

DRAFT FINAL REPORT

**IBS ADOPTION IN GOVERNMENT & PRIVATE PROJECTS
IN MALAYSIA 2016**

EXECUTIVE SUMMARY

CHAPTER 1

INTRODUCTION

1.1 Malaysian Construction Industry

The Malaysian economy expanded 4.4 percent year-on-year in the third quarter of 2018, following a 4.5% expansion in the previous three-month period and below market consensus of 4.6%. It was the weakest growth rate since the third quarter of 2016, as net external demand contributed negatively to GDP growth, while investment, private consumption, and government spending continued to rise at a solid pace. GDP Annual Growth Rate in Malaysia averaged 4.80% from 2000 until 2018, reaching an all-time high of 10.30% in the first quarter of 2010 and a record low of -6.20% in the first quarter of 2009.

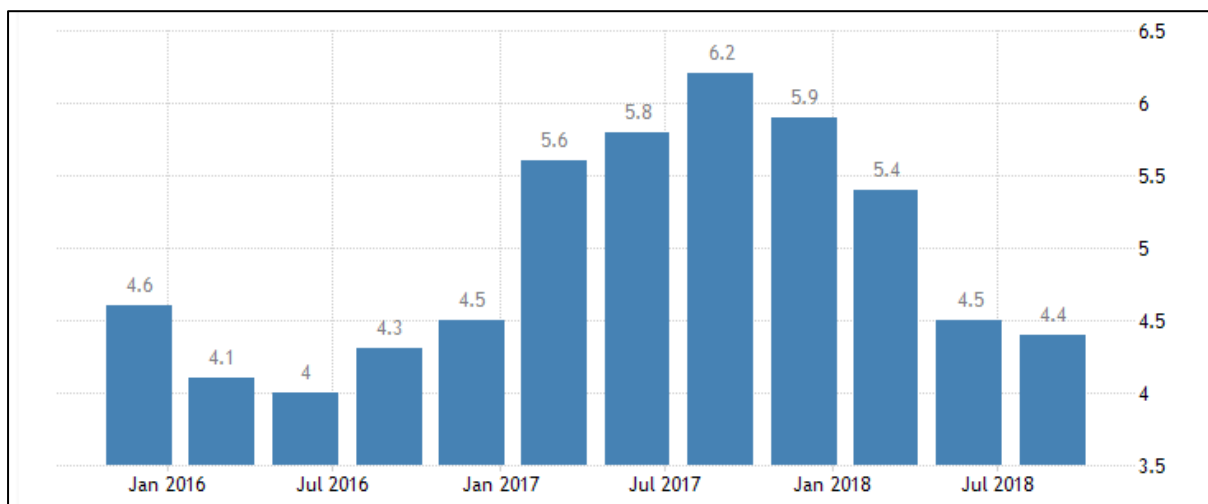
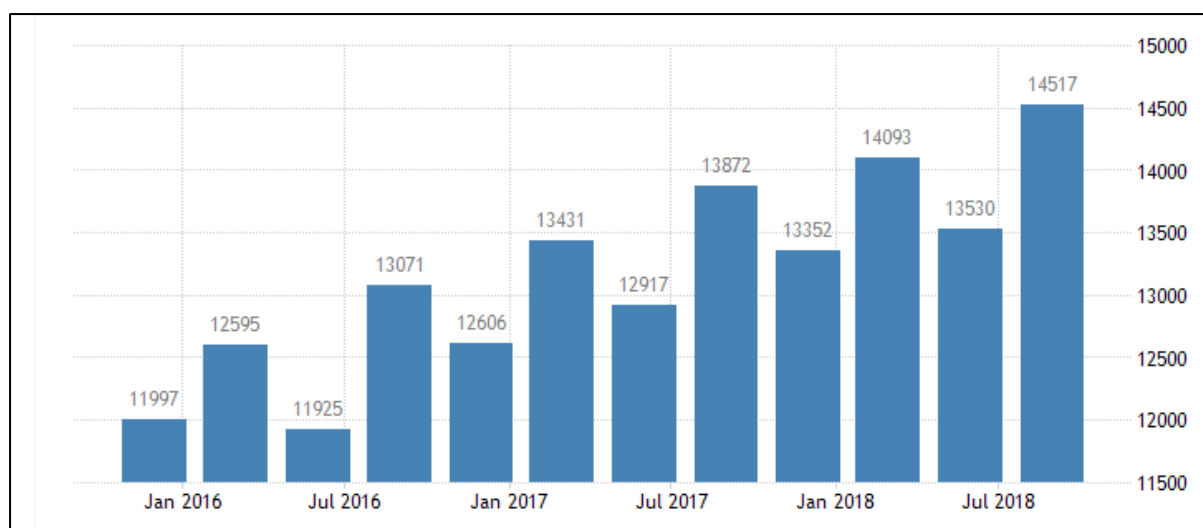


Figure 1: GDP Growth in Malaysian Construction Industry

GDP From Construction in Malaysia increased to 14517 MYR Million in the third quarter of 2018 from 13530 MYR Million in the second quarter of 2018. GDP From Construction in Malaysia averaged 10484.26 MYR Million from 2010 until 2018, reaching an all-time high of 14517 MYR Million in the third quarter of 2018 and a record low of 6464 MYR Million in the first quarter of 2010 (Department of Statistics (DOSM), 2018).



Real GDP By Kind Of Economic Activity 2010 - 2020

	Average Annual Growth Rate (%)	
	RMKe-10 (2011 - 2015)	RMKe-11 (2016 - 2020)
Real GDP	5.3	5.0 - 6.0
Services	6.3	6.9
Manufacturing	4.8	5.1
Construction	11.1	10.3
Agriculture	2.4	3.5
Mining & Quarrying	0.9	1.3

Note: GDP based on 2010 prices

Source: EPU and DOSM

CIDB defines IBS as a construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works. The IBS included precast concrete system, formwork system, steel framing, timber framing, block work and innovative system. IBS Roadmap 2003-2010 (CIDB, 2003) has highlighted six (6) main IBS system and components as shown in Table 1.4.

Table 1.4

Categorisation of System and Component of IBS

System	Component	Description
Pre-cast Concrete	Column Beam Wall Slab	The common IBS used includes precast concrete elements, lightweight precast concrete and permanent concrete formwork.
Formwork	Column Beam Wall Slab	The common IBS used includes precast concrete elements, lightweight precast concrete and permanent concrete formwork.
Steel Framing	Column Beam Roof truss	Commonly used with precast concrete slab, steel framing system has always been a popular choice and used extensively in the fast track construction of skyscrapers. The recent development of this IBS includes the usage of light steel trusses consisting of cost efficient profiled cold formed channel and steel portal frame system. These are the alternatives to the heavier traditional hot rolled section.
Prefabricated Timber Framing	Column Beam Roof truss	This system consists of timber building frames and timber roof trusses. Timber building frame system also has their market and demand, offering attractive designs from simple dwelling units to buildings that required high aesthetical values such as resorts and chalets.
Block Work	Column Beam Wall	The construction method of using traditional bricks has been revolutionised by the developments of interlocking concrete masonry units and lightweight concrete blocks. The tedious and time-consuming traditional bricklaying tasks are vastly simplified by the usage of these practical solutions.

Innovative	Wall	In order to classify new systems introduced in the Malaysian construction industry that are not belong in the five mains IBS in the CIDB's IBS classifications (2003), CIDB introduced innovative system to classify the new and innovative systems in IBS approach.
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1.1 Government Circular on IBS

The IBS Policy began in 1999 with the IBS Strategic Plan to provide clear direction to players in the construction industry in the private and government sectors. Followed by IBS Roadmap 2003-2010, Roadmap IBS 2011-2015 is supported by Construction Industry Master Plan 2006-2015 and Construction Industry Transformation Program (CIDB, 2015b).

1.2.1 Construction Industry Transformation Programme (CITP) 2016 - 2020

Construction Industry Transformation Plan (CITP) was launched on 10th September 2015 and was initiated in 2014 by Ministry of Works through the Construction Industry Development Board (CIDB) Malaysia. It is a 5-year programme covering the period from 2016 until 2020. The CITP was formulated through a series of engagements with more than 150 government agencies, research institutions and industry players, with the goal of addressing the existing roadblocks in the construction industry while paving the way for a more modern, sustainable and productive sector overall.

The CITP is recognised as an important focus and strategy within the 11th Malaysia Plan. It is aimed at propelling the construction industry forward to meet the demands of the marketplace. The critical role of the construction industry is documented under Chapter 8, Focus Area D of the 5 year 11th Malaysia Plan, which is the last leg towards Malaysia achieving a high income, developed nation status by the year 2020.

There are 4 strategic thrust identified under the CITP which are:

- i. Quality, Safety and Professionalism
- ii. Environmental Sustainability
- iii. Productivity
- iv. Internationalisation

The IBS issue fall into Productivity thrust. Productivity is the primary engine of growth towards Malaysia's high-income target and is important strategic thrust that aims to more than double

productivity in the construction industry, matched by higher wages. Productivity issues still plague the construction industry and these needs to be addressed.

There is largely unskilled workforce and inadequate or mismatch in training and development. Overall, 40% of the local workforce in the industry is still unskilled and this is compounded by the larger 93% of the foreign construction workers in the construction workers and personnel in the construction industry still has much room for improvement.

Malaysia still has a low take-up rate Industrialised Building System (IBS) in construction. Only 24% (CIDB, 2015b) of public projects worth RM10 million and above achieved IBS score of 70, a far reach from the intended 100% take up rate, despite a Ministry of Finance circular mandating it.

Over and above this, the construction industry lends importance to a sizable pool of entrepreneurial activity. There is a High proportion of sub-scale SMEs, including Bumiputera SMEs and Entrepreneurs. The construction industry is one that is highly fragmented with sub-scale SMEs collectively accounting for 90% of total contractors while large contractors make up the remaining 10%. In addition, Bumiputera firms account for 56% of the construction industry and of this, two third are G1 contractors. This prevents them from investing in high capital-intensive modern construction methods and technology.

Construction Industry Transformation Plan (CITP) has highlighted that IBS equipment has charged high for duty tax import with 40% as compared with other countries which are Singapore (7%), Thailand (7%), Philippines (12%) and Indonesia (20%). Thus, this will bring to increasing of capital cost to the contractor. The upfront payment and long lead time make IBS take-up costlier (CIDB, 2015b).

1.2.2 11th Malaysia Plan 2016 – 2020

A review on IBS requirements for public and private sector projects will be undertaken to expedite its adoption. A supportive and rewarding environment for the industry to invest in advanced construction methods will also be created, particularly through the review of public procurement policy and Uniform Building By-Laws (UBBL).

The use of IBS in the construction sector will be further enhanced through government procurement to increase efficiency while reducing dependency on unskilled labour. Greater collaboration amongst key stakeholders such as the Ministry of Finance (MOF), Ministry of Works, CIDB, Public Works Department (JKR) and Ministry of International Trade and Industry (MITI) will be forged to increase

the uptake of IBS. Regulatory bottlenecks such as incompatibility between UBBL clauses and IBS component specifications will be addressed.

1.2.3 Construction Industry Master Plan 2006-2015

The Construction Industry Master Plan 2006-2015 (CIMP 2006-2015) has been published in December 2006 as means to chart the future direction of the Malaysian Construction Industry. The importance and effort to promote IBS is highlighted under Strategic Thrust 5: Innovate through R&D to adopt new construction methods such as IBS in the Construction Industry Master Plan 2006-2015 (CIDB, 2007).

1.2.4 IBS Roadmap 2011-2015

The objective of IBS Roadmap 2011-2015 is to sustain the existing momentum of 70% IBS content for public sector building projects through to 2015 and to start a minimum IBS content for private sector building projects gradually increase by 50% in 2012 to 55% by 2015. There are 4 work streams stated in the roadmap which are through institutional strengthening, focusing on user, focusing on product and focusing on industry.

