawi, Mohamed, Othman, & Yahya, 2006) and (Alaghbari et al., 2001).

Poor documentation did not assist engineer to deals with different events on site so lead to the project to be drag for a long time and cost not within budget. Research conducted by A (Abudul-Rahman, Berawi, Mohamed, Othman, & Yahya, 2006) proved that project that did not adopted systematic procedures tend to have problem for cost and time overrun during construction project. Used of high technology methods and procedure for documentation and design process help to improve the process of construction project and the documents will be more organized. Error in cost estimation gave significant impact on cost estimation according to research findings done by (Chitkara, 2011). Besides that, (Wachs, 1990) pointed out that the probable cause of cost overruns in infrastructure projects is due to the inaccuracy of cost forecasts.

2.7.5 Cost Overrun due to materials related factors

The research results of (Ogunlana , promkuntong , & Jearkjirm, 1996), (Abdul-Rahman, Berawi, Mohamed, Othman, & Yahya, 2006), (Sambasivan & Yau, 2007), and (Alaghbari et al., 2001) stated that the shortage of construction materials in site was the main reason of delay and cost overrun. This result reflects the importance of materials in the construction process. Research done by (Al-najjar, 2008) found that the poor materials handling on site as the least factors to cause delay at this category. The interpretation of this result that the labor and the staff of contractor are aware to the importance of materials such as; method of use, handling, and how to best utilize of these materials, so regarding to this factor, the problems are rare, and the chance of delay is also rare. (Al-najjar, 2008) also stated that the respondents owners ranked the lack of materials in markets as the first factor to cause delay and lead to cost overrun.

This result contravenes with the result of (Ogunlana , promkuntong , & Jearkjirm, 1996), that price escalation of materials and for manpower is important factor of delay. In Thailand the economic level and availability of materials differ from the situation of Gaza. In Gaza Strip, the prices changes radically according to political situation, but in Thailand the escalation of prices is low (Al-najjar, 2008). In the South African construction context, (Baloyi & Bekker, 2010) identify the causes of cost overrun related to the stadia built or refurbished for the 2010 FIFA World Cup such as increase in material cost and inaccurate material estimates. Comparing the causes of cost overruns with those found in literature and FIFA World Cup stadia, ‘material cost’ and price fluctuations had a significant impact on both groups of projects. Fluctuation in price of material was ranked high by both contractor and consultant proved the factors as the most dominant factor affecting construction cost according to (Abdul et al., 2014).

2.8 Solution of Cost Overrun

Keeping construction projects within estimated costs and schedules requires sound strategies, good practices, and careful judgment. There are, however, steps that can be taken to minimize their causes cost overrun, the major one is using efficient project management tools and practices. Thus, previous researchers have given recommendations or suggestions to help accomplishing cost overrun reduction in construction projects. Findings from previous research by (Abudul-Rahman, Berawi, Mohamed, Othman, & Yahya, 2006) stated that site meeting is important to overcome the problems such as cost overrun with the condition that it should not be too frequent as it will waste of time and the participants should be seniors and those authorized to make decisions.

From the surveyed conducted by researcher, there are several ways to improve productivity and solve this problem which were by working overtime or working by shifts (29.2%) followed by request for extension of time (24%). If the problem was the shortage of resources, 32.3% suggested rescheduling the activities within the available resources, 27.8% by using more general and skilled labour and 12.8% by using subcontractors. From the research conducted it can be simplified that there is no specific procedure to solve this problems but it primarily depends on the causes of the problems. Cost overrun may cause many successive side effect if does not curb properly from early stages.

Thus, several researches have attempted to find the possible solution in order to minimize mistake in construction project and prevent the budget exceeding the limit. (Bhardwaj, 2015) have done their research on the Identification of Factor which Causes Cost Overrun and Delays in Infrastructure Projects come out with several recommendations to overcome the cost overrun problem. They recommend cost overrun must be prevent by each parties involves including all the key stakeholders such as owner, client and government.

2.8.1 Cost Overrun solution expected from consultant

Research findings from both researchers (Bhardwaj, 2015) come out with several steps that a consultant can implement in the construction project to overcome cost overrun such as provide comprehensive information required for easier interpretation of the drawings and setting out of the works. Comprehensive information was important to ease project participant understand the project thoroughly and to ensure that there is adequate and realistic specifications of materials and methods are stated in the contract documents. Consultants should prepare and approve drawings on time, and consultants should monitor the work closely by making inspections at appropriate times (Sambasivan & Yau, 2007).

Research by as (Ahsan & Gunawan, 2017) and (Monyane, Identifying causes of Cost Overrun and Effective cost Control Measures of Public Projects in The Free State Province, 2013) stated that continuous coordination by consultant and direct communication help to eliminate design discrepancies and errors. Other than that, it helps to provide an opportunity for professionals to review the contract documents thoroughly in order to eliminate change orders or variations due to discrepancy in contract documents. Both researchers also recommend consultant not to design complex drawing in order to achieve aesthetical value and they should create more flexible design to allow respond more proactively to imminent changes in client needs and requirements.

However, after completion of design and planning phase consultants should make sure the design and details were completely correct to eliminate error during construction stages and caused more money consumed. The remedy that is listed as most effective is that of the design being completed at time of tender according to (Monyane, Identifying causes of Cost Overrun and Effective cost Control Measures of Public Projects in The Free State Province, 2013). This is because, the impact of completed designs at the time of tender is that it regulates the unnecessary additions that the client could exploit, due to incomplete designs. Finalization of the design gives the project team a framework for what to expect from the project. (Albatsh, 2015) stated that consultants should be flexible in evaluating contractor works and compromising between the cost and high quality should be consider.

Consultant also should avoid mistake and discrepancies in design documents because they are common reasons for redoing designs and drawing and consume more time to make necessary corrections. In order to eliminate additional costs associated with design changes and additional works, it is important that careful consideration be given to issues in the preliminary stages, such as site and environmental conditions, design specifications, methods of construction and the availability of labor (Ameh et al., 2010).

2.8.2 Cost Overrun solution expected from owner

Research findings from both researchers (Bhardwaj, 2015)) also lead several recommendations that a client or project owner can adapt in their construction project to solve the problems of cost overrun. To minimize consumption of money for a construction project, clients should allow sufficient time for proper feasibility studies, planning, design, documentation and tender submission. Other than that, client or project owner should select suitable contractors not only on the basis of price and time offerings, but also on experience, financial standing, capacity and expertise (Odeh & Battaineh, 2002), (Albatsh, 2015), and (Abdullah, 2009). Other researcher such as (Amoa-abban & Allotey, 2014) also stated that the selection of a contractor should be based on expertise, financial standing, capacity and experience and not merely on the basis of price and time offerings as well as fraternal acquaintances.

This is because, contractor with different background and experience have different expertise and quality of work for example, contractor with high payment tend to used high quality material in construction project. This can cause inordinate delays in the project (Sambasivan & Yau, 2007). Clients can play a crucial role in ensuring the quality and reliability of cost estimates in the construction industry. Thus, clients start demanding realistic estimates, rather than the lowest estimates at the early stages of a project, the problem of cost overrun might remain with the industry for a long time to come (Ahiaga-Dagbui, 2014). Clients should ensure that adequate funds are available before projects are started, so that contractors can be paid in accordance with the contract agreement. This will reduce stalled projects and preventable cost overrun according to (Ombisa, 2013).

