

VARIATION AND ITS VALUATION IN DESIGN-BUILD CONTRACT WITH  
REGARD TO THE PUBLIC SECTOR OF MALAYSIA

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A project report submitted in partial fulfilment of  
the requirements for the award of the degree of  
Master of Science (Construction Contract Management)

Faculty of Built Environment and Surveying  
Universiti Teknologi Malaysia

JULY 2022

## **DEDICATION**

This work is dedicated to my beloved parents, family and friends,  
whose prayers helped me become the person I am today.  
I cannot thank you all enough for always being by my side.

## **ACKNOWLEDGEMENT**

First and foremost, I am deeply grateful to Allah SWT, my Creator, who has been the source of my strength, and I have only made it with His blessings. I would like to express my highest gratitude to my supervisor, Sr Dr. Norazam bin Othman for his invaluable guidance, continuous support and patience throughout this study. In the absence of his contributions, this study would not be possible.

A special thanks to Dr. Norhazren Izatie binti Mohd, my second reader, for her insightful comments and suggestions on this project report. I would also like to thank Dr. Hamizah Liyana binti Tajul Ariffin for all of her efforts in ensuring that the entire Construction Contract Management programme worked well. It is indeed worth mentioning how grateful I am to all of the other lecturers in the Construction Contract Management programme for their time and effort.

My gratitude extends to Jabatan Perkhidmatan Awam and Jabatan Kerja Raya for the opportunity to undertake my study at Universiti Teknologi Malaysia. Next, my appreciation goes to my parents, whose good examples have inspired me to work hard for what I want to achieve. I also appreciate the endless support I have had from the rest of my family, friends and colleagues, who have encouraged me along the journey and assured that I give it my all to finish what I have begun.

## **ABSTRACT**

Previous studies have shown that using a design-build approach may help keep costs down and avoid or significantly reduce the number of variation orders required. Despite this, there is always the possibility for variation to occur. According to the Auditor-General's Report 2018, several design-build projects expended an additional 20% of the contract sum due to variations and changes to the original scope of work. As a result, project costs and timelines can easily balloon out of control without adequate management. This study was carried out to identify the leading causes contributing to variations, as well as the method for valuing such variations. It focused specifically on design-build projects undertaken by public sector organisations. A total of 10 projects for building and civil engineering works completed between 2011 and 2021 using PWD Form DB 2010 were selected. The primary data were collected through semi-structured interviews with eight senior engineers and senior quantity surveyors involved in the variation administration of the selected case studies. Subsequently, a document study was undertaken to supplement the data collected during interviews. Findings indicate five causes of variation, with changes in the scope of work by the end user being the most common. These employer-related changes are most likely to occur as a result of ambiguity in the Government's Requirements. Finding out the main causes of variation might aid contract administrators in initiating proactive measures for future design-build public projects to minimise the negative impact on cost and time. Besides that, this study discovered that four methods for valuing variation were used in the selected case studies. Variation can be valued using either Contract Sum Analysis, Contract Schedule of Rates, a fair valuation, or a daywork basis. The suitability and appropriateness of the method for valuing variation varies depending on the conditions in which the obligations and types of work are to be performed. This study would serve as the best practice recommendations for administering variation work in design-build projects, which differ from the conventional projects that most contract administrators are familiar with.