1.2.5 IBS Roadmap 2003 – 2010

In line with the target of IBS Roadmap 2003-2010, Budget 2005 declared that all new government building projects are required to have at least 50% IBS content. In order to attract private clients, the second announcement was on the levy exemption for housing projects that have minimum IBS Score of 50%. Since then and boosted by the Construction Industry Master Plan 2006-2015 and 9th Malaysia Plan 2006-2010, numerous activities have been executed by the Government.

1.2.6 Treasury Circular Letter No. 7 Year 2008

Two of the latest major initiatives are the release of the Treasury Circular Letter No. 7 Year 2008 (*Surat Pekeliling Perbendaharaan Bil. 7 Tahun 2008*) and the announcement of the Action Plan for IBS Implementation in Government Projects (*Pelan Tindakan Pelaksanaan IBS dalam Projek-Projek Kerajaan*).

It replaces the earlier instruction released on 6th July 2005 by Treasury for the usage of 50% IBS content in all government projects. Released on 31st October 2008, the Treasury Circular Letter was issued to all Secretary Generals, Heads of Federal Department, State Secretaries, Heads of Federal Statutory Bodies as well as to all local authorities. The essence of the instruction is the usage of Open Building, MC design and 70% IBS Score for all projects. Agencies are required to submit periodical reports of IBS project implementation to ICU which acts as the central monitoring agency. Exemptions are offered for certain classes of projects and the IBS Centre will function as the main technical reference centre (Appendix I).

1.2.7 Annual Budget

IBS was mentioned in Malaysian annual budget starting year 2004. The current budget for year 2016, government also mentioned that there was allocation of RM 500 million to promote IBS in Malaysia. Currently, the usage of IBS in government and private sector is far from the expected. Table 1.3 shows the IBS mentioned in the Malaysian Annual Budget starting from year 2004.

Table 1.3: IBS in Malaysian Annual Budget

Year	Description
2004	New government building projects had been strongly encouraged to have at least 50% of IBS content in their construction elements which had been calculated using IBS Score Manual developed by CIDB.
2005	Full exemption from CIDB levy for housing projects with IBS content more than 50%.
2006	Capital expenditure on moulds by IBS manufacturers given Accelerated Capital Expenditure with maturity period of 3 years. This step will facilitate the reduction in the cost for IBS columns, beams, walls and slabs.
2016	Allocation to promote IBS for the construction of homes. It was revealed that there would be an IBS Promotion Fund of RM 500 million which would be provided by the SME bank.

1.3 Significance of the Study

This study is expected to encourage private sector to embark in the IBS industry and to be on a more level playing field. The implementation of IBS for both government and private sector can enhance the productivity of construction industry. This eventually will create a higher demand for IBS components and hence will lower the construction cost and material due to economic of scale.

Objective of the Study

- i. To measure the level of IBS adoption in both private and government construction project in Malaysia;
- ii. To measure the level of readiness upon IBS implementation in Malaysia;
- iii. Identify the IBS score with respect to types of building;
- iv. Understand the perception of private developer in using IBS for construction;
- v. List out companies that are using IBS in government and private project, thereby conducting analysis in terms of category/types of construction and system that are in use;
- vi. Identify those IBS one-stop centre companies (developer) and conduct a comparison with those companies that rely on supplier;
- vii. Identify the challenges in implementing IBS in both private and government sector;
- viii. Recommend ways that should be undertaken by CIDB in order to increase the level of readiness in using IBS in the construction industry.

CHAPTER 2

CURRENT STATE OF IBS IN MALAYSIA

1.2 State of IBS Implementation

IBS in Malaysia has been established, introduced and applied in the construction industry in order to deal with a growing demand for affordable housing , increased of construction cost, lower production rate, solving issues associated with foreign workers and improving quality, efficiency and productivity of construction industry (Mohamad, Ramli, Hn, & Sapuan, 2016).

Despite of all the advantages of IBS construction, the industry is still slow adaptation to the new system. They preferred conventional rather than the IBS system because of some reasons. According to IBS Roadmap Review report, the successful factor of adoption of IBS in Malaysia is a client driven. Client with a good knowledge and awareness of IBS benefit will surely encourage appointed designers to design building according to IBS. Unfortunately, lack of awareness program to understand client needs and giving correct information on IBS has contributing to a lack of interest from the client and decision makers.

According to Construction Industry Development Board (CIDB) Malaysia Chairman, Tan Sri Dr. Ahmad Tajuddin Ali, Malaysia is still 20 years behind in the adoption of industrialised building system (IBS) due to technical issues such as construction joints, standardisation of components size and economies of scale.

As reported by MIDF Research (2014), the IBS implementation in the private sector are still remains low. The Malaysian government has identified IBS as one of the ways forward in the construction industry. The IBS Strategic Plan was launched in 1999 to promote the usage of IBS in the construction industry. Subsequently, the IBS Roadmap 2003-2010 was introduced in 2003. The commitment to IBS was further reaffirmed when the IBS Roadmap was endorsed by the Cabinet as the blueprint to industrialise the construction sector by 2010. However, the adoption of IBS, specifically in the private sector remains low.

The next challenge is to convince the private sector to embrace IBS. Annually, more than half of the value of construction projects in Malaysia are awarded by the local private sector. The goal of IBS Roadmap (2011-2015) is to promote the usage of 50% IBS content in the private sector. In order to achieve this, the buy-in of the private sector is important. Residential projects such as flats, condominium and terrace houses have high IBS potential due to the repetitive nature of production. The private sector-built RM 13.6 billion worth of residential projects compared to only RM 1.8 billion by the public sector in 2013.

In order to implement IBS to the private sector, the supply and demand of the IBS should be matched. The number of manufacturer and supplier should be enough to cater the demand of the IBS construction. Figure 2.1 shows that as of October 2018, it was reported that at least 290 manufacturers are actively involved in the dissemination of IBS in Malaysia, of which 84 are Bumiputera players and 206 are non-Bumiputera. Overall, Selangor contributed the most with 109 suppliers and manufacturers. The components involved are precast, onsite precast, formwork, steel structure, metal roof trusses, timber frame, block and innovative systems.

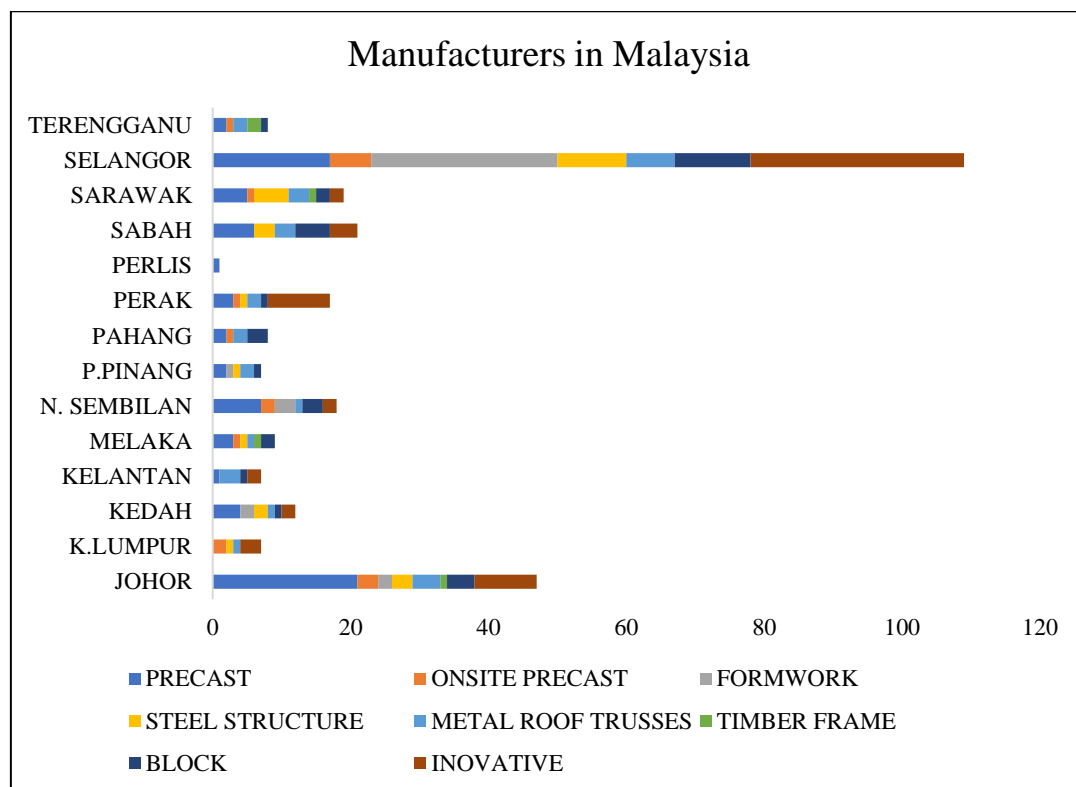


Figure 2.1: Number of Manufacturers in Malaysia

The details number of each system are illustrated in Table 2.1. Precast components recorded the highest number of IBS components manufactured in Malaysia followed by innovative systems. The least number of IBS components manufactured in Malaysia is timber frame due to higher price as compared with other systems.

Table 2.1: Number of Manufacturers and Suppliers Based on System and State

No.	State	Precast	Onsite Precast	Formwork	Steel Structure	Metal Roof Trusses	Timber Frame	Block	Innovative	TOTAL
1	Johor	21	3	2	3	4	1	4	9	47
2	K.Lumpur		2		1	1	0	0	3	7
3	Kedah	4		2	2	1	0	1	2	12
4	Kelantan	1			0	3	0	1	2	7
5	Melaka	3	1		1	1	1	2	0	9
6	N. Sembilan	7	2	3	0	1	0	3	2	18
7	P.Pinang	2		1	1	2	0	1	0	7
8	Pahang	2	1		0	2	0	3	0	8
9	Perak	3	1		1	2	0	1	9	17
10	Perlis	1			0	0	0	0	0	1
11	Sabah	6			3	3	0	5	4	21
12	Sarawak	5	1		5	3	1	2	2	19
13	Selangor	17	6	27	10	7	0	11	31	109
14	Terengganu	2	1		0	2	2	1	0	8
TOTAL		74	18	35	27	32	5	35	64	290

1.3 Impact of IBS to the Economy and Sector

The implementation of IBS will give a positive impact to the economy of Malaysian generally and construction sectors specifically. Based on findings from MIDF Research (2014), the IBS implementation have potential to reduce the government development expenditure. Potential savings as a result of implementing IBS would help to reduce the Government's development expenditure. IBS construction can therefore be a strategic initiative as part of the Government's move towards fiscal austerity. The Government has adopted a policy that its project must have at least 70 IBS score. The rate of IBS usage in Government projects is currently about 80% to 90%.

The job-skill ladder could be increase if the implementation of IBS is done. IBS can help to reduce the country's reliance on the mostly foreign unskilled labour in the construction industry and will also improve the industry's image as well as create awareness among local workforce on the benefits of joining the industry. Apart from attracting local manpower, IBS implementation would also help to up-skill existing labour force.

IBS can enhance the technology transfer and affordable houses in Malaysia. PR1MA is pursuing a partnership with a major Japanese company to undertake IBS housing projects. We can expect beneficial technology transfer as well as healthier bilateral trade relationship between the two countries, Malaysia and Japan, as a result of this initiative. The usage of the Japanese IBS is expected to help increase the supply of more houses within the affordable price range.

It also can reinforce Malaysia's ambition to be a hub of knowledge and technology. Malaysia is developing its technological base and convert its knowledge into value-added product and services. The transfer and development of IBS technology is an area that will contribute to this. as reported by MIDF Research (2014), only a small portion of the IBS technology used currently in Malaysia originate domestically.