According to (Albatsh, 2015) also an owner should develop an action plan for success of the project such as choosing a team to do follow-up project with suitable competence and experience in similar project and not allowing a contractor who does not fit their financial and technical capacity submission of the tender, and make sure when the tender evaluation of the experience of the contractor and the financial and technical ability implement the project. Project owner also should ensure that there is no delay in fund for project they should ensure that adequate funds are available before projects are started, so that contractors can be paid in accordance with the contract agreement. It have become project owner or client responsibilities to comply the contract agreement, especially as regards to payment of contractor's works duly executed, or settlement of fees accounts of consultants and possession of construction site. Adopting new approach to contract award procedure by giving less weight to the capabilities and past performance of contractors as suggested by (Odeh & Battaineh, 2002).

2.8.3 Cost Overrun solution expected from contractor

Both researchers (Bhardwaj, 2015) have narrowed out the possible solution that contractor can apply to minimize the cost overrun in construction project such as contractor should procure cost materials and other items in collaboration with the client ahead of time to reduce the time consumed and avoid delay in works. A contractor also should have the ability to solve any problem related to the construction project and proposed solutions for that particular problem proactively (Ombisa, 2013). Ability of contractor to solve the problem will help to hinder the subsequent problem such as delay and cost overrun. In addition, both researchers also recommend a contractor to ensure efficient time management through proper resource planning, duration estimation, and schedule development and control. Contractor ensure the efficient time management through proper resource planning, duration estimation, and schedule development and control and constructing programming must be ensured to avoid delay and hence, to avoid cost overrun due to delay according to (Al-Najjar, 2008) and (Amoa-abban & Allotey, 2014).

(Odeh & Battaineh, 2002) recommended adopting new approaches to contracting such as design-build and construction management (CM) types of contracts. Such contract will reduce delays by limiting owner interference, improving the design, improving the contractual relationships among all parties to the project. The contractor do the proper planning factor must be considered in order to avoid delays during construction stages (Abdelnaser, Peter , Hussin, & Aziz, 2005). In addition, a contractor should avoid shortage and low productivity of labour and they must provide enough number of labours should be assigned and be motivated to improve productivity. They also should manage his financial resources and plan cash flow by utilizing progress payment and provide suitable suppliers and sub-contractor according to (Albatsh, 2015).

Other than that, Implement cost reduction incentive proposals which are cost friendly to all the factors. By implementing such cost reduction proposals, the client will ensure that whatever they will be initiating is within the budget and minimal external support (Ombisa, 2013). Contractor should ensure the effective material management, efficient resource planning, proper financial management and standardized design method should be adopted for cost control of project (Ismail & Aftab, 2012). Cost overrun also can be reduce by identifying cause of and potential methods to correct critical deviations from planned performance and taking control action to correct an adverse trend or to taking advantage of an unusually positive trend (Roachanakanan, 2005).

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter described the methodology of this study includes two types of research strategy that were used in these study which are qualitative and quantitative. Quantitative approach was used to gather factual data and to study the relationship between facts and how the facts accord to the previous study and findings whereas qualitative was an approach to understand groups or individuals perception on the topic of the study. In this case, this approach was used to understand the perception of experience construction professionals such as contractor, consultant and owner regarding cost overrun.

The methodology for this study was divided into two phase which are vital to verify the reliability of this study. The first phase of this study was conducting an extensive literature review of cost overrun in construction from past thesis and research. Causes and solutions were first examined and identified through a relevant literature review and by interview a construction professional. Then for the second phase, a few copies of questionnaire survey were designed based on the information obtained from literature review and interview session. The questionnaire then was distributed to construction companies in Pahang that involved in this survey. The questionnaires were designed to investigate Malaysian construction project overrun through an industry-wide survey based on the review of extant literature in this field. The last part of this methodology was a crucial part which was carrying out analysis by using RII.

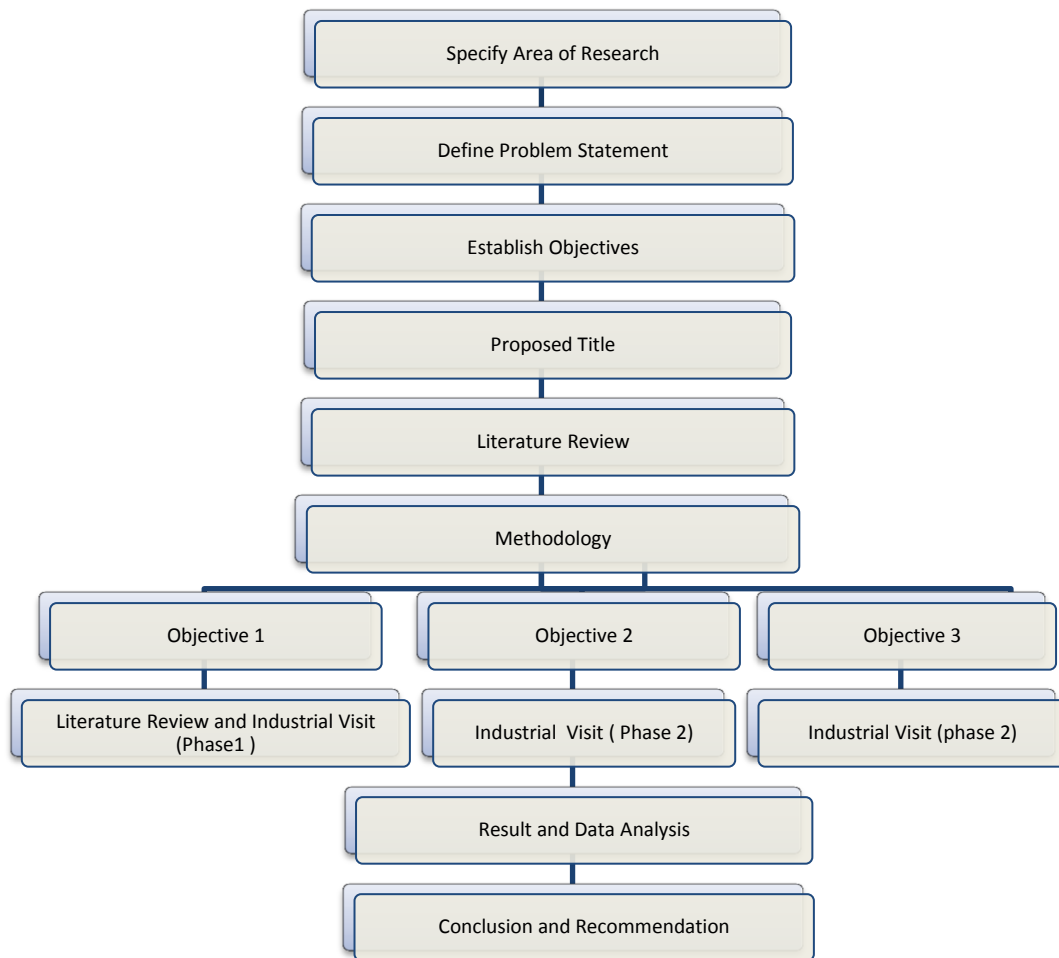


Figure 3.1 The methodology chart

3.2 Study Area

This study will specific for construction's company located in peninsular Malaysia which is Pahang Darul Makmur. Total area of Pahang state is 35,965 km² with total estimated population of 1.63 million. Survey was conducted among construction companies that were registered with CIDB Malaysia located at certain district of Pahang such as Temerloh, Bentong, Bera, Kuantan, Pekan, Jerantut, Muadzam Shah and Maran. The findings of research could increase the awareness and contribute to the construction industry especially in Pahang area.



