INVESTIGATING COST OVERRUN FACTORS IN CAMBODIAN CONSTRUCTION INDUSTRY USING STRUCTURAL EQUATION MODELING

THESIS

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PARAHYANGAN CATHOLIC UNIVERSITY
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HALAMAN PENGESAHAN

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DECLARATION

In the undersigned, with the following personal data:

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Do hereby declare that this thesis entitled:

"INVESTIGATING COST OVERRUN FACTORS IN CAMBODIAN CONSTRUCTION INDUSTRY USING STRUCTURAL EQUATION MODELING" has been written by me under the supervisor of Prof. Dr.-Ing.-habil Andreas Wibowo. It is the record of my own research study.

It has not been presented in any previous application for a higher degree and all sources of information are specification acknowledge using references.

Declare : Bandung, Indonesia

Date : 05 May 2018

Vith Boven

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ABSTRACT

Cambodia is a developing country, which has steadily witnessed the economic growth higher than seven percent during the last decade with the construction industry being one of the pillars for the growth. It has been generally accepted that cost overruns in the industry are commonplace in many countries and Cambodia is no exception. This study is conducted on identifying and investigating of the relationship among cost overrun factors in Cambodian construction industry using structural equation model (SEM). The factor identification was based on the relevance of relevant factors collected from previous literature to the nature of Cambodia. The quantitative research designed using questionnaire survey was conducted with experts from the perspective of contractor and consultant in Cambodia. The frequency evaluation of measured variables was input as raw data in program SPSS linking to the structural model analysis in AMOS. The final model indicated the most significant key factors are the contractor-related factors with the positive standardized coefficient and the owner-related factors with the negative coefficient. The contractor's influence contains three critical factors (1) mistake and rework during construction, (2) poor labor productivity, (3) poor site management and arrangement. The owner's influence contains (1) additional works required by owners, (2) design change and change in scope, (3) late progress payment by the owner for completed work. These findings have implications for providing knowledge to investors, project managers and other parties-related in the construction industry to beware of any critical factors that challenge to the project cost performance and avoid any flaws in the business when they involve into construction projects in Cambodia.

Keywords: Cambodia, Construction industry, Cost overrun, factor identification, Structural equation modeling

INVESTIGASI FAKTOR-FAKTOR COST OVERRUN DALAM INDUSTRI KONSTRUKSI DI KAMBOJA MENGGUNAKAN STRUCTURAL EQUATION MODELING

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ABSTRAK

Kamboja adalah negara berkembang, yang telah terus menyaksikan pertumbuhan ekonomi lebih tinggi dari tujuh persen dalam dasarwasa terakhir ini dengan industri konstruksi menjadi salah satu pilar pertumbuhan. Cost overrun sudah diterima adalah hal yang umum di industri konstruksi di banyak negari dan kecuali hal-hal itu juga ada di Kamboja. Penelitian ini dilakukan untuk mengidentifikasi dan menginvestigasi hubungan antara faktor-faktor cost overrun dalam industri konstruksi Kamboja menggunakan structural equation model (SEM). Identifikasi faktor didasarkan pada faktor yang bersangkutan dikumpulkan dari literatur sebelumnya dengan sifat Kamboja. Penelitian kuantitatif yang dirancang menggunakan survei kuesioner dilakukan dengan para ahli dari perspektif kontraktor dan konsultan di Kamboja. Evaluasi frekuensi variabel diukur adalah input sebagai data mentah dalam program SPSS yang menghubungkan ke analisis model struktural dalam AMOS. Model terakhir menunjukkan faktor kunci yang paling signifikan adalah faktor terkait kontraktor dengan koefisien standar positif dan faktor-faktor yang berhubungan dengan pemilik dengan koefisien negatif. Pengaruh kontraktor mengandung tiga faktor penting (1) kesalahan dan pengerjaan ulang selama konstruksi, (2) produktivitas kerja yang buruk, (3) manajemen dan pengaturan lokasi yang buruk. Pengaruh pemilik mengandung (1) karya tambahan yang dibutuhkan oleh pemilik, (2) perubahan desain dan perubahan ruang lingkup, (3) pembayaran kemajuan terlambat oleh pemilik untuk pekerjaan yang diselesaikan. Temuan-temuan ini memiliki implikasi untuk memberikan pengetahuan kepada investor, manajer proyek dan pihak-pihak terkait lainnya dalam industri konstruksi untuk berhati-hati terhadap faktor-faktor penting apa pun yang menantang kinerja biaya proyek dan menghindari segala kekurangan dalam bisnis ketika mereka terlibat dalam proyek konstruksi di Kamboja.

