ABSTRACT

The demand of building construction in Malaysia has increased rapidly from year to year together with the establishment of Industrialized Building System (IBS). IBS have been introduced to speed up the construction time and built affordable and quality houses. However, the traditional construction method still widely accepted as a convention and safe option incurring lower cost even slow in production rate. The implementation of guideline and practice within this industry are inconsistent among the players involved and it required more exertion or research to improve the construction time performance (CTP). The objective of study is to identify the main factors that influence CTP. For the second objective, the identification factors that influence CTP for IBS and conventional method of construction has been made. The last objective in this study is to established factors which can help to improve CTP. The survey research methodology is through the literature review, questionnaires and personnel interview with construction players. About thirty seven respondents out of fifty respondents had contributed their opinion and ideas and the data collection was analysed using an 'Average Index'. From the study, six main factors that influence the CTP which are management, financial, materials, workers, machineries and weather was discovered. Based on the factors highlighted, four of the factors which are financial, materials, workers and machineries mostly affecting the CTP for IBS as compared to conventional construction method. The factors to be improved CTP also was highlighted in this study.

ABSTRAK

Permintaan pembinaan bangunan di Malaysia meningkat secara mendadak dari tahun ke tahun sejajar dengan pendedahan Sistem Bangunan Industri (IBS). IBS telah dikenalpasti dapat mempercepatkan masa pembinaan dan menghasilkan rumah yang mampu dimiliki dan berkualiti. Walau bagaimanapun, pembinaan secara tradisional masih diterima secara meluas kerana ia melibatkan kos yang rendah walaupun masa yang diambil agak lama. Perlaksanaan IBS dalam industri pembinaan di Malaysia masih tidak konsisten dan memerlukan kajian terperinci dalam meningkatkan prestasi masa pembinaan (CTP). Objektif kajian ini adalah bertujuan untuk mengenalpasti faktor-faktor utama yang mempengaruhi CTP. Objektif kedua adalah untuk menentukan faktor-faktor yang mempengaruhi CTP bagi pembinaan secara IBS dan tradisional. Manakala objektif ketiga adalah untuk mendapatkan faktor-faktor yang boleh membantu dalam meningkatkan CTP. Kajian telah dijalankan melalui penilaian penulisan, kajian soal selidik dan temuramah mereka yang terlibat dalam projek pembinaan. Tiga puluh tujuh daripada lima puluh orang responden telah terlibat dalam memberikan pendapat dan idea. Data yang diperolehi telah dianalisa dengan menggunakan kaedah 'Average Index'. Melalui kaedah ini, enam faktor utama iaitu kewangan, bahan binaan, buruh, mesin atau alatan dan cuaca telah dikenalpasti sebagai faktor yang mempengaruhi CTP. Empat daripada faktor tersebut telah dikenalpasti sebagai faktor utama yang mempengaruhi CTP bagi pembinaan yang menggunakan sistem IBS iaitu kewangan, bahan binaan, buruh dan mesin serta alatan. Faktor-faktor yang dapat membantu dalam meningkatkan CTP juga diberi penekanan di dalam kajian ini.

TABLE OF CONTENTS

CHAPTER	TITLLE	PAGE
2	**INDUSTRIALISED BUILDING SYSTEM**	
	2.1 Introduction	9
	2.2 Introduction to IBS	9
	2.3 History of IBS in Malaysia	11
	2.4 Definition	16
	2.5 Classification on of IBS	19
	2.5.1 Modern Method of Construction	19
	2.5.2 Aspects of IBS	21
	2.5.2.1 Structural System	22
	2.5.2.2 Material	22
	2.5.2.3 Relative Weight of Components	23
	2.5.3 Types of IBS	24
	2.6 Essential Characteristic of IBS	25
	2.6.1 Closed System	26
	2.6.2 Opened System	27
	2.7 Sequence of Construction Method	28
	2.7.1 Conventional System	28
	2.7.2 IBS System	30
	2.8 Modular Coordination	33
	2.8.1 Standardization & Tolerances	34
	2.8.2 Mass Production	34
	2.8.3 Specialisation	34
	2.8.4 Organisation	35
	2.8.5 Integration	35
	2.8.6 Production Facilities	36
	2.8.7 Transportation	36
	2.8.8 Site Equipment	36
	2.9 Advantages of IBS	37