Figure 3.2 The maps of Pahang state

Source: Google maps

3.3 Research Method

Comprehensive literature review was conducted and subsequently the research design was formulated by addressing the research problem. Research questions were formulated to answer the research problems and objectives were also addressed based

on the research questions. A thorough literature survey was initially conducted to identify the factors and possible solution of cost overrun based on the past researchers findings. The general methodology of this study relies largely on the survey questionnaire which will be collected from the contractor, consultant and project owner by mail or by personnel meeting. A pilot study was conducted prior to conducting the main survey to test and ensure that the questionnaire questions were clear and would be answered in a manner that would achieve the target of the study. The questionnaire was modified based on the results of the pilot study and was then distributed to the respondents. The questionnaire was used to collect the required data in order to achieve the research objective and interviews with industrial practitioners were conducted to check effectiveness of questionnaire.

3.4 Sample Size Determination

The first draft questionnaire was piloted among a sample of 61 people from construction industry included contractor company, consultant and public sector owner that were registered in CIDB Malaysia in Pahang. The samples of population for this study were gathered from the construction companies that involved in varies field such as roads, drainage and sewerage, buildings and other public works. The contractor in construction company in Pahang with valid registration from CIDB was divided into different level of grade begins with grade 1 until the largest construction companies which were grade 7. Some of the construction company from lower grade was neglected since it was a new company and did not have enough experience in this field. Wood and Haber (1998) defined the sampling as the process of selecting representative units of a population for the study in research.

3.5 Questionnaire Design

Factors and solutions of cost overrun were first examined and identified through a relevant literature review and by conducting a pilot study that sought advice from experienced construction practitioners in the province. The questionnaire was divided into several sections which are section A, section B and section C. A preliminary review of the literature on cost overruns and estimation led to the following research questions that will guide the research in order to achieve the stated aims

Section A of the questionnaire addressed general information pertaining to the respondents in order to analyse data in relation to construction project in Malaysia. The general information in section A consists of respondent background, type of organization, working experience, major type of work and also number of constant employees.

Section B and section C in the questionnaire was about data collected regarding specific features of the projects that were identified as having potential bearing on cost variance and the possible solution of the cost overrun. Section B elicited responses pertaining to the factors causing cost overrun at various key stakeholders in construction project which are contractor, consultant and owner. Other factors causing cost overrun such as design and documentation and material also included in this section. Section C was basically concerned remedies to cost overrun in construction project by the key stakeholders in construction industry such as contractor, consultants, owner and government. A 5-point Likert scale ranging from 1 to 5 (not agree to extremely agree) option, was applied in the both section.

3.6 Data Analysis

Preliminary study also was conducted by interviewing experience personnel in the construction industry to validate the data collected from the content of the questionnaire and to identify the relevancy of the content. The raw data of questionnaire was collected from the structured questionnaire survey that was carried out within construction player in industry. In section A of questionnaire, the general organization information of the respondents was gathered. For section B and C the data of the factors influencing cost overruns and the possible solution of cost overrun was identified and the importance index is used to rank the most influence factors and solution of cost overruns. The data gathered from the questionnaire survey was analysed through a hierarchal assessment of causes and solution of cost overrun and also the correlation between the causes and solution of cost overrun.

3.7 Ranking of the causes and solution of cost overrun in Pahang

The hierarchal assessment of factors that causes cost overrun and the possible solution of cost overrun were carried out by studying the ranking of both factors and solutions (Sarathkumar & Loganathan, 2016). The hierarchal assessment was assessed based on Relative important index (RII) value and calculated for each group of respondent's i.e. contractor, consultant and owners and also the overall respondents as presented.

3.8 Relative Importance Indices (RII)

The questionnaire was developed by using open-ended question with a scale ranging from 1 to 5. The different scale indicated the range of the factors that the most and least important of causes of cost overrun and to rank the most influence factors and solution of cost overrun. The five-point scale ranged from 1(not agree) to 5(extremely agree) was used and transformed to relative importance indices (RII) for each factor as follows:

$$RII = (\sum w_i)/(A \times N) \quad 3.8$$

Equation 3.8 Relative Importance Index Formula

Where:

W= Scale for rating given by respondent range from 1-5

A= Highest weight of scale (5 in this case)

N= Total number of respondents

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter describes the results and discussion of questionnaire survey concerning factors and remedies of cost overruns from constructions player viewpoints in Pahang, Malaysia. This chapter also focused on describing the respondent's characteristics in addition to the discussion of the factors that influence cost overruns and the expected solutions of the cost overrun in Pahang, Malaysia. Apart from survey that was conducted to constructions player, an interview also was conducted to get more information and the opinion of the contractor that involved in construction at Kuantan, Pahang. The questionnaire was divided into three sections which are section A, section B and section C. Section A was mainly designed to provide general information about the respondents in terms of the type of organization, major type of work involved, working experience contact person, respondent background and the number of constant employees at the organization. Section B was designed to get information on the most influence factors of cost overrun and Section C was designed to obtain information on the most significance possible solution of cost overrun

4.2 Mode of Data Collection

Questionnaires, as we consider them here, are stand-alone instruments of data collection that will be administered to the sample subjects either through mail, phone or online. The choice of mode is guided by the extent to which each has differential administrative and resource burdens (Campanelli & Campanelli, 2011). These include the financial costs of implementing the survey in each mode and the time taken to complete fieldwork. The most commonly-used modes of data collection in this research thesis are face-to-face interviewing where respondent was visited at their workplace and administers the questionnaire in person. Other than that, data also was collected through email where the questionnaire was emailed to chosen constructions company in Pahang. The collected data were analyzed by using the Microsoft Excel software.

4.3 Response Rate

In this survey, there are 61 questionnaires were distributed to various construction companies to the targeted respondents. The questionnaire was completed by experienced consultants, contractors, and owners located in Pahang such as Kuantan, Pekan, Bentong, Maran, Temerloh, Jengka and Rompin. In those 30 responses has been received. The response rate of this survey was 49.18%. The response rate will be explaine in following table and chart.

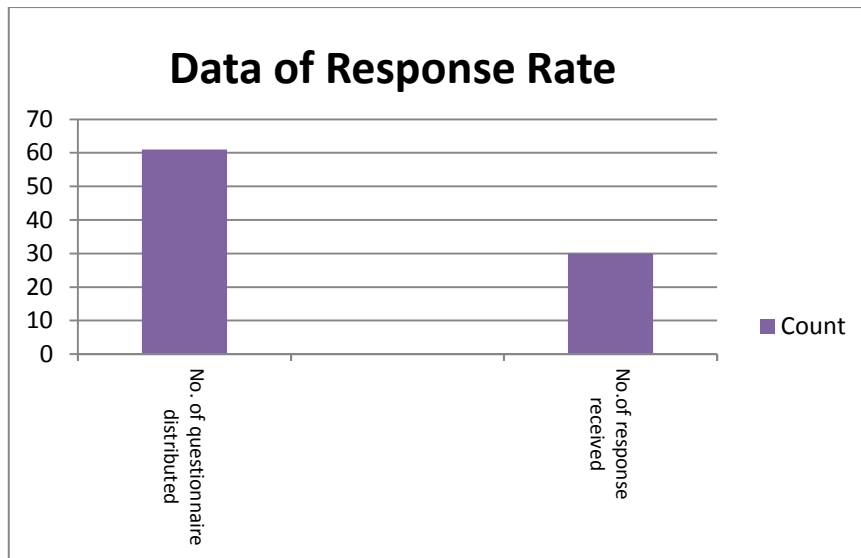


Figure 4.3 Data of response rate

Table 4.3 Data of response rate

Description	Count
No. of questionnaire distributed	61
No. of response received	30
Response rate (%)	49.18

4.4 Section A: General Organization Information

This part mainly designed to provide general information about the respondents since the questionnaires were distributed to various respondents with different background and expertise. From the survey conducted most of the respondents that participated in this survey had several years of experience in handling various types of projects. The characteristics of the respondents participated in survey are summarized in Table 4.4.1, Table 4.4.2, Table 4.4.3, Table 4.4.4.

