

MITIGATION MEASURES FOR CRITICAL FACTORS CAUSING COST
OVERRUN IN MALAYSIAN BUILDING PROJECTS

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DEDICATION

For my beloved father and mother



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ABSTRACT

Construction industry is one of the most important industries as it plays a vital role in the socio-economic growth of a country. However, construction industry faces severe problem of cost overrun. Like other countries, building projects in Malaysia are also affected by cost overrun. There are various factors contributing to cost overrun in building projects and it is vital to understand how they can be mitigated in order to improve cost performance in building project. Thus, the purpose of this study was to determine mitigation measures for critical factor causing cost overrun in Malaysian building projects. This study employed mixed method research covering both quantitative and qualitative approaches. A total of thirty six (36) factors causing cost overrun were identified from literature review. Based on these factors, a questionnaire survey was carried out to determine critical cost overrun factors. Results of the survey determined 31 critical factors causing cost overrun in building projects. Then, interview sessions with construction experts involved in handling of building projects were carried out to explore possible mitigation measures for each of the critical cost overrun factors. Finally, another questionnaire survey was conducted among construction experts to assess the level of significance of the mitigation measures. The findings from the survey showed the most significant mitigation for each critical cost overrun factors. For the top three critical cost overrun factors i.e. fluctuation in cost of materials, improper planning and scheduling and underestimate project duration, the most significant mitigation measures were establish applicable contract system with raw material suppliers, ensure effective planning at early stage of the construction project and appoint well skilled project planner respectively. This study would help the construction practitioners to apply specific measures to mitigate the critical factors that could possibly lead to the escalation of construction project cost. Thus, it will not only directly benefit the construction community, but also indirectly to the country economically.



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ABSTRAK

Industri pembinaan merupakan salah satu industri yang penting kerana ia memainkan peranan dalam pertumbuhan sosio-ekonomi bagi sesebuah negara. Walau bagaimanapun, industri pembinaan ini menghadapi masalah di dalam aspek kewangan. Seperti negara-negara lain, projek pembinaan di Malaysia juga terjejas disebabkan oleh peningkatan kos pembinaan. Terdapat pelbagai faktor yang menyumbang kepada peningkatan kos pembinaan yang melampau dalam projek pembinaan dan penting untuk kita memahami bagaimana ia dapat dikurangkan bagi meningkatkan prestasi kos di dalam projek pembinaan. Oleh yang demikian, tujuan kajian ini adalah untuk menentukan langkah-langkah pencegahan bagi mengenal pasti faktor utama yang menyebabkan lebih kos yang ditanggung bagi setiap projek pembinaan di dalam Malaysia. Kajian ini menggunakan kaedah penyelidikan campuran yang meliputi pendekatan kuantitatif dan kualitatif. Sejumlah tiga puluh enam (36) faktor yang menyebabkan lebih kos telah dikenalpasti dari kajian literasi. Berdasarkan faktor-faktor ini, kajian soal selidik telah dijalankan bagi menentukan faktor utama yang memberi kesan ke bagi masalah ini. Keputusan kaji selidik mendapati 31 faktor kritikal yang mengakibatkan lebih kos di dalam projek pembinaan. Kemudian, sesi wawancara bersama pakar pembinaan yang terlibat dalam pengendalian projek-projek bangunan telah dijalankan bagi mengambil kira langkah-langkah pencegahan yang mungkin boleh dilakukan berdasarkan setiap faktor kritikal tersebut. Akhirnya, satu lagi kajian soal selidik telah dijalankan di kalangan pakar pembinaan untuk menilai tahap kepentingan langkah-langkah pencegahan tersebut. Keputusan dari kajian soal selidik tersebut telah menunjukkan langkah-langkah pencegahan bagi setiap faktor utama tersebut. Terdapat tiga faktor utama yang menyebabkan peningkatan kos berlaku iaitu turun naik harga kos bahan, perancangan yang tidak betul serta penjadualan atau jangka masa projek yang tidak tepat, langkah-langkah pengurangan kos yang paling ketara adalah dengan mewujudkan sistem kontrak yang bersama pembekal bahan mentah bagi memastikan perancangan yang berkesan pada peringkat awal projek



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pembinaan dan melantik perancang projek yang mahir. Kajian ini akan dapat membantu pengamal pembinaan bagi melaksanakan langkah-langkah khusus agar dapat mengurangkan faktor kritikal yang mungkin membawa kepada peningkatan kos projek pembinaan. Tambahan lagi, ia bukan sahaja memberi manfaat secara langsung kepada masyarakat pembinaan, malah ia juga secara tidak langsung memberi manfaat kepada ekonomi negara.