## ABSTRAK

Kajian terdahulu telah menunjukkan bahawa pelaksanaan projek secara reka-bina boleh membantu mengurangkan kos dan bilangan perubahan kerja dengan ketara. Walaupun begitu, terdapat kemungkinan untuk perubahan kerja berlaku. Menurut Laporan Ketua Audit Negara 2018, beberapa projek reka-bina membelanjakan tambahan sebanyak 20% daripada jumlah kontrak disebabkan oleh perubahan pada skop kerja asal. Akibatnya, kos projek dan tempoh pembinaan boleh hilang kawalan dengan mudah tanpa pengurusan yang sewajarnya. Kajian ini dijalankan untuk mengenal pasti punca utama yang menyumbang kepada perubahan kerja, serta kaedah untuk menilai perubahan kerja tersebut. Ia tertumpu kepada projek reka-bina yang dilaksanakan oleh organisasi sektor awam. Sebanyak 10 projek bagi kerja-kerja bangunan dan kejuruteraan awam yang disiapkan antara 2011 dan 2021 menggunakan Borang Kontrak JKR DB 2010 telah dipilih. Data primer dikumpul melalui temu bual separa berstruktur dengan lapan jurutera dan juruukur bahan yang menguruskan perubahan kerja dalam kajian kes yang dipilih. Seterusnya, kajian dokumen telah dijalankan untuk melengkapkan data yang dikumpul semasa temu bual. Penemuan menunjukkan terdapat lima punca perubahan kerja, di mana perubahan dalam skop kerja oleh pengguna akhir adalah yang paling kerap berlaku. Perubahan berpunca daripada pihak majikan ini berkemungkinan besar berlaku akibat kekaburan dalam Penyata Kehendak Kerajaan. Mengenal pasti punca utama berlakunya perubahan kerja boleh membantu pentadbir kontrak dalam mengambil langkah proaktif untuk meminimumkan kesan negatif ke atas kos dan masa bagi projek reka-bina di sektor awam pada masa akan datang. Selain itu, kajian ini mendapati bahawa empat kaedah untuk menilai perubahan kerja telah digunakan dalam kajian kes yang dipilih. Perubahan kerja boleh dinilai menggunakan sama ada kadar harga kontrak, Jadual Kadar Harga, penilaian saksama atau berasaskan kadar kerja harian. Kesesuaian dan ketepatan kaedah untuk menilai perubahan kerja berbeza-beza bergantung pada keadaan di mana kewajipan dan jenis kerja perlu dilaksanakan. Kajian ini akan berfungsi sebagai cadangan amalan terbaik untuk mentadbir perubahan kerja dalam projek reka-bina, di mana ia berbeza daripada projek konvensional yang menjadi kelaziman bagi kebanyakan pentadbir kontrak.

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## LIST OF ABBREVIATIONS

BQ	-	Bill of quantities
JKR	-	Jabatan Kerja Raya
PWD	-	Public Works Department
P.D	-	Project Director
SKALA	-	<i>Sistem Kawal dan Lapor</i>
SOP	-	Standard operating procedures
UTM	-	Universiti Teknologi Malaysia
VO	-	Variation order
BIM	-	Building Information Modelling

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

Design-build is a procurement method that provides a single point of responsibility for the design and construction of the project, where the selected contractor is solely liable for the whole project execution (Putro & Latief, 2020). Previously, the majority of building projects in Malaysia were procured using a conventional method in which the design and construction stages were separated. The employer appoints a consultant team consisting of an architect, engineer and quantity surveyor to provide feasibility study, detailed designs and specifications, and contract documentation. Following that, a contractor is appointed to construct the works. Construction projects in Malaysia have become increasingly complex in recent years, necessitating a larger focus on management and engineering expertise. The design-build procurement approach provides an alternative to the traditional project delivery method that has been widely adopted, particularly in the public sector.

Generally, a construction project goes through several phases, including planning, architectural and engineering designs, cost estimation, bidding, contracting and execution of construction work. Many decisions must be taken throughout these phases based on inadequate information, assumptions and the personal experience of construction professionals. Regardless of the project's scope or the construction processes' size, they all have one thing in common: variation. Variations are highly prevalent and likely to occur at any point in the construction process.



Variations are unavoidable in every construction project due to their complexity. It is almost impossible to complete the project without making changes to the design, scope of work, specification or the construction process itself. Projects constructed using the conventional method frequently experience variations during the construction phase. Significant variations lengthen the construction period. The cost incurred by the employer substantially increases as a consequence of variations, which may lead to loss and expense claims, as well as the extension of time. In comparison to the conventional method, having a single point responsibility allows the employer to expect fewer variations, shorter completion time, higher profit and a final product that is fit for purpose in a design-build project (Saaidin, Endut, Abu Samah & Mohd Ridzuan, 2016).

