INVESTIGATING PROJECT COST MANAGEMENT FOR HIGH-RISE RESIDENTIAL BUILDINGS

LING CHEE SOON

A project report submitted in partial fulfilment of the requirements for the award of Master of Project Management

Lee Kong Chian Faculty of Engineering and Science
UniversitiTunku Abdul Rahman

April 2021

DECLARATION

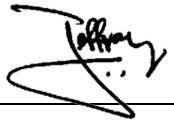
I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

Signature	:	
Name	:	Ling Chee Soon
ID No.	:	20UEM20329
Data	:	19/04/2021

APPROVAL FOR SUBMISSION

I certify that this project report entitled "**INVESTIGATING PROJECT COST MANAGEMENT FOR HIGH-RISE RESIDENTIAL BUILDING**" was prepared by **LING CHEE SOON** has met the required standard for submission in partial fulfilment of the requirements for the award of Master of Project Management at Universiti Tunku Abdul Rahman.

Approved by

Signature	:	
Supervisor	:	Ir. Dr. Jeffrey Yap Boon Hui
Date	:	19.04.2021

ACKNOWLEDGEMENTS

I would like to thank everyone who had contributed to the successful completion of this project. I would like to express my gratitude to my research supervisor, Ir. Dr. Jeffrey Yap Boon Hui for his invaluable advice, guidance and his enormous patience throughout the development of the research.

In addition, I would also like to express my gratitude to my loving parents and friends who had helped and given me encouragement throughout the entire process to complete this research. They have also provided me some useful information and opinions and inspired me when I encountered some problems while doing my research.

Lastly, I would also like to thank all of respondent who are generous time to participate in my survey.

ABSTRACT

Malaysia was a developing country whose economy was still dominated by construction, especially high-rise residential buildings. But construction was consistently rated locally as one of the country's most dangerous industrial activities, which would affect the country's gross domestic product (GDP). For the researched aimed was the purpose of this studied was to understand and analyze the costed overruns that often occurrence in the construction industry of high-rise residential buildings in Klang Valley. In ordered to ensure that the construction costed management of the high-rise construction project was within the budget range, cost control in the construction project was an important factor. The construction of the project in the construction of over-expenditure phenomenon in the field of common occur. The length of the project development phase from preliminary planning to construction appears to have been a major factor in the extent of cost overruns. The longer it took and the bigger the project, the easier it was to create cost overruns. The study would be able to identify cost overruns that affect the total building cost. The cost overrun of construction projects was due to a variety of reasons, and many researchers had conducted a variety of studies to determine the factors that caused this problem. In recent years, the concept of construction cost over time have had attracted extensive attention. Many studies tried to identify and analyze the factors of cost overrun, the influence on the construction industry and found out the most important solution to overcome the cost overrun. The researched methodology method was used quantitative method in this researched. The data analysis would use SPSS software for further analysis of the data collected from the respondents, techniques used in data analysis included Cronbach's alpha, Mean ranking, Kruskal-Wallis test, One-sample t-test, and Spearman`s correlation test. The findings of this surveyed review that the main factor causing cost overruns in the construction industry was poor financial management, and that the most important solution to overcome cost overruns would be effective site management and supervision. Cost management in the construction industry would effectively result in lost profits for contractors, sub-contractor, consultants and developers.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AC	Actual cost
CI	Construction industry
CV	Cost variance
CBS	Cost Breakdown Structure
CPI	Cost Performance Index
CVR	Cost value reconciliation
CVR	Cost value reconciliation
CPM	Critical Path Method (CPM)
EV	Earned value
EVA	Earned Value Analysis
GDP	Gross domestic product
PV	Planned value
PMBOK	Project management book of knowledge
PERT	Project Evaluation and Review Technique
SPSS	Statistical Practical for Social Science
TCPI	To-complete Performance Index
WBS	Work Breakdown Structure

CHAPTER 1

INTRODUCTION

1.1 Research Background

In Malaysia, the economic grow rapidly as a fast-developing country since the seventies, especially in high-rise building (Rohani, et al., 2005). The construction industry (CI) has played an important role in the Malaysia economy growth, especially in a high-rise buildings demand is increasing. The construction industry has been consistently contributed approximately 3.1% of the national Gross Domestic Product (GDP) in Malaysia (Uzir, 2021). However, various uncertainties in economy, environmental impact, national political factors, technological progress, the technical capability of the project management team and other aspects Economic development that could shake and affect the construction industry (Hirudini, et al., 2018). However, the prevailing impression in the market is that the construction industry in Malaysia is associated with time and cost overruns, which affect the amount of physical infrastructure development that can be undertaken. In Malaysia, many factors may have influenced construction time and cost overruns.

The construction sector is one of the most dangerous industrial activities in the country. Because of the hazards and dangers in the construction field, construction problems are one of the important factors affecting the economic growth of various countries whenever major accidents occur (Low, et al., 2014). In construction projects, it is of great significance to control the cost performance of projects and ensure that the cost of each project is within the budget. This demonstrates the importance of high quality, efficient control and management of the project. The number and scale of buildings, especially high-rise building projects, have increased in the Klang Valley. Generally speaking, we can know that the bigger the building project is, the more difficult it is to control the cost. Therefore, contractors are aware of the importance of cost factors to control costs.

To successfully complete a project in the construction industry, one of the basic standards of construction project management is to ensure that the project is completed on schedule within the planning phase and budget estimates. Because of the possible uncertainty, how to control the construction cost within the budgeted cost has become a major and challenging task for construction contractors. In building complex projects, cost control is an important process to control the project cost within the projected budget by implementing various technologies during the planning stage. The main purpose of cost control is to help maximize the profit of the construction project completed within the planned time limit (Punam & Darade, 2018).

1.2 Problem Statement

In order to define the success of a high-rise residential project, the cost, time, quality and safety performance of the project must be evaluated. According to Atkinson (1999) The issue of cost management is always more important than the issue of time performance, because the cost factor has a greater impact on time (Atkinson, 1999). Therefore, if a construction project has the right and excellent technology to control its financial resources, then this particular project usually does not have time overruns. The construction industry is one of the main sectors of Malaysia's national economy and plays an important role in economic growth. The implementation of construction projects often provides necessary public or private infrastructure services and physical structures, which may also promote the growth of businesses, utilities and other industries. The involvement of high costs in the construction industry makes the development of the construction industry directly proportional to the national economics.

The problem statement of this study is to conduct an empirical study on the cost overrun of construction projects in Malaysia, because there is a lack of research on the causes of cost and time overrun in the construction industry in Malaysia. Chan (2001) used Brimelow’s model to investigate the relationship between time and cost of a construction project (Chan, 2001). This study is not representative of Malaysia as a whole. Takim (2005) studied the success factors of the construction industry in Malaysia (Takim, 2005). Given the importance of the construction industry to the Malaysian economy, it is important to examine the cost overruns in the Malaysian construction industry and the

factors that influence these overruns. These factors may come from all project stakeholders in the construction and development.

Despite the rapid development of the project, the Malaysian construction industry suffers from major defects such as low quality and productivity, cost overrun, overdue schedule, poor construction waste management, and poor safety performance (Abas, et al., 2016) .Olawale and Sun have told us that the cost overruns have had a significant impact on the overall development of the country. Most importantly, as reported by Kaming (1997) it is difficult for any construction project to be completed within the estimated cost (Kaming, et al., 1997). The studies from Memon (2012) agree with the findings, which indicate the need to understand the various perspectives of construction project stakeholders (e.g., contractors, subcontractors, consultants, and developers) regarding existing problems (Memon, et al., 2012). From the contractor's point of view, project delays (time overruns) can increase the overall cost of the project, directly reduce profit margins, and also damage the contractor's reputation. Not only that, but the client also has to pay all the extra fees and professional fees, while getting a small profit due to the late stay.

Consider a few real cases from the past, for huge construction projects have been known for their project cost overruns and completion date delayed (Rahman, et al., 2013). Abdellatif (2006) mentioning that the lower cost of high-rise residential buildings has always been criticized for poor quality and defective outcomes, for this situation, the project has deteriorated badly due to rushed construction, poor design planning and lack of maintenance (Abdellatif & Othman, 2006). Poor quality in the project may be due to poor construction management planning, failure schedule management, poor materials, incorrect concrete grade and poor drainage systems (Auchterlounie, 2009). The prime contractor is an important part of the cost control of the construction project. “There are many construction projects around the world that have cost control problems, resulting in cost and time overruns.". In Malaysian construction industry, it is commonly finding out that the actual cost of project work is always exceeding the estimated cost. Projects completed within budget are rarely found compared with cases of projects with a cost

overrun. According to Chimwaso (2002) proper cost management, planning and effective cost control techniques is required in resolving cost overrun problem (Chimwaso, 2000).

As a developed country, the construction industry has become one of the key pillars of the Malaysian economy, so it is necessary and meaningful to study the factors that influence cost overruns. There are many previous studies, but most of them focus on infrastructure construction projects and general building construction projects. However, research on the cost and time overruns of high-rise building construction projects, especially in Malaysia, is still lacking. Therefore, the main purpose of this study is to explore the factors that influence the construction cost overrun of high-rise residential buildings construction projects in the Klang Valley area and to determine their significance.

1.3 Aim

The purpose of this study is to understand and analyze the cost overruns that often occurrence in the construction industry of high-rise residential buildings in Klang Valley.

1.4 Research Objective

The research objectives of this study are as follow: -

1. To determine the factors of cost overruns that affect the construction cost.

2. To examine the cost significant elements for high-rise residential buildings.

3. To appraise the cost control techniques used in building construction projects in Malaysia.

1.5 Research Questions

In accordance with the previous problem statements, the research question of this study was as follow: -

1. What are the common factors of cost overrun that affect the construction cost?

2. What is the cost significant building element and their effect to the construction cost?

3. What are the effect of cost control techniques on the construction project?

1.6 Research Scope

In terms of the scope of this study, the construction industry understanding of the significant cost factors of a high-rise building project. The study will focus on the Klang Valley region, the research is of great importance to the private sector and all participants in the construction industry. The research is to be crucial because the successful and up-trending construction industry will beneficial to the profitability of all construction industry players and contribute a higher value of the Gross Domestic Product of the country. By reviewing this research, it encourages every involved party in the construction industry to awareness and understands the importance and effectiveness of cost control techniques.

1.7 Research Significant

Cost management has become a major problem in the construction industry, and it could affect sectors of the Malaysian economy. Most high-rise projects face cost overruns due to a lack of attention from contractors or project managers. This study will provide more detailed information on the factors of cost overruns and their influence on the total construction cost. Besides, this study also discusses the cost significant element for high-rise residential buildings. For contractors and subcontractors, it is useful to refer to this study because it provides sufficient information to explore the details of cost overruns. Finally, this study focuses on the cost control techniques used in construction projects.

As the study will focus more on public works projects, the findings will also provide information to governments or local authorities on the impact of cost management if no action is taken to address the problem. And provide solutions for future projects to avoid overspending. This research also allows every construction industry player to examine the cost significant elements for high-rise residential buildings, and to appraise the cost control techniques used in building construction projects in Malaysia.

1.8 Methodology

In terms of researched methodology, development of a questionnaire was used in this researched project. The questionnaire method was to prepare surveyed question form to collected data from respondents. The questionnaire form consists of several questions in the researched question. For the rating was consisted 5 category which was: (5) strongly agreed, (4) agreed, (3) undecided, (2) disagreed, and (1) strongly disagreed. The researcher would be providing an online google form send to all construction industry firms from Klang valley.

To achieve the objectives of this study, the data would be collected from two main resources which were the primary and secondary data resources. The primary data would be collected via a questionnaire surveyed. Questionnaire surveyed forms would be designed and administrated to the group of selected respondents. The group of selected respondents could have been the parties who were involved in the construction industry (main-contractor, sub-contractor, consultant, and developer). Consequently, the statistical practical for social science (SPSS) would be adopted to further examine all quantitative data acquired from the preliminary analysis. SPSS would provide data analysis for descriptive statistics, prediction of numerical results and group identification prediction (Margaret, 2018).

Besides that, the secondary data resource would be collected from the journal articles, researched papers, newspapers, books, etc. The reviews from these resources would contribute much to the three (3) objectives in this study. A systematic process of research would be conducted in ordered to achieve the aims and objectives of this research. The researched process would begin with identified the researched topic and literature

review. Subsequently, identify the researched problem, aimed and objectives would be carried out before reporting on the literature review. After reporting on literature review, the data would be collecting and analyzing all the data to derive the final results. Then, the last stage would be a conclusion and recommendation. The proper sequences process of research was shown in figure 1. 1

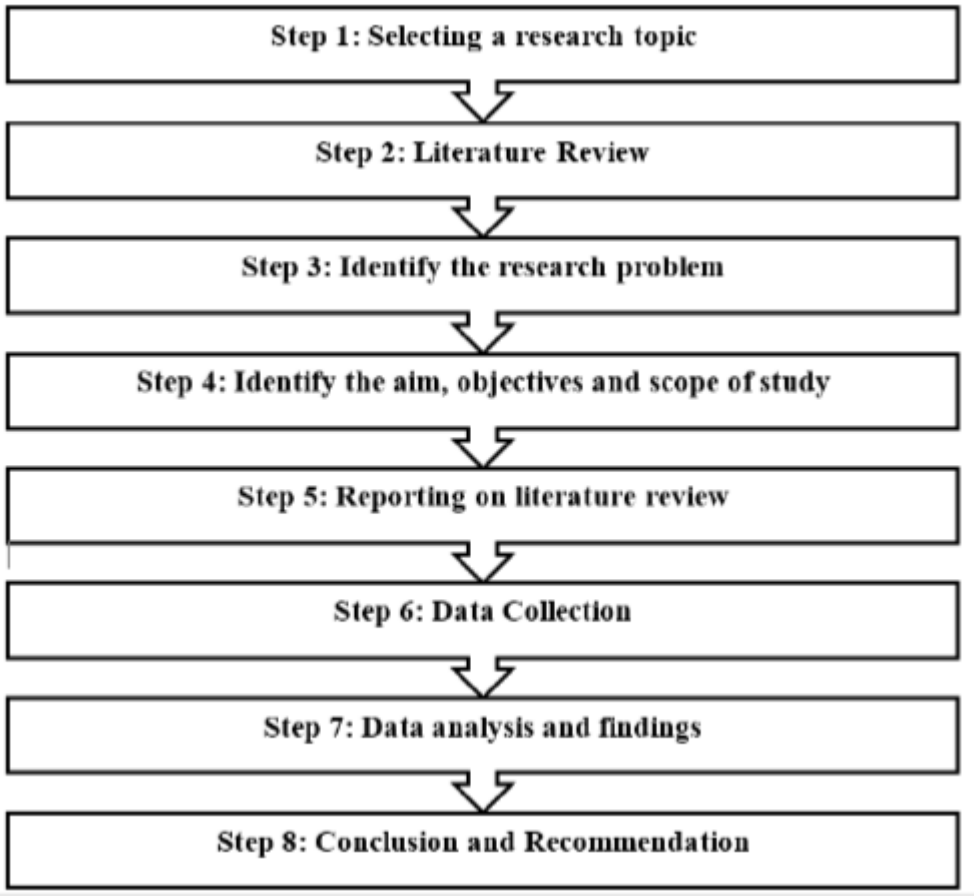


Figure 1.1: Systematic process of research (Rajasekar, 2013)

1.9 Structure of Study

Chapter 1

This chapter will begin with the research background and problem statement on the study. This chapter also covers the research question and objectives to solve the problem statement. The scope of study, limitation and the method to collect data as stated in the research methodology will also outline in this chapter.

Chapter 2

This chapter outline the literature review of this study. This review includes the factors of cost overrun that influence the total construction cost, cost significant element for high-rise residential buildings and the cost techniques used in building construction projects in Malaysia. In this chapter, the data will be collected from secondary data sources such as journals, books, thesis, articles and etc.

Chapter 3

This chapter disclosure the research methodology to be adopted for both data collection and data analysis. Quantitative studies will be applied by distributed the questionnaire survey form to the selective respondents. The non-profitability sampling method will be used to selecting the group of respondents for the quantitative studies. Subsequently, the SPSS software will be carried out to analyze the data collection.

Chapter 4

This chapter reveals the data analysis and results of this study. This chapter analyzed the data collected by the secondary data resources and quantitative approach through distributing the questionnaire survey forms. The knowledge between the primary and secondary data collected will be sorted out after the completion of data analysis.

Chapter 5

This chapter will be the conclusion of this study and also the last chapter in this dissertation. This chapter concludes the whole objectives of the study together with the recommendations as well as to conclude the main issue and factors of high-rise residential buildings cost management in the construction industry.

1.10 Summary

In the conclusion, the introduction is describing the information of the research topic the problem statement is about the financial problems encountered by the construction industry in the construction of high-rise residential projects. determine the research objective and question is based on the research problem statement. At the same time, because of the research scope, the researcher needs the research site and people. The research methodology includes methods to understand what has been done in the study. Finally, the purpose of this chapter is to allow researchers to understand the research topic from more perspectives

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In developing countries, especially in Malaysia, the construction industry has a certain influence on the country's economic contribution. However, despite the rapid development of the project, the construction industry still faces several major problems, including low quality and productivity, cost overruns, time overruns, poor management of construction waste and poor safety performance (Abas & Lingard, 2011). Sun (2010) has informed it known that the cost overruns on construction projects had a significant impact on the overall development of the country (Olawale, 2010). From the point of view of the contractor, the delay of the project will lead to an increase in part of the cost of the project, directly affect the profit margin, and also hit the reputation of the company. Not only that, but customers also have to pay all the extra fees and professional fees, and profits will be reduced due to late occupancy rates. It will discuss and focus on cost management in high-rise residential buildings in Klang Valley.

2.2 Overview of Cost Overrun

In Malaysia, the dynamic and uncertainties of the construction industry are major challenge faced by building contractors. Each construction project involves different unique design and each project may face a different difficulties and challenges. Risks occurring in the construction industry are inevitable and cannot be eliminated (Hughes, et al., 2015). Therefore, it is risky for local building contractors for ensuring the completion of the construction projects in priorities regarding quality, time and cost. However, the cost is the main aspect of a construction project as well known. The risky uncertainties in the construction industry are particularly prone to cost overrun issues (Cunningham, 2017).