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LIST OF SYMBOLS AND ABBREVIATIONS

C	-	Margin of error
I	-	Response category index = 1, 2, 3, 4, 5.
N	-	Number of items
X_i	-	Frequency of the response given
Z	-	Confidence level
\bar{r}	-	Average inter correlation among items
σ	-	Cronbach alpha coefficient
Σ	-	Sum
MS	-	Mean score
SS	-	Sample size
GDC	-	Gross domestic capital
GDP	-	Gross domestic product
CIDB	-	Construction industry development board
SPSS	-	Statistical package for the social sciences
CREAM	-	Construction research institute of Malaysia



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CHAPTER 1

INTRODUCTION

1.1 Research background

Construction sector plays a vital role in the economic growth and development of any country. Construction sector not only provides essential infrastructures for examples, residential buildings, industrial buildings, educational buildings, hospitals, roads, recreational centres, airports, ports, highways, and railways for improving the quality of lifestyle but it also generates a large number of employment opportunities. The construction industry is among one of the world's largest industries as it shears for roughly 11% to 13% of the world's Gross Domestic Product (GDP) and employing around 180 million people or 7% of the global employment (Jones, 2014). However, despite its proven importance, construction industry faces severe problems like excessive resource consumption, environmental threats, poor quality, construction waste, low productivity, low skilled workers, time overrun, and cost overrun. According to Mahamid & Dmaid (2013) and Alzebdeh, Bashirb & Siyabic (2015) cost overrun is one of the main problems in the construction industry. As cost is one of the major concerns throughout the project management lifecycle and it can be considered as the driving force for a project success (Aziz, 2013).

Cost overrun is the variance between initially estimated cost and the final cost of the project at the completion time of a construction project (Abban & Allotey, 2014). Cost overrun is a universal and regular feature in the construction industry, where by only few projects completed within the estimated budget (Aljohani, Dagbui & Moore, 2017). The problem of cost overrun in construction industry is existed in both developed and developing countries, however, it is more chronic in developing

countries where overruns sometimes go beyond 100% of the estimated cost of the projects (Vaardini, Karthiyayini & Ezhilmathi, 2016). Rivera et al. (2016), reported that globally, on average 63% of the construction projects experienced cost overruns with 24% increase in the estimated budget. Aziz (2013), states that the construction projects experience cost overrun of about 33% on average. In United Kingdom, Meng (2012), surveyed 103 construction projects and found that 25.2% of the sampled projects experienced cost overrun. Sweis et al. (2013), investigated cost overrun in public construction projects in Jordan and observed that 65% of the projects had cost overrun. In Singapore, a survey was carried out by Yongjian et al. (2015), the findings of the survey revealed that almost 60% of the projects were affected by cost overrun. In United States of America (USA), Chen et al. (2016), investigated cost overrun in 418 design and build projects, the results showed that more than 50% of the projects had cost overrun. Senouci, Ismail & Eldin (2016) examined the problem of cost overrun in 122 public construction projects in Qatar and found that 54% of the projects had cost overrun. Saidu & Shakantu (2017), probed cost data of 30 building projects in Nigeria and concluded that the entire building projects were affected by cost overrun with average cost overrun of 44.46%.

Cost overrun is prevalent in all types and sizes of construction projects (Saidu & Shakantu, 2017). However, Mamman (2014) & Kostka & Anzinger (2016), cited that cost overrun is more frequent and severe in building projects. Kostka & Anzinger (2016), examined cost overrun in building and transportation projects in Germany and showed that 51% of the building projects had cost overrun while 31 % of the transportation projects experienced cost overrun. The researches carried out by Abban et al. (2014), Ikechukwu et al. (2017) & Mahamid et al. (2013), also confirmed that cost overrun is a major issue in building projects.

