IMPROVING CONTRACTORS' PRACTICES OF INDUSTRIALISED BUILDING SYSTEM (IBS) IMPLEMENTATION IN CONSTRUCTION INDUSTRY

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DEDICATION

Thank you, Allah, for always being there for me. This thesis is dedicated to my family and my friends who stand behind me in the hard times. To all hands that helped to stand again whenever I fell down and to all who gave me love.

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ABSTRACT

Malaysian construction industry plays an important role in creating wealth for the country as developing social, economic and infrastructure. The government has adopted industrialised building systems (IBS) since the 1960s and has made significant efforts in this area. It aims to achieve several improvements within the industry, such as higher productivity levels and better quality construction products. The main reason for delay the completion of construction projects was due to poor practice of contractors. Lack of experience, financial problems, lack of technical knowledge and lack of skilled labour are very important barriers to successful IBS implementation. The objectives of this research were to investigate current contractors' practices of IBS implementation in construction industry, to identify influencing factors for contractors' practices of IBS implementation in construction projects and to recommend ways to improve contractors' practices of IBS implementation in construction industry. The research was take place in Johor Bahru the capital of Johor state where various development and construction activities are currently on going. Quantitative method was used by distribution of questionnaire that is designed based on the research objectives, data collected was analysed using the Statistical Package for the Social Science 22.0 software to carry out the research aims. Target respondents were the construction industry player, namely Grade 7 (G7) contractors. Contractors G7 was chosen because they are the main contractor with unlimited tendering abilities and they are involved with wide practice of IBS adaption. The study reveals that there are some problems faced by contractors in their practices of IBS implementation such as low productivity, management aspects and financial problems. Therefore, training to labour, IBS instruction guideline and improving finance and procurement mechanism is the top recommended factors to improve contractors' practices of IBS implementation for more IBS adaption success.

ABSTRAK

Industri pembinaan Malaysia memainkan peranan penting dalam mewujudkan kekayaan untuk negara sebagai membangunkan sosial, ekonomi dan infrastruktur. Kerajaan telah mengguna pakai sistem bangunan perindustrian (IBS) sejak tahun 1960-an dan telah membuat usaha yang ketara di kawasan ini. Ia bertujuan untuk mencapai beberapa penambahbaikan dalam industri, seperti tahap produktiviti yang lebih tinggi dan produk pembinaan yang berkualiti tinggi. Sebab utama untuk menangguhkan penyiapan projek pembinaan adalah disebabkan oleh amalan yang tidak memuaskan oleh para kontraktor. Kurangnya pengalaman, masalah kewangan, kurang pengetahuan teknikal dan kurang tenaga kerja mahir adalah halangan yang sangat penting dalam pelaksanaan IBS yang berjaya. Objektif penyelidikan ini adalah untuk menyiasat amalan kontraktor semasa pelaksanaan IBS dalam industri pembinaan, untuk mengenal pasti faktor mempengaruhi amalan kontraktor pelaksanaan IBS dalam projek pembinaan dan untuk mencadangkan cara untuk meningkatkan amalan kontraktor pelaksanaan IBS dalam industri pembinaan. Penyelidikan ini dijalankan di Johor Bahru, ibu negeri Johor di mana pelbagai aktiviti pembangunan dan pembinaan sedang dijalankan. Kaedah kuantitatif digunakan dengan pengedaran soal selidik yang direka berdasarkan objektif penyelidikan, data yang dikumpulkan dianalisis dengan menggunakan Perisian Statistik untuk perisian Sains Sosial 22.0 untuk menjalankan penyelidikan. Responden sasaran adalah pemain industri pembinaan, iaitu kontraktor Gred 7 (G7). Kontraktor G7 telah dipilih kerana mereka adalah kontraktor utama dengan kebolehan tender tanpa had dan mereka terlibat dengan amalan luas IBS adaption. Kajian ini mendedahkan bahawa terdapat beberapa masalah yang dihadapi oleh kontraktor dalam amalan pelaksanaan IBS seperti produktiviti yang rendah, aspek pengurusan dan masalah kewangan. Oleh itu, latihan untuk tenaga kerja, garis panduan arahan IBS dan memperbaiki mekanisme kewangan dan perolehan adalah faktor yang disyorkan untuk memperbaiki amalan kontraktor IBS untuk lebih banyak kejayaan adaptasi IBS.