Building contractors are commercial enterprises whose aim to make a higher profit from undertaking and executing construction projects. However, most of the building contractors in Malaysia did not apply the proper techniques in managing construction

costs, this causes a severe problem for them as contractors will lower down their profit-making. Additional finance required arising from cost overrun problem is always a critical impact of building contractors. Poor management in cost performance will reduce or eliminates their profit margins. A proper and suitable cost control technique will become a very demanding task for contractors as this will helps them in achieving a more stable and higher profit margin (Cunningham, 2017).

As mentioned by Cunningham (2017), it is a sense to notice that the cost overrun issue demanding additional funds to cover the excess gap between the higher actual construction cost and lower cost budget. In public works contracts such as government construction projects, cost overrun problems will initiate negative impacts in the wider economy as it needs to convert or shift the additional funds from other construction projects. On the other hand, when a cost overrun problem happened in the private sector, it may lead to the failure of a project or company and even bankruptcy of that company because private organizations may not have a large amount of cash flow and much depending on a bank loans (Cunningham, 2017).

Despite various cost control techniques are available in the industry, the majority of the construction projects still unable to manage actual construction costs within the estimated cost budget. Cost overrun is a severe issue hidden in the construction industry which may cause by unplanned or unexpected events as this will also delay the time for completion of the construction project. Therefore, the prevention of cost overruns must be the main objective in carrying out construction projects. To optimize the prevention stage, factors that lead to cost overrun must be identified and corresponding measures of cost control techniques must be implemented in the execution of the construction projects.

2.3 Cost Overrun in Malaysia Building Project

In Malaysia, various studies on the cost performance of construction projects have shown that the cost performance is poor and that most construction projects are not completed within the estimated budget (Shehu, et al., 2014). Shehu (2014) investigated the cost performance of recently completed construction projects in Malaysia and found that over 55.4% of construction projects experienced cost overruns. The cost and time of

construction projects in the southern and central regions of Malaysia, the findings of this study indicate that 89% of the project experience costs mean 5-10% of the total contract amount is overrun and 92% of the construction projects have completed the planned schedule (Rahman, et al., 2012).

In Malaysia, cost overruns in private construction projects are more common than in public construction projects. Shehu et al. (2014) pointed out that only 37.2% of private construction projects were completed within the expected cost range, while 46.8% of public construction projects were completed within the planned cost range. However, overruns on public projects have been greater than on private sector projectable. The cost overruns of construction projects in the Klang Valley and found that most of the projects had cost overruns (Ali & Kamaruzzaman, 2010). Meanwhile, for the cost overruns of large projects in Malaysia, Memon et al. (2012) conducted a survey, and the survey results showed that 96% of respondents stated that the cost overruns of most projects were between 5% and 10% of the contract value on average (Memon, et al., 2012).

Most of the projects in Malaysia have been facing the long-term problem of cost overrun (Sambasivan & Soon, 2007). Factors related to cost overruns may increase the risk probability and directly contribute to the benefits of the project (Ali & Kamaruzzaman, 2010). Reasons include the original costs exceed the budget cost estimate is not accurate, project planning and plan is not reasonable, lack of project management, contract management defects, engineering cost of inflation, the rise in the cost of machinery, raw materials price fluctuations, unforeseen project site conditions, insufficient funds, construction equipment plan don't fit, design errors and also revealed that cost management issue for contractors often happen in the construction site, where most contractors do not have a financial plan or check their cost during the project capacity before taking tender for new construction projects, so the company financial issue occur during executing the project (Patil, 2017).

The prime contractor needs to establish a dynamic management system to facilitate project coordination and coordinate the scope of the stakeholders. Abdullah et al. (2013) point out that the project management of site and location is very important for success, because the failure of the project routine management may lead to the project cost increase

or overspend. According to the Patil (2017) mention that many contractors were poor in planning, monitoring manpower, and controlling the progress of work on site.

Communication management plays a vital role in all stages of a project, such as design, production, organization and management (Mohammed, et al., 2016). Effective communication can provide stakeholders with faster data sharing and correct decisions to solve problems that may arise in the process of the project. This statement is also agreed by Memon et al. (2014) and Patil (2017) that poor communication between contractors and other parties in construction projects is a major factor affecting project cost overruns.

Materials and machinery in the project are extremely important resources. Materials are considered to be the backbone of construction projects, accounting for nearly 70% of the total value of the project (Memon, 2010). A survey by Azis et al. (2013) found that 71.5% of respondents listed material and mechanical issues as the particular cause of cost overruns in the Malaysia construction industry, as these resources are important for improving construction efficiency and can save significant time and costs. Therefore, as opposed to using outdated and inadequate equipment, adequate and efficient use of equipment is of Paramount importance (Ali & Kamaruzzaman, 2010).

Labor plays an important role in building projects. The construction industry is considered to be labor-intensive and highly dependent on labor to perform work (Memon, 2010). A successful project depends not only on the number of workers, but also on the efficiency of the labor force. Therefore, effective labor management is an important aspect to avoid project costs over time (Azis, et al., 2013).

2.4 Factor of the Cost Overrun Influence the Construction Cost

Different types of factors may lead to different degrees of cost overrun. For example, in the construction of large projects of high-rise buildings, the cost overrun may occur due to various factors. Based on the survey conducted by Ali and Kamaruzzaman (2010) mention that construction projects of all sizes are subject to cost overruns, such as inaccurate budgets, poor project management, raw material inflation, machinery cost factors, unanticipated site conditions and environments, insufficient funds, outdated

construction methods and design errors. However, the most serious factors that are most likely to cause the cost overrun problem are identified through research (Kamaruzzaman & Ali, 2010).

2.4.1 Ineffective project management

Project management has many gears and wheels that need to work together to create maximum value for the project. However, today's high-rise residential project management is no longer just a project, it needs a holistic approach that takes into account real-world scenarios. In fact, it is difficult to cover all aspects of project management, and inefficiencies can occur during the project lifecycle. So that ineffective project management is the major factor influence the construction cost. Project management focuses on the application of knowledge, skills, tools, and construction techniques to project tasks, including on-site supervision throughout the project (Institude of project management, 2010). The Contractor's ability and qualification will be the level of construction site management. Improving building management is an important tool to improve overall construction efficiency. Reducing cost overruns is therefore critical (Ade, et al., 2013).

2.4.2 Poor information and communication technology

According to Ade (2013) Poor information and communication are one of the causes of cost overruns. In a complex project, there are many stakeholders involved, such as the architecture, contractor, developer, subcontractor, quantity surveyor, engineer consultant, etc. The Effective communication system is very important, it can provide faster and convenient data sharing so that various stakeholders can make decisions early in the project execution process and solve any problems without delaying the project schedule. Coordination and communication between different parties will be improved through the appropriate implementation of information and communication technologies. To address errors and discrepancies, causing delays in construction activities, and avoiding cost overruns (Ade, et al., 2013).

When there are no proper communication channels, a bad project culture begins to develop. Lack of weak internal team meetings, lack of correct project information, and lack of clarity on important decisions can all lead to a poor project culture. Good project culture is the cornerstone of successful project delivery. Communicate effectively to spread a cohesive and collaborative project culture. Project communication is a bridge between people. If project management software is a spinal cord that ties projects together, project communication is the nervous system that ties the different organs of a project together. Project team members will be more accountable if they communicate regularly. The senior management or the executive team regularly updates on the progress of the project, they will not only let you do your work but also provide support for you to complete the project.

2.4.3 Fluctuation of raw materials cost

One of the key factors that can lead to cost overruns in a volatile raw material market is price volatility. Accurately estimating or predicting changes in the cost of materials is not easy, as many factors are contributing to price fluctuations. For example, a high inflation rate will change material prices in an unstable trend. Such fluctuations in raw material costs will lead to cost overruns on most construction projects (Kamaruzzaman & Ali, 2010).

2.4.4 Weak labour productivity

The construction industry in Malaysia relies heavily on labor. Labor productivity will be determined by the efficiency and effectiveness of labor and the performance of field organizations. According to Gichuhi (2013) survey mention that the labour costs account for about 25-35 percent of the total value of construction projects in Malaysia (Gichuhi, 2013). Most construction workers spend an average of 40 percent of their available time on productive activities and another 33 percent on non-value-added activities. A variety of reasons can contribute to this unproductive time, including unorganized work time, idle waiting for machines or materials, delayed instructions from supervisors, lack of experience, etc. (Henry, et al., 2006). As a result, any decline in Labour productivity could

lead to poor cost-effectiveness or even serious cost overruns in high-rise construction projects.

2.4.5 Poor design in construction

The overall design of the project is the implementation system guide of the construction project. In the stage of project planning, proper design is a necessary factor to ensure the smooth progress of project construction. Poor design can lead to poor construction performance or even lower cost and profit margins as changes are required during execution. This factor may be due to the consultant's lack of skill or experience in designing accurate working drawings and providing appropriately detailed specifications that can be implemented during the construction process (Ade, et al., 2013).

2.4.6 Quality of raw materials

Raw materials are very important resources to every project which occupied approximately 70% of the total value of a construction projects (Augustine, et al., 1993). Poor quality of raw materials will cause the projects to severe cost overrun issues because a large amount of wastage on raw materials happened unpredictably. Wastage of raw materials can occur anytime during the procurement process, storage at the site and during utilization especially to the low-quality raw materials (Hendrickson, 2000). Quality of raw materials determines the level of wastage due to damages and breakage during handling, high rate of deterioration, short-shelf life and exposure to extreme climatic conditions. An immoderate wastage will affect the work progress adversely, with consequences in a delay of construction duration and cost overrun (Chitkara, 2014).

2.4.7 Poor in financial management

Successful construction projects can only be achieved by excellent financial management. In contrast, poor financial management in a construction project might lead to serious cost overrun. Hence, it is advisable to monitor the financial system well from the feasibility study of the project until the commissioning of the project. However, the delay of monthly interim payment to contractors is a huge financial difficulty that affect the project cash flow of building contractors. Therefore, an appropriate funding method should be

determined at the inception of a construction project so that cash flow can be maintained in good condition (Stephen, et al., 1996).

2.4.8 Poor competency of consultants

Poor actions and advice provided by consultants to clients is another factor of the cost overrun problem in Malaysia. That advice from consultants will affect the priorities and decisions of the client in execution regarding quality and project duration. This will influence the project's cost performance. Hence, poor competency of consultants will lead to poor performance of administrative duties and slow decision making by clients which creating difficulties in managing cost performance and cost overrun may occur (Cunningham, 2017).

2.4.9 External factors

There is no control over external factors. Project management the smooth construction of the project depends on the weather conditions on the site, unpredictable environmental conditions. Of course, the change of government policy will also affect the progress of project management and the unstable economic situation. This will affect the progress of the construction in the agreed period time cannot complete the work (Larsen, et al., 2015).

2.4.10 Lack of experience

The high-rise residential project is complicated because it involves a lot of stakeholders. There are many high-rise residential projects in the Klang Valley. If the project team and workers are inexperienced, the progress of the project will be seriously and the cost management of the project will be affected. Not having enough experienced teams and workers to complete a project or meet productivity goals is a huge risk. The project may be affected by a long construction schedule and may delay the delivery of the project to the client on time (Ameh, et al., 2010).

2.4.11 Inadequate documentation and tracking

High-rise residential buildings need a huge amount of information and documents, so tracking information and documents is very complex and extensive. Like anything with a

lot of change, success or failure often depends on the changes that happen along the way. Projects are no exception. Successful project management should effectively track change to ensure that everyone on the project team is held accountable and that audit trails are maintained for stakeholders. But project tracking isn't just about establishing checkpoints and schedules; it's about establishing a complete system to monitor project completion and truthfully report whether the project has been completed and if there are any problems encountered. With a good tracking system, it's almost impossible to let unfinished tasks or missed deadlines slip through the cracks unnoticed (Hendrickson, 2000).

2.4.12 Frequent design change

Design changes occur when the project design or requirements change (Burati, et al., 1992). After the contract of the construction project is awarded, the design change is the regular increase, decrease and adjustment of the design and construction work, which affects the contract provisions and construction conditions, making the construction in a dynamic and unstable state. Similarly, once a design change is any change in the design or construction of a project after the contract is awarded and signed. Changes to the design work due to errors may affect the subsequent construction schedule, as well as the cost management of the project. Emphasize design modifications or changes made after contract award. As a result, some changes may be major causes of interruption, dispute, claim, loss.

2.4.13 Summary of common factors of cost overrun

Table 2.1: Common factors of cost overrun by different author

Ref	Common factors of cost overrun	Author														Total
		Kamaruzzaman & Ali, 2010	Institude of project management, 2010	Ade, et al., 2013	Kamaruzzaman & Ali, 2010	Gichuhi, 2013	Henry, et al., 2006	Augustine, et al., 1993	Hendrickson, 2000	Chitkara, 2014	Stephen, et al., 1996	Cunningham, 2017	Larsen, et al., 2015	Ameh, et al., 2010	Burati, et al., 1992	
B1	Ineffective project management	x														1
B2	Poor information and communication technology		x	x												2
B3	Fluctuation in cost material				x											1
B4	Weak labour productivity					x	x									2
B5	Poor design construction			x												1
B6	Quality of raw material							x	x	x						3
B7	Poor in financial management										x					1
B8	Poor competency of consultants											x				1
B9	External factors												x			1
B10	Lack of experience													x		1

Ref	Common factors of cost overrun	Author														Total
		Kamaruzzaman & Ali, 2010	Institude of project management, 2010	Ade, et al., 2013	Kamaruzzaman & Ali, 2010	Gichuhi, 2013	Henry, et al., 2006	Augustine, et al., 1993	Hendrickson, 2000	Chitkara, 2014	Stephen, et al., 1996	Cunningham, 2017	Larsen, et al., 2015	Ameh, et al., 2010	Burati, et al., 1992	
B11	Inadequate documentation and tracking								x							1
B12	Frequent design change														x	1

2.5 The Effect of Cost Significant Element of Buildings Work

2.5.1 Cost of substructure

The most basic structure of a high-rise building is the substructure work, so in the early design of the project, the substructure design is based on the strength of the soil, the type of soil to determine the design. Therefore, with different types of soil conditions, the cost of the project will be different due to different construction methods (Halliburton & Mark, 1972). In another example, as example, if the soil condition is a swamp, it will increase the cost of the project because the base type will change from strip to deep strip, which will increase the cost of the infrastructure. If the soil conditions of the project site are rocky, the operation and maintenance costs of the machinery are higher, which increases the cost of the underground structure as more powerful machinery is required to excavate. According to Seely (1997) mention that the soil conditions of a project site cause different foundation costs for other similar projects (Seeley, 1997). Figure 2.1 shows the substructure park in the high-rise building.

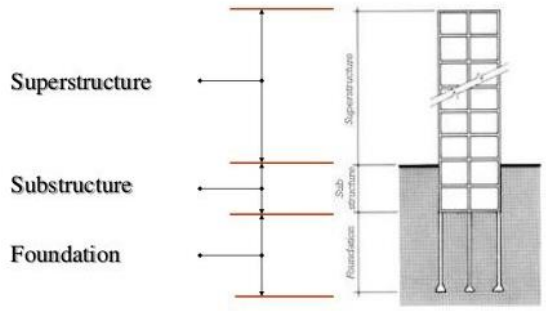


Figure 2.1: Major building part (Peters, 2018)

2.5.2 Cost of superstructure

The number of blocks designed will directly affect the cost of superstructure costs, as more raw materials and human resources are required for construction. As a result, this will increase the cost of construction, as high-rise residential projects are more expensive than traditional residential projects (Seeley, 1997). According to the project of high-rise residential building, fire protection systems, ceiling design, floor quality, and floor area of staircases can also add to building costs. Investigation of Seeley (1997), he found that

the cost patterns are different cost in a different storey. In general, high-rise residential buildings with more than 35 stories are more expensive than 34 stories due to specific unit wall area and design, such as square meters. This will directly increase the cost of construction.

2.5.3 Cost of envelop

Exterior buildings are usually made of concrete and then painting. There are two kinds of bricks commonly used in the construction field, one is brick, the other is concrete brick. Which apply type of the brick should depends on the site condition, weather, specific drawing from architecture. For example, Brick walls were installed to keep out the occasional bad weather, including hot and cold air. Opening Windows such as double glazing or triple glazing can increase the construction costs. In addition to bricks, walls on the market today are also filled directly into concrete and set (Cunningham, 2013).

2.5.4 Cost of stairs

The stair of a residential high-rise building is the first safeguard that evacuates the dweller to escape safely when a fire happens, so stair is particularly important in a high-rise building. Usually, the stairs are made of concrete and the interior must be reinforced with steel. The cost of the stairs depends on the type of stairs used, such as straight stairs, L-shaped stairs, library stairs, etc. Although the cost of the stairs is only a fraction of the cost of the building, this may also affect the cost of the building (Ade, et al., 2013).

2.5.5 Cost on frame (Column, Beams, Steel Bar)

According to the residential high-rise building project, the cost of the frame structure will increase in the first few floors, as the frame bears the load of the upper successive floors (Seeley, 1997). The higher the building project, the higher the cost of the framing. The addition of upper floors will require additional support beams and the proportion of the upper floor area to the total floor area may change. The load from the upper floor is transferred to the beams and columns. Therefore, the additional strength of high-rise residential buildings requires the addition of beams and columns, which will lead to an increase in the cost of framework engineering. Besides, When the upper floors have

special columns and beams, the design of the steel structure becomes more complicated, which directly results in the construction cost of the frame.

2.5.6 Cost of Roof Work

According to the high-rise building projects, the cost of a roof is determined by the height and design of the building, because all units in the same building share the same roof, and the taller the building, the stronger the wind on the roof, so a roof with strong wind resistance is needed. The cost of a house is higher than the cost of a high-rise building. Roof types include flat roofs and pitched roofs. A flat roof is cheaper than a pitched roof, but because there are no gutters, rainwater cannot flow out of a flat roof, so a flat roof costs extra for drainage (Newberry & Eaton, 1976)

2.5.7 Cost of service

Service is to make people comfortable in the buildings they live in, including sound, sight, temperature, wind and so on. The range of options for high-rise buildings has increased, and since then, the service has become more complex, it said. Besides, fees for services such as elevators in high-rise apartment projects will increase rapidly. Other than that, buildings with more specific shapes require additional arrangements for acoustics, lighting and ventilation in high-rise buildings (Saidu, et al., 2015).

2.5.8 Cost of fitting

Fitting is a temporary architectural element, but it is permanently attached or built into the building (Benge, 2012). Doors, Windows, ceiling and other parts of the building installation accessories (fitting). The cost of the accessories(fitting) depends on the brand and the quality of the accessories chosen.