CHAPTER	TITLLE	PAGE
	2.10 Disadvantages of IBS	38
	2.11 Summary	40
3	**CONSTRUCTION TIME PERFORMANCE**	
	3.1 Introduction	42
	3.2 Construction Project	43
	3.2.1 Performance Indicator	44
	3.2.2 Benchmarking	46
	3.2.2.1 External Benchmarking	47
	3.2.2.2 Internal Benchmarking	48
	3.2.3 Performance Measurement	48
	3.2.4 Conceptual of KPI	49
	3.3 Factors that Influence CTP	51
	3.3.1 Project Management	56
	3.3.2 Financial	57
	3.3.3 Materials	57
	3.3.4 Equipments & Machineries	58
	3.3.5 Workers	58
	3.3.6 Environment & Weather	59
	3.4 Factors for CTP Improvement	59
	3.4.1 Construction Management	59
	3.4.2 Financial	60
	3.4.3 Materials	61
	3.4.4 Equipments & Machineries	61
	3.4.5 Construction Workers	61
	3.4.6 Weather	62
	3.4.7 Safety Precaution at Construction Site	63
	3.5 Summary	63

CHAPTER **TITLLE** **PAGE**

CHAPTER	TITLLE	PAGE
6	**CONCLUSION & RECOMMENDATION**	
	6.1 Introduction	86
	6.2 Conclusions	87
	6.2.1 Objective 1 – Factors Influence CTP	87
	6.2.2 Objective 2 – Factors Influence CTP for IBS & Conventional Method	88
	6.2.3 Objective 3 - Factors for CTP Improvement	88
	6.3 Recommendation for Future Study	90
	REFERENCES	91-95
	APPENDIXES	96-110

CHAPTER 1

INTRODUCTION

1.1 Introduction

The Construction Industry plays an important role for growth of the Malaysia economy, which has contributed about 2.5% of gross domestic product (GDP) in year 2007. In the Malaysia Master Plan 2006-2015, more than 800,000 job opportunities have been created within these industries. Therefore efforts towards improving construction efficiency in cost-effectiveness and shorten construction time would be implemented from time to time.

Dissanayaka and Kumaraswamy (1999) in their study stated that time, cost, quality target and participation satisfaction have been identified as the main criteria for measuring the overall success of construction projects. Due to that, cost and time tend to be the most important and visible, always considered as very critical because of their direct economic implications if they are unnecessarily exceeded.

The demand of building construction in Malaysia has increased rapidly from year to year together with the establishment of Industrialized Building System (IBS). The use of IBS as a method of construction in Malaysia today is growing to lead more local manufacturers established themselves in the market. IBS is defined as a construction system in which components are manufactured in a factory, on or off site, transported and assembled into structure with minimal additional site work, according to CIDB (2003). In general, IBS is a methodology which drives local construction industry towards the adoption of an integrated and encourages parties in the construction industry to produce and utilize pre-fabricated and mass production of the building at their work sites. The aims of IBS are to enhance the efficiency of construction process, thus allowing a higher productivity, quality, and faster project completion time.

Construction researchers and industry practitioners over the past three decades acknowledged construction time as one of the most important performance criteria of many successful projects. This creates an increasing global concern about benchmarking best practice measures of construction time performance (CTP) for use by clients, consultants and contractors in the construction industries.

This study is to identify main factors that influence time performance and indicate which identified factors influence IBS construction method before identifying with a suggestion for CTP improvement. About 37 out of 50 respondents had contributed their opinion and ideas and the data collection was analysed using an 'Average Index'. From the study, six main factors that influence the CTP which are management, financial, materials, workers, machineries and weather was discovered. Based on the factors highlighted, four of the factors which are financial, materials, workers and machineries mostly affecting the CTP for IBS as compared to conventional construction method. The guideline to improve the CTP was also highlighted in this study.