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LIST OF ABBREVIATIONS

GDP	-	Gross Domestic Product
CIDB	-	Construction Industry Development Board of Malaysia
IBS	-	Industrialised Building Systems
PPP	-	Public Private Partnerships
ICT	-	Information and Communication Technology
CIMP	-	Construction Industry Master Plan
SPSS	-	Statistical Package for the Social Sciences
G7	-	Tendering capacity of more than 7 million Ringgit Malaysia

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CHAPTER 1

INTRODUCTION

This chapter provides a brief overview of the discussion of the research background and the research problem statement. It also explains the purpose of the study, research questions, research aim and research objectives. Furthermore, significance of the study, scope of the study, and brief methodology considered are discussed. Finally, it describes the structure of the thesis.

1.1 Research Background

The Malaysian construction industry plays an important role in creating wealth for the country as developing social, economic and infrastructure. The industry provided employment opportunities for 800,000 people, accounting for 8% of the total number of employees. The construction industry is one of the production sectors that continues to contribute to the economy. Its growth rate fluctuates between the two ends, from 21.1% in 1995 to as low as 24% in 1998. Since the 1990s, the contribution of the construction sector to Gross Domestic Product (GDP) has also fluctuate. Although it is relatively stable, it was as high as 4.8% in 1997 and an estimated 2.7% in 2005 (Hamid *et al.,* 2011) . This shows that building demand is very sensitive to the development of other economic sectors (Kamar *et al.,* 2010). Recent data showed that the construction sector growth at 5.3% in 2007 and contributed 2.1% total GDP of Malaysia (CIDB, 2008). The contribution to GDP would be much higher if one considers input from the whole supply chain activities of construction from design to

maintenance. The total number of contractor registered with the Construction Industry Development Board (CIDB) as in June 2008 is 63,610 (CIDB, 2008).

The new way of changing the perspective of the construction industry depends on the concept of focusing on improving construction efficiency. A superior construction phase can help increase productivity and change the paradigm that currently lacks perspective. There is a need to focus more on achieving a better structure that meets the needs of the end user, and attention must be paid to improving the traditional construction process. The use of industrialised building systems (IBS) modern buildings seems to be one of the construction improvements in Malaysia as IBS is a construction system built using pre-fabricated engineering components (Yahya *et al.*, 2014). In addition, Malaysia is implementing the industrialisation of the construction industry under the term Industrialised Building System or (IBS). The Malaysian government has adopted industrialised building systems since the 1960s and has made significant efforts in this area (CIDB, 2008). Many of the benefits of this system have been derived from many studies, including shortening construction time, reducing overall costs, reducing dependence on foreign workers, improving construction quality, promoting safe and systematic plant work environments, and providing cleaner and neater site (Oliewy, 2009). It aims to achieve several improvements within the sector, such as higher productivity levels and better quality construction products. Reports and case studies from different parts of the world have shown that prefabrication and on-site assembly are becoming common practices (Wang & Hubbard, 2017).

The main reason for delay the completion of construction projects was due to poor practice of contractors (Sambasivan & Soon, 2007). In most cases, the contractor's practices with project implementation is vital. Lack of experience, lack of technical knowledge and lack of skilled labour are very important barriers to successful IBS adoption. There have been cases where buildings were awarded and constructed using the IBS system but it contributed to project delays and bad quality (CIDB, 2010). Furthermore, there is a lack of proper project management techniques, specifically for IBS, and there is no specific cost control mechanism adopted by contractors in IBS (Mohamad Kamar, 2011b). It is very important to investigate the contractors' practices to ensure that their practice is optimal. Their motives and cooperation should be investigated so that they can work in a conducive work environment. Poor practice of contractors can hinder the environment for improving implementation of IBS and

reduce the quality of project outcomes. There is a need for better understanding of the influencing factors of contractors' practices to enhance the productivity for IBS implementation. Therefore, this study intends to investigate the contractors' practices in implementation of IBS in Malaysian construction industry.