2.5.9 Cost of external wall

According to the Saidu (2015) mention that external works were carried out prior to the construction of the superstructure, such as soil backfilling, excavation and grass laying. As with the superstructure, external work in high-rise residential buildings needs to determine the

condition of the soil. Therefore, if the soil quality is poor, it is difficult to excavate and backfill, which will cause additional external work costs (Saidu, et al., 2015).

2.5.10 Cost of external door

In high-rise buildings, a door is extremely important, because the higher the height of the floor, the greater the wind, so when choosing the quality and cost control. Cost considerations need to depend on the quality, quantity, size, and type of external components used. Door material includes lumber, steel frame, glass and so on can affect construction cost. Different types of quality materials for the door will result in different costs compared to another door (Azis, et al., 2013).

2.5.11 Cost of the internal wall

The interior decoration of the building mainly includes walls, so its types are brick walls, concrete walls and partition walls. The choice of materials needs to be considered in terms of cost. Assuming that the interior walls will be aesthetically complex in design and high-quality materials, such as aluminum, this will affect the cost of the building. If the shape and size of the wall are different, it will also affect the cost, and the irregular shape will lead to higher cost (Ade, et al., 2013).

2.5.12 Cost of consideration

The relationship between quality and cost is often expressed as "you get what you pay for”. Ruskin (1889) mention cost is a key factor in most construction projects, and some clients will seek a lower price (Ruskin, 1889). However, the competition between low and high construction costs is having a negative impact set of quality standards and achieve the best value for money. Assuming that in the current below-cost economic environment, tendering may increase the risk of bankruptcy for the company, it is possible to prevent such risk. However, unrealistic and inadequate project budget considerations often lead to projects becoming capital scapegoats, with people preferring cheaper alternatives to better or more sustainable alternatives. If some client has a fixed budget, must not exceed it under any circumstances. In this case, the client expects the quantity surveyor to maintain cost control below the financial plan to complete the project within budget. Meeting cost

limits may directly affect beneficial features or changes to the design of the project, which may result in excessive operational and maintenance costs later.

2.5.13 Cost of the Design

The geometry of a building has a strong effect on cost. The architectural form is related to the building shape, size and complexity. This section briefly introduces the main morphological factors that affect the cost of construction projects (Seeley, 1996). Large building projects with simple, rectangular, regular plans and facades are generally cheaper per square meter of floor area than smaller, complex shapes, curves or angled buildings. Economies of scale spread fixed overhead costs over a wider "production" space. Simple setup and buildable solutions encourage more plant use and produce higher productivity and less waste. The complex layout and detail of a building results in slower assembly and may involve many transactions and problems, leading to a greater risk of errors and defects. The degree of division and duplication also affects the overall cost of the work. New construction works are much cheaper than repair works or works on existing buildings. Single-story structures tend to be more expensive than buildings with more than three stories, and buildings with more than three stories become increasingly expensive.

2.5.14 The location of the Site

The location of a project will affect its cost. High-value locations attract high-value development, and it is inappropriate to put low-value projects in valuable locations. In any case, the policies of the local government are different in each area, so if you want to develop in the local area, it may be because of the policy factors that the plan is limited to what can be built in these areas. It is also more expensive in urban areas than in rural areas, but because of lower wages, restricted access, limited space for workers' accommodation and storage of materials, and additional security measures and costs (Cunningham, 2013).

2.5.15 Physical site conditions

The site topography of the project, site features, ground conditions and obstacles, existing and adjoining buildings, underground and aboveground services, all this affect the design of the building and the subsequent cost of the building. The nature of each site must be

examined individually to identify potential problems (Cunningham, 2013). Greenfield development costs less than brownfield development, which can incur significant demolition, site clearance and restoration costs. Sites with higher slopes, which require a large amount of stepping or digging and filling, Maybe dangerous and adversely affect working conditions and operator productivity and plant output. Sites with poor bearing capacity will require more expensive foundations, while exposed or flooded sites will also reduce overall productivity. The costs of dealing with unforeseen ground conditions, archaeological finds and encounters with unknown burial services can be substantial and will be borne by the client or contractor, depending on the form of contract used.

2.5.16 Facilities of the building

The use of facilities in a building will have a significant impact on costs. There is a gap in the cost range of housing, condominiums and commercial development. For example, building a commercial tower is the cost of providing public entertainment facilities such as a conference center, a theater and a sports arena. On the other hand, public infrastructure such as hospitals or schools cannot be directly linked to commercial buildings, because these two buildings require different facilities. So, the cost of each building has to be related to its design. As the complexity of the project increases, the cost of building the facility increases, and have found that the cost of such facilities often varies with the nature of the project's size, design, and complexity. when the actual operation and maintenance costs of the project are higher than planned. Recent evidence indicates that over half of construction projects exceed construction cost and time targets in terms of operational and maintenance costs (Ali & Kamaruzzaman, 2010). The operation and maintenance cost of facilities is 4-5 times higher than the construction cost (Ohara, 2019). Cost performance measurement is important in analyzing the success rate and improvement of the project (Ofori-Kuragu, et al., 2016).

2.5.17 Summary of cost significant building element

Table 2.2: Cost significant building element by different author

Ref	Cost significant building element	Author												
		Halliburton & Mark, 1972	Seeley, 1997	Cunningham, 2013	Ade, et al., 2013	Newberry & Eaton, 1976	Saidu, et al., 2015	Benge, 2012	Azis, et al., 2013	Ruskin, 1889	Ali & Kamaruzzaman, 2010	Ohara, 2019	Ofori-Kuragu, et al., 2016	Total
C1	Cost of substructure	x	x											2
C2	Cost of superstructure		x											1
C3	Cost of envelop			x										1
C4	Cost of stairs				x									1
C5	Cost of frame		x											1
C6	Cost of roof work					x								1
C7	Cost of service						x							1
C8	Cost of fitting							x						1
C9	Cost of external wall						x							1
C10	Cost of external door								x					1
C11	Cost of the internal wall				x									1
C12	Cost of consideration									x				1
C13	Cost of the design		x											1

Ref	Cost significant building element	Author												Total
		Halliburton & Mark, 1972	Seeley, 1997	Cunningham, 2013	Ade, et al., 2013	Newberry & Eaton, 1976	Saidu, et al., 2015	Benge, 2012	Azis, et al., 2013	Ruskin, 1889	Ali & Kamaruzzaman, 2010	Ohara, 2019	Ofori-Kuragu, et al., 2016	
C14	The location of the site			x										1
C15	Physical site conditions			x										1
C16	Facilities of the building										x	x	x	3

2.6 Types of Cost Control Techniques

The focus of cost control must be balanced with the importance of delivering value to the client (Catherine, et al., 2007). It is a challenging and complex project in high-rise buildings, so no matter how well planned the project is, there will always be some unexpected things or accidents. These things may be man-made, natural disasters and so on, which will make the original plan and the estimated cost budget deviation. All of these events impose additional costs on top of the construction project. Therefore, the implementation of cost control technology is more important than traditional methods in construction projects.

According to ‘Project management book of knowledge (PMBOK), there are different types of cost control techniques that are useful for controlling project construction cost in the construction industry. For instance, these techniques including Project Evaluation and Review Technique (PERT) and Earned Value Analysis (EVA).

Chitkara (2005) believes that the relationship between time and cost is very important for project cost control. It is important to record and report daily all work, including material, labor and plant on site daily diary reports and project budgets. The labor productivity achieved at the construction site for a given task is an indicator to measure worker efficiency and site organization level. It shows the total time the labor was employed at work, the time he was productive at work and the time he remained unproductive (Chitkara, 2005).

2.6.1 Project evaluation and review technique (PERT)

Firstly, the type of cost control technique that available in Malaysia is Project Evaluation and Review Technique (PERT). PERT is a cost control technique that helps determine the estimated feasibility of completing a construction project within a specified time and cost budget. The PERT chart presents the overall progress of the construction project in graphical form while indicating the major events, related tasks, parallel tasks, and planned tasks that need to be completed.

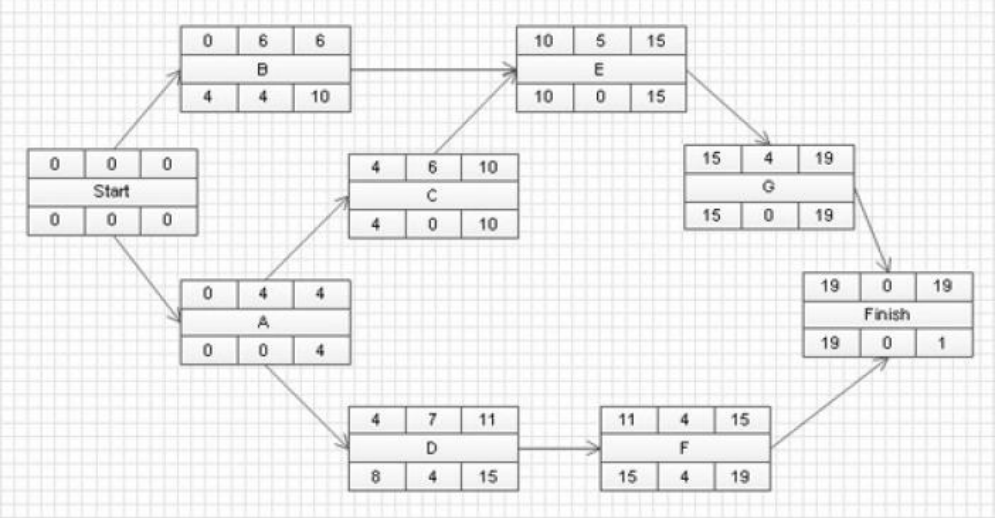


Figure 2.2: Example of PERT chart

The Chart above is an example of a PERT chart. The alphabet A, B, C, D, E, F and G represent the construction activities. At the top, it indicates the possible earliest start and finish date of that particular construction progress. The first column at the left is the earliest start date while the third column at the right represents the earliest finish date. The second column in the middle is the duration required to complete that construction activity. On the other hand, the bottom part, shows the possible latest start date at the left and the finish date of the construction activity at the right. The duration required to complete the task will be stipulated in the middle column.

PERT is similar to the Critical Path Method in construction management but CPM is more based on activities while PERT is majorly based on events. With the purpose of PERT in scheduling, organizing and coordinating tasks in a project, PERT technique also served as an effective cost control technique in ensuring actual construction costs maintaining within the estimated cost budget in Malaysia (Burke, 2013).

2.6.2 Earned value analysis

The earned value analysis is an effective cost control technique in The Malaysian construction industry. It is a simple tool for managing project cost performance, as well as involving schedule and technical performance considerations. The main purpose of

EVA is to compare the earned value of the currently completed project with the actual construction cost and estimated cost budget, to evaluate the cost performance of the project and to determine the appropriate measures to be taken in the implementation process.

Compared with the traditional project cost control method, earned value analysis integrates the time and cost functions, and provides the project management team with a more accurate cost performance measurement method, enabling the project management team to carry out the following work in the right direction. There are three main sources, which are vital to this technology, including:

Planned value (PV) - Part of the estimated budget for the construction work to be spent over any given time period starting from the planning stage.

Earned value (EV) - a description of the current pace of work that reflects the amount of work actually done in any given time frame.

Actual cost (AC) - the amount of cost actually incurred to execute and complete construction activities.

Through the comparison of the three cost factors, the earned value analysis.

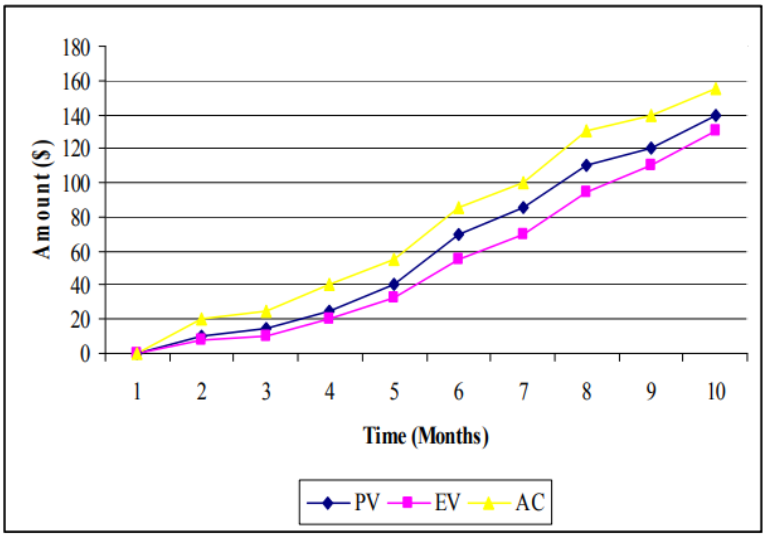


Figure 2.3: EVA Graph (Khamidi, 2011).

Moreover, the current and future cost performance of the project can be determined through the comparison between PV, EV and AC. Cost variance (CV) is the difference between values of the completed work and actual costs spent in the execution of works which able to compute for evaluation of project cost performance.

CV = EV - AC

A positive CV indicates that the cost management of the project is running well, because the cost is lower than the estimated budget, while a negative CV indicates that the actual cost exceeds the estimated budget. The project management team will be aware of the negative value of CV and take corrective action as necessary to minimize the cost overruns.

Cost Performance Index (CPI) is available in Earned Value Analysis which shows the efficiency in the allocation of resources available and determines the value of work achieved by spending construction costs on it.

CPI = EV ÷ AC

2.6.3 Gantt charts or bar charts

The Gantt Charts or Bar Charts are also an effective cost control technique to be executed in the construction projects. The function of Gann Charts is to do scheduling of the construction activities and resources effective and efficient with the consideration of cost and time.

There are a large number of construction activities involved in a construction project which need an effort to arrange every single activity sequential. If the sequence of construction activities did not schedule well, it may affect corresponding activities and delays of projects will have occurred. A higher amount of money would be needed to spend a result of the delay.

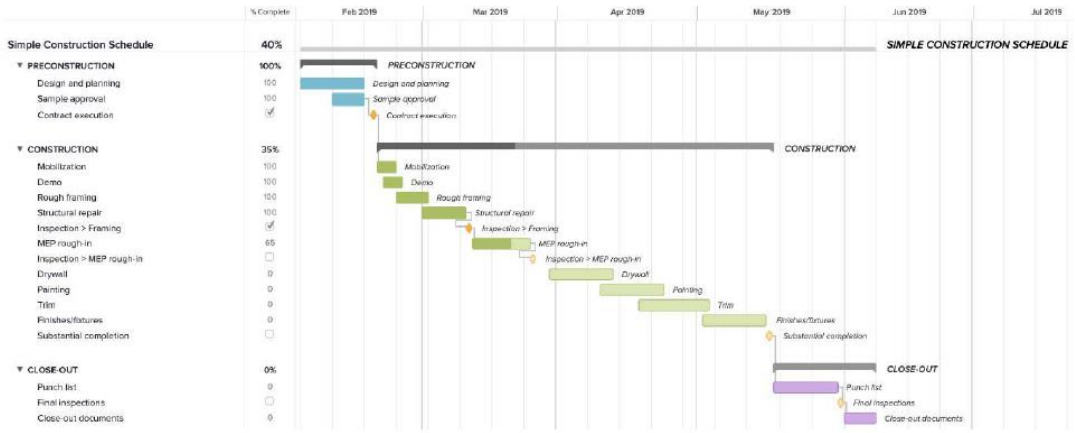


Figure 2.4: Example of Gantt chart (Hira, et al., 1994)

With the assistance of Gann Charts, the construction managers enable to identify the schedule and progress of the construction activities accurately. The Cost Breakdown Structure (CBS) and Work Breakdown Structure (WBS) in Gann Charts can enhance the cost performance and project performance with the detailed breakdown of each construction activities which generates an accurate assessment of cost. Besides, CBS allows construction projects to identify labour, material, equipment, overhead costs and other related costs in further facilitate to control the construction costs as optimizing the core activities (Burke, 2013).

There are few types of software that are feasible to be implemented in producing proper and accurate Gann Charts or Bar Charts such as Microsoft Project, Primavera Software and others. This technique is very important as it scheduling the project activities well and preventing a delay. Hence, cost overrun problems occurred from the delay of construction activities will be minimized and mitigate by this cost control technique (Hira, et al., 1994).

2.6.4 Cost value reconciliation (CVR)

Moreover, another cost control technique that available to implement in the construction industry is Cost value reconciliation (CVR). The function of this method is to examine the profitability of a construction project while comparing cost with value and time. The comparison is conducted between interim payments from clients and the construction cost involved in carrying out the works. CVR aims to identify problems, reasons for any loss with information for preventing the same mistakes and the necessity for reserves. The most important thing is the expenditures against budgets of the construction project can be monitored and measured with the application of CVR. Thus, this management information will be utilized effectively to counter the problems of bad cost performance.

In short, CVR aims to minimize and control current or future expenditure while generating more accurate outcomes in future project pricing. Hence, CVR can be served as a valuable management tool for the management team in controlling the actual construction costs within the boundary of the cost budget while avoiding costly expenditure and imbalance earnings (Barrett, 1992).

2.6.5 To-Complete Performance Index (TCPI)

Besides, the to-complete Performance Index is another popular cost control technique that available in the Malaysian construction industry. TCPI is a tool that computes the estimation of future cost performance according to the value of remaining work to achieve specified goals. It is useful for a construction project as it assists in achieving planned cost target or the latest calculated budget on completion while improving the cost performance of the construction project (Hirudini, et al., 2018).

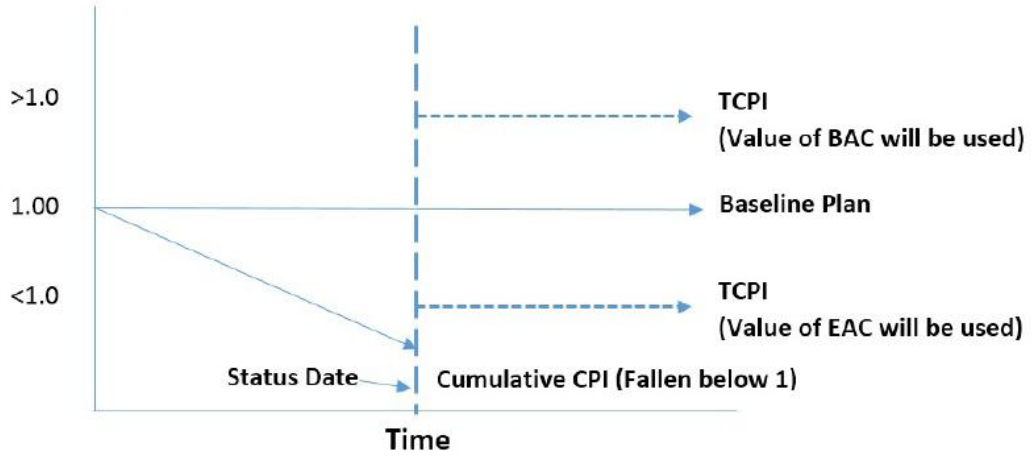


Figure 2.5: Example of TCPI Graph (Usmani, 2019)

The graph above shows the level of performance based on TCPI to forecast the future cost performance and determine the future level of efficiency required for construction works to be carried out. If Budget at Completion (BAC) is no longer feasible, a calculated Estimate at Completion should be determined. On the other hand, if the previous cumulative Cost Performance Index (CPI) falls below the baseline plan, every future construction works of that project have to be executed on the basis in the range of TCPI to control costs within the fixed BAC.