The implementation of IBS can rise the construction sector specifically such as can offers positive impact on both, the construction and property sector. IBS will undoubtedly support the development of the construction and property sectors in Malaysia. The IBS construction method will contribute towards the improvement of design, components and building quality. More importantly, it will improve the net profit margin of companies. The previous research has proved that IBS will reduce costs such as labour

and wastage costs. Combined with better project delivery in terms of time, earnings will therefore be less volatile and more visible.

Besides that, construction sector will have better management of building material. During robust construction period, there could be a supply shortage in building material such as sand, aggregates and ready-mixed concrete. As a result, the increase in demand over the supply can raise the construction costs and burden builders. The adoption IBS will enable companies to manage their usage of building material better. A more widespread use of IBS will probably even have the effect of stabilizing building material prices.

The implementation IBS can increase the competitive price and better-quality products as it is increasing availability and standardisation of IBS components will help to further reduce construction costs hence make house prices more affordable. Apart from that, the ISO certification for manufacturers will boost buyer's confidence in the quality of the IBS product.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This study employed explanatory mixed methodological approach utilizing both quantitative and qualitative approach. Questionnaire and focus group are used in this study. Qualitative approach involved focus group methods while quantitative approach involved survey questionnaire method. The focus group method is used to validate the questionnaire before it is distributed while the questionnaire method is used to undertake the study. In order to support the quantitative data, it is needed to undergo the qualitative method. The interview method is used to collect some additional information on the implementation of IBS. The purpose of using qualitative method after applying quantitative research is to understand unanticipated results from quantitative data. The qualitative method is also used to identify issues or obtain information on variables not obtained by quantitative surveys.

3.2 Research Process

Literature review was conducted to understand the current status of IBS adoption in Malaysian construction industry and the challenges that hinder the implementation of IBS. Several informal interviews were carried out to grasp the idea on the suggestion of IBS implementation for private projects.

Input from literature review and informal interview were used as guidance to construct questionnaire, to collect data from the targeted group of contractors, consultants, manufacturer and developer. Once the data collection completed, the survey data were analysed using the Statistical Packages for Social Sciences (SPSS) version 23.0. During the analysis, outputs from the informal interviews and focus group discussion are incorporated with the survey data to produce an in-depth data interpretation. Finally, conclusions are drawn and their compatibility with research objectives is examined. A conclusion needs to be drawn in-line with the objectives of the research. At the same time, some appropriate recommendations related to the problems may be made for a better solution in relation to the said problem. Figure 3.1 illustrates the entire research process from the early process until the end of the process.

The five (5) objective outlined in this research are to recognise the readiness of private sector to achieve 70 IBS score, to identify the capacity of local IBS contractors and suppliers, to identify the current issues of implementation IBS projects to private sectors, to propose enforcement strategies to implement 70 IBS score for private projects and to determine the optimum IBS score for private projects.

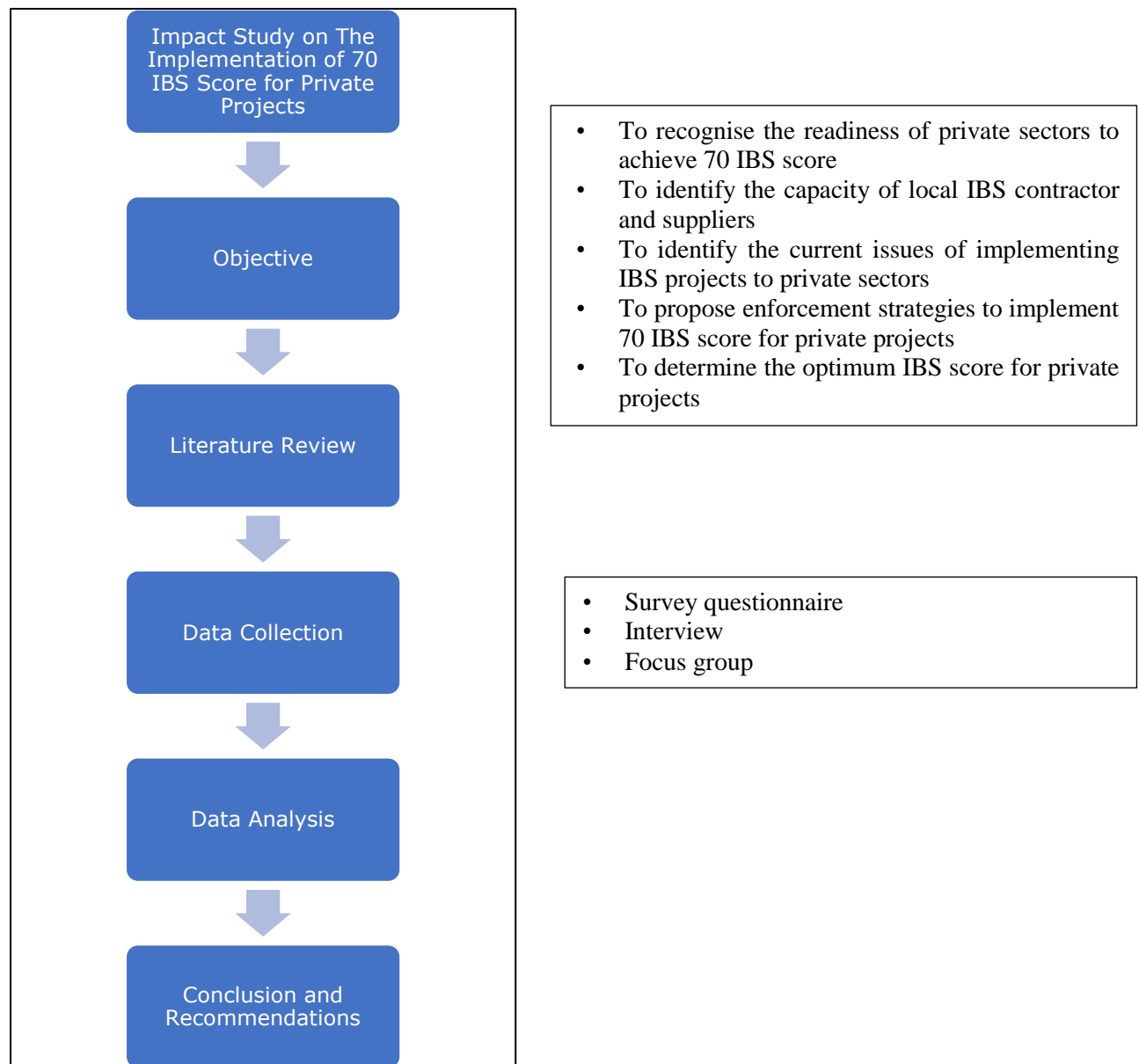


Figure 3.1: Research Process

3.3 Quantitative Method

The analysis is based on four (4) main parties in the Malaysian construction industry which are contractors, consultants, developers and manufacturers. 40 samples for each category was selected to carried out an analysis. There are two (2) parts in the questionnaire which Part A explains about the demographic profile of the respondents while Part B demonstrate the readiness of private sector to achieve 70 IBS score. In the part B, the opinion about the compulsory of IBS projects in the private projects, suitable IBS score, level of IBS usage in the company, issues in implementing IBS, challenges in IBS implementation and suggestions are included. The Likert scale used for issues in implementing IBS and the challenges in IBS implementation. The distribution of questions in the questionnaire is distributed as follows (Table 3.1):

Table 3.1: Distribution of Questions

Part	Number of Questions
Part A: Demographic Profile	2
Part B: Readiness of private sector to achieve 70 IBS score	24
TOTAL	26

3.4 Reliability Statistics

Nunnally & Bernstein(1994) and Bland & Altman (1997) stated that there are different reports about the acceptable values of alpha, ranging from 0.70 to 0.95. A low value of alpha could be due to a low number of questions, poor interrelatedness between items or heterogeneous constructs. George & Mallery (2003) provide the rules of thumb as shown in Table 3.2.

Table 3.2: Indication of Cronbach's Alpha Value

Cronbach's Alpha Value	Indication
>0.90	Excellent
>0.80 – 0.90	Good
>0.70 – 0.80	Acceptable
>0.60 – 0.70	Questionable
>0.50 – 0.60	Poor
< 0.50	Unacceptable

Since the Cronbach's Alpha value in this study is 0.855 as shown in Table 3.3, it is indicated that the content of the questionnaire reliable as rated as "Good". This statistic proves that the sampling in this study reflects the population.

Table 3.3: Cronbach's Alpha Value

Cronbach's Alpha	N of Items
.855	48

3.5 Qualitative Method

The workshop has been done on 23rd November 2018 (Friday) at IBS Centre from 9.00 am until 5.00 pm. The workshop involves the industry to discuss on the suitability to implement the 70 IBS score to the private sector. It also discusses whether the 70 IBS score is achievable or another score suitable for private sector implementation.

3.6 Population and Sample

In this study, purposive sampling is chosen as the sampling design. The sampling is necessary to obtain information from specific target groups. The sampling is confined to specific types of people, in this case the contractors who can provide the desired information, either because they are the only ones who have the knowledge (Sekaran and Bougie, 2010). They have characteristics such as their wide experiences in payment issues which will best enable them to answer the research questions. Purposive sampling can also provide researchers with the justification to make generalisations from the sample that is being studied. The sample involved in this study are contractor, consultant, manufacturer and developer. 40 sample is selected for each group of stakeholders. The data collected are through questionnaire and validated by focus group approach.

3.7 Data Analysis

In this stage, it can determine whether the stated objectives have been achieved or vice versa. Different types of analysis will be carried out according to the requirements of the objectives. The data is analysed using SPSS version 23.0. Excel is also used to produce graphics for the report. Descriptive statistics were used to illustrate the findings of the study.

Frequencies can be referring to the number of times various subcategories of a certain phenomenon occur, from which the percentage and the cumulative percentage of their occurrence can be easily

calculated. Frequency distribution, bar charts, histograms and pie charts provide a great deal of basic information about the data. Formula for calculated percentage is as follow:

$$\text{Percentage: } \% = F / N$$

Where:

% = Percentage

F = Frequency

N = Number of respondents

The mean or the average is a measure of central tendency that offers a general picture of the data without unnecessarily inundating one with each of the observations in a data set. Formula of mean for Likert Scale is as below:

$$\text{Mean: } X = \Sigma f(x) / N$$

Where:

Σx = sum of all data

f = Indication of Likert Scale (1,2,3,4,5,6)

N = number of respondents

CHAPTER 4

DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

There are two (2) types of analysis in this study which are secondary data analysis and primary data analysis. The secondary data comes from IT Department, Construction Industry Development Board (CIDB) Malaysia. The analysis in this section is based on the questionnaire distribution to the Malaysian contractor. The questionnaire is distributed to the 500 Malaysian contractors registered with CIDB.