In 1996, the Public Works Department (PWD) formed a technical contract committee to develop a standard form of contract for design-build projects, which included representatives from the Ministry of Finance, Ministry of Works, the Attorney General's Chambers, the PWD, the Department of Irrigation and Drainage, and Kuala Lumpur City Hall. The committee meeting resulted in the formation of the PWD Form DB/T Edition 2002, which was later revised to PWD Form DB 2007. Following another amendment, the most recent PWD Form DB 2010 was formed and is still in use today. All government ministries and agencies utilise PWD Form DB 2010 for project execution using the design-build approach.

According to Singh and Kandan (2004), the majority of standard form of contract commonly have explicit provisions pointing out contractual requirements, including the right of the employer to make a variation to the contract. This is done in order to prevent the difficulty of having to re-negotiate a contract as a result of a change in the scope of work. To enable for such changes to be made, as well as any subsequent changes to the contract sum, the variation provisions are included. A contractor is expected to carry out the works in the manner originally stipulated in the contract unless a variation is specifically requested. Otherwise, the contractor would be in breach of contract.

Variation provisions are incorporated in the majority of construction contracts, even if the contract is a lump sum, such as a design-build contract. Such provisions provide flexibility to the regulations that govern the parties' obligations under construction contracts. Under these provisions, the employer has the unilateral power to vary the work, and the contractor is obligated to carry out the changes that have been ordered. Commonly, the contract administrator is given the authority to issue variation instructions. They are usually appointed by the employer to do so on the employer's behalf. In the absence of a variation provision, the employer cannot change any agreed-upon works, and the contractor cannot be obligated to execute additional works. Any changes to the scope of the works would have to be mutually agreed by the parties in a written supplemental agreement to the original contract.

Clause 23 of PWD Form DB 2010 explains the definition and conditions relevant to variations, whereas Clause 24 specifies the basis for valuation of variations. Variation in design-build contract is permitted only when the Project Director (P.D) authorises changes to Government's Requirements. If a change to the contractor's proposed design is essential for the purpose of functionality, suitability and safety of the work, it is not considered a variation that must be borne by the Government. As a result, if the variation incurs additional cost, the contractor must bear those cost. However, if the variation results in cost savings, the savings must be deducted from the contract sum.

## **1.2 Problem Statement**

Despite its increased demand among industry participants and recognition as being advantageous to all parties, including employer, contractor and consultant, the design-build contract is not without drawbacks. This method did not completely deliver its expectations when it was implemented. The roles and responsibilities of the parties to a design-build contract differ from those of the conventional procurement

method. Rashid (2002) stated that a design-build contract provides cost certainty throughout the construction process as long as the employer's requirements are well described, and variations are avoided. Due to unanticipated variations, the design-build project may still have cost overruns, schedule delays, and poor quality (Aminudin, 2011).

Theoretically, the design-build contract allows relatively limited scope for variations and changes since the contractor is solely liable for design. However, a study conducted by Mohd Sarman, Mazlan and Abd. Latiff (2008) revealed that 36 of 50 design-build projects in the public and private sectors experienced variations as a result of unclear or imprecise employer's requirements during the tender stage and requests for changes by the employer during the construction stage. Azizan and Ibrahim (2015) found that variations caused by employer-related changes are the highest risk that has happened in most design-build projects owing to misconception among the parties and changes occurring in unforeseen situations. According to Saaidin, Endut, Abu Samah and Mohd Ridzuan (2016), the failure of the employer to set definite design criteria and explicitly specify those requirements in the employer's requirements would result in variation and additional cost.