There is two formulas to be applied in calculating TCPI based on different situations. However, the concept of each formula is similar which dividing the remaining work from the remaining funds. The remaining funds might be differing from the originally planned budget due to different unexpected circumstances.

Situation 1 - Actual construction cost within budget:

TCPI = (BAC-EV) / (BAC-AC)

Situation 2 - Actual construction cost over budget:

TCPI = (BAC-EV) / (EAC-AC)

BAC = Budget at Completion, AC = Actual Cost, EV = Earned Value, EAC = Estimate at Completion.

An excellent level of TCPI is achievable according to the number of considerations which including construction risks, schedule of works and technical performance. Hence, To complete Performance Index is a beneficial technique in controlling construction costs as it helps to determine the future efficiency of the project while as a guideline in planning future execution of the remaining construction works (Usmani, 2019).

2.6.6 Contract variance analysis (Unit costing)

Furthermore, one of the important cost control techniques is contract variance analysis which also known as unit costing. In the technique of contract variance analysis, unit costs are calculated by dividing the actual construction cost for each type of work by the quantity completed of that work. The actual unit costs calculated based on the actual work done can be used to compare with the rates of each work stipulated in contract documents. This comparison served as an analysis tool of the cost-effectiveness or cost performance in that construction project.

Not only that, the reports of actual unit costs can use in estimating the final cost performance of the project which may result in profit or loss circumstances. Potts (2008) highlights that the probability of loss on future similar works will be reduced as the urgency for corrective action will be taken out when the first loss was made. This cost control technique is suitable for the project which involving the bulk of repetitive works as loss can be minimized by reports on actual unit costs, therefore an accurate estimating of the final costs of the construction project will be created (Potts, 2007).

2.6.7 Summary of cost control techniques

Table 2.3: Cost control technique by different author

Ref	Cost control techniques	Author									
		Catherine, et al., 2007	Chitkara, 2005	Burke, 2013	Khamidi, 2011	Hira, et al., 1994	Barrett, 1992	Hirudini, et al., 2018	Usmani, 2019	Potts, 2007	Total
D1	Project evaluation and review technique (PERT)	x	x	x							3
D2	Earned value analysis				x						1
D3	Gantt charts or bar charts			x		x					2
D4	Cost value reconciliation (CVR)						x				1
D5	To-complete performance index (TCPI)							x	x		2
D6	Contract variance analysis (Unit costing)									x	1

2.7 Summary

The high-rise residential building plays an important role in the economic and social development of a country. However, it is facing serious cost overruns. The cost overrun problem has been a global phenomenon for many years. Construction projects in the Klang Valley and urbanized areas face this problem, but it is more common in developing countries. In this study, founded 14 kinds of Factors of the cost overrun influence the construction cost, these factors are likely to cause construction projects to fall into the cost overrun problem. Moreover, 16 effects of building elements on the construction cost in this research. Last but not least, 6 types of cost control techniques to control the construction project cost management.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The main reason for constructing Chapter 3 is to discuss the adoption of the appropriate research method in this research study. This Chapter is divided into seven (8) sub-sections. Section 3.2, it will discuss the research processes being carried out in this research. Next, Section 3.3 is discussing the methods in obtaining the primary and secondary sources to be used in this research. Besides, the development and design of the instrument implemented and the structure of such an instrument to obtain answers in accordance to research objectives will be discussed in Section 3.4. Moreover, Section 3.5 of this study will be discussing the pre-test carried out for the research instrument. Furthermore, in Section 3.6, the sampling population selected and the approach of sampling method for the purpose to obtain the target respondents will be highlighted. Last but not least, Section 3.7 will be highlighting the techniques implemented for data analysis of primary sources collected from the questionnaire survey of this study. Section 3.8 is the expected work schedule/ timeline.

According to Rajasekar and Philominathan (2013), it defined research methodology is a comprehensive method in solving a problem. A research problem may be in a theoretical or a practical situation. It is important in assessing the problem and choosing an appropriate research methodology for that particular problem. This is because the level of effectiveness of research methodology in solving problems might differ when facing a different type of problems. Hence, the selection and implementation of an appropriate and suitable research methodology is a critical process in determining the effectiveness of that particular method in resolving any problems (Rajasekar, 2013).

3.2 Research Process

According to Hair and Celsi (2012), research process are sequence of procedures design to determine and resolve research problems from the initial stage of identifying any research problem to the final stage of providing research results. The research process is categorized into four phases with eleven steps (Joseph, et al., 2012).

The first phase of the research process is determining the research problem. This is the most critical phase in research as it showing the intention of a study while determining the direction of that study. Next, the second phase is the selection of proper research design. In this phase, it explains the appropriate way in choosing suitable characteristics of respondents and sample size, developing of the effective research instrument and also testing of the effectiveness of that chosen instrument. Hence, an appropriate design can be developed to solve the research problem effectively.

Moreover, the execution of research design is important as the third phase in the research process. The proper execution of appropriate research design including collecting primary sources, analyzing the collected data and also detailed interpretation of data according to the research problem. Last but not least, the last phase in the research process is the communication or presentation of the research results. To provide a conclusion report with the data analysis and interpretation to resolve the research problem (Joseph, et al., 2012)

Table 3.1: Phases and steps in a research process (Joseph, et al., 2012)

Phase	Process
Phase 1	**Determine the Research Problem** Step 1: Identify and clarify information requirements Step 2: Define the research problem and questions Step 3: Specify research objectives and determine the information reasonable
Phase 2	**Select the Research Design** Step 4: Determine the research design and data sources Step 5: Develop the sampling design and sample size Step 6: Examine measurement issues and scales

Phase	Process
	Step 7: Design and pre-test the questionnaire
Phase 3	**Execute the Research Design** Step 8: Collect and prepare data Step 9: Analyse data Step 10: Interpret data to create knowledge
Phase 4	**Communicate the Research Results** Step 11: Prepare and present final report

3.2.1 Phase 1 of Research Process – Determine the Research Problem

The very first step in the research process is to identify the information needs in this study. The information found must be explored and understand well by the researcher, therefore the researcher can clarify the information needs in detail. This information is crucial in further steps of the research process such as formulating a research problem and also defining the research objectives of the study. Besides, the second step in the research process is to define the research problem and questions. The research question of this study is the common factors of cost overrun that influence the construction cost. Cost overrun problem in a high-rise building project is happening more frequently over these years without any improvement in the cost aspect of the construction project. Hence, with adequate information with details, it can be found out that the problem of this study the cost significant elements for high-rise residential buildings and cost control techniques used in building construction projects in Malaysia. Next, the third step in the research process is to specify the research objectives. A researcher has to ensure that the information gathered and collected is valuable and specified to the objectives of the study. Hence, a better concept and quality of research study can be generated with an appropriate research problem that resulted from proper selected information.

3.2.2 Phase 2 of Research Process – Select the Research Design

In the second phase of the research process, the selection of research design is emphasized. The next step in this process is to determine the research process and data sources.

According to Kothari (2004), there are three types of research design which are exploratory, descriptive and hypothesis-testing research design. Descriptive research design is a concern in described characteristics, situations, problems in research. Data sources such as primary or secondary are crucial in determining the success of a research study. Primary data are the first-hand quantitative sources gathered from different respondents through questionnaire while secondary data are sources which have been collected before and readily available from other sources (Kothari, 2004). Then, the next step is to develop the sampling design and sample size. The random sampling method is implemented in this study to ensure the uniqueness of the result and prevent Any biased content in the information collected. Furthermore, the sixth step in the research process is to examine measurement issues and scales. A close-ended questionnaire survey will be implemented in this study to gather information from different respondents. The following step is to design and carry out a pre-test to examine the feasibility of the questionnaire survey. Any mistakes or errors contained in the questionnaire survey can be found out and appropriate improvement on that particular research instrument can be executed to achieve a better quality of the research study.

3.2.3 Phase 3 of Research Process – Execute the Research Design

Moreover, the process of collection and preparation of data will be categorized in phase 3. The collection of primary data will be executed through the distribution of a questionnaire survey to building contractors in the Klang valley area by using email and google form. Next, SPSS software will be used in analyzing the primary data collected from targeted respondents in the previous step. After that, an interpretation of data will be expected from the data analysis to create further knowledge according to the research objectives.

3.2.4 Phase 4 of Research Process – Communicate the Research Results

Last but not least, the last step in the research process is to prepare and present the final report. From the beginning of identified research problem to the data analysis and interpretation of data, every single step is quite important and every piece of information is useful in resolve the research problem. Hence, the final research report requiring an

excellent presentation to the public to deliver the results properly as people might benefit from this research study.

3.3 Methods for Data Collection

Quantitative research is a method to use statistical data as a tool, which has the advantage of saving time and resources. Quantitative research methods focus on the collection and analysis of data from the opinions of many people. Thus, quantitative methods can be defined as science. When researchers use quantitative methods in creating research projects, they can spend more time and energy describe the results of the analysis, which can save a lot of time. Besides, quantitative research is a mathematically based method to analyze data for explaining phenomena.

3.3.1 Questionnaire

The preliminary data is the first-hand information collected during the interview, a questionnaire and observations of the researcher. In this study, questionnaire survey is carried out for the collection of data. A questionnaire survey is straight forward and simple technique in collecting data sources which are structured in a series of questions designed according to the research objectives, targeted respondents will be answering these questions based on their preferences and own point of view. The time for primary data collection can be shortened by using this method as it is convenient to collect information from a large number of respondents in a shorter time. The design of the questionnaire survey will be simple to ensure the understanding of questions by respondents.

3.3.2 Pilot study

It`s a test for accuracy and validity, reliability and suitability of the questions, 30 sets of questionnaires are required to be sent out in advance and returned. A pilot test is a small pilot study of the feasibility of a prepared questionnaire for better testing before a full-scale study. The test is one of the key elements of a research project that uses 30 sets of questionnaire questions designed by the institute to ensure that respondents understand and interpret the questionnaire in the same way. Also, prior testing helps to improve

research instruments before conducting further research and early testing is necessary to avoid inaccurate data.

3.4 Questionnaire Development

This study will adopt the method of a questionnaire survey to collect data. for the questionnaire part, it will involve 12 questions of common factor cost overrun, 16 costs significant building elements and 6 types of cost control techniques in project high-rise residential building. However, the questionnaire will be divided into 5 categories which are (1) Strongly Disagree, (2) Disagree, (3) Undecided, (4) Agree, (5) Strongly agree. After that, this form of questionnaire is distributing to the construction field (main-contractor, sub-contractor, consultant and developer) in Klang Valley Malaysia to fill up the questionnaire. The data collect from each firm of the construction field is very important because different types of positions and company will provide the different viewpoints of answers (Adigüzel, 2008).

In order to understand the views of different stakeholders in the high-rise residential building industry on the cost overrun factors, this study adopts the questionnaire survey method. This is the primary tool for collecting data from the target respondents. The questionnaire was divided into four parts to meet all three research objectives.

- Section A had question to determine the respondent background
- Section B was design to get factors of cost overrun that influence the construction cost
- Section C was design to get effect of building element to the construction cost
- Section D was design to get effect of cost control techniques on the construction project

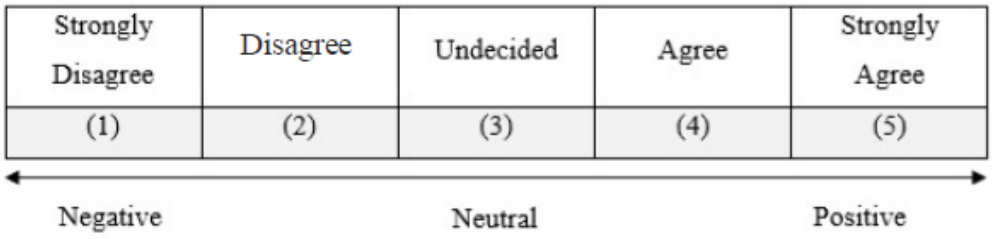


Figure 3.1: 5-Scale Likert Scale

3.5 Pre-test of Questionnaire

Before distributing questionnaire surveys to targeted respondents, a pre-test of the questionnaire must be carried out. According to Beckman (2008), the purpose of undertaking a pre-test is to improve the Credibility and efficiency of the questionnaire survey before executing to collect actual data from targeted respondents. In the process of pre-test, it will emphasize the understanding of respondents to the questions and structure of the questionnaire survey without any confusion or chaos. The understanding of this questionnaire survey by respondents is important as this reflects the quality and result of research (Beckman, 2008).

According to Kothari (2004), the pre-test instrument is crucial as it enhances the structure and design of the questionnaire and the quality of answers can be maintained in expectations (Kothari, 2004). Therefore, an appropriate pre-test must be executed incautious with two important stages which are a selection of pre-test respondents and communication with pretest respondents.

<u>Selection of pre-test respondents</u>

The selection of respondents is important in the process of the pre-test instrument. The characteristic of respondents selected in the pre-test must be similar to the respondents in an actual research study. Therefore, the understanding and opinion of this questionnaire by pre-test respondents are closer than the view of respondents in the research study.

Communication with pre-test respondents

The communication of the researcher with pre-test respondents is extremely crucial to the quality of the pre-test instrument. This is because the goal of the pre-test instrument is to seek advice from pre-test respondents regarding the quality and validity of the current questionnaire survey. Hence, proper communication between the researcher and respondents must be carried out to gather feedback on their understanding of this questionnaire survey.

In this study, pre-test instrument of questionnaire survey will be executed by distributing the questionnaire in the draft to certain targeted respondents with 5 categories of experience in the construction industry (below 5 years, 6 to 10 year, 11 to 15 year, 16 to 20 year and 21 years and above). The example of such respondents will be building contractors or lecturers who teaching on construction industry subject. Close communication will be carried out with these respondents as well to collect valuable feedback from them to improve or amend into a better quality questionnaire survey.

From the pre-test of a questionnaire, it can identify the possible mistakes and obstacles in the draft questionnaire survey. Any improvement against these errors can be carried out with proper rectification. Hence, the clarity and suitability of the questionnaire can be assessed and improvement of questionnaire design can be enhanced as well (Beckman, 2008).

3.6 Population and Sampling

In this research, the population is known as a group of individuals who are currently involving themselves in the construction industry of Malaysia. These individuals can contribute primary data sources to the research by answering the questionnaire survey. On the other hand, sampling is a method of selecting samples from the population. Building contractors in Klang Valley area will be chosen in participating in the samples to answer the questionnaire and provide primary data to this research. This is because the aspects of cost issues shall be concerned and noticed by them. There are several types of sampling

techniques, such as random sampling or non-random sampling. In this research, random sampling will be selected in determining the respondents to avoid the problems of bias.

The targeted respondents in this study will be selected from the main-contractor, sub-contractor, consultant and developer firms registered G7 in Klang Valley area randomly. However, in Klang valley, there are 2376 construction firms registered G7 with CIDB as referring to statistics of the CIDB official website. Cochran's formula in determining sample size will be implemented in this study (CIDB, 2019).

$$n_0 = \frac{Z^2 pq}{d^2}$$

Z= The value corresponding to level of confidence required (assumed as 95% of confidence interval which is 1.96 in Z-Score.)

p = The estimated proportion of population (assumed p is 0.5 as maximum), q = 1 – p

q = 1 – p

d = The acceptable margin of error (Maximum error allowed, assumed as 5%)

n_0 = The required sample sizes

$$\mathrm{n_0} = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.05^2} = 385$$

Due to the quality of a collection of primary data, the sample size can be reduced to a smaller size of the sample. This is because a smaller population will provide more and accurate information than a larger population. Hence, Cochran's correction formula can be implemented to calculate the final sample size (Bartlett, 2001).

$$\mathrm{N_1} = \frac{n_o}{1 + \frac{n_o}{Population}}$$

N1 = The corrected sample size

Population = 2376 (total G7 construction firm in Klang valley)

$$N_1 = \frac{385}{1 + \frac{385}{2376}} = 332$$

Based on these calculations, the total numbers of sample size should be 332 of contractors in Kuala Lumpur.

3.7 Techniques used in Data Analysis

After the collection of primary data from targeted respondents by using the questionnaire survey, data analysis on these sources must be carried out. SPSS software will be implemented as a technique in analyzing the data of this research study. SPSS is used for both logical batched and non-batched statistical analysis on statistical data. Not only that, SPSS can perform highly interpretation of complex data with simple and convenient instructions. The outcome from the primary data collected will be analyzed and ranked in position by using the Frequency and Mean analysis method.

Table 3.2: Rating Scale of Likert Scale in Questionnaire

Level of agreement	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Rating scale	1	2	3	4	5

Each level of the agreement will represent a different rating scale. This rating scale will contribute to the identification of different rank level in this research. In the process of data analysis, the collected data will be sorted out, sorted out and tabulated, and the result interpretation stage will be entered. In this study, the data analysis methods will be using 5 technique to analyze the data which is Cronbach's alpha reliability test that will be the first one to analysis, the mean ranking should be the second process for discussion after analyzing the data, for the Kruskal-Wallis test and one-sample t-test will be combined with one table to compare the data, and the last technique is spearman's correlation test.

SPSS software to let the research easy to integrated statistical analyses of the collected data. SPSS is usually used to generate tabular reports, charts, and distributions. It can also perform complex statistical analysis.