1.2 Problem Statement

Contractors are the stakeholder who handles project management and solves construction issues in day-to-day basis work. They are responsible for the means and methods used in the project construction process according to the contract documents, as well as the supply of all materials, labor, equipment (engineering vehicles and tools) and services needed for the construction of the project (Mohamad Kamar, 2011b). In many cases, the use of IBS does not lead to complete satisfaction and may actually be less productive than traditional methods. In the past, IBS was associated with low-quality buildings delivered by contractors, leaks, abandoned items, and other such defects (CIDB, 2006). Contractors' practices also suffered from poor productivity and financial issue (CIDB, 2010). This is due to the fact that the contractor must pay the supplier in advance for the purchase of components. This is a very high capital investment in which 30% of the project value will be pre-sold (CIDB, 2010). Payment delays mean that component delivery delays ultimately affect project productivity.

The characteristics of IBS have the potential to improve the practices of contractors delivering high-quality buildings at a lower cost within an acceptable completion time. Prefabrication, off-site production, standardised components, modular coordination and large-scale production can reduce the use of labor, waste and improve the quality of buildings. However, in dealing with this innovative technology, appropriate plans and strategies are needed to prevent unnecessary additional costs, unpleasant community disturbances and declining environmental practice (Yunus *et al.,* 2016). Systematic measurement of contractors' practices is important to help project owners assess the contractor's capabilities and their interest in completing the project. In addition, the assessment will help identify areas for improvement and measure participant perceptions of the product or outcome.

The main reasons for delay in early completion of projects in IBS construction industry are supply delay, bad weather, and shortage of raw material. In some cases, the main reason for the delay was the lack of labor experience. This is because certain

types of IBS construction as reported from initial stage in Malaysia and the labor force is still not familiar with the special erection procedure required by those systems (Badir *et al.*, 2002). Based on Mohamad Kamar *et al.* (2009), Contractors in Malaysia are lack of past experience in IBS and their professional is lack of technical knowledge in this area . In addition there are also observed lack of R&D, low IT adoption and limited technology availability have generally discourage IBS take up. It also appears that most innovative system and components or using innovative materials are based on imported technologies which are obviously more expensive and difficult to purchase by local contractor (IBS Roadmap Review, 2007). In the perspective of components' manufacture, IBS contractors requires high initial investment capital for pre-casters to purchase and use new machinery, mould, importing foreign technology and wages of skilled workers for installation process (Mohamad Kamar *et al.*, 2009).

According to Hamid *et al.* (2011), establishing a good planning and scheduling activities include site planning and logistics play an important role to contractors' practices to deliver the project successfully. The road passing through the site may need to be adjusted and an entrance or loading platform built. During the installation phase, the contractor needs to determine the best route and time for the site, the ground conditions and the size of the site before the installation work begins. In order for contractors to be a specialist in IBS, the contractor needs improve their practices and provide the necessary knowledge for IBS implementation. The contractors' organisation also needs to make some changes to its processes, practices, procedures and management to embrace IBS. Therefore, it is important to find out the influencing factors for contractors' practices of IBS implementation in order to improve the IBS contractors' practices in IBS construction industry.

1.3 Research Questions

It is essential to develop research questions in order to help on focus the area of research. Following are some research questions that arise when conducting the research:

(i) What is the current contactors' practices of IBS implementation in construction industry?

(ii) What are the influencing factors for contractors' practices of IBS implementation in construction industry?

(iii) What will be the ways for improving contactors' practices of IBS implementation in construction industry?

1.4 Research Objectives

The aim of this research is to provide mechanism for improving practices of contractors of IBS implementation in construction industry. Therefore, in order to achieve the above aim, the following objectives have been identified:

(i) To study the current contractors' practices of IBS implementation in construction industry.

(ii) To identify the influencing factors for contactors' practices of IBS implementation in construction industry

(iii) To recommend ways for improving contactors' practices of IBS implementation in construction industry.