1.2 Problem Statement

Construction industry in Malaysia considered as fragmented industry, whereby policy, implementation guideline and practice within this industry are inconsistent among the players involved. In one project, many people involved which lack of communication and less interaction among the project team contributes to the problem. During design stage commonly, planners, architects and designer's work independently with little input and lack of communication with each other. Due to this, revisions of plans and designs always occurred to affect the construction time performance for the project. Other than that, all parties including the government and the private sector are required to have a close collaboration and working together to bring positives changes in the industry.

Reliance on unskilled and cheap foreign workers has absolutely contributed to low productivity of work and extra working time taken for each activity. Unskilled workers might be cheap, but they are not efficient and result in high wastage. Therefore, the quality and time performance of construction are badly affected due to unskilled working method and has lead to delay of the construction process. Numerous indications and complaints of low quality of work have been made by consumers through media and authorities which lead to decreased quality of life in uncomfortable and unfriendly environments CIDB (2000). Poor quality control at site, common problems such as project delay and possible economic losses are a constant dilemma for the client. Late delivery of work will often resulted in late occupancy of the building, and this often caused inadequate for public facilities.

The perception of construction parties for traditional construction method widely accepted as a convention and safe option incurring lower cost even slow in production rate. So far, there is no guideline or benchmark which can provide information readily

on construction time performance especially between conventional and IBS construction system in Malaysia's construction industry.

1.3 Aim and Objectives of Study

The aim of this study is to provide the necessary information to improve construction time performance for IBS construction method. To achieve the above aims, the following objectives have been identified:

1. To identify the main factors that influences construction time performance;

2. To identify factors that influences construction time performance for IBS and conventional method; and

3. To establish factors that can help to improve time performance of IBS construction method.

1.4 Scope and Limitation of Study

The study is limited to construction time performance between IBS and conventional construction system. Data was collected mainly from questionnaire survey and informal interviews with similar nature using IBS and conventional method. The respondents of the questionnaire survey and interview were from construction players

such as clients, consultants, contractor and construction workers who have experience in both type of construction method.

1.5 Research Methodology

This section discusses on the structure of research. This will help to understand the fundamental stages of methodology executed or steps of process carried out in order to achieve the aims and objectives of this study. The framework of methodology represented diagrammatically in Figure 1.1 to show the distinctive stages and sequence carried out.

Conceptualization is the understanding the importance and basics of the construction time performance for two different types of construction method intended to be carried out. The problems affected construction time performance was identified to get clear objectives through literature review, questionnaires and personnel interview with construction players. Data collection from survey was analyzed to come out with a good recommendation and suggestion to solve the problems.