Kata kunci: Kamboja, Industri konstruksi, cost overrun, identifikasi faktor, Structural equation modeling

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Bandung, Sat, 26 May 2018

VITH BOVEN

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDIX

CHAPTER 1
INTRODUCTION

1.1 Background of study

1.1.1. Introduction

In ASEAN region community, Cambodia is a developing country which has steadily increased the economic higher than 7.0% during the last decade and newly becomes Asia's new tiger economy, according to Asian Development Bank's Asian Development Outlook 2016. Construction industry is one of the pillars which have been driving the national economic growth and development in Cambodia and also produces 19.2% increased in 2015, notably accounting for significant share with its Gross Domestic Product (GDP), (Asian Bank Development, 2016). The potential of Cambodian construction is the development of both public sectors (government projects) and private sector (private projects). After the application of win-win to end the civil war for the whole country in 1998, until now, Royal Government of Cambodia have been constructing amount of projects such as infrastructure system, transportation system, government office building, road, school building (especially in remote area), bridge, hospital, Buddhist pagoda…etc. so far, for the private sectors, there are many projects which already finished and under construction, such as high rise building, residential & condo building, hotel, shopping mall, store building invested by both local and foreign investors.

Construction activities in a country are considered one of a dynamic sector in the economy of that nation due to its strong linkage with other industries (Lewis, 2004). Anaman and Osei-Amponsah (2007) mentioned that the construction project such as building, transportation system, public and private infrastructure serve to the social needs and link to other industries by making production industry of shelters and consumer goods, renovating the city view, improving land condition, increasing national cash flow, and in particular, producing employment for the citizens.

Similarly, this industry is also an important role to play in contributing to the national economy in both developed and developing countries around the world. Unfortunately, the problem caused by the cost overrun in the construction industry is a global phenomenon and many construction projects face cost overrun problem which has involved adherently in the projects and become almost a natural part of both buildings and infrastructure projects (Rosenfeld, 2014).

Generally, a successful construction project is usually considered if it is completed within its estimating budget cost, target time and specified quality (Sambasivan & Soon, 2007). However, the construction sector generally gets suffering from the conflicts among the involved parties- related in the projects, inappropriate practices and also from the systematic waste of time, resource and budgets (Rosenfeld, 2014). Cost escalation is still an anxiety as the global phenomenon and so far cost estimated also have not been improved. Furthermore, this issue has also not decreased for over 70 years in the construction industry around the world (Flyvbjerg, Skamris & buhl, 2004). Therefore, the overrun or

escalation would appear when a construction project fails in showing a good cost performance and effective in cost management during the project's lifecycle.

In some developed countries, the result of cost overruns is almost more serious and could sometimes over than 100% of the initial anticipated budget for the project (Angelo & Reina 2002). It would happen if there are several uncovered factors and problems affecting to the cost performance in the project (Rahman, Mernon & Karim, 2012).

The cost overrun factors can influence on the budget during construction process, especially in conception and design phases. This challenge was carefully studied and investigated by many cost-estimating practices of the contractors (Cheung, Wong & Skitmore, 2008). Elasewhere, the factors influencing to cost performance of the primary estimate, have been widely published in different locations and they also relate dependently to the project complexity, uncertain of work scope, up-to-date technology requirements as well as the team workers requirement (Akintoye, 200).

Noteworthy, the relationship between additional cost and time are almost the common problem and significantly associated with each other. Cost and time have a cohesive correlation in the construction industry in accordance with both the reality of practice at the site and theoretical research study. Schedule delays usually can cause the overhead on estimated budget. There are about 161 construction projects in Korea facing with the total cost of overrun about $11,986 million and delay of schedule was one of the major causes to produce the overhead budget (Lee, 2008).

In some cases of miscommunication between contractors, subcontractors, owners and other parties-related are likely as the main thing leading to project delay. However, in many previous occurrences, imprecise estimation of time and budget for the project is the reason to make the construction delayed (Enshassi, Al-Najjar & Kumaraswamy, 2009). Generally, in the normal practice, when a project gets delay due to any problems happened, then it will automatically extend the schedule as well as require to accelerate work. Finally, the additional cost is then included into the budget in terms of the contract. The contractual project cost contains two budgets that are the cost for implementation and another cost for contingency.

As global academic studies, there are many previous studies about the cost overruns in the construction industry for over the world, because it is one of critical topics for the sector. In the United stated, Shane (2009) studied on construction project focused cost escalation factors. He mentioned about the budget overruns in the US construction projects in both public and private side for over historical years. As result, he found that approximately 50% of active large transportation projects have met the overruns above their anticipated budget (Shane, Molenaar, Anderson & Schexnayder, 2009).