Treasury Instructions 202 specify that any matters pertaining to variations to the original contract that exceed 30% of the contract sum are under the Treasury's jurisdictions in order to effectively manage such variations in public projects. Despite this, according to the Auditor-General's Report 2018, several design-build projects expended an additional 20% of the contract sum due to variations and changes to the original scope of work. However, the report did not provide any justifications for the occurrence of such variations. Variations may be mitigated if the underlying causes are identified. Although variation orders may involve omission work which lead to a savings for the employer, the majority of variation orders result in additional work that causes the employer to suffer monetary loss (Suratkon, Yunus & Deraman, 2020).

The presence of a variation provision in design-build contract does not give the employer carte blanche to make large-scale or significant changes to the scope of the works. The employer may mistakenly believe that the variation orders issued to the contractor are limitless. According to Mohd. Majid (2009), any variation orders must be within the initial scope of work, however there is always conflict among parties as to how far the contract administrator is empowered to issue variation orders in the context of the Government's Requirements under Clause 23 of PWD Form DB 2010. While it is commonly specified in contracts that variations would not void the contract, determining the bounds of the limitation may be challenging (Singh, Salleh & Lim, 2019).

The Court concluded in *Goh Eng Lee Andy v Yeo Jin Kow* that the important feature of a design-build contract is that it operates as a lump sum contract. Because the obligations of design and construction are integrated and principally entrusted to the contractor in a package deal, design-build contracts are also classified as lump sum. As a result of this consideration, the way of valuing variations is a typical issue since it is difficult to quantify. The Contract Sum Analysis or Contract Schedule of Rates does not provide enough details to value the variations as a bill of quantities (BQ) does, unless the design at tender stage was highly developed (Wall, 1994; Ismail, 2010). The approaches for valuing variation are based on the circumstances that may lead to disagreement among the parties, particularly where fair valuation is involved (Mohmad Zainordin, Abd Rahman, Sahamir & Mohd Khalid, 2019).

The variation provisions are typically drafted in broad terms that appear to be all-inclusive. Based on a study by Mohayidin (2014), although the descriptions are clear, it is difficult to ascertain if it is variation or new work, and it is unclear from the scope of these provisions how substantial a change may be and still be binding. As a result, variation clauses frequently cause conflict. It is necessary to have a thorough understanding of the valuation rules while performing the process of valuing variation works so that the variation works may be valued appropriately and in accordance with the contract.

Consequently, as the degree of complexity of design-build projects rises over time, variations would become an issue that should not be disregarded among project stakeholders. The foregoing discussion will highlight several pertinent issues that may be beneficial to the public sector, which are:

- (i) Despite the fact that the design-build contract is supposed to have less allowances for variations than the conventional contract, what are the causes of variations in the design-build contract?
- (ii) Based on case studies of previous design-build projects, how are variation works being valued?

### **1.3 Research Objectives**

This study aims to investigate the issue of variation in design-build projects undertaken by the public sector, which would include:

- (i) To identify the causes of variation in the design-build contract
- (ii) To identify the method for valuation of variation in the design-build contract

### **1.4 Scope of Study**

The scope of this study will be limited to the following areas:

- (i) Focus on the design-build projects in the public sector;

- (ii) Concentrate on the parameters of projects completed between 2011 and 2021, and use the most recent version design-build contract, PWD Form DB 2010;
- (iii) Limit to the nature of the design-build approach as governed by the standard form of contract PWD Form DB 2010, regardless of the types of work, whether building works or civil engineering works; and
- (iv) The respondents will be the engineers and quantity surveyors from the public sector who were directly involved in the variation administration of the selected design-build projects.

## **1.5 Significance of Study**

This study will be beneficial in identifying the main causes that contribute to variation, assisting contract administrators in evaluating and taking proactive measures to reduce the negative impact on cost and time for prospective design-build projects. Identifying the causes that contribute to variations serves as the foundation for solving such issues before they become a serious problem.

Since there is no standardise approach for valuation of variation for design-build projects, this study could provide contract administrators in the public sector with a better understanding of the method for valuing variation, which differs from the conventional project that most of them are familiar with. The outcome from this study would serve as the guidelines for the best practice in administering the variation work in design-build projects.