4.4.1 Major Type of Work Involved

Major type of work that was executed by the respondents also was identified in this survey such as buildings, roads, water and sewage and electro mechanics. From the data collected, it can be seen that most of the respondents involved in the same field of work which is buildings with approximately 56.67 % (17). Other field involved by respondents recorded quite low as compared to buildings where about 33.33% (10) respondents involved in roads work, 10% (3) involved in water and sewage and no respondents recorded from electro mechanics field. The data of major type of work involved have been summarized in as follows:

Table 4.4.1 Type of work executed by the respondents

Item	Frequency	Age (%)	Cumulative (%)
Buildings	17	56.67	56.67
Roads	10	33.33	90
Water and Sewage	3	10	100
Electro mechanics	0	0	100
Total	30	100	

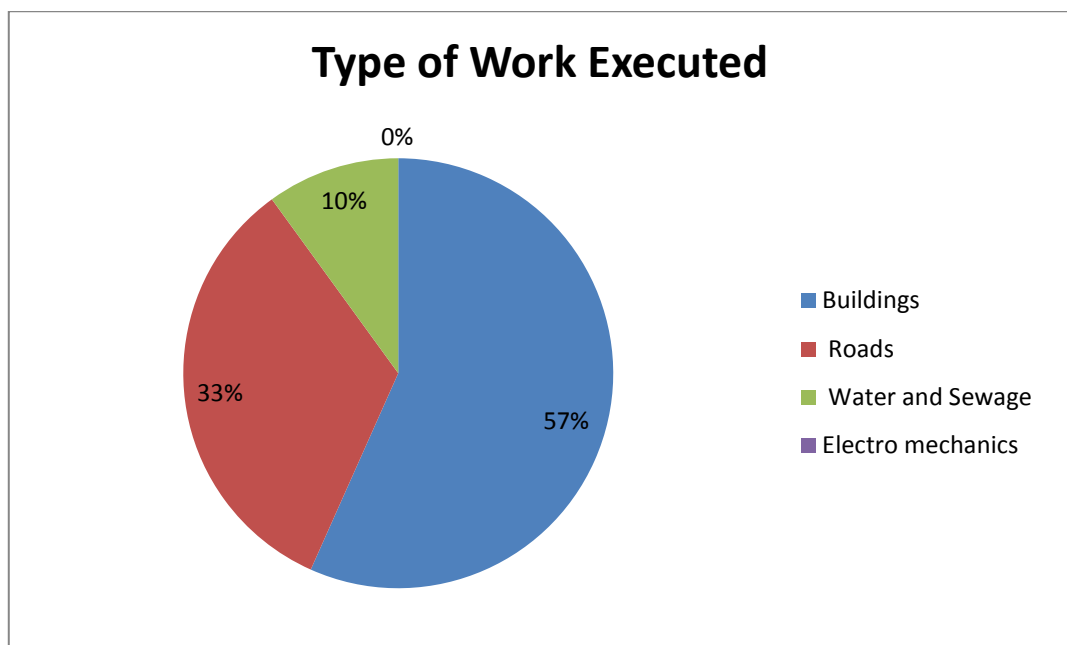


Figure 4.4.1 Percentages type of work executed

4.4.2 Respondents Background

In this study, the respondent background that participated had been investigated through the demographic question provided in section A of questionnaire. More than half of number respondents participated in this survey were Contractor which is about 63.33 % (19). About 30% (9) of respondents were Site/Consultant engineer and about 6.67 % (2) of respondents were Owner of organization. The data of respondents background that have participated in the survey conducted was summarized in the Table 4.4.2 and Figure 4.4.2.

Table 4.4.2 The respondent's background

Item	Frequency	Age (%)	Cumulative (%)
Owner of organization	2	6.67	6.67
Site/Consultant Engineer	9	30	36.67
Contractor	19	63.33	100
Total	30	100	

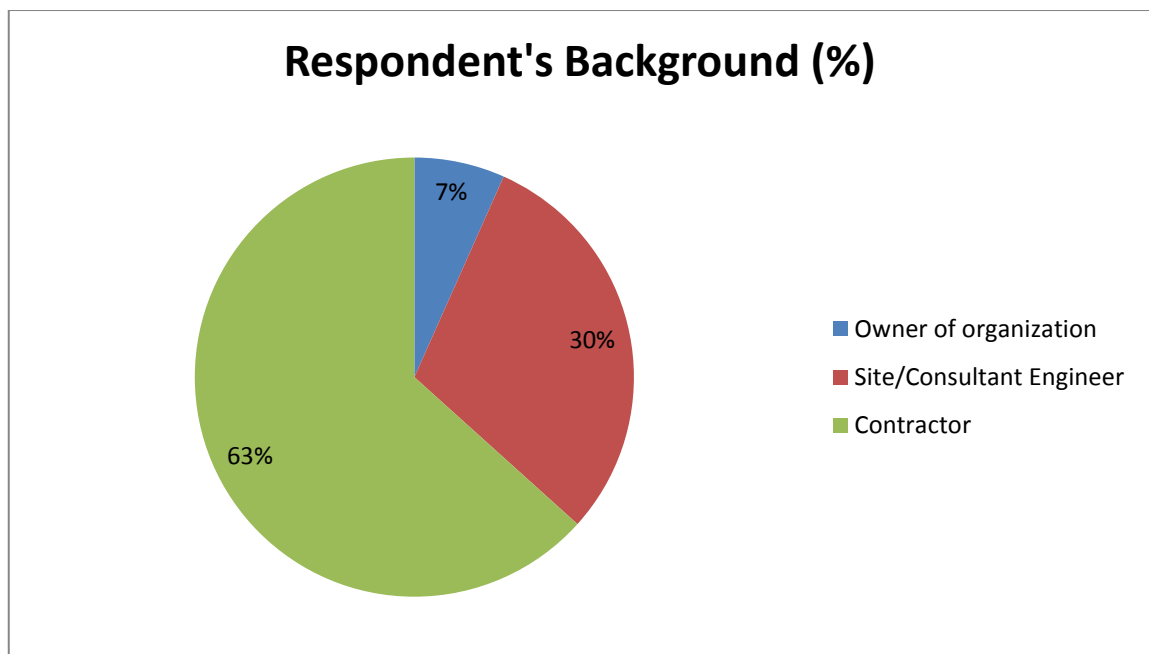


Figure 4.4.2 Percentages of respondent's background

4.4.3 Relevant Working Experience

From the survey conducted, the working experiences of the respondents have been identified in order to verify the data were gathered from respondents with enough experiences only. Table 4.4.3 shows that 43.33% (13) of the respondents have experience between 3 to 5 years in construction works. From the data collected in demographic question also about 30% (9) of respondents have experience between 5 to 10 years and about 10% (3) of respondents have more than 10 years experienced. Less than 20% of respondents have experience between 1-3 years which is about 16.67% (5).