3.7.1 Cronbach's alpha

This technique to evaluate the questionnaires data and interpret the data, verifying the validity and accuracy of the data is a basic assessment for the research. Cronbach's alpha is a measure of internal consistency, that is closely a group of projects is connected as a group. It is considered a measure of the reliability of a scale. The "high" value of alpha does not mean that the measurement is one-dimensional. If, in addition to measuring internal consistency, to provide evidence that the scale in question is one-dimensional, additional analysis can be performed. Exploratory factor analysis is a way to test dimensions. Technically, Cronbach's alpha is not a statistical test, it is a reliability (or consistency) factor. Cronbach's alpha can be written as a function of the number of items tested and the average correlation between items. Here, for conceptual purposes, Present the formula for Cronbach's alpha:

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N-1)\bar{c}}$$

The alpha values increase if the data collected are related to the research (Tavakol & Dennick, 2011). The researcher before analyzes the data collected from the respondent that should be analyzing the alpha value every time. Figure 3.1 below shows the standard of Cronbach's alpha reliability coefficients (Gliem & Gliem, 2003).

Range	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$\alpha < 0.5$	Unacceptable

Figure 3.2: Standard of Cronbach's Alpha Reliability Coefficient (Gliem & Gliem, 2003)

3.7.2 Mean ranking

It is used to calculate the mean to rank the variables considered important by the respondents. An average is a mathematical mean that measures the central tendency of data. The central tendency measure describes the location of the distribution of data collected during the analyses of the data. However, the mean is used to investigate the data. That will be an analyses relationship between different all of the variables collected data. Whether there is a significant difference between samples (Rajasekar, 2013). After calculating the mean of every variable and sort the variables against the calculated mean. Mean is the most important measure of central tendency is usually denoted by ū. The mean is calculated by the following formula:

$$\bar{U} = \frac{\Sigma u}{n}$$

n = is the number of values

3.7.3 Kruskal-Wallis test

Kruskal-Wallis test is a non-parametric arithmetic test (Guo, et al., 2013), that can be used to determine whether there is a statistically significant difference between two or more groups of one-way ANOVA, and an extension of the Mann-Whitney U test (Pallant, 2005). Non-normally distributed data such as ordinal numbers or rank data are more suitable for the Kruskal-Wallis test. There is a parameter test named One-way Analysis of Variance (ANOVA) that can be used for normally continuously distributed variables. The Kruskal-Wallis test was used to test hypotheses from multiple unpaired samples from the same sample population. In addition, a more generalized Kruskal-Wallis test is a nonparametric statistical version of one-way ANOVA. If there is normally a statistically significant difference between the two groups, the null hypothesis should be rejected. If the calculated h value exceeds the chi-square table value, the null hypothesis can be rejected at a given level of significance (Kothari, 2004).

For the Kruskal-Wall solution and formula mentioning as below (Kothari, 2004):

$$H = \left[\frac{12}{n(n+1)}\sum_{t=1}^{k}\frac{{R_i}^2}{n_i}\right] - 3(n+1)$$

n = Total sample size ($n_1 + n_2 + \ldots + n_k$)

k = The number of samples

n_i = The number of observations in the i th sample

R_i = The sum of the ranks assigned to n_i values of the i th sample

3.7.4 One-Sample T-tests

A Single-sample t-test is a member of the t-test family. All tests in the t-test family compare continuous level (interval or ratio), normally distributed data for equipartition difference. Unlike the independent or dependent sample t-test, the single-sample t-test has only one mean score. The single-sample t-test compares the mean of a single sample to a predetermined value to determine whether the sample mean is significantly greater or less than the value. The t-test is a hypothesis test that is used to analyzing the data collected from the questionnaire and see whether it the statistically significant or just incidental.

The T-value may be calculated using the following formula (Ross & Willson, 2017),

$$t = \frac{\bar{X} - \mu}{\frac{s}{\sqrt{n}}}$$

where,

μ = Proposed constant for the population mean

$\bar{X}$ = Sample mean

n = Sample size (i.e., number of observations)

s = Sample standard deviation

$\frac{s}{\sqrt{n}}$ = Estimated standard error of the mean

There is an inextricable relationship between the t-value and the p-value. The larger the t-value, the smaller the p-value, which generates more evidence against the null hypothesis. If the P-value is large, that means there is no reason, and there is no evidence that the difference in the population mean can be seen in the data. If the p-value is small, the commonly defined mean is less than 0.05, it indicates that the difference is statically significant, and therefore the null hypothesis can be rejected. The result P-value (value = 3) was higher than 0.0.5, so the respondents did not significantly perceive the inducing design changes of building projects (Yap, et al., 2018).

3.7.5 Spearman's Correlation Test

Spearman's correlation test is normally implemented in the research study to determine whether there is existence of correlation between two sets of ranked data. In this research, the Spearman's correlation test was adopted to examine the relationship among two sets of variables. (Aksorn, 2008).

The correlation coefficient refers to find out the strength of the relationship between the two groups of variables, which ranges from -1 to 1. If the correlation coefficient is 0, it means there is no relationship between two groups of variables. If the correlation coefficient is close to 1, there is a completely positive correlation between the two. When the correlation coefficient is close to -1, there is a complete negative correlation (Pallant, 2005). However, if the direction of the relationship, not the strength of the relationship, that is because the sign is a negative relevant value.

Size of correlation	Interpretations
0.10 to 0.29 (-0.10 to -0.29)	Small correlation
0.30 to 0.49 (-0.30 to -0.49)	Medium correlation
0.50 to 1.00 (-0.50 to -1.00)	Large correlation

Figure 3.3: Correlation Strength between Variables (Cohen, 1988)

3.8 Summary

This chapter has identified and discussed the research method to be conducted is by quantitative research. The research process and method for data collection are also discussed in detail to help the researcher understanding the method used. The pilot test is carried out to increase the accuracy and of the questionnaire prepared before formally distributing the questionnaire to the professionals of the construction field. In the data analysis, the Cronbach's Alpha reliability test, one-sample t-test, mean ranking, Kruskal-Wallis test, spearman correlation test is adopted to analyze the data obtained from the survey. All the tests conducted can be analyzed such as the reliability of data and the subsequent use for analyzing the results and discussion later in Chapter 4.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter illustrates the identification of investigating the project cost management for high-rise residential buildings throughout the questionnaire data. The results and discussion were used for analysis, and the analysis data were collected from the respondent. The collected data were processed and submitted by SSPS software. Through a qualitative approach find out the result due to the research objective.

4.2 Questionnaire development

To perception of the main-contractor, sub-contractor, consultant and developer for the high-rise residential building against cost management in Malaysia industry. The main purpose of the 5-section questionnaire is to prevent respondents from giving up on the way or getting bored with too many questions in a row (Adigüzel, 2008).

For the questionnaire include 4 section which is section A to D. The section A is design by respondent background information it like position, working experience, academic level and so on, section B is the common factors of cost overrun that affect the construction cost, section C is cost significant building element and their effect to the project of high-rise residential construction cost, and section D is the effect of cost control techniques on the construction project. The strategy for the questionnaire is used 5-point Likert scale (1 - strongly disagree, 2 - disagree, 3 - undecided, 4 - agree, 5 - strongly agree).

4.3 Pilot study

For the pilot study, provided 30 sets of the questionnaire to distributed through google form to the construction industry (main-contractor, sub-contractor, consultant and developer) in various position for the pilot test, all the form are revived and the response rate is 100%. Reliability test is to test whether the questionnaire design is reasonable and

whether the data are reliable. If the results are acceptable, the study can be continued and more questionnaires can be distributed to other professionals.

Table 4.1 shows the Cronbach`s coefficient alpha values from 30 sets of questionnaires by respondents. All the pilot test data collected is analyses by SPSS. According to table 4.1, the 3 sections there (section B to D) Cronbach's alpha is more than 0.7. so that all section were excellent internal consistency of data. The data show that the response of the preliminary study is reliable. Since this questionnaire has not been modified in any way, all the data from the 30 questionnaires will be added from data collected from the respondent. This indicates that the response to the preliminary study is reliable. In the absence of any further modifications to the pilot study questionnaire, all 30 responses will be incorporated into the main study.

Table 4.1: The result of Cronbach's Coefficient Alpha values for pilot test

Category	Number of items	Cronbach's alpha
Factors of cost overrun	12	0.94
Cost significant building element	16	0.91
Effect of cost control techniques	6	0.93

4.4 Response rate

In the main study of the research, the questionnaire is used mostly to distribute the form by google form. The form was distributed about 300 questionnaires out to respondents by used by E-mail, WhatsApp and contacted respondent by phone before sending the google form link. The area where the form is distributed is Klang valley Malaysia. The 30 sets of questionnaires remained unchanged and the responses were added to data collected from the respondent. From table 4.2 the Cronbach alpha test in the pilot study overall is > 0.7. The total the questionnaire is collected have 131 respondent's fill-up the form. Overall, for the response rate is 39%.

Table 4.2 is showing the result from the respondent. based on the Nulty (2008) mentioning the most of the physical-based of the questionnaire survey from response rate

would be much higher than the online survey. however, this research is used an online survey which is google form to distribute the questionnaire, this research as shown in Table 4.2 were considered optimistic. The paper-based survey could achieve such a high response rate (Nulty, 2008).

A total of 131 valid responses were received, with an effective rate of 39.7%. Gmail and contact (WhatsApp) responses are easier to collect than through face-to-face to collect the data during in covid-19 pandemic. The total response rate was only 39.7%, among which the response rate of the manual questionnaire was 33.67%. Based on table 4.2, this indicates that the response of the preliminary study is reliable. all 30 responses from the pilot study will be incorporated into the main study.

Table 4.2: The result of response rate

Distribution method	Questionnaire		Response rate
	Distributed	Collected	
Pilot study			
Paper-based survey	30	30	100 %
Main study			
Online-survey	300	101	33.67 %
Overall	330	131	39.70 %

4.5 Respondent background

Table 4.3 show the background information of the respondent included gender, role in the project, designation in the project, academic qualification, working experience and the size of the project who have involved in terms of the contract amount. Based on the survey, the questionnaire frequency was distributed to 75 main-contractor (77.3 %), 23 sub-contractor (17.6 %), consultant 20 (15.3), 13 developer (9.9 %). Based on the data collected, the male respondent is 117 (89 %) and the female is 14 (11 %) almost is less amount in the construction industry.

Table 4.3: The result of background information from respondent

Ref	Profile	Description	Respondents group				Total	Frequency (%)
			Main-Con	Sub-Con	Consultant	Developer		
Q1	Gender	Male	75	21	11	10	117	89.3
		Female	0	2	9	3	14	11.0
Q3	Designation	Junior level	36	6	5	3	50	38.2
		Senior level	21	9	8	7	45	34.4
		Manager level	12	7	3	1	23	17.6
		Executive level	3	1	3	0	7	5.3
		Director / Top management	3	0	1	2	6	4.5
Q4	Academic qualification	High School	4	2	0	0	6	4.6
		Diploma	10	10	1	2	23	17.6
		Bachelor Degree	56	9	12	9	86	65.7
		Mater Degree	1	2	6	2	11	8.4
		Doctor of Philosophy	4	0	1	0	5	3.7
Q5	Working experience	Less than 5years	28	4	5	3	40	30.5
		6 to 10 years	15	6	1	2	24	18.3
		11 to 15 years	15	8	8	5	36	27.5
		16 to 20 years	13	3	3	1	20	15.3
		21 year and above	4	2	3	2	11	8.40
Q6	Size of project (RM)	100 million and below	1	2	3	0	6	4.6
		100 million to 200 million	6	1	3	3	13	9.9
		200 million to 300 million	6	4	0	1	11	8.4
		300 million to 400 million	11	4	1	2	18	13.7
		400 million to 500 million	13	8	8	1	30	22.9
		500 million and above	38	4	5	6	53	40.5

For designation in the project, more than half of the respondents is the frequency of junior (38.2 %) and senior level (34.4) is 72.6 %, and the frequency of manager level (17.6 %), executive level (5.3 %) and director or top management (4.5 %) less than 20 %. Most of the respondents held bachelor's degree certificates, this is showing the managerial staff in the industry are highly educated in work, and the below bachelor degree holder in frequency contain is 22.2 % against high school and diploma.

According to table 4.3, the below 10 year working experience of frequency average is 48 %, and for the frequency in more than 10 year working experience there are contain average 51 % from respondents. Moreover, for the size of the project who are handling by the respondent, the frequency of more than RM 300 million for each category is more than 10 %, which is RM 500 million and above is 40.5 %, RM 400 million to RM 500 million is 22.9 % and RM 300 million to RM 400 million is 13.7 %. However, this survey analyses are showing most of the high-rise residential building in Klang valley is more than RM 300 million.

To conclude, the questionnaire distribution almost is main-contractor, the designation level almost is junior level, more of the academic level at least bachelor degree holder, the more of the respondents working experience at least 5 year, and the majority size of project is more than RM 300 million. The data survey shows that table 4.3 is reliable and experienced enough to take a broader view of the cost management of high-rise residential buildings in the Klang valley Malaysian construction industry.

4.6 Reliability of result

The questionnaire returned by the first 30 sets of questionnaires was a pilot test in advance, which showed that the questionnaire was acceptable and reliable, that will be distributed the questionnaire further, and in the end, the total amount collected is 131 responses from professionals in the construction industry.

According to the data collected by respondents, Cronbach`s coefficient alpha value is generated by SPSS (Bulmer, 2004). Based on table 4.4, the result for data collected from respondent are all more than 0.7, and the two of the categories is considered to excellent consistency. The reliability test for the effect of the cost control technique is between the range of $0.8 > \alpha \geq 0.7$, which indicated that the internal consistency is acceptable. The factor of cost overrun and cost significant building element is good because it is in the range $0.9 > \alpha \geq 0.8$. Alpha values of all variables are greater than 0.7, which is considered feasible and a reliable contribution to this study.

Table 4.4: The result of Cronbach's Coefficient Alpha Values Test

Category	Number of items	Cronbach's alpha
Factors of cost overrun	12	0.846
Cost significant building element	16	0.851
Effect of cost control techniques	6	0.734

4.7 Mean Ranking

The investigate cost management of high-rise residential building towards the Klang valley Malaysian are arrange the ranking by mean, ranking and standard deviation based on perceptions of four respondent groups which is main-contractor, sub-contractor, consultant and developer.

4.7.1 Common factors of cost overrun

The common factors of cost overrun are prioritized in accordance with factors categories as shown in Table 4.5. In the perspective of main-contractor, the top five agreed common factors of cost overrun in Klang valley Malaysia are:

1. Ineffective project management (mean = 4.293, δ = 0.955)
2. Poor information and communication technology (mean = 3.933, δ = 0.723)
3. Quality of raw material (mean = 3.800, δ = 0.900)
4. Frequent design change (mean = 3.787, δ = 0.810)
5. Fluctuation in cost material (mean = 3.773, δ = 0.863)

Moreover, the top five agreed common factors of cost overrun as perceived by sub-contractors are:

1. Ineffective project management (mean = 4.435, δ = 0.788)
2. Poor information and communication technology (mean = 4.000, δ = 0.522)
3. Fluctuation in cost material (mean = 3.956, δ = 0.825)
4. Frequent design change (mean = 3.870, δ = 0.757)
5. Weak labour productivity (mean = 3.739, δ = 0.810)

Furthermore, the top five agreed common factors of cost overrun as perceived by consultant are:

1. Ineffective project management (mean = 4.100, δ = 0.852)
2. Poor information and communication technology (mean = 3.850, δ = 0.366)
3. Fluctuation in cost material (mean = 3.850, δ = 0.745)
4. Weak labour productivity (mean = 3.800, δ = 0.768)
5. External factors (mean = 3.750, δ = 0.639)

Besides, the top five agreed common factors of cost overrun as perceived by developer are:

1. Poor design construction (mean = 4.154, δ = 0.801）
2. External factors (mean = 4.000, δ = 0.707）
3. Ineffective project management (mean = 3.923, δ = 1.320）
4. Quality of raw material (mean = 3.923, δ = 0.641）
5. Lack of experience (mean = 3.923, δ = 0.954）

Overall, in the top five agreed common factors of cost overrun are:

1. Ineffective project management (mean = 4.251, δ = 0.956）
2. Poor information and communication technology (mean = 4.916, δ = 0.668）
3. Fluctuation in cost material (mean = 3.802, δ = 0.845）
4. Quality of raw material (mean = 3.763, δ = 0.858）
5. Frequent design change (mean = 3.763, δ = 0.739）

The ranking order is based on the mean and standard deviation values. If two or more variables have the same mean, the lower the standard deviation is considered to be the more consistent the variable (Rahman, et al., 2013). Based on table 4.5, that are several pairs of the mean and ranking are the same reading.

In rating scale, 3 is undecided, therefore, the factor which has mean less than 3 are considered not influence factor. However, as you can see in table 4.5, the mean throughout of table is more than 3. It can be concluded that the majority of the respondents agreed all the factors influence the cost overrun in high-rise residential buildings.

Ineffective project management is higher ranked, the project management focuses on the application of knowledge, skills, tools and construction techniques to project tasks, including on-site supervision throughout the project (Institude of project management, 2010). Project management in the project is like a foundation plan, an

effective project management will better control the cost management in the construction project.

Besides, the poor information and communication are placed in second-ranked, a better plan can be provided faster and convenient data sharing, so that various stakeholders can make decisions early in the project execution process and solve any problems without delaying the project schedule (Ade, et al., 2013). And also, better poor information that can reduce the conflict by people to people.

The last ranked by a factor of cost overrun is a frequent design change, even though the rank is top 5, the range in the mean still more than 3, which is a fluence factor in the cost overrun against high-rise residential building. Changes to the design work due to errors may affect the subsequent construction schedule, as well as the cost management of the project (Burati, et al., 1992).

There is not much difference in the ranking by different roles of position. It can be concluded that the variety of roles of position does not affect their perspective on the common factor of cost overrun in high-rise residential buildings.