1.2 Problem statement

The construction industry can be regarded as one of the important contributors to the Malaysian economic development. In Malaysia, construction industry shears 4.4% to overall Gross Domestic Product (GDP) of the country (Bank Negara Malaysia, 2016). However, like other countries, construction industry of Malaysia is also affected by the issue of cost overrun (Ismail et al., 2014 & Jatarona et al., 2016). Study on cost

overrun in the southern and central regions of Peninsular Malaysia found that 89% of the projects experienced cost overrun (Rahman et al., 2012). Meanwhile, a survey conducted by Memon, Rahman & Azis (2012) showed that 96% of the construction projects experienced cost overrun, with an average cost overrun ranging from 5% to 10% of the planned cost. The Kuala Lumpur International Airport 2 also experienced the problem of cost overrun, the total cost of the project increased from RM1.6 billion to RM4 billion (Ismail et al., 2014). Shehu et al. (2014), performed a survey on cost overrun in Malaysian building projects and revealed that more than half of the building projects experienced cost overruns. These studies confirm that cost overrun is a serious problem in the Malaysian construction industry and particularly more phenomenal in building projects.

The problem of cost overrun in building projects is caused by various factors. Many researches have been conducted to explore the factors that cause cost overruns in construction projects in Malaysia (Jamaludin et al., 2014). However, little research is carried out on critical factors of cost overrun in building projects. The problem of cost overrun in building projects can be minimized by determining the mitigation measures for each of the critical factors that cause cost increase. Currently, limited research is carried out on determining mitigation measures for each of the factors causing cost overrun in building construction projects. In other parts of the world, Olawale & Sun (2010), studied the mitigation measures for cost overrun factors in the construction projects in United Kingdom. They carried out a study on controlling cost and time overruns in construction projects and determined mitigation measures for factors instigating cost and time overruns in construction projects. However, the mitigation measures were determined for only top five factors of cost overrun, which were changes in design, uncertainties related with projects, inaccurate project duration, complexities of work, and incompetent subcontractors.

Cost overrun in construction projects differ with geographical location and types of project (Cantarelli, Flyvbjerg & Buh, 2012). Factors causing cost overrun could be different from country to country because of the changes in economic, political, social and environmental conditions (Abban & Allotey, 2014). Thus, a study devoted to examine the same context in the local environment is of great importance because of the difference in economic policy, project characteristics, practical problems and resources availability of Malaysia in comparison to other countries. Currently, few studies are carried out on mitigation measures for cost overrun in



Malaysia. Azis et al. (2013), proposed a total of fifteen (15) controlling measures to cope cost increase in construction projects. However, the measures were general recommendation and suggestions, provided without matching with factors causing cost overrun. Roslan, Zainun & Memon (2015), checked the relevancy of mitigation measures in relation with factors causing time and cost overruns in construction projects. However, the scope of the study was limited to southern region of Peninsular Malaysia only.

Apparently, the previous studies have generally focused more on identifying the factors initiating cost overrun and little attention on determining mitigation measures for cost overrun factors. Moreover, some of the studies had surveyed relatively small sample sizes of population, which may affect the credibility of their findings. Thus, there is a gap of investigation on mitigation measures for each critical factors causing cost overrun in Malaysian building projects as factors causing cost overrun vary with types of the construction project (Kim et al., 2017). Hence, this study focused on determining mitigation measures for each critical factors causing cost overrun in Malaysian building projects.

1.3 Research questions

Based on the problem statement, this study has come up with following research questions:

- i. What are the critical factors influencing cost overrun in building projects in Malaysia?
- ii. How to minimize the occurrence of cost overrun problem in Malaysian's building projects?
- iii. What are the most significant mitigation measures for causative factors of cost overrun in building projects?

1.4 Research aim and objectives

The aim of this study is to determine the mitigation measures for critical factors causing cost overrun in Malaysian building projects. This is expected to assist construction practitioners in coping with the factors that would lead to cost overrun problem associated with building projects. In order to accomplish this aim, the following objectives were set as follow:

- i. To identify the critical factors causing cost overrun in building projects.
- ii. To determine the mitigation measures for critical factors of cost overrun in building projects.
- iii. To determine the most significant mitigation measures for critical factors of cost overrun in building projects.

1.5 Scope of the research

The main scope of this study is limited to building projects in Peninsular Malaysia. Peninsular Malaysia includes two federal territories (Kuala Lumpur and Putrajaya) and 11 states (Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor, and Terengganu). This study used mix research method, quantitative approach was used for identifying the critical factors of cost overrun and qualitative approach was used to determine the mitigation measures for each critical cost overrun factors. Targeted respondents for data collection were contractors, clients and consultants having working experience of building projects. Contractors were selected from Construction Industry Development Board, Malaysia (CIDB) registered under the category of “buildings”. For quantitative approach, questionnaire survey was performed by mail, email, in-person and using web services. While, for qualitative approach face to face semi structured interviews were carried with construction professionals.