Furthermore, many construction managers challenge with many critical problems. One of those issues is inefficient cost control procedures, remarkable in the developing region. As an evidence, cost overruns have been becoming an anxiety concern to the investors and construction companies in Thailand construction industry in the late of 1990s (Roachanakanan, 2005). In a case study of his research on the cost overruns in a condominium project in Bangkok, incomplete drawing and design changes come from owner, contractor and

construction procedure were found as the factors leading to the project cost overrun, and he also gave the recommendation to reduce the problems as well as to improve the construction management system for the future execution.

In the last few years, a study on the large construction project in the southern part of Malaysia was conducted. The project has been faced with the cost overruns in average about 5% to 10% of the contract sum with 35 commons factors response from clients, contractor, and consultant (Memon, Rahman & Aziz, 2012). In Indonesia, Kaming (1997) have studied on the cause influencing to the time and cost overrun in high-rise construction building in Jakarta and Yogyakarta and many variables factor impacted were found which undertaken with the project managers who work in the project. Even the research focus to Indonesian constructions but so far the findings are also handled to research study for others countries which face to similar problems, especially for the industry in developing countries (Kaming, Olomoyaiye, Holt & Harris, 1997).

1.1.2. General of cost overrun

Cost overrun in a construction can be another called and also known as “cost increase”, “cost escalation”, “budget overrun”. Cost Overrun refers to the budget required for the work in the real payment which over and above the initial estimated cost amount (Zhu & Lin, 2004).

In the normal practice, the overhead budget can be investigated by comparing the actual total costs of work requirement exceed the previously estimated value. The degree of cost overrun in percentage is possibly determined

by the change of contract amount divided by the original contract award amount (Jackson, 1999).

The contingency or unforeseen expenses is also a significant path of additional budgets in the project. Actually, the unexpected expenditures are expected additional expenditures which necessary include in the bill of quantities (BOQ) as a safeguard during the tender stage of the project with the owner (Rosenfeld, 2014). In the most of construction projects, especially in the large projects, construction management consultant is a very important role to play in the estimating of construction costs, construction planning and scheduling as well as the various techniques of implementing at the site to complete all activities of the projects.

Usually, even though the cost overruns and time overruns are unavoidable in the project but the possibility of either avoidable is also available. Like the overruns occurred by the problems of design plan or project management are actually escapable because they could have reasonably been foreseen and prevented. Nevertheless, there are some unavoidable costs such as those due to unanticipated events which cannot reasonably be prevented. Cost overruns may add value to projects when extra work is done with the intention of producing a better output. Overruns may also add value when they involve work that was omitted from design plans but clearly needed to be done. However, some overruns may not add value and represent wasted money if they do not result in a better product (Yogini & Pankai, 2016).

1.2. Problem identification

The successful implementation of construction projects within estimated costs and prescribed schedule requires the sound strategies, good practices, and careful decision. Many projects experienced the additional cost which significantly affects the owners, contractor, and consultant (Enshassi, Al-Najjar & Kumaraswamy, 2009). In many cases, project cost overruns and delays are the most common problems causing an extending schedule in the construction industry for both developed and developing counties (Enchase, 2009). A nine of ten projects have faced with the cost overruns in 258 companies across 20 countries and 5 continents around the world (Flyvbjerg, Skamris & buhl, 2004).

Memon (2013) has reported that the issue of cost overruns has become a serious concern to the contractors, owners, particularly, for the investors in Malaysia. It requires more additional researchers seeking a better continuous solution to solve this problem as long as it still appears. The addition to the mentioned recommendation, the practitioners, and academic people should conduct more research on the issues of project cost performance in Malaysia (Toh, Ali & Aliagha, 2011).

So far, there were many previous studies in many countries on the cost escalation by both local intellectuals as well as the international researchers and experts, majoring in construction engineering and management. Many professional articles have shown that some researchers focused on quantifying the factors (Jomah & Ensashi 2008; Flyvbjerg, 2004; Lee, 2008), some authors seek for the prevention of the factors (Assaf, 1995; Kumaraswamy, 1998) and some studied focus on controlling and planning the factors (Lo, 2007; Zhao, 2008).

The finding in some ASEAN countries revealed that the cost overruns involve inherently in the construction industry, for example, a study entitled on cost overruns in high-rise projects in Indonesia (Kaming, Olomoyaiye, Holt & Harris, 1997), a case study of cost overruns in a Thai condominium project in Bangkok, Thailand (Roachanakanan, 2005), a study of delay and cost overruns in Vietnam (Hoai, Dai Lee & Yong Lee, 2008) and finally, a study on structural modeling of cost overrun factors in Malaysia (Memon & Rahman, 2013).