The technical contract committee, led by the PWD, is drafting the most recent standard form of contract for design-build projects. Perhaps the findings of this study will provide useful feedback on variation clauses in existing Design-Build Contract PWD Form DB 2010, allowing those provisions to be appropriately structured in the upcoming form of contract to safeguard the interests of contracting parties.

## **1.6 Research Methodology**

The research methodology for this study is divided into four stages: preliminary study, data collection, data analysis and finally conclusion and recommendations. The following is a brief overview of the research methodology for this study, and Figure 1.1 illustrates the flowchart of the entire process.

### **1.6.1 Stage One: Preliminary Study**

The problem statement emerges from extensive reading of published materials, such as electronic books and printed books, newspapers, journals, articles, conference papers, thesis, reports and case law, all of which are freely accessible through the UTM library database and other platforms. The objectives and scope of this study have been identified based on the problem statement.

### **1.6.2 Stage Two: Data Collection**

10 projects around Malaysia that carried out by the public sector will be selected. The main source of the data collection for this study is by conducting the semi-structured interviews with engineers and quantity surveyors who were directly

involved in the variation administration of the selected projects. To supplement the information gathered from the respondents, a document study of contract document, standard form for variation administration such as *Kelulusan Perubahan Kerja*, *Arahan Perubahan Kerja* and *Pelarasan Harga Kontrak*, final account, minutes of meetings, *Sistem Kawal dan Laporan* (SKALA) and other related documents will be conducted in order to extract information such as project details, instructions of variation, total variation cost and calculation for variation works.

### **1.6.3 Stage Three: Data Analysis**

All of the data obtained in the second stage will be analysed qualitatively before being presented in statistical form and discussion.

### **1.6.4 Stage Four: Conclusion and Recommendation**

In the final stage, the entire process of this study will be critically assessed to determine whether both research objectives have been met. The outcomes of the third stage analysis are utilised to formulate conclusion and recommendation.