Table 4.4.3 Experience of respondents (years)

Item	Frequency	Age (%)	Cumulative (%)
1-3 Years	5	16.67	16.67
3-5 Years	13	43.33	60
5-10 Years	9	30	90
>10Years	3	10	100
Total	30	100	

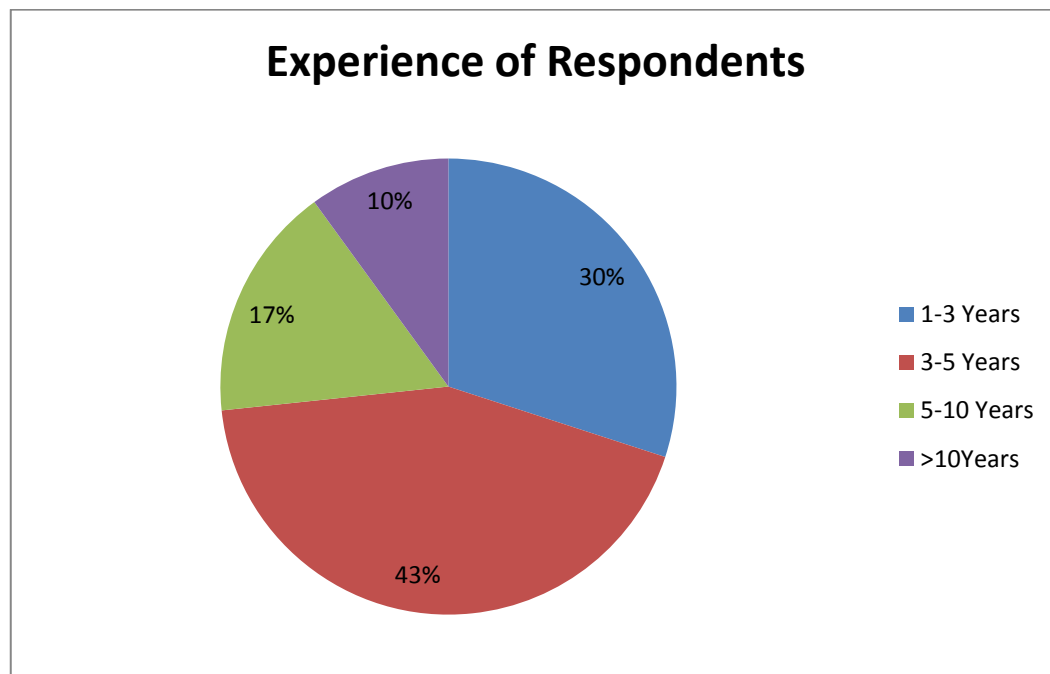


Figure 4.4.3 Percentages of respondent's experience (years)

4.4.4 Number of Constant Employees

From the survey conducted, the total number of constant employees differs with each company. Majority of the constructions company that participated in the survey has number of constant employees less than 10 due to the need of several employees at the organization to perform the required works, it can be understood that majority of construction companies have about 36.67% (11) has less than 10 employees. The table 4.4.4 shown that about 30% (9) companies have 10-15 employees and about 23.33% (7) of construction companies have 15 to 20 number of employees while only 10% (3) of construction companies have more than 20 employees.

Table 4.4.4 Number of constant employees at Organization

Item	Frequency	Age (%)	Cumulative (%)
Less than 10	11	36.67	36.67
10-15	9	30	66.67
15-20	7	23.33	90
More than 20	3	10	100
Total	30	100	

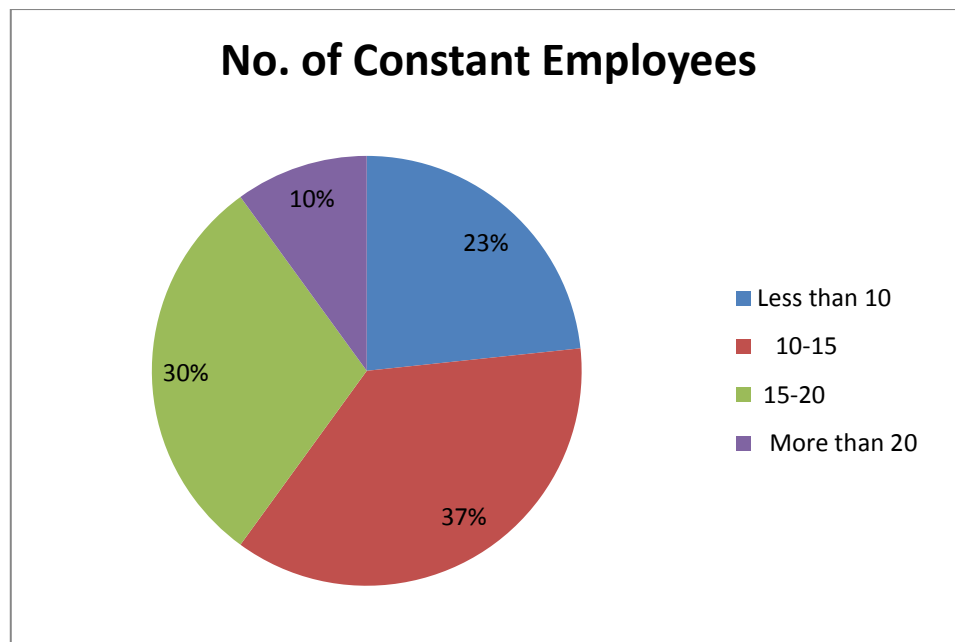


Figure 4.4.4 Percentages of constant number employees

4.5 Section B: Factors Influencing Cost Overruns of Construction Project in Pahang

This part consists of results and discussion of factors that influence cost overruns in construction industry in Pahang, Malaysia. The survey was carried to satisfy the objectives that were created at the beginning of the research thesis which are to study factors of cost overrun and the possible solution of cost overrun in construction projects and to identify and analyse the most influence factors in cost overruns. Section B of the questionnaire consists of total number of 25 factors that were classified into five groups, these groups are; contractor's responsibility, consultant's responsibility, owner's responsibilities, design and documentation and materials related factors. The data obtained from this section were analysed by using Relative Important Index (RII) method as follows:

$$RII = (\sum wi)/(A \times N) \quad 4.5$$

Equation 4.5 Relative Importance Index Formula

Where:

W= Scale for rating given by respondent range from 1-5

A= Highest weight of scale (5 in this case)

N= Total number of respondents

From the value obtain from Relative Important Index (RII) formula the significant of each factor can be identified and the factor can be rank based on the RII value obtained. The value of RII that close to 1 can be classified as more important factor of cost overrun as compared to lower value of RII that close to 0.

4.5.1 Factor 1: Contractor's responsibilities

Table 4.5.1 Rank of Contractor's responsibilities

Factors 1	RII	Rank
Cash problem during construction	0.67	2
Poor site management and safety	0.63	3
Equipment and tools shortage on site	0.62	4
Non- performance of subcontractor	0.75	1
Unethical behavior of contractors	0.59	5

Table 4.5.1 show that the respondents ranked non-performance of subcontractor in the first position with relative importance index value close to 1. This is because contractors usually award smaller works to subcontractors not based on technical qualifications. Thus, subcontractors may not have sufficient experience to efficiently do the work. This is supported by the research done by researcher such as (T.Subramani, 2014). Other than that, researcher such as (Sun, 2010) that study on United Kingdom's construction industry have identified 21 factors that caused cost overrun including the factors non-performance of subcontractor. This proved the finding that non-performance of contractor caused cost overrun not only in Malaysia but also in other country such as United Kingdom.

4.5.2 Factor 2: Consultant's responsibilities

Table 4.5.2 Rank of Consultant's responsibilities

Factors 2	RII	Rank
Slowness in giving instruction	0.63	3
Delay of materials approval	0.67	2
Waiting time for approval of tests and poor inspection	0.57	4
Variations	0.69	1
Centralization of decision making process	0.56	5

Table 4.5.2 show that the respondents ranked variations in the first position with relative importance index value much closer to 1 as compared to other factors. Other factor such as delay of materials approval, also rank high in this study due to the effect of the factor on the cost estimation in construction project however most of the respondent chose variations as the main reason of cost overrun. This finding coincides with (Chitkara, 2011) that stated lack of project management during execution such as changes in scope of works can cause cost overrun due to delay in works. Other than that, research from (Le-Hoai L. Y., 2008) also stated that poor project management in construction project such as design changes during construction works can lead to problem such as rework that consume more cost.