1.6 Significance of the research

From the results of this research, possible mitigation measures for the factors causing cost overrun in building projects in Malaysia are determined. Recommendations are formulated for improving cost performance in building projects. The results of this study can be used as a guidance to construction practitioners such clients, consultants and contractors in order to overcome the cost overrun issue in building projects.

This research is in line with the government's aim to increase productivity particularly in construction project management. According to the 11th Malaysia plan, the government strategy is to emphasize on efficient and effective project management and implementation to ensure the completion of projects within the planned time, quality and cost requirements. Thus, the results of this research would help in achieving the Malaysian Government's aim of improving productivity in the construction sector.

Minimizing cost overrun in building projects will reduce the conflicts among construction stakeholders. Controlling cost overrun will minimize the overall or final cost the building projects. Thus, the results of this research will directly benefit the building construction community and indirectly to the country economy.

1.7 Thesis layout

This study focused on determining the mitigation measures for critical factors causing cost overrun in building projects in Malaysia. The thesis for this study has been structured as follows:

Chapter 1 describes the background of the study to illustrate a distinct understanding of the problems and explaining the need for the research. Following which, the objectives, scope, and significance of the research are presented.

Chapter 2 presents the situation of building projects in Malaysia and the risk of cost overrun in building projects. This chapter is focused on reviewing published research works on the issue of cost overrun and exploring the common causes of cost overrun. Further, it highlights the studies on mitigation measures.

Chapter 3 illustrates the research plan to accomplish its objectives, to select the suitable method of data collection and various analysing approaches for data analysis.

Chapter 4 discusses the analysis of collected data including questionnaire surveys and semi structured interviews. It demonstrates the critical cost overrun factors, their mitigation measures and most significant mitigation measures for critical factors causing cost overrun in building projects.

Chapter 5 summarizes the main findings of the research. It also includes limitation and contribution of the research.



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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents a thorough literature review, it presents overall scenario of the Malaysian construction industry and problems related to it. Further, it discusses how cost overrun has become a critical problem in building construction projects. Review of studies conducted on the problem cost overrun in various countries was carried out. Further, a detailed review of the common causes of cost overrun in construction industry is performed. This review was essential for this research, as one of the objective of this study was to determine the critical factors of cost overruns in Malaysian building projects. Further, it describes review of studies on mitigation measures for cost overrun factors.

2.2 Overview of the Malaysian construction industry

The construction industry is one of the important sector in any country, as the progress of this sector is vital for increase in the national income and infrastructure development. It is among the largest sectors that generate large number of employment opportunities and a key driver for the social development of the country. Construction sector has a considerable shear in Gross Domestic Product (GDP) and Gross Domestic Capital (GDC) of any country economy.

According to Ofori (1990), the construction industry can be defined in terms of activities and products that are included in or excluded from it as shown in Figure 2.1.