4.2 State of IBS Implementation

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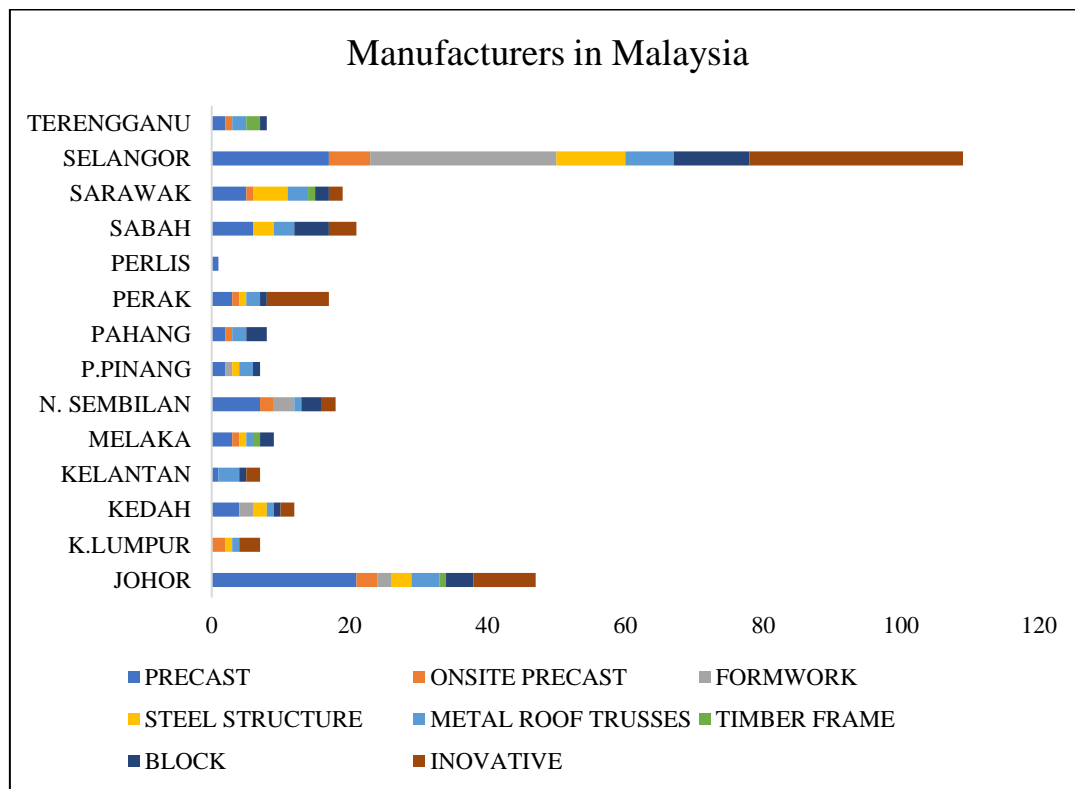


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4	Kelantan	1			0	3	0	1	2	7
5	Melaka	3	1		1	1	1	2	0	9
6	N. Sembilan	7	2	3	0	1	0	3	2	18
7	P.Pinang	2		1	1	2	0	1	0	7
8	Pahang	2	1		0	2	0	3	0	8
9	Perak	3	1		1	2	0	1	9	17
10	Perlis	1			0	0	0	0	0	1
11	Sabah	6			3	3	0	5	4	21
12	Sarawak	5	1		5	3	1	2	2	19
13	Selangor	17	6	27	10	7	0	11	31	109
14	Terengganu	2	1		0	2	2	1	0	8
TOTAL		74	18	35	27	32	5	35	64	290

1.4 Impact of IBS to the Economy and Sector

The implementation of IBS will give a positive impact to the economy of Malaysian generally and construction sectors specifically. Based on findings from MIDF Research (2014), the IBS implementation have potential to reduce the government development expenditure. Potential savings as a result of implementing IBS would help to reduce the Government's development expenditure. IBS construction can therefore be a strategic initiative as part of the Government's move towards fiscal austerity. The Government has adopted a policy that its project must have at least 70 IBS score. The rate of IBS usage in Government projects is currently about 80% to 90%.

The job-skill ladder could be increase if the implementation of IBS is done. IBS can help to reduce the country's reliance on the mostly foreign unskilled labour in the construction industry and will also improve the industry's image as well as create awareness among local workforce on the benefits of joining the industry. Apart from attracting local manpower, IBS implementation would also help to up-skill existing labour force.

IBS can enhance the technology transfer and affordable houses in Malaysia. PR1MA is pursuing a partnership with a major Japanese company to undertake IBS housing projects. We can expect beneficial technology transfer as well as healthier bilateral trade relationship between the two countries, Malaysia and Japan, as a result of this initiative. The usage of the Japanese IBS is expected to help increase the supply of more houses within the affordable price range.

It also can reinforce Malaysia's ambition to be a hub of knowledge and technology. Malaysia is developing its technological base and convert its knowledge into value-added product and services. The transfer and development of IBS technology is an area that will contribute to this. as reported by MIDF Research (2014), only a small portion of the IBS technology used currently in Malaysia originate domestically.

The implementation of IBS can rise the construction sector specifically such as can offers positive impact on both, the construction and property sector. IBS will undoubtedly support the development of the construction and property sectors in Malaysia. The IBS construction method will contribute towards the improvement of design, components and building quality. More importantly, it will improve the net profit margin of companies. The previous research has proved that IBS will reduce costs such as labour

and wastage costs. Combined with better project delivery in terms of time, earnings will therefore be less volatile and more visible.

Besides that, construction sector will have better management of building material. During robust construction period, there could be a supply shortage in building material such as sand, aggregates and ready-mixed concrete. As a result, the increase in demand over the supply can raise the construction costs and burden builders. The adoption IBS will enable companies to manage their usage of building material better. A more widespread use of IBS will probably even have the effect of stabilizing building material prices.

The implementation IBS can increase the competitive price and better-quality products as it is increasing availability and standardisation of IBS components will help to further reduce construction costs hence make house prices more affordable. Apart from that, the ISO certification for manufacturers will boost buyer's confidence in the quality of the IBS product.

4.2 Distribution of IBS Projects in Malaysia for year 2016

Table 4.1: Construction in Private and Public Projects

Types of Projects	2010	2011	2012	2013	2014	2015	2016	2017
Private Projects	5,424	5,771	5,997	6,228	6,276	5,711	5,846	5,449
Public Projects	1,878	1,954	2,001	1,971	1,800	1,939	2,098	2,099
Total	7,302	7,725	7,998	8,199	8,076	7,650	7,944	7,548

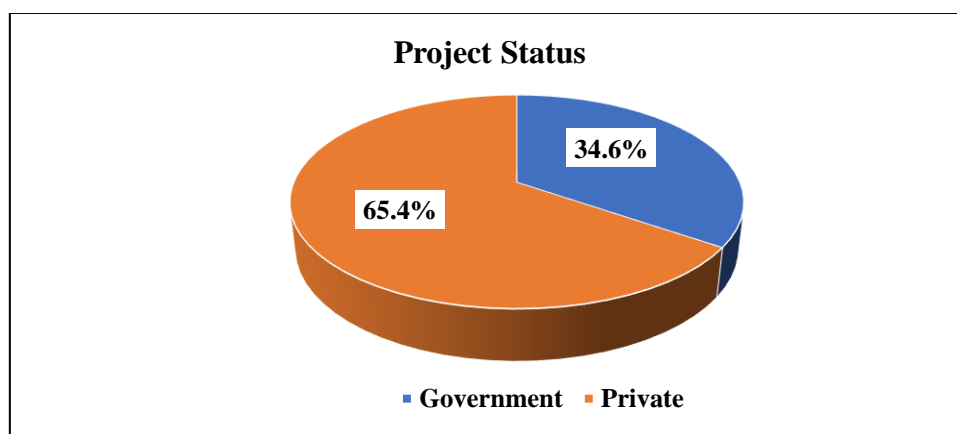
Table 4.2 shows the number of contractors for building projects. The total projects for building contractors including conventional and IBS projects.

Table 4.2:

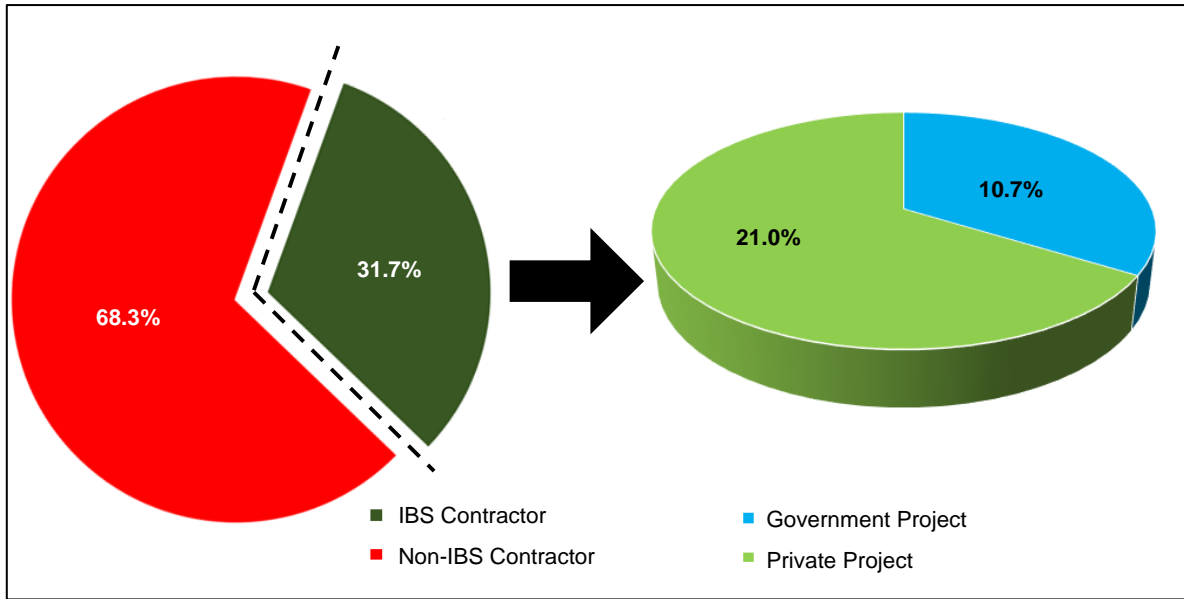
Grade	Number of Contractor	Sector	Code of Specialisation					Total IBS Contractor
			B01: Precast Concrete	B02: Steel Framing	B19: Reusable Formwork	B22: Block-work	B23: Timber Framing	
G1	15	Government	0	0	0	0	0	0
		Private	0	0	0	0	0	

G2	23	Government	0	1	0	0	0	2
		Private	0	1	0	0	0	
G3	198	Government	0	14	1	1	0	19
		Private	0	3	0	0	0	
G4	285	Government	7	53	0	1	4	78
		Private	1	12	0	0	0	
G5	423	Government	1	45	2	2	0	90
		Private	5	34	0	1	0	
G6	271	Government	1	34	0	0	1	65
		Private	0	28	0	0	1	
G7	1789	Government	28	115	2	4	5	698
		Private	58	472	11	3	0	
TOTAL	3004		101	812	16	12	11	952

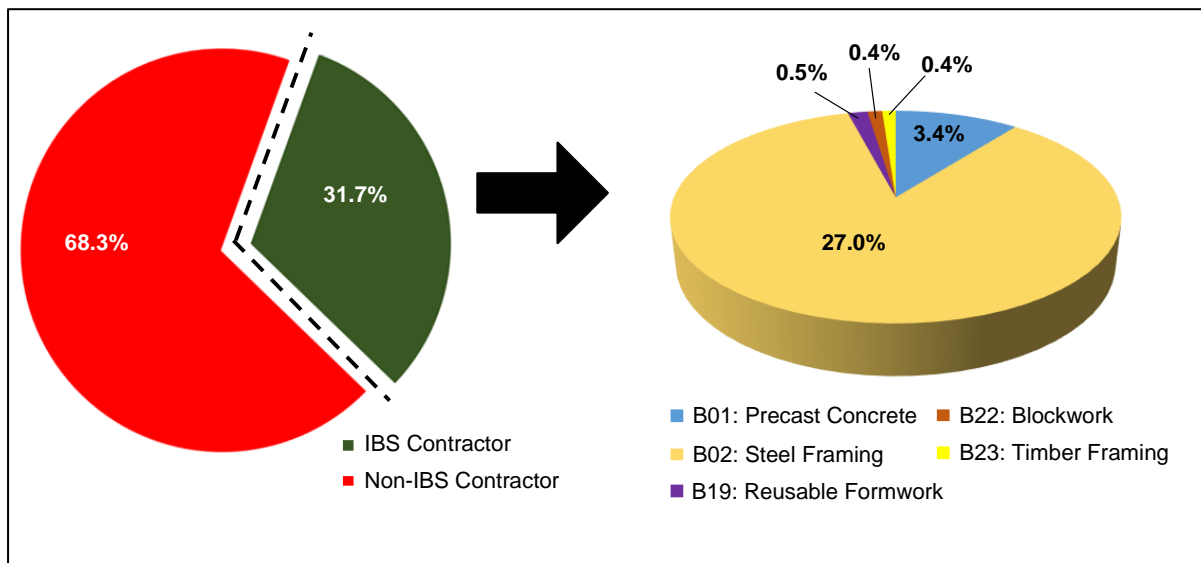
4.3 Sector Distribution for Project Status