1.5 Research Scope

This research focused on improving the contractors' practices in implementation IBS in construction industry in Malaysia. The respondents involved in data collection are limited to the construction practitioners under G7 contractors aware of content, who have an experience in the IBS construction Industry. Besides that, the participants involved in this study are project manager, site manager and site engineer. Furthermore, this study identifies the influencing factors to the contractors' practices in implementation the projects of IBS in construction industry in Johor Bahru, Johor, Malaysia.

1.6 Significance of Research

Currently the main challenges in construction projects are lack of innovation, soft-skills, motivation, poor knowledge, technology skills as well as lack of training. Client and approving authorities have poor knowledge of IBS compared to conventional

buildings. Familiarity with IBS concept and its benefits is vital to its success because IBS requires different approach in construction industry. The barriers of IBS implementation in construction projects can be summarised and categorized in several themes, which are standardisation, and quality issues, issues in consumer perception, issues in professional perception, technology, training and education, finance and costing, incentive and communication issues as well.

The purpose of this study is to identify the influencing factors in improving practices of IBS contractors in construction industry. It provides more knowledge about IBS as whole in construction industry and more information technology skills of implementation as well. The result of the research can contribute a new knowledge in construction industry by giving possible strategies of implementing the IBS in construction projects. The study intends to provide an inquiry into the current practices of contractors of IBS in construction industry because it contributes to the infrastructural development, which is significant to the development of its economy. If there is a failure in the construction industry, it manifests into weak infrastructure which affects productivity and the economy as a whole.

1.7 Research Methodology

The research method adopted to achieve the study objectives associated by literature review and questionnaire survey. The literature review is done by reviewing academic research journals, textbooks, and ultimately the information available on the internet to compare the current use of IBS in construction projects and identifying contactors influencing factors. The questionnaire survey was designed to determine the IBS contractor influencing factors of IBS implementation in Malaysian construction industry.

1.8 Structure of Thesis

This thesis is structured into five (5) chapters. The contents of the chapters are briefed as follows.

Chapter 1: Introduction

This chapter lays the basis of the research; discussing the research background and problem statement, including the aim and objectives of the research, and outlining the research scope, methodology and significance of the research.

Chapter 2: Literature Review

This chapter discusses the review of previous researches on the factors affecting contractor practices in implementation of IBS in construction industry. It is also review the adaptation of IBS in Malaysian construction industry and success factors of implementation the IBS in construction industry.

Chapter 3: Research Methodology

This chapter discusses on research approaches and strategies, and research procedures used as well as the process of both data collection and analysis of research were developed.

Chapter 4: Data Analysis and Discussion

This chapter focuses on the analysis of gathering information and analysing data in influences factors affecting contractors' practices in implementation of IBS in construction industry. Data is presented and the results discussed.

Chapter 5: Conclusion and Recommendation

This chapter provide the conclusion of the research exercise, following the recommendation for implementation and future research.

1.9 Summary

This chapter provided the research background and detailed the influence factor that affect the practices of contractors in implementation IBS in construction industry. The objective of this study are clearly stated based on the research question. The research outcome and significances are identified. The research methodology is explained to ensure the objectives could achieved. Subsequently, the research scope identified to ensure this study focuses on the problem to be addressed. The next chapter will be discussed literature review.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides a working definition of the Industrial Building System (IBS) and discusses the embedded industry background. Literature review is organized for the purpose of seeking the information related to contractors' practices of IBS implementation in Malaysian construction industry. This literature review also discussed the influencing factors toward contractors' practices handling the projects of IBS in construction industry. This review is very significant for the objectives of this research, the goal of this study is to recommend ways to improve contractors' practices of IBS implementation in Malaysia construction industry.

2.2 IBS Practices in Malaysian Construction Industry

Construction industry is considered as one of the main contributors to Malaysia Gross Domestic Product (GDP). However, there are some unresolved issues arising from the ongoing and widespread adoption of the conventional method of construction such as the resultant fragmentation of the industry itself; delays in production and delivery time of unnecessary wastages and lack of sustainability practice. It has been continuously encouraging by Malaysian government to the industry to use, partly or if not wholly, the IBS which is assigned to be an important part of sustainable construction initiative. IBS was presented to Malaysia as the solution to issues related to dependencies of foreign workers, raising demand for affordable accommodations

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