4.5.3 Factor 3: Owner's responsibilities

Table 4.5.3 Rank of Owner's responsibilities

Factors 3	RII	Rank
Contract Modifications	0.56	4
Unrealistic Contract Durations	0.65	3
Owner Interference	0.70	1
High Quality Of Work	0.54	5
Slow Decision Making	0.68	2

Table 4.5.3 show that the respondents ranked owner interference in the first position with relative importance index value close to 1 as compared to other factors. Research done by (Kaliba, 2009) previously confirm this finding because additional work request by client can caused problem in construction phase due to not enough time to execute the work within the time limit. This finding also coincide with findings by (Nega, 2008) that study on predominant factors for cost overrun in public building construction projects in Ethiopia have identified change orders due to enhancement required by clients as the main caused of cost overrun in construction project. Thus, it can be said that owner interference can affect the construction project in term of cost and time not only in Malaysia but also in other country such as Ethiopia. Owner interference results in cost required beyond the scope of work because of owner fail to fulfill commitments according to specifications and their request clearly not within the scope of work.

4.5.4 Factor 4: Design and Documentation

Table 4.5.4 Rank of Owner's responsibilities

Factors 4	RII	Rank
Incomplete Design At The Time Of Tender	0.69	2
Poor Documentation	0.68	3
Designer Lack Of Experience	0.45	5
Unclear Specification	0.47	4
Error In Cost Estimation	0.79	1

Table 4.5.4 show that the respondents ranked error in cost estimation in the first position with relative importance index value which is 0.79 close to 1. Other factors such as factors ranked below due to lower value of relative important index. This result indicates that error in cost estimation give significant impact on cost estimation and this finding coincide with research findings done by (Chitkara, 2011). Besides that, (Wachs, 1990) pointed out that the probable cause of cost overruns in infrastructure projects is due to the inaccuracy of cost forecasts. Pressure for distorting estimation gives significant impact on cost overrun by inducing underestimation of costs, completion times, and overestimation the benefits. Error in estimation occurred due to several reasons such as mathematical errors by pressing wrong keys, omissions and miscalculations. However, error in estimation also can occur due to inexperienced estimator in the field of expertise.

4.5.5 Factor 5: Materials

Table 4.5.5 Rank of Materials

Factor 5	RII	Rank
Delay Of Material Delivery To Site	0.70	2
Lack Of Materials In Markets	0.68	3
Low Quality Of Materials	0.50	4
Materials Do Not Comply With Material Standard Requirement	0.62	5
Fluctuations In The Cost Of Materials	0.71	1

Table 6 show that the respondents ranked fluctuations in the cost of materials in the first position with relative importance index value closer to 1. This is because contractor estimates prices of the tender according to the present prices at local markets so there is a chance of price fluctuation as stated by research done by (Al-Najjar, 2008) and (Abdul et al., 2014). Based on study of Palestine building construction by (Ibrahim Mahamid, 2013), results also showed that price fluctuation of materials is the 2nd out of 41 cost overrun factors The basic reason of cost overruns as quoted by most contractors is prices based estimates, and unfortunately, the price change so quickly that the initial budget figure becomes completely unrealistic (Azhar N. R., 2008). This factor also can be attributed from various reasons such as monopoly of suppliers or unavailability of construction materials locally.

4.6 Section C: Solution Cost Overruns of Construction Project in Pahang

This part consists of results and discussion of possible solutions of cost overruns in construction industry in Pahang, Malaysia. The survey was carried to satisfy the objectives that were created at the beginning of the research thesis which are to study factors of cost overrun and the possible solution of cost overrun in construction projects and to identify and analyse possible solutions to minimize or control cost overrun. Section C of the questionnaire consists of total number of 15 possible solutions that were classified into three groups, these groups are; expected from contractor, expected from consultant and expected from client or project owner.

4.6.1 Solution 1: Expected from Consultant

Table 4.6.1 Rank of expected from consultant

Solution 1	RII	Rank
Continuous Coordination	0.74	1
Provide Comprehensive Information	0.63	5
Cost Reduction Measures	0.72	2
Avoid Complex Designs	0.66	4
Cross-Check Designs And Details	0.69	3

Table 4.6.1 show that the respondents ranked factors continuous coordination in the first position with relative importance index value close to 1. This is because continuous coordination can eliminate change orders in contract document and help to eliminate design discrepancies and errors. Continuous coordination and direct communication, which will abolish design inconsistency and errors as well as omissions in design and also give a chance to expert to audit the contract documents completely. Other researchers such as (Ahsan & Gunawan, 2017) also recommend to curb cost

overrun in construction project was by using organizational strategy include regular coordination between the associated parties and appropriate prominence on previous experience. Other than that, it helps to provide an opportunity for professionals to review the contract documents thoroughly in order to eliminate change orders or variations due to discrepancy in contract documents.

4.6.2 Solution 2: Expected from Project Owner

Table 4.6.2 Rank of expected from Project Owner

Solution 2	RII	Rank
Sufficient Time For Proper Feasibility Studies	0.74	2
Goals Should Be Realistic	0.68	3
Funds Are Available Before Project Are Started	0.62	5
Select Suitable Contractors	0.76	1
Detailed Site Investigation	0.63	4

Table 4.6.2 show that the respondents ranked select suitable contractors in the first position with relative importance index value close to 1 as compared to other factors. The high position indicates that selection of suitable contractors not only on the basis of price and time offerings, but also on experience, financial standing, capacity and expertise (Abdullah, 2009). Thus, as a project owner they are advised not to depend on the lowest bid contractor to execute the project. Other researcher such as (Amoa-abban & Allotey, 2014) also stated that the selection of a contractor should be based on expertise, financial standing, capacity and experience and not merely on the basis of price and time offerings as well as fraternal acquaintances. This is because,

contractor with different background and experience have different expertise and quality of work for example, contractor with high payment tend to used high quality material in construction project. This can cause inordinate delays in the project (Sambasivan & Yau, 2007).

4.6.3 Solution 3: Expected from Contractor

Table 4.6.3 Rank of expected from Contractor

Solution 3	RII	Rank
Procure Correct Construction Materials	0.62	5
Solve Problems And Propose Solutions	0.65	3
Ensure Realistic Specifications	0.73	2
Standardized The Specification	0.65	4
Efficient Time Management	0.75	1

Table 4.6.3 show that the respondents ranked efficient time management in the first position with relative importance index value close to 1 as compared to other factors. Cost overrun can be minimized if contractor ensure the efficient time management through proper resource planning, duration estimation, and schedule development and control and constructing programming must be ensured to avoid delay and hence, to avoid cost overrun due to delay. Ability of contractor to manage time efficiently will help to hinder the subsequent problem such as delay and cost overrun in construction project. This finding is supported by the research from (Al-Najjar, 2008) and (Amoa-abban & Allotey, 2014).

4.7 Overall ranking of factors influencing cost overruns at construction projects

Table 4.7 shows the rank of all factors of cost overruns that have been investigated in this research from contractor, consultant and owner view point. Total of 25 factors that influence cost overruns in Pahang have been studied and discussed. The rank was based on Relative Important Index value.