The challenge in cost performance is highlighted as the main issue throughout the project lifecycle. Project cost can be considered as one of the most important options leading failure to a project if there is no an appropriate consideration to take into account. Several issues of cost overruns are still attracted by many researchers, experts for over decades and they are either an interesting topic for the research study (Mahmid, 2012).

Facing the rapid growth of construction projects in Cambodia, many projects, construction companies are actually facing the problems caused by the cost overrun so far. Yet that nevertheless those issues are not yet compiled and studied as a lesson for the people working at the real site and the knowledge for the future development of construction in Cambodia. Likewise, a publication of the council for the development of Cambodia (CDC) has reported that there are 2 principle challenges in Cambodian construction industry, the first one is poor cost while the second one is schedule performance (Durdyev, Omarov & Ismail, 2017). Therefore, facing the global competition, in the ASEAN region community, in particular, a study of cost overruns in Cambodian construction projects should be conducted. The investigation of cost overrun factors will aim to the investors,

project managers and other parties-related to avoid any failure or flaws in the business as well as making a careful decision when they involve into a construction project.

The purpose of this study is to identify and investigate the major factors which contribute to cost overruns in Cambodian construction projects via the Structural Equation Model (SEM). Evaluation of the frequency of selected factors from the perception of respondents being contractors and consultants is very useful data for the analysis. Then, the structural model is used to represent and explore the correlation between the latent variables and, also their impact on the cost overruns in Cambodia.

1.3. Research questions

1. What are the significant causes leading cost overruns for construction projects in Cambodia?
2. How is the statistical relationship between variable cost overrun factors of the construction project in Cambodia by using structural equation model?
3. What is the difference between the dominated factors in Cambodian construction industry and the ASEAN countries especially Indonesia and also other selected countries?

1.4. Aim and Objective of the study

1. Investigating and identifying the factors caused by cost overruns from previous literature regarded to the situation of construction projects in Cambodia.
2. Developing a correlation modeling of cost overrun factors in Cambodian construction projects with the method of Structural Equation Modelling (SEM) and using the frequency evaluation of occurrence of the cost overrun variables as the sample data.
3. Exploring the significant key factors influencing to cost overruns and their statistical relationship in AMOS version 20.00.
4. Comparing the significant factors found in the research study with the other selected countries, especially with ASEAN countries.

1.5. Scope and delimitation of the study

This study focuses on ranking and analyzing the factors of cost overrun in Cambodian construction industry. The form of structural equation modeling is used to show relationship statically between the factors in function with the overhead budget. From the beginning until the end of the study in this thesis, a certain scope is required to set a clear plan as well as a certain work required for processing the research. The specific scopes of this study are conducted as following tasks:

1. **Task 1** is about determining and compiling the causal factors leading to additional overhead budget in the construction projects regarded with the local circumstances of Cambodian construction situation. The relevant

causes are devoted from previous studies of other researchers, in particular, in the regional research studies in ASEAN countries.

2. **Task 2** is to design a questionnaire of selected factors for doing quantitative data collection. The arranged questionnaire form are respectively spread to the respondents who have many years of experience executing with project cost performance and management in Cambodia. The characteristic of respondents are the professional engineers from Contractor and Consultant Company.
3. **Task 3** is to develop a multi-correlation equation model in term of the statistical concept by using Structural Modelling Equation to explore the relationship statically among various factors. The statistical computer aid program SPSS will be used to analyze the collected data.
4. **Task 4** is to discuss the finding result and compare the situation in Cambodia with other selected countries, especially with the regional countries of ASEAN.
5. **Task 5** is to make a conclusion, recommendation and provide a recommendation for the future research study in order to improve construction situation from project cost overruns.

1.6. Thesis Organization

The brief overview of important outline for this thesis is mainly devoted as follows

Chapter 1 of study begins by presenting the Introduction which includes the background of study on Cost Overrun, Problem identification, Research questions as well as Aim and objective of the study.

Chapter 2, the literature review, discuss on relevant study associated with the problem addressed on the cost overrun by other authors, literature, and theory which required for the calculation in the methodology step.

Chapter 3 presents the research methodology and procedures used for data collection from Cambodian construction projects.

Chapter 4 contains the analysis of collected data, discussion, and presentation of the results.

Chapter 5 offers a summary and discussion of the research's findings, implications for practice, and recommendations for future research.