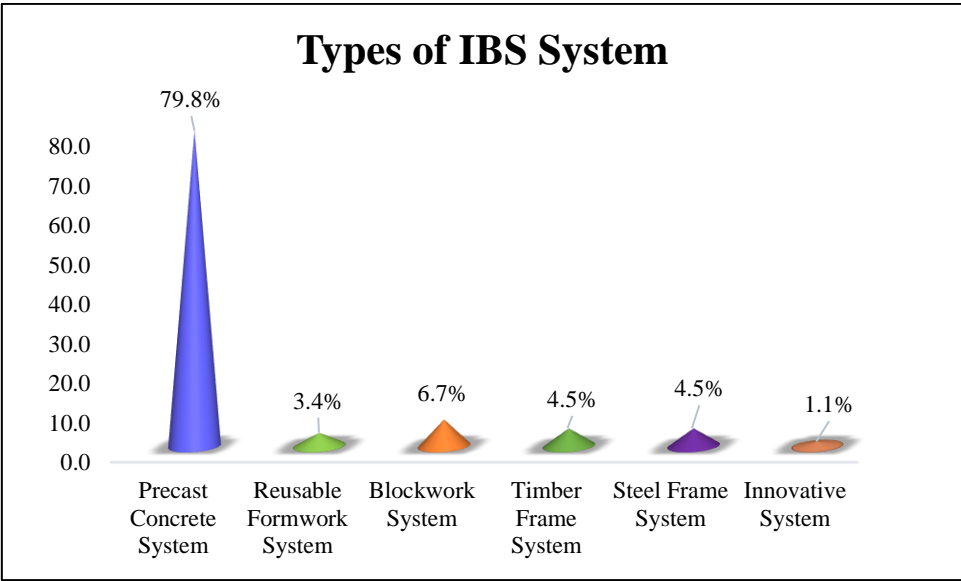
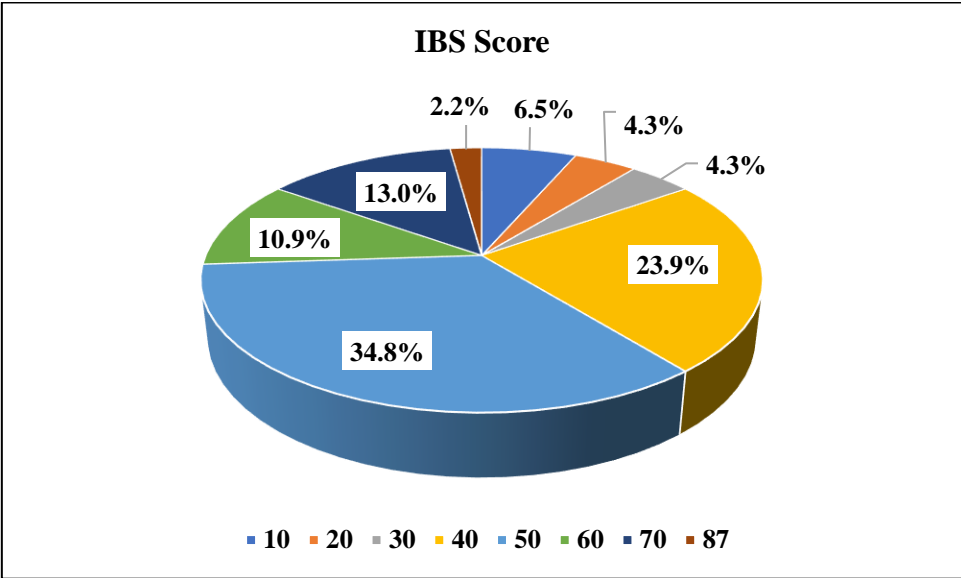
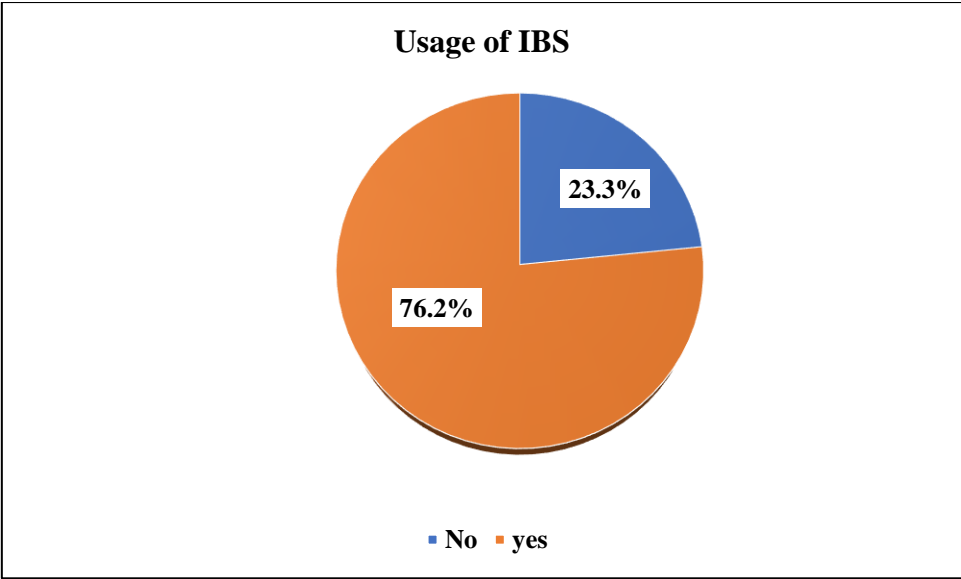
4.4 Fraction of Percentage for IBS and Non-IBS Contractor Based on Government and Private Project

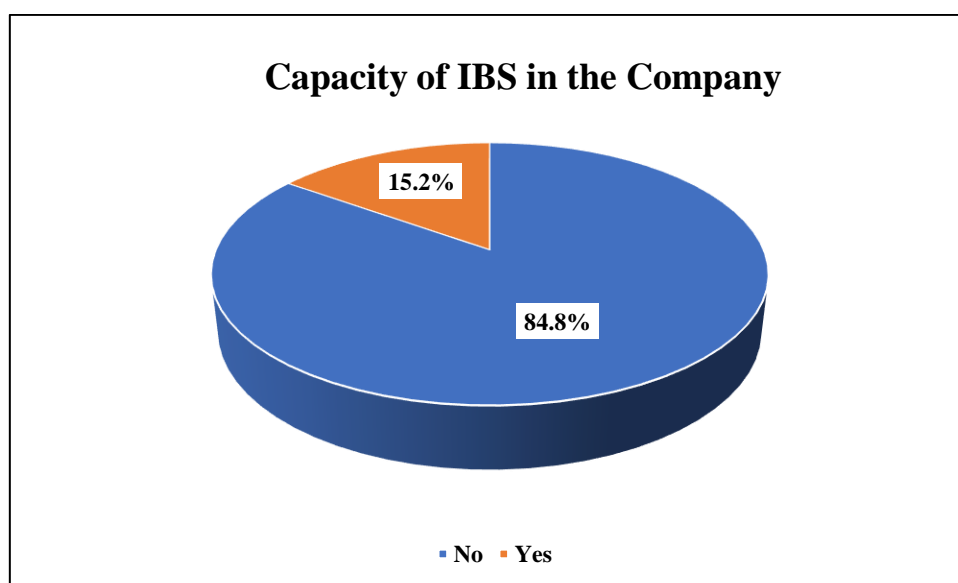
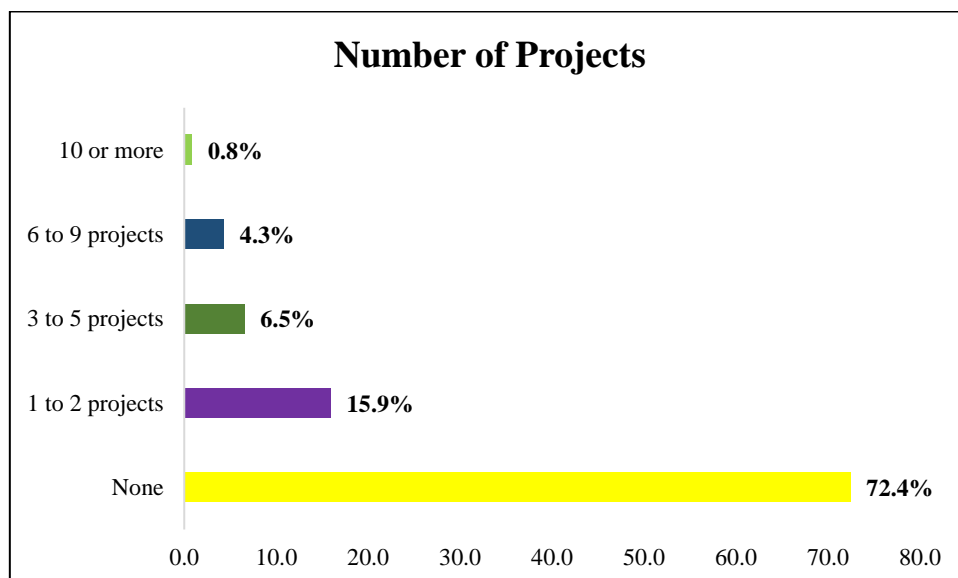
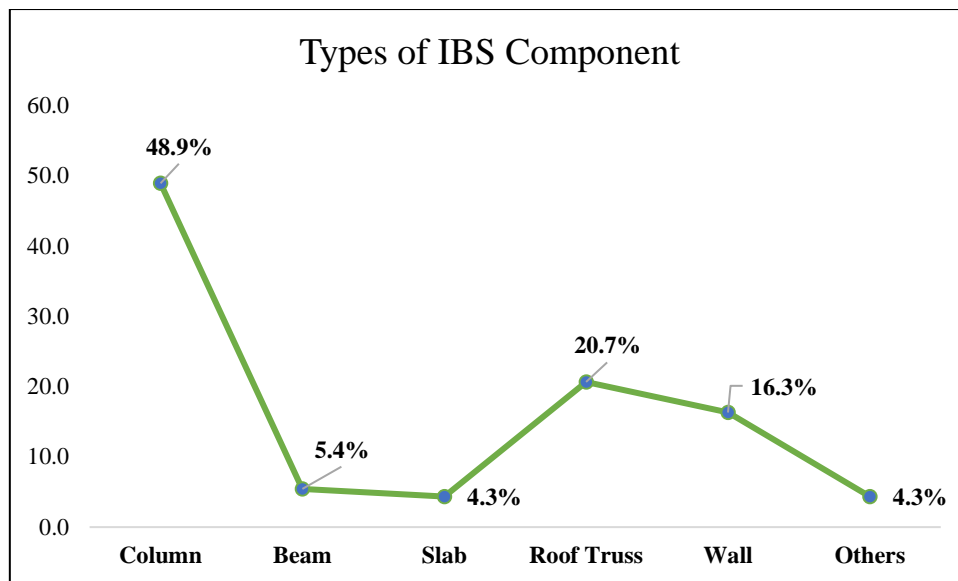