Table 4.7 Rank of factors influencing cost overruns at construction projects

The factors	RII	Rank	Group
Error in cost estimation	0.79	1	Design and Documentation
Non- performance of subcontractor	0.75	2	Contractor's responsibility
Fluctuations in the cost of building materials	0.71	3	Material
Owner Interference	0.70	4	Owner's responsibility
Delay of material delivery to site	0.70	5	Material
Variations	0.69	6	Consultant's responsibility
Incomplete design at the time of tender	0.69	7	Design and Documentation
Shortage of construction materials at site and market	0.68	8	Material
Poor documentation	0.68	9	Design and Documentation
Slow decision making	0.68	10	Owner's responsibility
Cash problem during construction	0.67	11	Contractor's responsibility
Delay of materials approval	0.67	12	Consultant's responsibility
Unrealistic contract durations	0.65	13	Owner's responsibility

Poor site management and safety	0.63	14	Contractor's responsibility
Slowness in giving instruction	0.63	15	Consultant's responsibility
Equipment and tools shortage on site	0.62	16	Contractor's responsibility
Materials on site do not comply with material standard requirement	0.62	17	Material
Unethical behavior of contractors	0.59	18	Contractor's responsibility
Waiting time for approval of tests and poor inspection	0.57	19	Consultant's responsibility
Contract modifications	0.56	20	Owner's responsibility
Centralization of decision making process	0.56	21	Consultant's responsibility
Low quality of materials	0.50	22	Material
High quality of work	0.54	23	Owner's responsibility
Incomplete design at the time of tender	0.47	24	Design and Documentation
Lack of designer's experience	0.45	25	Design and Documentation

Table 4.7 shows that top 5 most significant factors of cost overruns ranked by overall respondents are error in cost estimation, non-performance of sub-contractors, fluctuations in the cost building material, delay of material delivery on site and also variations. Error in cost estimation was ranked first (RII = 0.79) as agreed by the entire respondent. This factor can be attributed from various reasons such as plans and specification errors and mathematical errors by the estimator. Thus, a triple check by a competent person, preferably a manager, is necessary to prevent avoidable errors and to review estimates. Non-performance subcontractor rank second with the (RII=0.75) as agreed by the entire respondents. This factor can be attributed from various reasons such inexperienced subcontractor hired by main contractor caused difficulty to run the project within the time and cost limit. Fluctuation in cost material ranked third

(RII=0.71) due to increase of material prices will directly increase the cost of construction project if not controlled by local authority. Owner interference and delay of construction material on construction site shared the same value of RII were ranked fourth and fifth as agreed by all respondents.

4.8 Overall ranking factors influencing cost overruns at construction projects

Table 4.8 shows the rank of all factors of cost overruns that have been investigated in this research from contractor, consultant and owner view point. Total of 15 factors that influence cost overruns in Pahang have been studied and discussed. The rank was based on Relative Importance Index value.

Table 4.8 Rank of Possible Solution cost overruns at construction projects

The solution	RII	Rank	Group
Select suitable contractors	0.76	1	Expected From Clients/Project Owners
Efficient time management	0.75	2	Expected From Contractors
Continuous coordination and direct communication	0.74	3	Expected from Consultants
Sufficient time for proper feasibility studies	0.74	4	Expected From Clients/Project Owners
Ensure realistic specifications	0.73	5	Expected From Contractors
Cost reduction measures	0.72	6	Expected from Consultants
Cross-check designs and details	0.69	7	Expected from Consultants
Goals should be realistic	0.68	8	Expected From Clients/Project Owners
Avoid complex designs	0.66	9	Expected from Consultants
Standardized the specification as much as possible	0.65	10	Expected From Contractors

Solve problems and propose solutions	0.65	11	Expected From Contractors
Provide comprehensive information	0.63	12	Expected from Consultants
Detailed site investigation	0.63	13	Expected From Contractors
Funds are available before projects are started	0.62	14	Expected From Clients/Project Owners
Procure correct construction materials	0.62	15	Expected From Contractors

Table 4.8 shows that top 5 most significant factors of cost overruns ranked by respondents are select suitable contractor, efficient time management, continuous coordination and direct communication, sufficient time for proper feasibility study and ensure realistic specification. Select the suitable contractor ranked first with slightly high value of Relative Importance index (RII=0.76). The high value of RII indicates the important of project owner or client to carefully choose contractor during bidding of tender process to ensure the hired contractor able to execute the project efficiently. Efficient time management by contractors was ranked second (RII=0.75) as agreed by all respondents that participated in this survey. This is because poor time management in construction project will cause delay in construction project and consume more cost than it should.

Continuous coordination and direct communication was ranked third (RII=0.74). The solution shared the same RII value with provide sufficient time for proper feasibility study by project owner or client that was ranked fourth from overall possible solution of cost overrun. Most of the respondents agreed that one of the best solutions of cost overrun is to keep on monitor the progress of construction project and provide enough time for more details feasibility study to be conducted before project begins. Ensure realistic specifications by contractor was ranked fifth by all respondents (RII=0.73). The realistic specifications will help the progress of construction project because the absence of clear plans leaves much room for disagreement about what, exactly, was bid on. This can lead to change orders and extra costs for extra work.

CHAPTER 5

CONCLUSION

5.1 Introduction

Construction industry is one of the main contributors to the economic development of a country. The basic goal in any industry is to achieve the completion of project within time and stipulated cost budget. Study of previous literature revealed that cost overrun is a very common phenomenon and it affects projects greatly. Many studies point out that the situation is more severe in developing countries. Therefore, identification of causes leading to cost overrun and assessing its impact and frequency is necessary to avoid or reduce cost overrun and its effects. The main purpose of this study was to access the causes and solution of cost overrun in Pahang construction industry by using quantitative approach.

To achieve the objectives, the thesis research used desk study and questionnaire survey as research instruments. Clients, consultants and contractors were asked to identify and rate the causes of cost overrun. The data collected using the questionnaires was analysed using Relative Importance Index. Based on the descriptive statistical analysis was carried out using Microsoft Excel and the following findings were discovered: where the most influence factor of cost overrun is error in cost estimation and the most recommended possible solution of cost overrun is select suitable contractors. Based on the key findings and conclusions therefore, the research makes the several recommendations for improvement of research study in the future.

5.2 Groups of factors influencing cost overruns

Results of the research show that different group influences the cause of cost overrun where "design and documentation factors" group has been ranked in the first position by contractor, consultant and owner. Results also show that "contractor's responsibilities" group has been ranked in the second position by all respondents that participated in this survey. Respondents ranked "material related factors" in the third and fifth position. "Owner's responsibility" ranked in the fourth position shared the same level of significance with "material related factors". The last group ranked by respondents is "Contractor's responsibility" where it positioned in sixth placed out of 5 group of factors.

5.3 Groups of possible solutions of cost overruns

Results of the research show that different group of possible solution the cost overrun where "Expected from Clients/Project Owners" group has been ranked in the first position by contractor, consultant and owner. Results also show that "Expected from Contractors" group has been ranked in the second position by all respondents that participated in this survey. Respondents ranked "Expected from Consultants" in the third position.

5.4 Recommendation

The following points can be recommended to all parties in order to minimize and control cost overruns in construction projects. Contractors are recommended to have qualified and quantified technical staff with appropriate experience of the project in order to be able to follow the different technical and managerial aspects of the project. The staff will be more effective if it is consisted of enough numbers of engineers, technicians, and foremen, so the responsibilities would be shared between all of them. Owners are recommended to revise the bid documents such as technical specifications, drawings, bill of quantities and the design of the project in a good way.

Owners are recommended to detect the available materials that present with contractor and to assess his financial ability to implement the project they are advised not to depend on the lowest price contractor to execute the project. Consultants are recommended to avoid centralization of decisions especially those related to consultant work because this may lead to project delay and they should continuously coordinate the progress of the constructions work to avoid discrepancy and cost overrun. The response rate for this survey quite low, thus in order to improve the response rate the surveyor should take out irrelevant questions that don't work towards the goals and increase the number of survey sent to respondents.