Table 4.5: Result of mean, ranking, standard deviation, chi-square and Asymp. Sig. from common factors of cost overrun

Ref	Common factors of cost overrun	Overall (N = 131)			Main-contractor (N = 75)			Sub-contractor (N = 23)			Consultant (N = 20)			Developer (N = 13)			Chi-square	Asymp. Sig.
		Mean	SD	R.	Mean	SD	R.	Mean	SD	R.	Mean	SD	R	Mean	SD	R.		
B1	Ineffective project management	4.251	0.956	1	4.293	0.955	1	4.435	0.788	1	4.100	0.852	1	3.923	1.320	3	16.259	0.180
B2	Poor information and communication technology	3.916	0.668	2	3.933	0.723	2	4.000	0.522	2	3.850	0.366	2	3.769	0.927	7	11.748	0.228
B3	Fluctuation in cost material	3.802	0.845	3	3.773	0.863	5	3.956	0.825	3	3.850	0.745	3	3.615	0.961	10	4.620	0.866
B4	Weak labour productivity	3.748	0.807	6	3.747	0.840	6	3.739	0.810	5	3.800	0.768	4	3.692	0.751	9	3.218	0.994
B5	Poor design construction	3.748	0.817	7	3.720	0.798	7	3.696	0.822	6	3.650	0.845	7	4.154	0.801	1	14.448	0.273
B6	Quality of raw material	3.763	0.858	4	3.800	0.900	3	3.652	0.885	7	3.650	0.813	8	3.923	0.641	4	6.628	0.881
B7	Poor in financial management	3.611	0.864	11	3.653	0.830	9	3.348	1.027	12	3.650	0.671	9	3.769	1.013	8	17.039	0.148
B8	Poor competency of consultants	3.634	0.879	8	3.653	0.893	10	3.391	1.033	11	3.700	0.733	6	3.846	0.689	6	5.335	0.946
B9	External factors	3.618	0.915	10	3.573	0.918	11	3.435	1.161	9	3.750	0.639	5	4.000	0.707	2	15.673	0.207
B10	Lack of experience	3.634	0.930	9	3.680	0.932	8	3.435	1.037	10	3.500	0.761	11	3.923	0.954	5	13.169	0.357
B11	Inadequate documentation and tracking	3.519	0.939	12	3.560	0.990	12	3.522	0.898	8	3.350	0.813	12	3.538	0.967	12	13.124	0.360
B12	Frequent design change	3.763	0.793	5	3.787	0.810	4	3.870	0.757	4	3.650	0.813	10	3.615	0.768	11	16.637	0.045*

Note: * The mean different is significant at the 0.05 level of significant

4.7.2 Cost significant building element

Table 4.6 illustrated the ranking of 16 costs significant building elements and the effectiveness to the construction cost. Mean and the standard deviation is ranked. All of the factors are rated by 131 respondents measured by 5-point Likert Scale and the mean is calculated for all single factors.

Based on Table 4.6, there are only 6 of the cost significant building element have mean value exceed 4.000 and all of the cost element their have the mean value more than 3.000. on the rating scale, 3 is undecided, however, the factors which have a mean value less than 3 are considered disagree by the respondent's item. However, all the cost significant building elements shown in the table above has meant more than 3. It shows that most of the respondents agreed all these costs significant building elements and the effect to the construction cost.

Based on table 4.6, the top 5 ranked are shown as below:

1. Cost of substructure (mean = 4.260, $\delta = 0.847$)
2. Cost of superstructure (mean = 4.061, $\delta = 0.731$)
3. Facilities of the building (mean = 3.863, $\delta = 0.821$)
4. Cost of envelop (mean = 3.832, $\delta = 0.746$)
5. Physical site conditions (mean = 3.702, $\delta = 0.772$)

The nature of the soil determines its strength. The design of a building and the decision of the cost in a particular building or drawing scheme greatly influence its construction (Ferry, et al., 1999). In general, the more complex the shape of the horizontal projection of an item, the more money will be spent on that item, as the shape of the building has a great influence on some architectural structural elements, such as the foundation, walls, Window and roof (Ashworth & Hogg, 2004). However, the research results on the significance of construction cost are based on the understanding of building form and geometric characteristics, and lack of empirical verification. The perimeter/floor ratio, unit cost, and total project cost are affected by changes in plane shape, degree of narrowness, and complexity of the plane shape.

The cost sub-structure is the top rank in table 4.5, most of the respondents are agree with these costs significant building element and the effective to the construction cost. The high-rise building is the huge and complex project, that is consist a lot of the element need to be a consideration under the cost management. However, the substructure is the project the fundamental which is foundation, each type of the building is a different design of substructure. Most significant of substructure against high-rise residential building. The nature of the soil determines its strength. The strength of concrete depends on many variables, such as soil type, cement content, curing time, water content, compaction method and cost, and an increase in the temperature of solidified limestone soils will lead to an increase in strength (Halliburton & Mark, 1792). Assuming that the foundation is swamp soil, the cost of the foundation increases with the condition of the soil.

Moreover, the cost of the superstructure is the second-place ranking in table 4.5. In general, high-rise residential buildings with more than 35 stories are more expensive than 34 stories due to specific unit wall area and design, such as square meters. This will directly increase the cost of construction (Seeley, 1997). Seeley (1997) in his survey and investigated the cost of high-rise buildings, it is surprising to find the cost differential between the number of a high-rise buildings on different floors. Because the three-story building is about 30 percent more expensive than a two-story building, so that, the cost is related to a specific unit of floor area, such as square meters. Increasing unit height by three to five-storey increases the cost by about 12 % (6% per floor).

Besides, the facilities of the building ranking of 3 among all the 16 elements. Design errors and omissions are usually the results of human error or negligence of the building facility design department. And also defected due to design errors often show in the service life of the building, the impact on the building performance and obstacles, which often equates to nearly half of maintenance costs (Das & Chew, 2011). Inappropriate decisions made during the design phase will result in lower building quality and an inevitable need for the early maintenance of the useful life of the building (Waziri, 2016). Therefore, to prevent uncontrolled maintenance during the

residence, it is necessary to consider maintenance issues during the design phase of the project because the design defects are wrong and have value for the life of the occupants.

Furthermore, physical site conditions fifth place ranked in table 4.5. The actual site condition of the discovery work is usually not determined until the excavation is completed. Sometimes site conditions may be overlooked by the initial review or conditions may change due to weather conditions or changes in subsoil conditions (Nega, 2008). The unexpected circumstances of the subsurface environment sometimes require a radical redesign of the project and are costly. The changing conditions of the field become a problem for machines and supplies to get in and out of the field. This adds to the cost.

Table 4.6: Mean and ranking of cost significant building element

Ref	Cost significant building element	Overall (N = 131)			Main-contractor (N = 75)			Sub-contractor (N = 23)			Consultant (N = 20)			Developer (N = 13)			Chi-square	Asymp. Sig.
		Mean	SD	R.	Mean	SD	R.	Mean	SD	R.	Mean	SD	R	Mean	SD	R.		
C1	Cost of substructure	4.260	0.847	1	4.267	0.890	2	4.478	0.790	1	4.050	0.686	1	4.154	0.899	1	13.766	0.131
C2	Cost of superstructure	4.061	0.731	2	4.903	0.791	1	4.130	0.694	2	4.000	0.694	2	4.061	0.731	4	10.007	0.615
C3	Cost of envelop	3.832	0.746	4	3.733	0.794	4	4.043	0.706	3	3.800	0.616	4	4.077	0.641	2	7.831	0.798
C4	Cost of stairs	3.618	0.940	7	3.533	0.977	13	3.826	0.937	5	3.500	0.827	14	3.923	0.862	5	8.712	0.727
C5	Cost of frame	3.634	0.896	6	3.613	0.914	8	3.609	0.941	8	3.650	0.745	11	3.769	1.013	7	11.912	0.453
C6	Cost of roof work	3.557	0.887	12	3.573	0.873	10	3.304	1.020	12	3.700	0.657	10	3.692	1.032	8	12.614	0.398
C7	Cost of service	3.511	0.931	14	3.493	0.828	14	3.304	1.222	13	3.800	0.616	5	3.538	1.266	10	16.921	0.153
C8	Cost of fitting	3.435	0.937	16	3.453	0.859	15	3.174	1.230	16	3.750	0.639	7	3.308	1.109	16	15.960	0.193
C9	Cost of external wall	3.580	0.885	10	3.627	0.866	7	3.304	1.146	14	3.750	0.550	8	3.538	0.877	11	15.698	0.205
C10	Cost of external door	3.534	0.816	13	3.560	0.793	11	3.391	0.988	11	3.600	0.681	12	3.538	0.877	12	4.702	0.967
C11	Cost of the internal wall	3.588	0.773	9	3.653	0.726	6	3.261	0.915	15	3.500	0.688	15	3.923	0.760	6	16.505	0.169
C12	Cost of consideration	3.481	0.788	15	3.360	0.765	16	3.565	0.843	9	3.800	0.696	6	3.538	0.877	13	20.188	0.064
C13	Cost of the design	3.611	0.957	8	3.613	0.957	9	3.913	1.041	4	3.350	0.933	16	3.462	0.776	14	20.180	0.064
C14	The location of the site	3.580	0.859	11	3.560	0.842	12	3.565	0.992	10	3.750	0.910	9	3.462	0.660	15	7.910	0.792
C15	Physical site conditions	3.702	0.772	5	3.720	0.831	5	3.783	0.795	6	3.600	0.598	13	3.615	0.650	9	6.252	0.903
C16	Facilities of the building	3.863	0.821	3	3.840	0.901	3	3.783	0.736	7	3.900	0.736	3	4.077	0.862	3	12.838	0.381

4.7.3 Effect of cost control techniques

Table 4.7 illustrated the ranking of 6 cost control techniques to reduce the cost of the construction project. It is ranked according to the mean and standard deviation. All of the factors are rated by 131 respondents measured by 5-point Likert Scale and the mean is calculated for all single cost techniques.

Based on Table 4.6, there are only 5 of the cost control technique have mean value exceed 4.000 and all of the cost control technique their have the mean value more than 3.000. On a rating scale, 3 is undecided, however, the cost control technique which has a mean value of less than 3 is considered to disagree by the respondent's type of techniques. However, all the cost control technique shown in the table above have mean more than 3. It shows that most of the respondents agreed all these costs significant buildings element and the effective to the construction cost.

Based on table 4.6, the top 3 ranked are shown as below:

1. Project evaluation and review technique (PERT) (mean = 4.069, $\delta = 0.986$)
2. Earned value analysis (EVA) (mean = 3.985, $\delta = 0.868$)
3. Gantt charts or bar charts (mean = 3.962, $\delta = 0.798$)

Most building professionals and other planning agencies have recognized the importance of cost control techniques in practical settings. According to the Olawale and Sun (2010) mentioning the 84% of respondents indicated that they used a greater degree of cost control techniques in their projects, and 16% of respondents indicated that they used cost control measures consistently in their projects (Olawale & Sun, 2010). The survey showed no respondents or no use of cost control techniques. Therefore, the findings reveal the importance of cost control leading to successful project delivery in the UK. The professionals in the field of construction believe that, in addition to time control factors and project-specific factors, cost control is the most critical factor affecting the on-time delivery of a construction project (Sohail & Baldwin, 2004).

The top-ranked outcome is the project evaluation and review technique, Project Evaluation and Review Technique (PERT) is developed and tested as a cost control method that allows management to identify the estimated probability of project completion within a certain amount of time and cost. With the purpose of PERT in scheduling, organizing and coordinating tasks in a project, PERT technique also served as an effective cost control technique in ensuring actual construction costs maintaining within the estimated cost budget in Malaysia (Burke, 2013).

Then it will be followed by earn value analysis (EVA), EVA common use in the construction industry. Earn value analysis is a method to measure the amount of work actually performed in a construction project beyond the basic review of cost and progress reports. EVA provides a means to allow projects to be measured by the progress achieved. The project manager can then use the measured progress to predict the total cost and completion date of the project based on trend analysis or the application of the project's burn rate, the approach relies on a key metric called project earned value. Although earned value analysis may be most easily associated with project cost monitoring and evaluation conducted within the organization, it can also be easily applied to project cost control implemented by contractors and suppliers, with some adjustments. In this case, however, it is important to recognize that customers and contractors have different views of actual and budgeted costs. The study also points out that EVA has significant value and presents unique characteristics that will benefit clients, consultants and contractors in the construction industry (Sagar, et al., 2012).

After that, the Gantt chart or bar chart is in the third place, the technique is effective to solve the cost management in a construction project which is high-rise residential building. There are few types of software that are feasible to be implemented in producing proper and accurate Gann Charts or Bar Charts such as Microsoft Project, Primavera Software and others. This technique is very important as it scheduling the project activities well and preventing delay (Hira, et al., 1994).

Table 4.7: Mean and ranking of cost control techniques

Ref	Effect of the cost control technique	Overall (N = 131)			Main-contractor (N = 75)			Sub-contractor (N = 23)			Consultant (N = 20)			Developer (N = 13)			Chi-square	Asymp. Sig.
		Mean	SD	R.	Mean	SD	R.	Mean	SD	R.	Mean	SD	R	Mean	SD	R.		
D1	Project evaluation and review technique (PERT)	4.069	0.986	1	4.107	0.967	1	3.913	1.164	1	3.950	0.887	3	4.308	0.947	1	13.933	0.305
D2	Earned value analysis	3.985	0.868	2	3.933	0.875	3	3.783	0.951	2	4.000	0.562	1	3.923	0.760	2	11.085	0.522
D3	Gantt charts or bar charts	3.962	0.798	3	4.013	0.814	2	3.783	0.951	3	4.000	0.562	2	3.923	0.760	3	12.183	0.431
D4	Cost value reconciliation (CVR)	3.702	0.926	4	3.733	0.963	4	3.565	1.037	4	3.900	0.718	4	3.462	0.776	6	9.728	0.640
D5	To-complete performance index (TCPI)	3.649	0.885	5	3.640	0.880	5	3.565	1.080	5	3.850	0.875	5	3.538	0.519	5	12.144	0.434
D6	Contract variance analysis (Unit costing)	3.557	1.001	6	3.560	1.068	6	3.478	0.994	6	3.550	0.826	6	3.692	0.947	4	9.785	0.635

4.8 Kruskal-Wallis Test

For the research, the Kruskal-Wallis test was analyzed by SPSS software to determine whether there was A striking difference in the opinion of the respondents. The two hypotheses tested by Kruskal-Wallis are as follows:

- The null hypothesis (H0); There was no significant difference among all groups.
- Substitution hypothesis (H1); There were significant differences between groups.

Since there are three groups to be tested, the value of alpha is 0.05, and Because that has two degrees of freedom. When the asymptotic significance value is less than or equal to 0.05, the null hypothesis is rejected, which supports a 95% confidence level of substitution (Chua, 2013).

4.8.1 Common factors of cost overrun

Used Kruskal-Wallis test whether the views point of the four groups of respondents on common factors of cost overruns were compared. The results revealed that among the total of 12 common factors od cost overrun, there are statistically significant differences only in frequent design change across the 4 respondent groups (main-contractor, sub-contractor, consultant, developer) at 95% of confidence level, the significant value is Based on Table 4.5, there is only one asymptotic significant value which is less than 0.05. Hence, the statically significant difference shows the common factors of cost overrun. It is possibly due to a homogenous view in terms of perception among the role in position. Since the asymptotic significant value less than 0.05 and therefore, it indicated that there are significant differences in these 12 factors among the role in position. The more detail in differences between these 12 factors among 4 different roles of the position will be further determined and tabulated in Table 4.5 by using Mann-Whitney Test.

There was also a statistical difference in the opinions of developers, contractors, subcontractors and consultants regarding frequent design changes. On average, only contractors and subcontractors ranked frequent design changes as the fourth largest

cost overrun factor, while developers and consultants ranked 10th and 11th, respectively. The large differences in the rankings further indicate that there are significant differences between respondent groups in their perceptions of the importance of frequent design changes as a factor in cost overruns. Not surprisingly, contractors and subcontractors cited frequent design changes as one of the biggest causes of cost overruns. This is because of the concept of contractors and subcontractors working on the site for a long time. Then the cost management of the construction project is the main factor of the construction industry.

4.8.2 Cost significant building element

Table 4.6 is tested with different company sizes including the four different roles in position is construction industry which are main-contractor, sub-contractor, consultant and developer. Based on Table 4.6, there is no asymptotic significant value which is less than 0.05. Therefore, there is no statically significant difference presented in the table above for the 16 types of cost significant building elements. It is possibly due to identical opinions and views in terms of perception among the size of the company.

4.8.3 Effect of cost control techniques

Table 4.7 is tested with different company sizes including the four different roles in position is construction industry which are main-contractor, sub-contractor, consultant and developer. Based on Table 4.7, there is no asymptotic significant value which is less than 0.05. Therefore, there is no statically significant difference presented in the table above for the 6 types of cost control techniques. It is possibly due to identical opinion and views in terms of perception among the size of the company.

4.9 One sample T-test

A Single-sample t-test was used to evaluate the significance of each variable (Yap & Skitmore, 2018). For a sample t-test, variables with an assumed significance value lower than 0.05 are considered to be significant variables in this study.

4.9.1 Common factors of cost overrun

The one-sample T-test is to compare the mean of a single sample to a pre-specified value but not comparing sample means more than two groups. Then, it will be tested for a standard deviation from that value and the value will be named as t-value. There are two ways to indicate the hypothesis which is indicating the t-value or p-value. The larger the t-value, the smaller the p-value. By indicating the t-value, the null hypothesis is rejected if the t-value exceed the critical value from the t-distribution table. Other than that, the null hypothesis will also be rejected if the significance level is less than 0.05 which indicated that there is 95% of confidence accuracy around the mean. P-value is shown in the table above at the column of significant (two-tailed). The one-sample t-test is adopted to test whether the various barriers identified earlier are significant.

The one-sample t-test results of this research show all the common factors in cost overrun have 0.000 of significant level which is less than 0.05 as shown in Table 4.8. It means that the results are at 95% of the confidence level. It can be concluded that the null hypothesis is rejected and all the 12 factors of cost overrun show the statically significant impact when constructing the high-rise residential building in the Klang Valley. Thus, it can be said that the majority of respondents agreed that all the 12 common factors in cost overrun in project high-rise residential building.

Table 4.8: Result of one sample t-test for common factor cost overrun

Ref	Factor	Test Value = 3			
		Mean	t-value	Std. Deviation	Sig. (2-tailed)
B1	Ineffective project management	4.252	14.996	0.956	0.000**
B2	Poor information and communication technology	3.916	15.686	0.669	0.000**
B3	Fluctuation in cost material	3.802	10.856	0.845	0.000**
B4	Weak labour productivity	3.748	10.608	0.807	0.000**
B5	Poor design construction	3.748	10.485	0.817	0.000**

6	Quality of raw material	3.763	10.185	0.858	0.000**
B7	Poor in financial management	3.611	8.086	0.864	0.000**
B8	Poor competency of consultants	3.634	8.251	0.879	0.000**
B9	External factors	3.618	7.732	0.915	0.000**
B10	Lack of experience	3.634	7.798	0.930	0.000**
B11	Inadequate documentation and tracking	3.519	6.325	0.939	0.000**
B12	Frequent design change	3.763	11.024	0.793	0.000**

**P = $p \leq 0.01$

4.9.2 Cost significant building element

The one-sample T-test of means compares the mean of only one sample to a pre-specified value but for sample means which is more than two groups. The standard deviation will be tested and the t-value will be calculated. There are two ways to indicate the hypothesis which is indicating the t-value or p-value. There is a negative relation between t-value and p-value whereby the greater the t-value, the smaller the p-value. When the t-value is more than the critical value shown in the t-distribution table, the null hypothesis will be rejected. On the other hand, the null hypothesis will also be rejected if the significance level (2-tailed) is less than 0.05 which indicated that there is 95% of confidence accuracy around the mean.