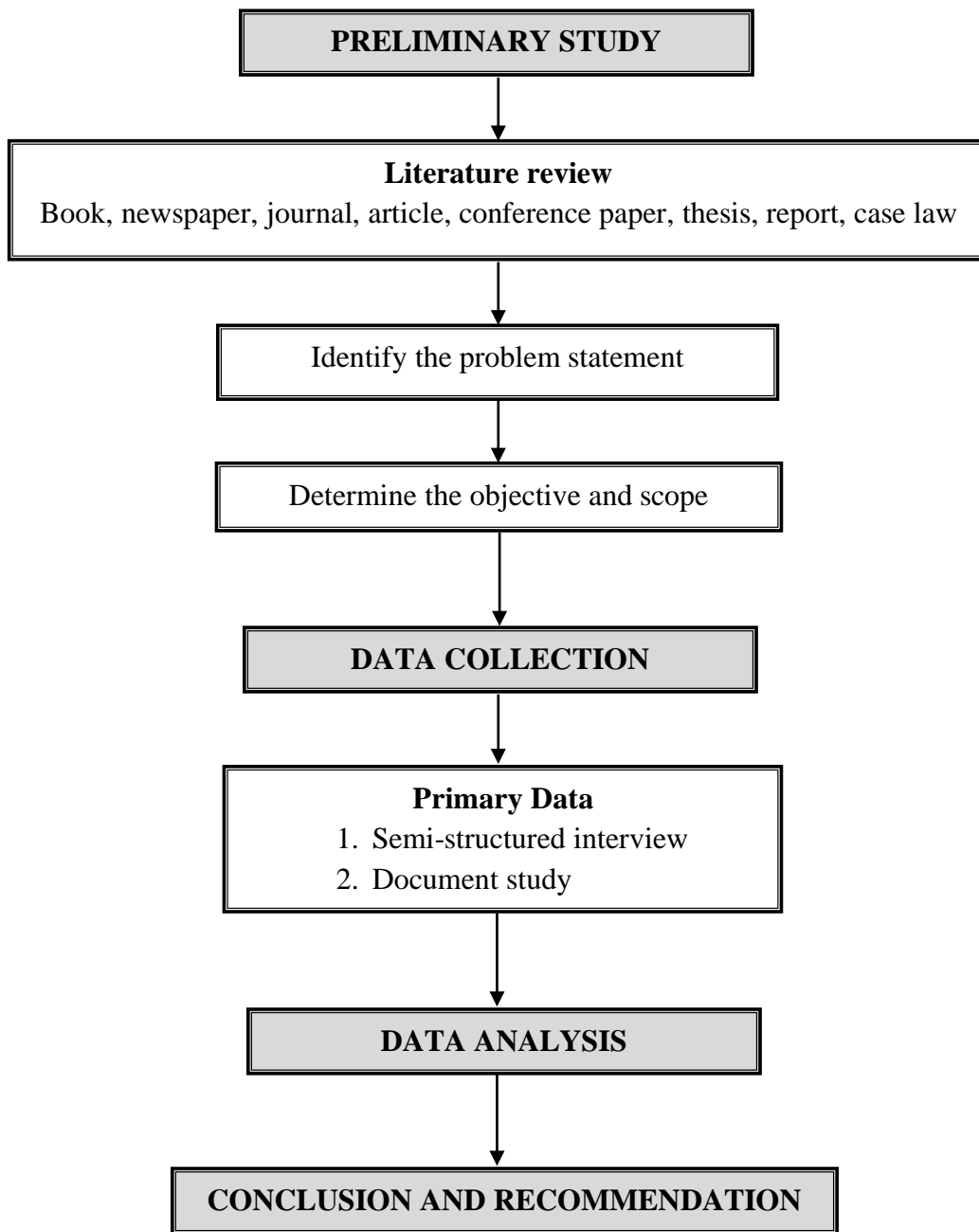


Figure 1.1 Flowchart of research methodology

## **1.7 Organisation of Thesis**

There are five chapters in this thesis. The following is a brief overview of each chapter:

### **(a) Chapter One: Introduction**

This chapter provides an introduction to the research, containing the background of study, problem statement, research objectives, scope of study, significance of study, research methodology and organisation of thesis.

### **(b) Chapter Two: Literature Review**

This chapter presents a literature review on the variation in design-build contracts in Malaysia's public sector. The explanation will be based on the findings of other researchers published in a variety of electronic books and printed books, newspapers, journals, articles, conference papers, thesis, reports and case law. Chapter Two will be divided into two parts. First, this chapter will go through the overview of the design-build concept, including background, definitions, features, stages of the design-build process and design-build contract elements. Next, the second part of this chapter presents the overview of variation aspect, which includes definition and terminology of variation. It then goes on to describe the contractual provisions for variation and valuation of variation under PWD Form DB 2010. Issues on variation administration relating to design-build contract will also be discussed based on current case law.

**(c) Chapter Three: Research Methodology**

This chapter will contain all the information required to achieve the research objectives. The research methodology used in this study will be discussed, along with an explanation of the rationale behind the selection of approach for data collection and analysis. This chapter will also emphasise the limitations of the study, which may have an impact on the research's findings.

**(d) Chapter Four: Data Analysis and Discussion**

This chapter will focus on data analysis and will analyse the findings of this study. The semi-structured interviews with engineers and quantity surveyors who were directly involved in the variation administration of the selected projects will provide all of the primary data. The finding of causes that contribute to variation in design-build public projects will be analysed. Aside from that, the method for valuing variation in design-build public projects will be identified and critically discussed. A document study of contract document, standard form for variation administration such as *Kelulusan Perubahan Kerja*, *Arahan Perubahan Kerja* and *Pelarasan Harga Kontrak*, final account, minutes of meetings, SKALA and other related documents will be done to extract information such as project details, instructions of variation, total variation cost and calculation for variation works in order to supplement the information gathered from respondents.

**(e) Chapter Five: Conclusion and Recommendation**

In Chapter Five, relevant conclusions will be drawn from the findings in relation to the research objectives. It will also provide recommendations for future studies.

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