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APPENDIX A

QUESTIONNAIRE FOR RESEARCH THESIS OF FINAL YEAR PROJECT

Prepared by: Nurafiqah Binti Abu Hasan

Title of Thesis: Cost Overrun of Construction Project in Pahang (Causes and Solutions)

SECTION A: GENERAL ORGANIZATION INFORMATION

1. Type of organization: _____

2. Major type of work involved:

- Buildings
- Roads
- Water and Sewage
- Electro mechanics
- Others, please specify: _____

3. Respondents background:

- Owner of organization
- Site/Consultant Engineer
- Project manager
- Contractor
- Others, please specify: _____

4. Relevant working experience (Years):

- 1-3 Years
- 3-5 Years
- 5-10 Years
- >10Years

7. No. of constant employees:

- Less than 10
- 10-15
- 15-20
- More than 20

SECTION B: FACTORS INFLUENCING COST OVERRUNS OF CONSTRUCTION PROJECT IN PAHANG

Please indicate the significance of each factor by ticking the appropriate boxes. Add any remarks related to each factor on the last column e.g. as to the reasons, the critical factors or the solution

Extremely Agree = 5
Very Agree = 4
Moderately Agree = 3
Slightly Agree = 2
Not Agree = 1

Objective: To identify and analyze the most influence factors in cost overruns

NO.	FACTORS OF COST OVERRUN	1	2	3	4	5	REMARKS
Contractor's responsibilities							
1	Cash problem during construction						
2	Poor site management and safety						
3	Equipment and tools shortage on site						
4	Low productivity of labor						
5	Unethical behaviors of contractors to achieve the highest possible level of profit						
Consultant's responsibilities							
1	Slowness in giving instruction						
2	Delay of materials approval by consultant						
3	Waiting time for approval of tests and poor inspection						
4	Variations (design changes/ extra work)						
5	Centralization of decision making process from consultant party						
Owner's responsibilities							
1	Contract modifications (replacement and addition of new work to the project and change in specifications)						
2	Unrealistic contract durations imposed by owner						

3	Owner interference						
4	High quality of work						
5	Slow decision making						
Design and Documentation							
1	Unclear specifications						
2	Poor documentation and no detailed written procedures						
3	Lack of designer's experience						
4	Incomplete design at the time of tender						
5	Error in cost estimation (Bill of Quantities)						
Material							
1	Delay of material delivery to site						
2	Lack of materials in markets						
3	Low quality of materials						
4	Materials on site do not comply with material standard requirement						
5	Fluctuations in the cost of building materials						

SECTION C: POSSIBLE SOLUTION OF COST OVERRUNS IN CONSTRUCTION PROJECT IN PAHANG

Please indicate the significance of each factor by ticking the appropriate boxes. Add any remarks related to each factor on the last column e.g. as to the reasons, the critical factors or the solution

Extremely Agree = 5
Very Agree = 4
Moderately Agree = 3
Slightly Agree = 2
Not Agree = 1

Objective: To identify and analyze possible solutions to minimize or control cost overruns

NO.	SOLUTION OF COST OVERRUN	1	2	3	4	5	REMARKS
Expected from Consultants							
1	Continuous coordination and direct communication						
2	Provide comprehensive information required for easier interpretation of the drawings and setting out of the works						
3	Detailed and comprehensive cost reduction measures						
4	Avoid complex designs and consider seriously the issue of build ability in the design						
5	After completion of designs and plans, cross-check designs and details to eliminate errors						
Expected From Clients/Project Owners							
1	Clients should allow sufficient time for proper feasibility studies, planning, design, documentation and tender submission						
2	Client goals should be sufficiently accurate and realistic						
3	Clients should ensure that adequate funds are available before projects are started, so that contractors can be paid in accordance with the contract agreement						

4	Select suitable contractors not only on the basis of price and time offerings, but also on experience, financial standing, capacity and expertise						
5	Detailed site investigation						
Expected From Contractors							
1	Procure construction materials and other items in collaboration with the client ahead of time						
2	Solve problems and propose solutions on construction projects proactively						
3	Ensure efficient time management through proper resource planning, duration estimation, and schedule development and control						
4	Standardized the specification as much as possible for ease of understanding by project participants						
5	Ensure adequate and realistic specifications of materials and methods are stated in the contract documents						

APPENDIX B: SUMMARY OF LITERATURE REVIEW: CAUSES COST OVERRUN

No	Causes of cost overrun	(Alwi, Sugiharto and Hampson, & Keith, 2003)	(Ameh et al., 2010)	(Sambasivan & Yau, 2007)	(Abdul et al., 2014)	(Morris, 1990)	(Ogunlana , promkuntong , & Jearkijim, 1996)	(Alagbari et al., 2001)	(Odeh & Battineh, 2002)	(Kaming , Olomolaiye , Holt , & Harris, 1997)	(Chitkara, 2011)	(Wachs, 1990)	(Fong , Wong, & Wong , 2006)	(Enshassi, Lisk, Sawalhi, & Radwan, 2003)	(Daniel & Kumaraswamy Mohan M, 1996)	(T.Subramani, 2014)	(Le-Hoai, Lee, & Lee, 2008)	(D., Akan G., & Gurdamar S., 1985)	(Nega, 2008)	(Al-najjar, 2008)	(Chimwaso, 2001)	(Chan & Kumaraswamy, 2002)	(Yakubu & Sun, 2010)	(Azhar, Farooqui , & Ahmed, 2008)	(Abdudl-Rahman, Berawi, Mohamed, Othman, & Yahya, 2006)	(Baloyi & Bekker, 2010)	(Kaliba et al., 2009)	(D., Akan G., & Gurdamar S., 1985)	
1	Poor site management							*	*	*				*								*							
2	Inadequate contractor experience								*					*	*														
3	Tools and equipment shortage													*															
4	Mistake during construction							*																					
5	Unethical contractor behavior						*																						
6	Delay of supply raw material					*																							
7	Lack of communication																												
8	Variations						*			*	*				*		*	*				*							
9	Poor inspection												*																
10	Delay of material approval												*																
11	Slowness giving instruction																												*
12	Delay in freeing financial												*	*								*							
13	Contract modification																												

SUMMARY OF LITERATURE REVIEW: SOLUTION COST OVERRUN

No.	Solution of cost overrun	(Al-Najjar, 2008)	(Albatsh, 2015)	(Odeh & Battaneh, 2002)	(Abdul-Rahman, Berawi, Mohamed, Othman, & Yahya, 2006)	(Abdelhaseer, Peter, Hussin, & Aziz, 2005)	(Bhardwaj, 2015)	(Amoa-abban & Allotey, 2014)	(Ahsan & Gunawan, 2017)	(Monyane, Identifying causes of Cost Overrun)	(Abdullah, 2009)	(Sambasivan & Yau, 2007)	(Ameh et al., 2010)	(Ombisa, 2013)	(Ahiaga-Dagbui, 2014)	(Ismail & Aftab, 2012)	(Roachakananan, 2005)
1	Site meeting				*												
2	Provide comprehensive information						*										
3	Continuous coordination							*	*	*	*						
4	Avoid complex drawing						*		*	*							
5	Design complete at time of tender								*	*							
6	Flexible evaluating		*														
7	Sufficient time for feasibility study									*				*			
8	Select Suitable Contractors		*	*				*			*	*		*	*		
9	Develop follow-up team		*														
10	New approach of contract document			*		*											
11	Procure material ahead of time						*										
12	Low productivity of labor						*										
14	Efficient time management	*						*						*		*	
15	Client should not interfere										*						
16	Approve drawings on time										*						
17	careful consideration in the preliminary stages											*			*		
18	Cost reduction measures													*			*
19	Funds are available before project are started													*			