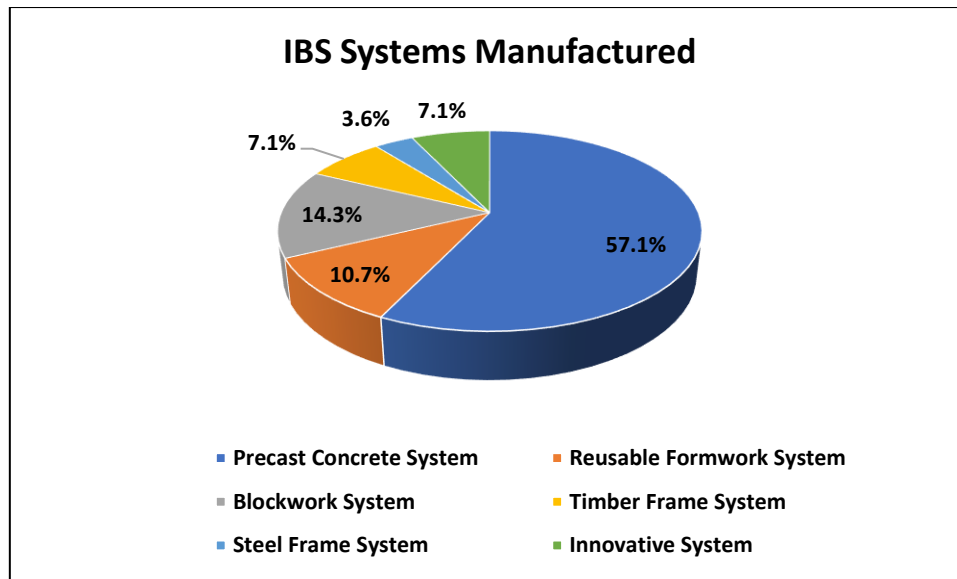
4.5 Fraction of Percentage for IBS and Non-IBS Contractor Based on Types of IBS Categorisation



PRIMARY DATA







Challenges of IBS Adoption in Malaysia

No.	Challenges	Mean	Ranking
1.	High cost of IBS components	3.48	2
2.	Lack of people with IBS project management skill and knowledge	3.34	5
3.	Lack of on-site specialized skills for assembly and erection of components	3.35	4
4.	Additional cost in hiring special equipment and machinery in implementing IBS	3.52	1
5.	Lack of IBS design knowledge among designers and architects	3.31	7
6.	Lack of IBS knowledge and awareness among developers and clients	3.33	6
7.	Lack of standardization on IBS and availability of quality control	3.35	4
8.	Difficulty in obtaining financial support from bank for IBS project	3.38	3

- Cheap unskilled workers make contractor prefer conventional against prefabricated system
- Fragmentation and diversity in construction industry make it difficult to organise IBS plan stage which need consensus among parties
- High cost in delivery from factory to site
- Inability of prefabricated components to change which might be required in buildings over its economic especially in small span room size
- Shortage in raw materials, supply delay and bad weather which affect on transportation
- Shortage in raw materials, supply delay, and bad weather which effect on transportation are the main reasons for delay in IBS projects completion
- Storage process needs large area in a factory to store IBS components and area for trailers and crane movement
- the weakness of connection and jointing systems in IBS. These systems are very critical and sensitive to error and sloppy work

- Transportation process also has its limitation like difficulties to access site and difficulties to transport components from factory to site

The respondents also mentioned other issue related to the IBS implementation. There are ten (10) issues related to the IBS implementation as follows:

i. Transportation

IBS required adequate access to transport IBS components from the factory plant to the construction sites. It will give difficulty if the site is long distance from factory and construction site. Based on study done by the study by (Abraham Warszawski, 1999) on the suitable distance from the new potential development area to the fabrication plant should be the distance with a variance from 50km to 100km.

ii. Capability

The mandatory of IBS implementation should not be forced to the private sector since it will destroy the small contractor because they did not have any factory facilities. The industry should be prepared in term of skills, monetary and knowledge to implement IBS construction.

iii. High Cost

The implementation of IBS construction will increase the cost about 20% since the labour cost of skilled worker is expensive. Besides that, to implement IBS along with BIM, the purchasing of Revit software is needed which incurred cost in the project. The IBS construction related so much with the volume of the demand. If the demand is huge, the cost could be reduced as compared with the conventional construction because of the fast construction. The high cost also includes the plant and machinery preparation for assembling IBS components.

iv. Supply and Demand

The issue of monopoly is still happening in all states. There is also issue in demand. As reported by one of the respondents, the demand of IBS construction is still low.

v. IBS Knowledge

There is still lack of knowledge of IBS amongst the industry player. The training and skills development will take time for the industry player to adopt IBS construction in their project.

vi. Land

The scarcity of land available especially in the centre area is also contributes to the challenges of IBS adoption.

vii. Industry's Acceptance and Perception

Some of the industry player would prefer conventional method rather than new system because they already familiar with the current practice. They can't accept the new system because it will involve new knowledge and skills. Besides that, not all field suitable with IBS construction especially in civil engineering and manufacturing. Most of them agree if the IBS score will remain at 50 IBS score. The implementation of 70 IBS score should be focusing on the G3 to G7 contractor.

viii. Job Opportunity

The respondent mentioned that the job opportunities will decrease if the IBS is adopted. This is the challenges for government and related parties such as CIDB to disburse the information to the player that the main objective of the IBS implementation is to reduce the foreign worker and it will create the new job opportunities with high skills such as precastor, installer and prefabricator of IBS components.

ix. Limitation of Design

There is an issue of the design if adopted IBS in their project. They mentioned that the IBS design is very limited and not attractive.

x. High Skills Required

Specialised skills require onsite for assembly and erection of IBS components. This issue can resolved through the training and practical provided by the Akademi Binaan Malaysia (ABM) or other related agency.

Recommendations

No.	Recommendation	Mean	Ranking
1.	Mitigate the additional cost of using IBS method of construction with non-cash incentives	3.46	7
2.	Provide fast approval for IBS project	3.51	6
3.	Standardising IBS products through the standardisation exercise	3.53	5
4.	Provide IBS training to the construction workforce	3.60	4
5.	Regular promotion and widespread about IBS implementation and its benefits through seminar, workshop, awareness program etc.	3.68	1
6.	Reduce duty stamp for buyers who purchase an IBS house	3.66	2
7.	Compulsory for every building construction plan to adopt IBS	3.64	3

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In conclusion, IBS should be an innovative improvement in the construction industry. IBS is seen as an evolution of construction using new and innovative techniques rather than revolution. IBS have high quality of finished product and minimal wastage due to factory-controlled prefabrication environment. IBS also can reduce the construction time periods and can save valuable time and help to reduce monetary losses. The implementation of IBS among private sector will enlarge the IBS adoption in Malaysia. However, certain things should be considered before mandate the policy. Using the latest CIS 18:2018, 70 IBS score is currently difficult to achieve without the usage of precast concrete system

Extra points can be gained through the following:

- Usage of BIM (up to 6 IBS score)
- Usage of block as alternative to bricks (up to 10 IBS score)
- Usage of Prefabricated Bathroom Unit (PBU) and prefabricated staircase (up to 4 IBS score)

If an increment on IBS score needs to be done, it can be increased to 60 IBS score in the future subject to more detailed study. The respondents agree that the 70 IBS score is implement if there are adequate skills of the construction worker, availability of IBS supplier and financial support from the government.

5.2 Suggestion

The suggestion drawn from this study objectively to increase the adoption of IBS in Malaysian construction industry. Fully acceptance of IBS in government and private sectors can be the starting point to implement the 70 or maybe more IBS score to the both sectors. Suggestions from the respondents in this study can be grouped into ten (10) categories which are:

5.2.1 Incentive

The incentive should be given to the IBS implementer (contractor, consultant, manufacturer and developer) to attract the IBS adoption in Malaysian construction industry. The incentive to buy the Revit software would help the consultant to adopt IBS and Building Information Modelling (BIM) from the planning stage until the implementation stage. The incentive of training and class to the industry will help the industry to have more knowledge on IBS and prefabrication. Thus, with the guarantee of

the incentive to the private sectors, it can help to increase the adoption of IBS in Malaysian construction industry and boost the productivity and skills of the construction workers.

5.2.2 Guideline

To increase the adoption level of IBS in Malaysia, the IBS standards and guidelines should be developed. The conventional and IBS construction method is different in term of procurement, construction process and technology used. Thus, the development of own IBS standard and guideline would help enlighten the process of IBS adoption in Malaysian construction industry.

5.2.3 Promotion of IBS Usage in Malaysia

The exposure on the IBS usage in the Malaysian construction industry is still low based on the opinions from the respondents. The information about IBS does not reach full audience of the industry and only reach certain parties. The information about the IBS usage in low-cost housing projects should be disbursed to the public to increase the awareness about IBS. Besides that, the improvement on the scientific information about the economic benefits of IBS and worker's experience in IBS projects. The knowledge and information about IBS can be spur through campaign and roadshow in all states in Malaysia. The introduction on Modular Component (MC). In term of academic purposes, the knowledge and information of IBS should start from universities and vocational school.

5.2.4 Skills Development

Skills development could be established through course and practical to the contractor related to IBS. Besides contractor, the training should be provided to the construction worker to gain more knowledge on the implementation of IBS. The promotion and training related to IBS should be spread to the government agencies, private developer, architect, engineer, contractor and manufacturer. The development of skills will increase the productivity level of construction industry.

5.2.5 Planning

In term of planning stages, the contractors need to do proper planning and installation to reduce IBS construction cost and manufacturer should register their available components to CIDB.

5.2.6 Open System

The open system should be encouraged to the industry to promote the interchange ability of components by various manufacturer.

5.2.7 Supply Chain

To continue the supply chain in the IBS industry, IBS supplier should be available in all state and provided with enough knowledge and skills of IBS construction. Besides that, it is important that every parties carry their responsibility efficiently. The contract term especially for private project should be revised align with the flow of work of IBS construction.

5.2.8 Financial Support

The financial support to the private projects should be provided to ensure the construction work run smoothly especially in the early stage of construction due to high initial cost in the IBS construction such as machinery, mould preparation, skills workers and factory preparation.

5.2.9 Research & Development (R&D)

The role of research institute, Construction Research Institute of Malaysia (CREAM) is to provide the latest research about the positivity of IBS construction to increase the positive impact and confident of stakeholders to use IBS in their next project. The centre should become the bridge the gap that may disbursed the information on the productivity, quality and utilisation of IBS project.

5.2.10 Policy

The government policies for the IBS construction should be changed according to the work of flow of IBS construction. The support from government in campaign awareness to the industry should be augmented. The IBS component should be controlled by the government to avoid the issue of monopoly.

5.3 Suggestion for Future Research

One of the suggestions to be taken into consideration is the classification of IBS should be expanded to cater the scope of volumetric (modular) and hybrid construction. IBS is not to be a threat to traditional methods. Both methods should be able to work in tandem and improve their processes collectively. IBS should move up the degree of industrialisation from prefabrication to reproduction through innovation. IBS needs to play more roles and must be involved in project life cycle. The reproduction level of industrialisation will involve the whole project life cycle from planning to maintenance. IBS is a solution to the whole life cycle if only it can achieve reproduction level of industrialisation.