One sample T-test is used to test whether the significance above provide statically significance to the cost element. As shown in Table 4.9, The t-test results of this analysis show all the cost significant buildings element have a significant level of 0.000 which is less than 0.05 at 95% of confidence level. It can be concluded that the null hypothesis is rejected and all the 16 type of building element shows the statically significant effect to the construction cost for high-rise residential building. Hence, it can be said that the majority of respondents agreed that all the 16 types of cost significant building element and their effect on the construction cost in high-rise residential buildings.

Table 4.9: Result of one sample t-test for cost significant building element

Ref	Cost significant building element	Test Value = 3			
		Mean	t-value	Std. Deviation	Sig. (2-tailed)
C1	Cost of substructure	4.260	17.028	0.847	0.000**
C2	Cost of superstructure	4.061	16.608	0.731	0.000**
C3	Cost of envelop	3.832	12.770	0.746	0.000**
C4	Cost of stairs	3.618	7.527	0.940	0.000**
C5	Cost on frame	3.634	8.092	0.896	0.000**
C6	Cost of roof work	3.557	7.189	0.887	0.000**
C7	Cost of service	3.511	6.286	0.931	0.000**
C8	Cost of fitting	3.435	5.314	0.937	0.000**
C9	Cost of external wall	3.580	7.500	0.885	0.000**
C10	Cost of external door	3.534	7.494	0.816	0.000**
C11	Cost of the internal wall	3.588	8.700	0.773	0.000**
C12	Cost of consideration	3.481	6.986	0.788	0.000**
C13	Cost of the design	3.611	7.301	0.957	0.000**
C14	The location of the site	3.580	7.731	0.859	0.000**
C15	Physical site conditions	3.702	10.418	0.772	0.000**
C16	Facilities of the building	3.863	12.032	0.821	0.000**

**P = $p \leq 0.01$

4.9.3 Effect of cost control techniques

The one-sample T-test is used to test whether the outcomes listed above shows significance to the effect of cost control techniques. By indicating the t-value, the null hypothesis is rejected if the greater than the critical value from a t-distribution table. Besides, the null hypothesis will also be rejected if the significance level is less than 0.05 which indicated that there is 95% of confidence accuracy around the mean. P-value is shown in the table above at the column of significant named two-tailed.

Based on Table 4.10, The t-test results of this survey show all the outcomes are significant in the point of view of the respondents. All the outcomes consist of significant level (0.000) that less than 0.05. The results can be proved that there is 95% of confidence level. Therefore, the null hypothesis is rejected and all the 6 type of cost control technique shows the statically significant to the cost management for high-rise residential building. It can be concluded that the most of respondents agreed that the outcomes above contribute significantly towards high-rise residential buildings in Klang Valley.

Table 4.10: Result of one sample t-test for effect of cost control techniques

Ref	Effect of cost control techniques	Test Value = 3			
		Mean	t-value	Std. Deviation	Sig. (2-tailed)
D1	Project evaluation and review technique (PERT)	4.069	12.406	0.986	0.000**
D2	Earned value analysis	3.985	12.983	0.868	0.000**
D3	Gantt charts or bar charts	3.962	13.793	0.798	0.000**
D4	Cost value reconciliation (CVR)	3.702	8.684	0.926	0.000**
D5	To-complete performance index (TCPI)	3.649	8.390	0.885	0.000**
D6	Contract variance analysis (Unit costing)	3.557	6.370	1.001	0.000**

**P = $p \leq 0.01$

4.10 Spearman correlation test

Spearman order correlation coefficient is a nonparametric test that measures the strength and direction of the correlation between two variables measured on an ordered or continuous scale. This is a useful test when the Pearson correlation does not run due to a violation of normality, or when ordinal variables are used. For example, a Spearman correlation is used to understand whether there is a correlation between high jump performance and training time. If there is a moderate, positive correlation, it is that the longer the training, the better the high jump performance. Or a Spearman

correlation to see if there is a link between the length of unemployment and health status. If there is a strong negative correlation, the longer the unemployed, the lower their health (Laerd, 2018).

4.10.1 Common factor of cost overrun

A Spearman's rank-order correlation was run to determine the relationship between 131 respondents from the construction industry. This study uses the Spearman correlation test to explore the common factors of construction cost overrun of high-rise residential buildings. Spearman correlation test results are shown in Table 4.11. Each factor was found to be associated with potential cost overruns. These cost factors can be used as reference materials to improve cost management in the future, and it is hoped that more attention can be paid to them in future studies. Based on table 11, The result is presented in matrix form, because the matrix form shows that the correlation is repeated. Meanwhile, Spearman's data were shown in the table to be correlated with each other, its significance value and the sample size on which the calculation was based. The average Spearman correlation coefficients were strong and had static significance.

Spearman’s correlation test was utilized in this research to investigate the statistical relationships between the common factor of cost overrun. Based on table 4.11 presents the results of Spearman’s correlation test. Each of the causes was found correlated with at least 6 common factors of cost overrun. The external factors (B9) and frequent design change (B12) had the least relationship with the common factors of cost overrun in high-rise residential buildings. These causes may need to take more attention in future studies. The weak labour productivity (B4) and Poor competency of consultants(B8) were found as one of the common factors of cost overrun that affect the construction cost with the greatest number of significant correlations (10).

There are a total of 144 numbers of relationships between a common factors of cost overrun. There was a strong, large correlation between ineffective project management (B1) and poor information and communication technology (B2), which was statistically significant ($R_S = 0.572$, $P = 0.000$). However, in this study, Malaysian construction practitioners believe that the common factors of cost overruns should be

addressed to reduce the problem of cost overruns in high-rise residential buildings. Because of the underlying factor relationships, it can be argued that ineffective project management factors are more effective at addressing the root cause of the problem than other common factors of cost overruns.

Note To table 4.11:

B1 - Ineffective project management; B2 - Poor information and communication technology; B3 - Fluctuation in cost material; B4 - Weak labour productivity; B5 - Poor design construction; B6 - Quality of raw material; B7 - Poor in financial management; B8 - Poor competency of consultants; B9 - External factors; B10 - Lack of experience; B11 - Inadequate documentation and tracking; B12 - Frequent design change.

Table 4.11: Spearman correlation test for common factor of cost overrun

Ref	Common factor of cost overrun N = 131	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	Total number of significant correlations
B1	Correlation Coefficient	1.000	0.572**	0.268**	0.237**	0.171	0.296**	0.136	0.221*	0.123	0.191*	0.182*	0.186*	8
	Sig. (2-tailed)	-	0.000	0.002	0.007	0.051	0.001	0.120	0.011	0.163	0.029	0.038	0.033	
B2	Correlation Coefficient	0.572**	1.000	0.453**	0.332**	0.231**	0.348**	0.124	0.257**	0.160	0.290**	0.203*	0.215*	9
	Sig. (2-tailed)	0.000	-	0.000	0.000	0.008	0.000	0.158	0.003	0.068	0.001	0.020	0.014	
B3	Correlation Coefficient	0.268**	0.453**	1.000	0.386**	0.362**	0.327**	0.286**	0.289**	0.245**	0.116	0.240**	0.131	9
	Sig. (2-tailed)	0.002	0.000	-	0.000	0.000	0.000	0.001	0.001	0.005	0.186	0.006	0.136	
B4	Correlation Coefficient	0.237**	0.332**	0.386**	1.000	0.461**	0.281**	0.336**	0.363**	0.338**	0.303**	0.219*	0.055	10
	Sig. (2-tailed)	0.007	0.000	0.000	-	0.000	0.001	0.000	0.000	0.000	0.000	0.012	0.530	
B5	Correlation Coefficient	0.171	0.231**	0.362**	0.461**	1.000	0.443**	0.364**	0.248**	0.332**	0.294**	0.197*	00.101	9
	Sig. (2-tailed)	0.051	0.008	0.000	0.000	-	0.000	0.000	0.004	0.000	0.001	0.024	0.252	
B6	Correlation Coefficient	0.296**	0.348**	0.327**	0.281**	0.443**	1.000	0.471**	0.371**	0.152	0.135	0.115	0.269**	8
	Sig. (2-tailed)	0.001	0.000	0.000	0.001	0.000	-	0.000	0.000	0.084	0.124	0.192	0.002	
B7	Correlation Coefficient	0.136	0.124	0.286**	0.336**	0.364**	0.471**	1.000	0.482**	0.305**	0.203*	0.120	0.214*	8
	Sig. (2-tailed)	0.120	0.158	0.001	0.000	0.000	0.000	-	0.000	0.000	0.020	0.171	0.014	
B8	Correlation Coefficient	0.221*	0.257**	0.289**	0.363**	0.248**	0.371**	0.482**	1.000	0.356**	0.284**	0.268**	0.069	10
	Sig. (2-tailed)	0.011	0.003	0.001	0.000	0.004	0.000	0.000	-	0.000	0.001	0.002	0.436	
B9	Correlation Coefficient	0.123	0.160	0.245**	0.338**	0.332**	0.152	0.305**	0.356**	1.000	0.363**	0.337**	0.130	7
	Sig. (2-tailed)	0.163	0.068	0.005	0.000	0.000	0.084	0.000	0.000	-	0.000	0.000	0.138	
B10	Correlation Coefficient	0.191*	0.290**	0.116	0.303**	0.294**	0.135	0.203*	0.284**	0.363**	1.000	0.421**	0.277**	9
	Sig. (2-tailed)	0.029	0.001	0.186	0.000	0.001	0.124	0.020	0.001	0.000	-	0.000	0.001	
B11	Correlation Coefficient	0.182*	0.203*	0.240**	0.219*	0.197*	0.115	0.120	0.268**	0.337**	0.421**	1.000	0.347**	9
	Sig. (2-tailed)	0.038	0.020	0.006	0.012	0.024	0.192	0.171	0.002	0.000	0.000	-	0.000	
B12	Correlation Coefficient	0.186*	0.215*	0.131	0.055	0.101	0.269**	0.214*	0.069	0.130	0.277**	0.347**	1.000	6
	Sig. (2-tailed)	0.033	0.014	0.136	0.530	0.252	0.002	0.014	0.436	0.138	0.001	0.000	-	

Correlation is significant at the 0.01 level (2-tailed).
Correlation is significant at the 0.05 level (2-tailed).
N = Number of respondents

4.11 Summary

This chapter analyzes the collected data, discussed and interpreted the results with reference from the literature review. The pilot test is carried out before the main survey is conducted because it is to ensure that the questionnaires prepared are suitable and the data collected is reliable for this research. The respondent`s background from respondents is also explained in this chapter to prove the results are reliable and adequate for this research having high education level and working experiences. Besides, the common factor of cost overrun is examined. The 12 types of factors has been ranked accordingly from the perception of the respondents who are working in the construction industry. Kruskal-Wallis test is conducted but it showed that there are no significant differences from the perception by role is position (main-contractor, sub-contractor, consultant and developer). In addition, 16 costs significant building element is also ranked accordingly. By using the Kruskal-Wallis test, it showed that there is a total 5 costs significant building elements have the statically significant difference from the point of view by respondents. Lastly, the 6 types of cost control techniques has been examined. So just choose the top 3 of the technique from the data collected to discussion in this chapter.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

The purpose of Chapter 5 is to discuss the conclusion of this research and conclude the contents of every topic discussed in this chapter. The main objectives of this study investigate project cost management for high-rise residential buildings in Klang Valley. These are extremely important as the issue of cost management will determine the future growth of the construction industry in Malaysia. for the findings are interrelated based on the aim and objectives of this research which has been shown in Chapter 1. Besides, the limitations while conducting this research are also stated and explained. Recommendations will be provided and suggested for the improvement of further study on similar research.

5.2 Conclusion

Construction is one of the booming industries in the world, especially in developing countries like Malaysia. In the Klang Valley, there are a lot of high-rises that have been completed or are under construction. The construction process is divided into the pre-construction stage, construction stage and post-construction stage. In these three stages, cost management plays a significant. More research is needed on the construction of high-rise buildings. Professionals are most needed during the whole process of a construction project. Therefore, cost management for a project is to improve project performance and lead to project success. Chapter 1, it stated the 3 main objectives to be achieved in completing this study. The objectives are shown as below:

1. To determine the factors of cost overruns that affect the construction cost.
2. To examine the cost significant elements for high-rise residential buildings.
3. To appraise the cost control techniques used in buildings construction projects in Malaysia.

For objective one in this study, respondents are asked to answer the question mentioned in Section B of the questionnaire prepared. The respondents are asked to rank the level of agreement on the 12 types of common factors that affect the cost overrun that have been identified earlier in the literature review. There is a lot of research did on the cost overrun in construction, but much of the research still on the surface, so further research is recommended on this area of study. The overall ranking for the 5 factors is:(1) Ineffective project management, (2) Poor information and communication technology, (3) Fluctuation in cost material, (4) Quality of raw material, (5) Frequent design change. This means that project management is very influential in building projects, followed by communication with stakeholders and human resources. However, there is not much difference between the views of the interviewees from different backgrounds.

Besides, to accomplish the second objective for this study. 16 type of cost significant building element that in the construction industry are identified in the literature review. In Section C of the questionnaire survey, it required the respondents to rank the level of importance on the 16 types of building element. The overall ranking for the top 5 costs significant building elements is (1) Cost of substructure, (2) Cost of superstructure, (3) Facilities of the building, (4) Cost of envelop, (5) Physical site conditions. The top 5 that have statically significant difference with different role position from respondents. These 5-cost significant building elements have a mean of more than 4.000 and thus implied that better influence of high-rise residential project can enhance control or improve the cost management, improve decision-making and problem-solving process as well as lead to project success.

Besides, the third objectives for this research are achieved through 6 types of cost control technique by respondents. 6 types of cost control technique have been identified stated in literature review which shows how effective cost management in the high-rise building project. The respondents are asked to rank the level of agreement on the 6 types of cost control technique stated in Section D of the questionnaire survey. The top 3 cost control technique is: (1) Project evaluation and review technique (PERT),

(2) Earned value analysis (EVA), (3) Gantt charts or bar charts. There is 3 cost control techniques that has statically significant differences with a roles in position.

5.3 Limitation of research

The study was targeted to be located in the Klang Valley region and was limited to Kuala Lumpur and Selangor (Ampang, Petaling Jaya, Klang, Shah Alam, Subang Jaya, Kajang, Selanyang), but fortunately, the technology is now advanced and it is possible to distribute the questionnaire via Gmail and WhatsApp. For the data analysis of this study, the results may not be truly representative of the whole Malaysian construction industry, but only for reference, because there are still many problems concerning the cost overrun of the construction of high-rise residential buildings during the research process. Although the sample size of this study may not be representative of the entire Malaysian construction industry, it is a good start because although there is a lot of resources (published paper) on cost overruns during the research process, it is still not sufficient after in-depth study. The construction of high-rise residential buildings is one of the complex projects in the construction industry. Hope in the future still need to further study the relevance of cost management in high-rise residential building project.

Due to the limited time available to conduct the study, it was difficult to collect more responses in such a short period time, and some respondents were reluctant to spend time answering the questionnaire because they thought it was not important to them. Therefore, the respondents' answers may not be accurate enough, and some responses have simply answered the questions to complete the questions as soon as possible. This will inevitably affect the reliability and validity of the data collected. Due to the COVID-19 pandemic and the movement control order in all parts of Malaysia, the researchers were unable to distribute the questionnaires to various destinations across the counties, so the distribution of questionnaires became a problem. But because of the pandemic, the only way to communicate with responders together is through Gmail and contact (WhatsApp). Due to the limited research time, it is not enough to collect and integrate more information about the cost management of high-rise residential construction projects in a short time.

5.4 Recommendation

To complete the research more smoothly in the future, here some personnel recommendations. Questionnaire surveys can be distributed to the respondents from other states of Malaysia who are involved in the construction industry especially from Penang and Johor which have a lot of high-rise buildings projects. Quantitative research might not sufficient enough to get accurate results. because sometime no need face to face interviews to collect more detailed data. However, a mixed-method which includes both quantitative and qualitative research method recommend to this study for getting validity of the data collected. the number of respondents should be increased as much as 200 respondents because more respondents are collecting more data to analyses accurate results.

However, the results of this study are useful and applicable in the Malaysian construction industry since the data were collected locally and the results are relevant to construction projects in Malaysia. Therefore, according to the analysis results of this study, the construction industry will grow without the cost overrun problem and will directly lead to the country's economic growth. In short,to comprehensively improve the cost performance of all aspects of the construction industry, it is necessary to conduct further research and detailed implementation of related topics in the aspects of project management, resource planning research, cost planning, cost budgeting and so on.

5.5 Summary

This chapter describes the conclusions of the whole research, which must be related to the 3 objectives in Chapter 1. The limitations of this study are also listed and some suggestions are provided for future study. Future researchers should focus on the project cost management for high-rise residential in the Malaysian construction industry. Besides, they should do their utmost to improve the quality of their research and provide more needed information.

REFERENCE

Abas, N., Blismas, N. & Lingard, H., 2016. *Knowledge-based energy damage model for evaluating Industrialised Building Systems (IBS) occupational health and safety (OHS) risk.* Melacca, The 3rd International Conference on Civil and Environmental Engineering for Sustainability 2015.

Abas, N. H. B. N. & Lingard, 2011. Development of a knowledge-based energy damage model to assess occupational health and safety (OHS) construction risks in Malaysia. *The 3rd CIBW099 Prevention: Means to the End of Construction Injuries, illnesses, and Fatalities (Washington, United States),* pp. 1-16.

Abdellatif, M. A. & Othman, A. A. E., 2006. Improving the sustainability of low-income housing projects: The case of residential buildings in Musaffah commercial city. *Emirates J. Eng. Res., 11(2), 47–58.*.

Ade, A. A. A. et al., 2013. Controlling Cost Overrun Factors in Construction Projects in Malaysia. *Research Journal of Applied Sciences, Engineering and Technology,* 5(8), pp. 2021-2629.