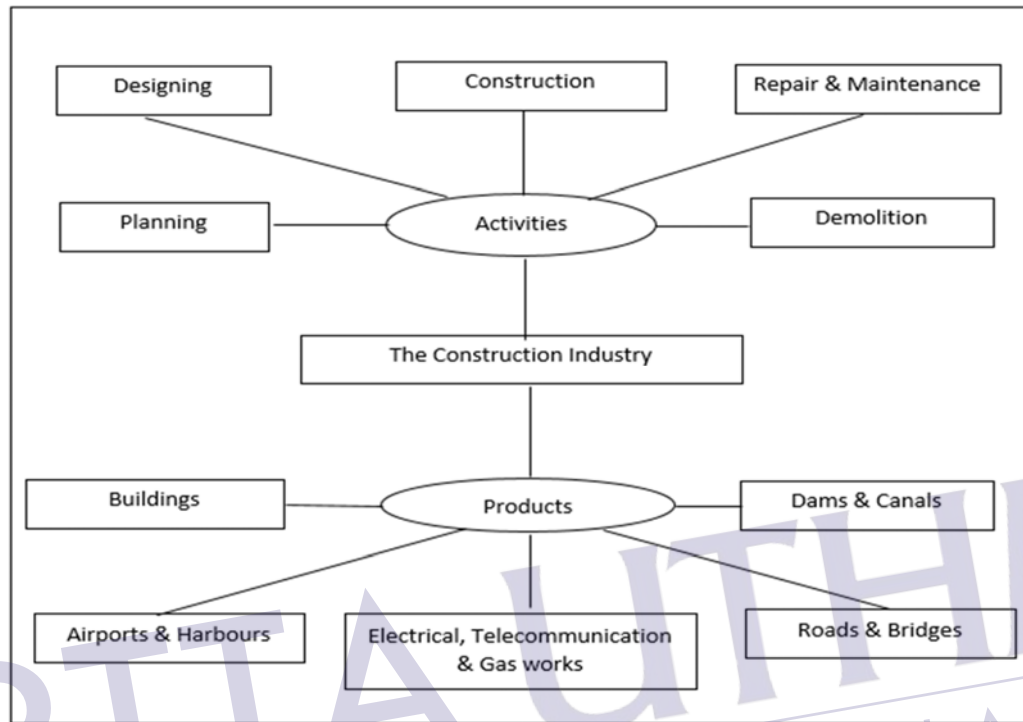


Figure 2.1: The construction industry (Ofori, 1990)

A vibrant construction industry is essential for the development plans and economic transformation program of Malaysia. Development in the Malaysian construction industry has been started since the independence of Malaysia in 1957, and it was considered as an important productive sector to develop infrastructures (Ibrahim et al., 2010). The Construction Industry Development Board (CIDB) is a regulatory body under Ministry of Works Malaysia, founded in July, 1994 to organize and regulate all activities in the construction industry and to develop the Malaysian construction industry. The construction industry provides considerable employment opportunities with a registered workforce of 1.2 million, representing 9.5% of the total workforce of Malaysia (Department of Statistics Malaysia, 2015). The Malaysian construction industry consists of thousands of registered contractors, consultants, clients, quantity surveyors, architects, labours, material and machinery suppliers, and

management staffs. The composition of the Malaysian construction industry by type of workforce is shown in Figure 2.2.

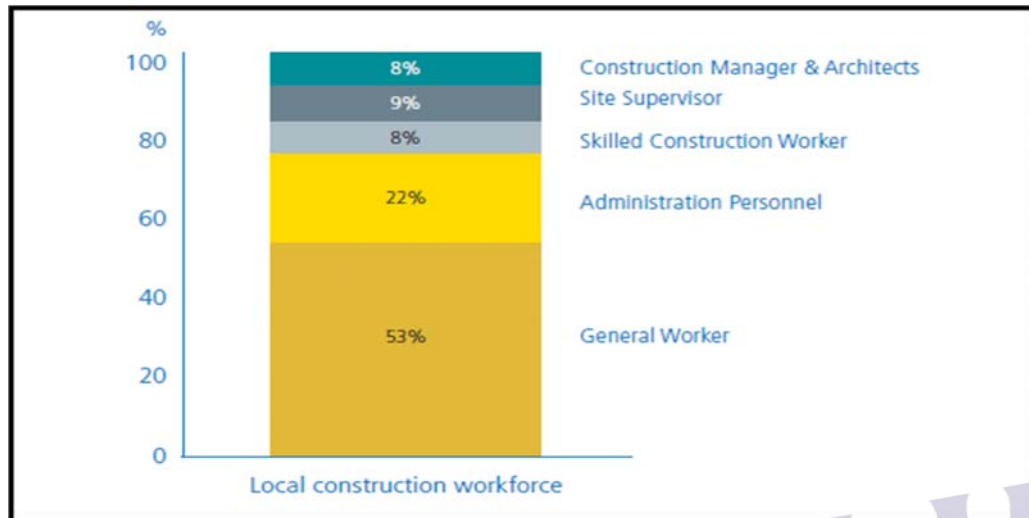


Figure 2.2: Composition of local construction workforce
(Department of Statistics Malaysia, 2015)

The construction industry of Malaysia is categorized into two sub-areas. One area is called “general construction works”, which includes works related to residential buildings, non-residential buildings, and civil engineering works. While, the second area is known as “special trade works”, which comprises of many activities like electrical works, carpentry works, metal works, tiling and flooring works, sewerage and sanitary works, painting works, and glass works in construction projects (Ibrahim et al., 2010). General construction has 95.2 percent share (non-residential buildings activity 34.8 percent, residential building 29.9 percent and civil engineering contributed 30.5 percent) and special trade works contribute 4.8 percent in all construction spending (Department of Statistics Malaysia, 2015).

Building projects share highest shear in Malaysian construction industry followed by civil engineering works and then in last special trade works. Figure 2.3 presents shear value of Malaysian construction industry by type of activities.

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