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APPENDIX

List of Respondents

1. 3M Synergy Sdn. Bhd.
2. AD Enam Enterprise
3. Adil Bina Enterprise
4. ADL Telus Bina Sdn. Bhd.
5. Ah Chew Construction Sdn. Bhd.
6. Aima Construction Sdn. Bhd,
7. Aima Construction Sdn. Bhd.
8. Aiman Platinum Sdn. Bhd.
9. Akmal Enterprise
10. Alor Construction
11. Alpha Nature Sdn. Bhd.
12. Alpine Dynamics Sdn. Bhd.
13. Amal Image Resources Sdn. Bhd.
14. Amalan Lengkap Sdn. Bhd.
15. Aman Selama
16. Ambang Mutiara Enterprise
17. Amber
18. Amity Diamond Sdn. Bhd.
19. AMJ Engineering Sdn. Bhd.
20. AMZ Construction
21. Ang Ah Chin Sdn. Bhd.
22. Aquamech Corporation Sdn. Bhd.
23. Arastana Enterprise
24. Architectural Acoustic Makers Sdn. Bhd.
25. Arif Benar Sdn. Bhd.
26. Armeen HW Enterprise
27. Arus Sutera Sdn. Bhd.
28. Arze Trading
29. As-Syaff Resources Sdn. Bhd.

30. Assyura Technique Enterprise
31. Astaka Punca Sdn. Bhd.
32. Awi Builder Sdn.Bhd
33. Awin Jaya Enterprise
34. Azam Enterprise
35. Azfar Berkat Resources
36. AZM Jitu Sdn. Bhd.
37. Azza Services Sdn. Bhd.
38. B-TAR
39. B.H Development Sdn. Bhd.
40. Baha Construction & Engineering Services
41. Baiduri Jujur Sdn. Bhd.
42. BBA Jaya Sdn. Bhd.
43. BD Engineering Sdn. Bhd.
44. BDB Synergy Sdn. Bhd,
45. Be3na Makmur Sdn. Bhd.
46. Beautylite Interiors Sdn. Bhd.
47. Belkron Trading Sdn. Bhd.
48. Benih Hadapan Sdn. Bhd.
49. Bersatu Jaya Construction Sdn. Bhd.
50. BF Construction Sdn. Bhd.
51. BGMC Corporation Sdn. Bhd.
52. BHO Sdn. Bhd.
53. Bina Kuria Bersatu
54. Bintang Fadzilat Sdn. Bhd.
55. BKS Construction Sdn. Bhd.
56. Blessplus Sdn. Bhd.
57. Boon Yong Lee Construction Sdn. Bhd.
58. Botanic Acres Development Sdn. Bhd.
59. BPC Civil Engineering Sdn. Bhd.
60. Budi Hayat Construction
61. Bulatan Mekar Sdn. Bhd.
62. Bumi Seroja Enterprise
63. Bumita Development Sdn. Bhd.
64. C.S Construction .o
65. C.Y. Palmer Builders Sdn. Bhd,
66. Camar Kreatif Sdn. Bhd.
67. Capital Network Sdn. Bhd
68. Caprifon Venture Sdn. Bhd.
69. Capriform Builders Sdn. Bhd,
70. Cemerlang Utara Sdn. Bhd.
71. Chan Lim yee Construction
72. Chang Sheng Demolition Specialist Sdn. Bhd.
73. CHB Construction
74. Chef Alliance Sdn. Bhd.
75. Chew KY Construction
76. Chin Keun Keong
77. Chong Yong Rock Blasting Sdn. Bhd.
78. Chuan Huat Contractor
79. Chuan Un Chye Sdn. Bhd.
80. Chuan Wang Decoration and Construction

81. Chunyu Construction Sdn. Bhd.
82. Cicet Corporation Sdn. Bhd.
83. Cintalam Sdn. Bhd.
84. Ciptaicon Development Sdn. Bhd.
85. City Piping Construction
86. CKH Engineering Sdn. Bhd.
87. CM Sales & Construction
88. CNM Enterprise Sdn. Bhd.
89. Comraya Sdn. Bhd.
90. Comset Sdn. Bhd.
91. Coproleh Sdn. Bhd.
92. CPP Builders
93. CSI Bina Sdn. Bhd.
94. CTA Engineering Sdn. Bhd.
95. Current Builders
96. CYLC Construction
97. Cylonix Geotech Sd. Bhd.
98. D'Palma Greens Sdn. Bhd.
99. Dasar Resources Sdn. Bhd.
100. Daya Builders Sdn Bhd
101. Dayatera Engineering Sdn. Bhd.
102. Dezend Interior Sdn. Bhd.
103. Dinaco Sdn. Bhd.
104. DIP Solutions Sdn. Bhd.
105. Doyes Engineering Sdn. Bhd.
106. Dua Daya Interior Sdn. Bhd.
107. Duragress Synergy Sdn. Bhd.
108. DZA Resources
109. E Max Electrical Sdn. Bhd.
110. Earthcare Environment Technology Sdn. Bhd.
111. Eastern City Development Sdn. Bhd.
112. Eastmont Sdn. Bhd.
113. Eco Highland Construction
114. Econpile Sdn. Bhd.
115. EGI Construction Sdn. Bhd.
116. Elanz Design Build Sdn. Bhd.
117. Elco Advance Engineering Sdn. Bhd.
118. Element Builders Sdn. Bhd.
119. EMC Pacific Sdn. Bhd.
120. Empayar Megah Engineering Sdn Bhd
121. Energiser Enterprise Sdn. Bhd.
122. Esta Valley Sdn Bhd
123. Etika Damai Sdn. Bhd.
124. Express Marble Sdn. Bhd.
125. F&B Facilities Sdn. Bhd.
126. FAA Sdn. Bhd.
127. Faco Trading
128. Fairview Construction Sdn. Bhd.
129. Fanware Sdn. Bhd.
130. Fasa Abadi Sdn. Bhd.
131. FDZ Engineering

132. Federal Engineering Works
133. Feng Fatt Construction Sdn. bhd.
134. First star Construction Sdn. Bhd.
135. Fitrah Resources Sdn. Bhd.
136. Fizwah Pembinaan Sdn. Bhd.
137. Fokus Era Maju Sdn. Bhd.
138. Fokus Teguh Dinamik Sdn. Bhd.
139. Forte Builders Sdn. Bhd.
140. Four Seasons Landscape Sdn. Bhd.
141. Fuh Yeh Construction Sdn. Bhd.
142. Fyda Enterprise
143. Gadekbena
144. Galatech Sdn. Bhd.
145. Gamuda Engineering Sdn. Bhd.
146. Ganda Tekad Sdn. Bhd.
147. GBC Interior & Engineering Works
148. Gemersik Corporation
149. Geohan Sdn. Bhd.
150. Geowing Sdn. Bhd.
151. GGT Manufacture Eco SV
152. Gold Li Development Sdn. Bhd,
153. Golden Comet Sdn. Bhd.
154. Goldexcel Development Sdn. Bhd.
155. GPM Trading
156. Great Jack In Sdn. Bhd.
157. Great Purpose Sdn. Bhd.
158. Greatchain
159. Green enhancement Sdn. Bhd,
160. GW Bersekutu Sdn. Bhd.
161. GYL Construction Sdn. Bhd.
162. Hakikat Engineering Sdn. Bhd.
163. Happy Lite Electrical Sdn. Bhd.
164. Hasta Gaya Sdn. Bhd.
165. HDZ Maju Engineering Sdn. Bhd.
166. Herald Design Sdn. Bhd.
167. high welta sdn bhd
168. Hijrah Perkasa Construction
169. Himpun Daya Sdn Bhd
170. HND Join Builder Sdn. Bhd.
171. Hong Chun Construction Sdn. Bhd.
172. Horizon Builders
173. Hormat Prima Sdn. Bhd.
174. HSA Setia Murni Sdn. Bhd.
175. HYK Enterprise Sdn. Bhd.
176. IHS Utara Malaysia Sdn. Bhd.
177. Imaging Space Design Sdn. Bhd.
178. Imaprima Sdn. Bhd.
179. Impian Gana Sdn. Bhd.
180. Impian Maju Jaya Sdn. Bhd.
181. Infra Raya Sdn. Bhd.
182. Ingrand Jovinas Sdn. Bhd.

183. Ira Enterprise
184. Ired Ventures Sdn. Bhd.
185. Iris Corporation Berhad
186. Island Landscape Construction Sdn. Bhd.
187. Iz Resources Sdn. Bhd.
188. Izinria Sdn. Bhd.
189. Jadi Bina Enterprise
190. Jasa Sand Resources
191. Jasakon Sdn. Bhd.
192. Jaya Bina Properties Sdn. Bhd.
193. JB Enterprise
194. JBS Engineering Sdn. Bhd.
195. Jenka Makmur Enterprise
196. Jentayu Tuah Sdn. Bhd.
197. Jian Fa Construction Sdn. Bhd.
198. Jie Mei Construction & Trading
199. Jinora Corporation Sdn. Bhd.
200. Jiven Construction Sdn. Bhd,
201. Jutabina Sempurna Sdn. Bhd.
202. KA Renovatio & Trading Sdn. Bhd.
203. Ka utara Enterprise
204. kalaka jaya sdn.bhd
205. Karib Engineering Sdn. Bhd.
206. Karib Serasi Sdn. Bhd.
207. Kasyaf Bina Sn. Bhd.
208. Katata Construction Sdn. Bhd.
209. Kayangan Jitu Teguh
210. KBE Construction Sdn. Bhd.
211. KCS Construction
212. Kean Aun Construction & Trading
213. KED Teknikal Sdn. Bhd.
214. Keen Way Development Sdn. Bhd.
215. Kejuruteraan Fajar Baru Sdn. Bhd.
216. Kejuruteraan Gagasan Teguh
217. Kejuruteraan Syatek Sdn.Bhd
218. Kelibat Megah Sdn. Bhd.
219. Kenforce Construction Sdn. Bhd.
220. KH Khoon Construction Sdn. Bhd.
221. Kibaran Pelangi Sdn. Bhd
222. Kim Huat Engineering
223. King Ong Development Sdn. Bhd.
224. Kinsanuri Sdn. Bhd.
225. Kluang Setia Construction Sdn. Bhd.
226. KMS Asia Builder Sdn. Bhd.
227. Ko Shen Enterprise
228. Kontrak Bina Enterprise Sdn. Bhd.
229. Koperasi
230. Koperasi Felda Mayam Berhad
231. Koperasi Peneroka Felda Keratong Tujuh Rompin Bhd
232. Koperasi Peserta FELCRA
233. Koperasi Serbaguna Felda Jumai Bhd

- 234. KR Vision Contractor
- 235. KT Bena
- 236. KTE Engineering Sdn. Bhd.
- 237. Kualiti Azamat Sdn. Bhd.
- 238. Kung Advance Builders Sdn. Bhd.
- 239. Kurnia Matang Sdn Bhd
- 240. L&Tan Contractor
- 241. Labu Hijauan Development Sdn. Bhd.
- 242. Laksamana Builders Sdn. Bhd.
- 243. LAL Elo Construction Sdn. Bhd.
- 244. Lam Lee Construction Sdn. Bhd.
- 245. Landhon Builders Sdn. Bhd.
- 246. Langkah Wawasan Enterprise
- 247. LBEC Sdn. Bhd.
- 248. Leading Global Engineering Sdn. Bhd.
- 249. Leadshine Sdn. Bhd.
- 250. Lean Ma Construction
- 251. Lee Brothers Engineering Sdn. Bhd.
- 252. Lee Suai
- 253. LHL Lim Engineering Sdn. Bhd.
- 254. LHT Piling & Trading Sdn. Bhd.
- 255. Liew Sing Properties Sdn. Bhd.
- 256. Lik Kuok Contractor
- 257. Lik Son Construction Training Sdn. Bhd.
- 258. Lim Boon Aik Construction Sdn Bhd
- 259. Lim Chin Chai Building Construction Sdn. Bhd.
- 260. Lim Hoo Construction Sdn. Bhd.
- 261. Lingkaran Kualiti Sdn. Bhd.
- 262. Lingkaran Muhibah Sdn. Bhd.
- 263. Lingson Bina Sdn. Bhd.
- 264. LKM Bina Maju
- 265. LKM Engineering & Construction Works
- 266. LMW Development Sdn. Bhd.
- 267. Lohdec Enterprise Sdn. Bhd.
- 268. Long Stay Construction Sdn. Bhd.
- 269. Longhouse Development (Labuan) Sdn. Bhd
- 270. Low Kuang Faat
- 271. LSB Construction Sdn. Bhd.
- 272. Lunas Megah Sdn. Bhd.
- 273. M-One Construction Sdn. Bhd.
- 274. Maba Trading
- 275. Mainline Sdn Bhd
- 276. Maju PBJ
- 277. Mamidor Reka Bina Sdn. Bhd.
- 278. Marang Engineering Sdn. Bhd.
- 279. Massufei Sdn. Bhd.
- 280. Master Coordinates Sdn. Bhd.
- 281. Max Annexe Sdn. Bhd.
- 282. Max P Enterprise
- 283. May Keong Sdn. Bhd.
- 284. Mega Megah