Adigüzel, F. a. W. M., 2008. Split questionnaire design for massive surveys. *Journal of Marketing Research,* 45(5), p. 608–617.

Aksorn, T. a. H. B., 2008. Critical success factors influencing safety program performance in Thai construction projects. *Safety Science,* 46(4), p. 709–727.

Ali, A. S. & Kamaruzzaman, S. N., 2010. Cost performance for building construction projects in Klang Valley. *journal of Building Performance,* 1(110-118), p. 1.

Ameh, O., Soyingbe, A. & Odusami, K., 2010. Siglllficant factors causing cost ovenuns in telecommunication projects in Nigeria. *J. Construct. Dev. Countries,* Volume 15, pp. 49-67.

Ashworth, A. & Hogg, 2004. *Willis' Practice and Procedure Quantity Surveyors.* s.l.:Blackwell Science Ltd.

Atkinson, R., 1999. Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management,* pp. 337-342.

Auchterlounie, T., 2009. Recurring quality issues in the UK private house building industry. Structural Survey. *27. 241-251. 10.1108/02630800910971365.* .

Augustine, Elinwa, U. & A, S., 1993. Construction Cost Factors in Nigeria. *Journal of Construction Engineering and Management,* 119(4), pp. 698-713.

Azis, A. A. A., Memon, A. H., Rahman, I. A. & Karim, A. T. A., 2013. Controlling cost overrun factors in construction projects in malaysia. *Research Journal of Applied Sciences, Engineering and Technology*, 5(8), p. 2621–2629.

Barrett, F., 1992. *Cost value reconciliation.* 2nd ed. Bracknell: Chartered Institute of Building.

Bartlett, J. K., 2001. Organizational Research: Determining Organizational Research: Determining Appropriate Sample Size in Survey Research Appropriate Sample Size in Survey Research. *Information Technology, Learning, and Performance Journal,* 19(1), pp. 43-50.

Beckman, W. S., 2008. Pre-Testing as a Method of Conveying Learning Objectives. *Journal of Aviation/ Aerospace Education & Research,* 17(2), pp. 61-69.

Bulmer, M., 2004. *Sage Benchmarks in Social Science Research Methods.* 1st ed. London: Sage Publications.

Burati, J., Farrington, J. & Ledbetter, W., 1992. Causes of quality deviations in design and construction. *Journal of Construction Engineering and Management,* 118(1), pp. 34-49.

Burke, R., 2013. *Project Management: Planning and Control Techniques.* 5th ed ed. New Jersey: Wiley: s.n.

Catherine, H., Ashworth, A. & Hogg, K., 2007. *Willis's Practice and Procedure for the Quantity Surveyor.* 12th ed ed. Hoboken, New Jersey: Oxford: Blackwell Publishing.

Chan, A., 2001. Time-cost relationship of public sector projects in Malaysia. *International Journal,* Volume 19, pp. 223-229.

Chimwaso, D. K., 2000. An Evaluation of Cost Performance of Public Projects. *Case of. Botswana, s.n.*.

Chitkara, K. K., 2005. *Construction project management: Planning, scheduling and controlling.* New York: Tata McGraw Hill .

Chitkara, K. K., 2014. *Construction Project Management.* 3rd ed. New Delhi: McGraw Hill Education (India) Private Limited.

Chua, Y., 2013. *Mastering research methods.* Shah Alam: McGraw-Hill Education.

CIDB, 2., 2019. *Centralized Information Management System.* [Online] Available at: http://cims.cidb.gov.my/ [Accessed December 10 2020].

Cohen, J., 1988. *Statistical power analysis for the behavioral sciences.* 2nd ed. Hillsdale: NJ: Lawrence Erlbaum Associates.

Cunningham, T., 2013. Factors Aff ors Affecting The Cost of Building W ecting The Cost of Building Work - An Ov ork - An Overview. *Dublin Institute of Technology.*

Cunningham, T., 2017. Cost Control during The Construction Phase of the Building Project: - The Consultant Quantity Surveyor's Perspective. *Dublin: Dublin Institute of Technology.*

Das, S. & Chew, M. Y., 2011. Generic method of grading building defects using FMECA to improve maintainability decisions. *J. Perform. Constr. Facil,* 25(6), p. 522–533.

Ferry, D., Brandon, P. & Ferry, J., 1999. *Cost Planning of Buildings,.* 7nd ed. s.l.:Blackwell science.

Gichuhi, F., 2013. *PERCENTAGE OF COST BREAKDOWN BETWEEN LABOUR, MATERIALS AND CONTRACTOR PROFIT IN CONSTRUCTION.* [Online] Available at: https://www.a4architect.com/ [Accessed 14 November 2020].

Gliem, J. & Gliem, R., 2003. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. *Midwest Research to Practice Conference in Adult, Continuing, and Community Education,* pp. 82-88.

Guo, S., Zhang, A. & Zhong, S., 2013. Privacy-preserving Kruskal–Wallis test. *Computer Methods and Programs in Biomedicine,* 112(1), p. 135–145.

Halliburton & Mark, 1792. Soil Science. *Journal of soil mechanic and foundation (ASCE),* 4(3), pp. 327-339.

Halliburton & Mark, 1972. Soil Science. *Journal of soil mechanic and foundation,* Volume (ASCE)4 (3), pp. 327-339.

Hendrickson, C., 2000. *Project Management for Construction.* 2nd ed. Pittsburgh: Prentice Hall.

Henry, M. A., Mwakali, J. & Hansson, B., 2006. Assessing the degree of industrialisation in construction. *Journal of Civil Engineering and Management,* Volume 12(3), pp. 221-229.

Hira, N., Ahuja, S., Dozzi, S. & Abourizk, 1994. *Project Management: Techniques in planning and controlling construction projects.* 2nd ed. Canada: John Wiley & Sons.

Hirudini, C., Wickramasinghe, M. & Dissanayake, D., 2018. Analysis of Cost Control Techniques Used on Building Construction Projects in Sri Lanka. *International Journal of Research,* Volume 5(23), pp. 909-923.

Hughes, W., Champion, R. & Murdoch, J., 2015. *Construction Contracts: Law and Management.* 5nd ed. Abingdon: Routledge.

Institude of project management, 2010. *A Guide to the Project Management Body of Knowledge.* 3rd ed. Pennsylvnia ed. s.l.:Project Mangement Institute.

Joseph, H. et al., 2012. *Essentials of Marketing Research.* 3rd ed. United States: McGraw-Hill Education.

Kamaruzzaman, S. & Ali, A., 2010. COST PERFORMANCE FOR BUILDING CONSTRUCTION PROJECTS IN KLANG VALLEY. *Journal of Building Performance,* Volume 1(1), pp. 110-118.

Kaming, P., Olomolaiye, P., Holt, G. & Harris, F., 1997. Factors influencing construction time and cost overruns on high-rise projects in Indonesia. *Construction Management and Economics,* Volume 15, pp. 83-94.

Khamidi, M. F., 2011. *The Cost Monitoring of Construction Projects Through Earned Value Analysis.* Singapore: IACSIT Press.

Kothari, C., 2004. *Research Methodology: Methods and Techniques.* 2nd ed. New Delhi: New Age International (P) Ltd.

Laerd, s., 2018. *Spearman's correlation in Stata - Procedure, output and interpretation of the output using a relevant example.* [Online] Available at: https://statistics.laerd.com/stata-tutorials/spearmans-correlation-using-stata.php
[Accessed 23 January 2021].

Larsen, J. K., Shen, G. Q., Lindhard, S. M. & Bruno, T. D., 2015. Factors Affecting Schedule Delay Cost Overrun, and Quality Level in Public Construction Projects. *Journal of Management in Engineering,* 32(1).

Low, H. Y., Chong & Siang, T., 2014. Cases, Accidents in Malaysian Construction Industry: Statistical Data and Court. *International Journal of Occupational Safety and Ergonomics.*

Margaret, R., 2018. *SSPS (Statistical Package for the Social Sciences).* [Online] Available at: https://whatis.techtarget.com/definition/SPSS-Statistical-Package-for-the-Social-Sciences
[Accessed 15 November 2020].

Memon, A. H., Rahman, I. A. & Azis, A. A. A., 2012. The cause factors of large projects cost overrun: a survey in the southern part of Peninsular Malaysia. *International Journal of Real Estate Studies,* 2(1-15), p. 7.

Mohammed, M., Haruna, A. & Musa, I., 2016. Causes And Effects Of Poor Communication Between The Client And Contractor During Construction Projects In

Nigeria. *Journal of Multidisciplinary Engineering Science and Technology (JMEST),* 4(2458-9403), p. 3.

Nega, F., 2008. *Causes and effects of cost overrun on public building construction projects in Ethiopia.* Addins Ababa University, Ethiopia: Phd Thesis.

Newberry, C. W. & Eaton, K. J., 1976. *Wind loading handbook building research establishment.* London: H.M.S.O. [for] Building Research Establishment.

Nulty, D. 2., 2008. Assessment & evaluation in higher education the adequacy of response rates to online and paper surveys: What can be done?. *Assessment & Evaluation in Higher Education,* 33(3), p. 301–314.

Ofori-Kuragu, J. K., Baiden, j. & Badu, E., 2016. Key performance indicators for project success in Ghanaian contractors. *Int. J. Constr. Eng. Manage,* 5(1), p. 1–10.

Ohara, S., 2019. *Japanese project management: KPM-innovation, development and improvement.* Singapore: World Scientific.

Olawale, S., 2010. Cost and time control of construction projects: inhibiting factors and mitigating measures in practice. *Construction Management Economic,* pp. 509-526.

Olawale, Y. & Sun, M., 2010. Cost and time control of construction projects: Inhibiting factors and mitigating measures in practice. *Construction Management and Economics,* 28(5), p. 509 – 526.

Pallant, J., 2005. *SPSS survival manual: A step by step guide to data analysis using SPSS.* 6ed ed. Maidenhead: Berkshire: Open University Press.

Patil, A. P., 2017. Analysis of Cost over run in construction Projects. *International Research Journal of Engineering and Technology,* p. 1234–1237.

Peters, L., 2018. *Major Building Parts SuperstructureSubstructureFoundation.* [Online]
Available at: https://slideplayer.com/slide/11695512/ [Accessed 02 March 2021].

Potts, K., 2007. *Construction Cost Management: Learning From Case Studies.* 1nd ed. Abingdon: Routledge.

Punam, B. K. & Darade, P. M., 2018. Cost Control Techniques for Construction Project. *International Research Journal of Engineering and Technology (IRJET),* pp. 2433-2436.

Rahman, A., Memon, I., Karim, A. & Ahmad, A., 2013. Significant Factors Causing Cost Overruns in Large Construction Projects in Malaysia. *Journal of Applied Sciences. 13. 286-293. 10.3923/jas.2013.286.293.*.

Rahman, I. A. et al., 2012. Time and cost performance of construction projects in southern and central regions of Peninsular Malaysia.. *Proceeding of the IEEE Colloquium on Humanities, Science & Engineering Research,* p. 52– 57.

Rajasekar, P., 2013. *Research Methodology*. [Online] Available at: https://www.arxiv.org/ [Accessed 4 December 2020].

Rohani, E. I., Akintoye, A. & Kelly, J., 2005. Cost and time overrun project in malaysia.

Ross, A. & Willson, V., 2017. One-Sample T-Test. *Basic and Advanced Statistical Tests,* pp. 9-12.

Ruskin, J., 1889. *The Seven Lamps of Architecture.* New York: Dover Publications.

Sagar, K., Bhosekar & Vyas, G., 2012. Cost Controlling Using Earned Value Analysis in. *International Journal of Engineering and Innovative Technology (IJEIT),* 1(4), pp. 2277-3754.

Saidu, I., Alumbugu & Azeez, P. O. A., 2015. Assessment of the Effect of Plan Shapes on Cost of Institutional. *International Refereed Journal of Engineering and Science (IRJES),* 4(3), pp. 39-50.

Sambasivan, M. & Soon, Y. W., 2007. Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management,* 25(5), p. 517–526.

Seeley, I., 1996. *Building Economics.* 4nd ed. Basingstoke Hampshire: Macmillan.

Seeley, I., 1997. *Quantity Surveying Practice.* 2nd ed ed. London: Macmillan.

Shari, I., 2000. Economic growth and income inequality in Malaysia. *Journal of the Asia Pacific Economy,* Volume 5(1-2), pp. 112-124.

Shehu, Z., Endut, I. R., Akintoye, A. & Holt, G. D., 2014. Cost overrun in the Malaysian construction industry projects: a deeper insight. *International Journal of Project Management,* 32(8), p. 1471–1480.

Sohail, M. & Baldwin, A., 2004. Performance indicators for micro-projects in developing countries. *Construction Management and Economics,* 22(1), pp. 11-23.

Stephen, O., Promkuntong, K. & Jearkjirm, V., 1996. Construction delays in a fast-growing economy: Comparing Thailand with other economies. *International Journal of Project Management,* 14(1), pp. 37-45.

Takim, R., 2005. A Framework for successful construction project performance. *PhD Thesis, Glasgow Caledonian University.*

Tavakol, M. & Dennick, R., 2011. Making sense of Cronbach's alpha. *International journal of medical education*, Volume 2, p. 53–55.

UKEssarys, 2018. *Malaysian Construction Industry Sector Economics Essay*. [Online] Available at: https://www.ukessays.com/ [Accessed 10 November 2020].

Usmani, F., 2019. *To-Complete Performance Index (TCPI) in Project Cost.* [Online] Available at: https://pmstudycircle.com/ [Accessed 15 December 2020].

Uzir, M. M., 2021. *Malaysia Economic Performance Fourth Quarter 2020.* [Online] Available at: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=100&bul_id=Y1MyV2tPOGNsVUtnRy9SZGdRQS84QT09&menu_id=TE5CRUZCblh4ZTZMODZIbmk2aWRRQT09#:~:text=Malaysia's%20Gross%20Domestic%20Product%20(GDP,4.3%20per%20cent%20in%202019.
[Accessed 14 April 2021].

Waziri, B. S., 2016. Design and construction defects influencing residential building maintenance in Nigeria. *Jordan J. Civ. Eng*, 10(3), p. 313–323.

Yap, J. B. H., Abdul-Rahman, H., Wang, C. & Skitmore, M., 2018. Exploring the underlying factors inducing design changes during building production. *Production Planning and Control. Taylor & Francis*, 29(7), pp. 585-601.

Yap, J. & Skitmore, M., 2018. Investigating design changes in Malaysian building projects. *Architectural Engineering and Design Management*, 14(3), p. 218–238.

APPENDIX

APPENDIX A: Questionnaire Survey

INVESTIGATING PROJECT COST MANAGEMENT FOR HIGH-RISE RESIDENTIAL BUILDING

Dear Respondents,

I am Ling Chee Soon, a student from Universiti Tunku Abdul Rahman (UTAR), studying Mater Degree of Project management and currently working on my research project with topic Investigating Project Cost Management for High-Rise Residential Building. This research focuses on the parties involved in the project residential high-rise building in Klang Valley.

There are three main objectives to be achieved:

1. To determine the factors of cost overruns that affect the construction cost.

2. To examine the cost significant elements for high-rise residential buildings.

3. To appraise the cost control techniques used in building construction projects in Malaysia.

The questionnaire consists of (4) sections:

Section A: Background Information

Section B: Factor of the Cost Overrun Influence the Construction Cost

Section C: The Effect of Building Element to the Construction Cost

Section D: Types of Cost Control Techniques

This survey will take approximately 5 to 10 minutes to complete. Rest assured that we will not attempt to disclose your identity throughout the research processual data will be used purely for academic purposes and will be strictly anonymous. However, if you feel uncomfortable with the survey, you can opt out at any time.

Thank you for your time and participation. All responses will be kept confidential and used for academic purposes only.

If you have any inquiries, please do not hesitate to contact me.

Best Regards,

Ling Chee Soon

lingcs97@1utar.my

Mater of Project Management

Universiti Tunku Abdul Rahman

Section A: Background Information

*Tick only one choice per question

A1. Gender

- Male
- Female

A2. Role in the project

- Main-Contractor
- Sub-Contractor
- Consultant
- Developer

A3. Designation in the project

- Junior level
- Senior level
- Manager level
- Executive level
- Director / Top management

A4. Academic qualification

- High School
- Diploma
- Bachelor Degree
- Mater Degree
- Doctor of Philosophy

A5. Working experience in construction industry

- Less than 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 years and above

A6. The size of project you have involved in terms of contract amount

- RM 100 million and below
- 100 million to 200 million
- 200 million to 300 million
- 300 million to 400 million
- 400 million to 500 million
- Above than 500 million

Section B: Factor of the Cost Overrun Influence the Construction Cost

*Please indicate one level of agreement on factor of the cost overrun influence the construction cost for each statement

Ref	Description	Strongly Disagreed (1)	Disagreed (2)	Undecided (3)	Agreed (4)	Strongly Agree (5)
B1	Ineffective project management					
B2	Poor information and communication technology					
B3	Fluctuation in cost material					
B4	Weak labour productivity					
B5	Poor design construction					
B6	Quality of raw material					
B7	Poor in financial management					
B8	Poor competency of consultants					
B9	External factors					
B10	Lack of experience					
B11	Inadequate documentation and tracking					
B12	Frequent design change					

Section C: The Effect of Building Element to the Construction Cost

*Please indicate one level of agreement on the effect of building element to the construction cost for each statement

Ref	Description	Strongly Disagreed (1)	Disagreed (2)	Undecided (3)	Agreed (4)	Strongly Agree (5)
C1	Cost of substructure					
C2	Cost of superstructure					
C3	Cost of envelop					
C4	Cost of stairs					
C5	Cost on frame					
C6	Cost of roof work					
C7	Cost of service					
C8	Cost of fitting					
C9	Cost of external wall					
C10	Cost of external door					
C11	Cost of the internal wall					
C12	Cost of consideration					
C13	Cost of the design					
C14	The location of the site					
C15	Physical site conditions					
C16	Facilities of the building					

Section D: Types of Cost Control Techniques

Please indicate one level of agreement on the types of Cost Control Techniques for each statement

Ref	Description	Strongly Disagreed (1)	Disagreed (2)	Undecided (3)	Agreed (4)	Strongly Agree (5)
D1	Project evaluation and review technique (PERT)					
D2	Earned value analysis					
D3	Gantt charts or bar charts					
D4	Cost value reconciliation (CVR)					
D5	To-complete performance index (TCPI)					
D6	Contract variance analysis (Unit costing)					

APPENDIX B: Turnitin Report