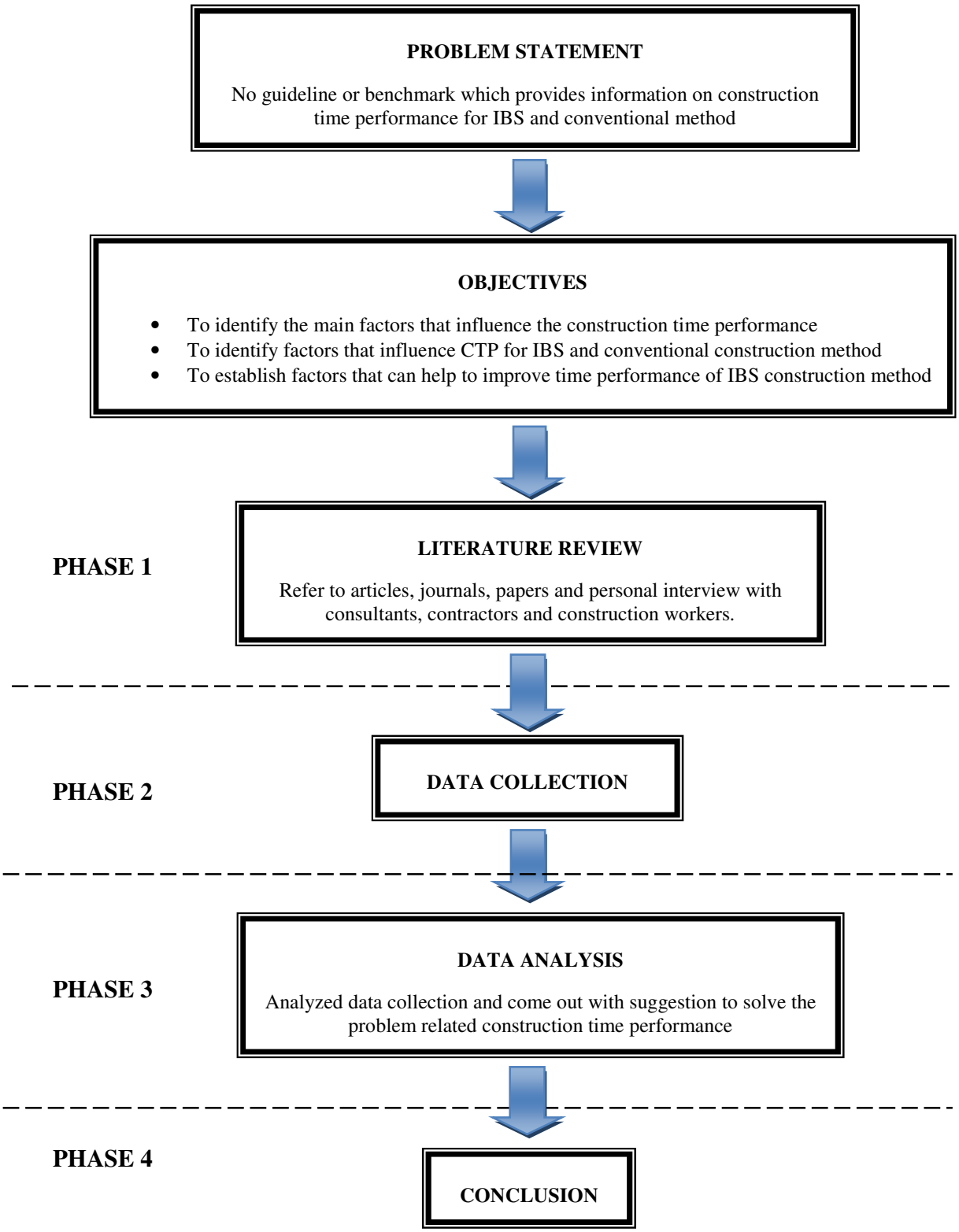

Figure 1.1: Flow chart of research methodology

1.6 Organization of Dissertation

The dissertation of this study is structured into five chapters. In Chapter One, a brief introduction and importance of the study is given along with the aim, objectives, scope and limitation of study.

The basic knowledge, historical background and significance of the IBS and conventional construction method are described in Chapter Two. Theoretical aspects of the research are also discussed briefly in second chapter.

Chapter Three is to determine the principles of construction time performance for IBS and conventional construction method. Various sources were referred particularly from publication of the journals, articles and conferences papers.

Chapter Four describes the research methodology adopted in the study. In this chapter, detail discussion on the research methodology was highlighted. There are four phases in this chapter which covered the identification scope of study, data collection, analysis and results and conclusion. The data collection methods and analytical methodologies used in each stages of the study are described to achieve the aim and objectives of the study.

A complete data collection approaches that specifically linked to the key questions was presented in Chapter Five. This chapter presents the questionnaire data and data was analysed to achieve the goal of study.

Based on the results obtained discussions of result were made in the Chapter Six. It also includes a description of the outcomes, especially expectations which enable the establishment of the factors that can help to improve construction time performance.

Chapter seven is the last chapter which presented conclusions to the findings of the study. This chapter highlighted on the conclusion for the study and recommendation for future research.