285. Mega Star Trading Sdn. Bhd.
286. Megabina Industries Sdn. Bhd.
287. Megamaju Bina Sdn Bhd
288. Mekar Mewah Construction Sdn. Bhd.
289. Melayujati Enterprise
290. Melbourne Sunrise Sdn. Bhd.
291. Mexajati Sdn Bhd
292. MF Multi Tech Enterprise
293. Midland Classic Sdn. Bhd.
294. MIQ Sedia Bina Sdn. Bhd.
295. Miracle Motion Sdn. Bhd.
296. MJ Top Builders Sdn. Bhd.
297. MLG Design & Construction Sdn. Bhd,
298. MMA Tech EGINEERING Sdn. Bhd.
299. MNK Kosa Sdn. Bhd.
300. Moh Seng Construction Sdn. Bhd.
301. Mohafaz Sdn. Bhd.
302. Mok Kim Loy Holdings Sdn. Bhd.
303. MSP Construction Sdn. Bhd.
304. Muhamad Ridzuan Enterprise
305. Mujur Sepakat Sdn. Bhd.
306. MYS Construction Sdn. Bhd.
307. Nadi Cergas Sdn. Bhd.
308. Nam Long
309. Nar Development Sdn.Bhd
310. Nazareka Sdn. Bhd.
311. Nazif Enterprise
312. New Bridge Synergy Sdn. Bhd.
313. NFZ Bina Enterprise
314. Ng Brother Construction Work Sdn. Bhd,
315. Ng Tian Seng
316. Ngai Sing
317. Nicolite Developmenr Sdn Bhd
318. Ninety Nine Kay Sdn. Bhd.
319. North Point Construction Sdn. bhd.
320. Nuripac Sdn. Bhd.
321. Nusa Prestij Sdn. Bhd.
322. Objektif Selatan Sdn. Bhd.
323. Ong and Chee Construction Sdn. Bhd.
324. Paramount Construction Sdn. Bhd,
325. Patih Villa Sdn. Bhd.
326. Peace Garden & Hobbyest Centre Sdn. Bhd.
327. Pembinaan Budi Tunggal Sdn. Bhd.
328. Pembinaan Cenderung Sdn. Bhd.
329. Pembinaan Din-Z Sdn. Bhd.
330. Pembinaan I&R Sdn. Bhd.
331. Pembinaan Jaya Megah Sdn. Bhd.
332. Pembinaan Jaya Timuran Sdn. Bhd.
333. Pembinaan Jaya Zira Sdn. Bhd.
334. Pembinaan Kerjadi Sdn. Bhd.
335. Pembinaan Koh & Lam

336. Pembinaan LNS Sdn. Bhd.
337. Pembinaan NKZ Sdn. Bhd.
338. Pembinaan Rastamas Sdn. Bhd.
339. Pembinaan SJA Sdn. Bhd.
340. Pembinaan TLT Sdn. Bhd.
341. Pembinaan Usadaya
342. Pembinaan Zakaria Salleh Sdn. Bhd.
343. Perfect One Contract Sdn. Bhd.
344. Perkasa Jauhari Sdn. Bhd.
345. Permai Pancar Sdn. Bhd.
346. Permata Makmur Sdn. Bhd.
347. Perniagaan Farros
348. Perniagaan Jumaah Hazim
349. Perniagaan Sunta Jaya
350. Persada Satria Sdn. Bhd.
351. Perteguh Sdn. Bhd.
352. Pertubuhan Peladang Kawasan Selama
353. Perwira Progresif Construction Sdn. Bhd.
354. Petronine Sdn.Bhd.
355. Phing Fatt
356. Piin Foong Construction Sdn. Bhd.
357. Platinum Matrix Construction Sdn. Bhd.
358. Polybuilding construction
359. Portland Arena Sdn. Bhd.
360. Portland Builders Sdn. Bhd.
361. Power Cold Engineering
362. President Sign Sdn. Bhd.
363. PRIMA Horizon Sdn. Bhd.
364. Pro Sucess Development Group Sdn. Bhd.
365. Proasia Construction
366. Profile Construction Sdn. Bhd.
367. Projadi Sdn. Bhd.
368. Proshen Construction Sdn. Bhd,
369. Prosignal Engineering Sdn. Bhd.
370. PSR Construction Sdn. Bhd.
371. Puncak Laksana Enterprise
372. Purisdec Sdn. bhd.
373. Quality Jaya Sdn. Bhd,
374. Quek & Company Sdn. Bhd.
375. Radiant
376. Raintree Building Construction Sdn. Bhd.
377. Raja Hussin Sdn. Bhd.
378. Real Art Interior Sdn. Bhd.
379. Ria Kistana Sdn. Bhd.
380. Rich Redhill
381. Rimbun Kristal Construction
382. Road Focus Engineering Trading
383. Rofar Vista Sdn. Bhd.
384. Rumah Gading Enterprise
385. S.M. Perusahaan Jaya Sdn. Bhd.
386. S&F Construction Sdn. Bhd.

- 387. SA Vertex Sdn. Bhd.
- 388. Sadiiah Trading
- 389. Sah Dynamix Enterprise
- 390. Salo Construction Sdn. Bhd.
- 391. Sama Setia Develpoment Sdn. Bhd.
- 392. Samamara Sdn. Bhd.
- 393. Sara Angkasa Sdn. Bhd.
- 394. Sarwaga Sdn.Bhd
- 395. Sawaja Maju Sdn Bhd
- 396. Scenic Home Development Sdn Bhd.
- 397. SDS Bina Sdn. Bhd.
- 398. See Yon Construction Works Sdn. Bhd.
- 399. Segar Bernas Sdn Bhd.
- 400. Sekitar Indah Sdn. Bhd.
- 401. Selenggara Maju Trading
- 402. Sena Jaya Construction
- 403. Seng San Construction Sdn. Bhd.
- 404. Sepang Cemerlang Sdn. Bhd.
- 405. Seri Jaya Perkasa Sdn. Bhd.
- 406. Seri Wajamas Sdn. Bhd.
- 407. Serita Maju Sdn. Bhd.
- 408. Setaraya Sdn. Bhd.
- 409. Setiason Sdn. Bhd.
- 410. Sg. Jaya Bina
- 411. Sharuddin Yusof
- 412. Sheng Ek Piling Works Sdn. Bhd.
- 413. Shin Wa Metals Sdn. Bhd.
- 414. Shing Wah Lim Sdn. Bhd.
- 415. Silang Bina Sdn. Bhd.
- 416. Sim Yeow Seng Construction Sdn. Bhd.
- 417. SinarHaszam Enterprise
- 418. Sitges Engineering Sdn. Bhd.
- 419. Solid Fenge Builders Sdn. Bhd.
- 420. Soon Lee Machine Construction
- 421. Soon Siang Sdn. Bhd.
- 422. SPK Asas Sdn. Bhd.
- 423. Sri Mansang Sdn. Bhd.
- 424. Star Eco Builders Sdn. Bhd.
- 425. Starhill Engineering Sdn. Bhd.
- 426. Summerville Landscape Sdn. Bhd.
- 427. Sunway Geotechnic Sdn. Bhd.
- 428. Supreme
- 429. Swee Jin Motor Sdn. Bhd.
- 430. Swerve Design Sdn. Bhd.
- 431. Syarikat Kejuruteraan Ikatan Jaya Sdn. Bhd.
- 432. Syarikat Layang
- 433. Syarikat Pembangunan Setia Jaya
- 434. Syarikat Raznik Construction Sdn. Bhd.
- 435. Syarikat Segaya
- 436. Syauqi Enterprise
- 437. Tackor Design Sdn. Bhd.

- 438. Tadmax Builders Sdn. Bhd.
- 439. Tag Innovation Sdn. Bhd.
- 440. TAKI Engineering Sdn. Bhd.
- 441. Tamaya Synergy Sdn. Bhd.
- 442. Tan Lee Soon Holdings Sdn. Bhd.
- 443. Tanjung Siang Sdn. Bhd.
- 444. Tay Mun Hua Enterprise Sdn. Bhd.
- 445. Tech Huat Enterprise Sdn. Bhd.
- 446. Teekh Construction Sdn. Bhd.
- 447. Tekad Warisan Sdn. Bhd.
- 448. Teras Jelapang Sdn. Bhd.
- 449. TG Target Sdn. Bhd.
- 450. Thak Soon Sdn. Bhd.
- 451. THN Development Sdn Bhd
- 452. Ting Foong Trading Sdn. Bhd.
- 453. Titisian Ilham Sdn. Bhd.
- 454. TM Builders Sdn. Bhd.
- 455. TMJ Buildcon Sdn. Bhd.
- 456. Total Dynamic Engineering Sdn. Bhd.
- 457. Total Modern Engineering Sdn. Bhd.
- 458. Traingle Capital PLT
- 459. Twin Title (M) Sdn. Bhd.
- 460. TYB Property Holdings Sdn. Bhd.
- 461. UCC Piling & Timber Trading Sdn. Bhd.
- 462. Ultimate Resources
- 463. Ultra Airconditioning Sdn. Bhd.
- 464. Unbros Construction Sdn. Bhd.
- 465. Uni Kawa Metal Trading Sdn. Bhd.
- 466. Uniplan Projects Sdn. Bhd.
- 467. Unitedhome Construction Sdn. Bhd.
- 468. Uniwise Engineering
- 469. Usahasama A&M Construction Sdn. Bhd.
- 470. Usahasama Mempaga Enterprise
- 471. V-Grass Sdn.Bhd
- 472. Verogroup Construction Sdn. Bhd.
- 473. Vibrant Rank Sdn. Bhd.
- 474. Vista Maju Construction Sdn. Bhd.
- 475. W&C Construction Engineering Sdn. Bhd.
- 476. Wah Construction
- 477. Wangsatama Sdn. Bhd.
- 478. Wawasan Intact Construction Sdn. Bhd.
- 479. Waz Lian Enterprise Sdn. Bhd.
- 480. WEK Enterprise Sdn.Bhd.
- 481. West Quay Builders Sdn. Bhd.
- 482. WH Creative Builders Sdn. Bhd.
- 483. Wibawa Pakat Construction Sdn. Bhd.
- 484. Wijaya Daya Sdn. Bhd.
- 485. Wing Seong Fatt Construction Sdn. Bhd.
- 486. Wonderful Sense Sdn. Bhd,
- 487. Wong Hock Choon
- 488. WT Renovation & Construction Sdn. Bhd.

- 489. WTN Builders Sdn. Bhd.
- 490. Yida Construction & Hradware Enterprise
- 491. YNH Construction Sdn. Bhd.
- 492. Yon Fatt Construction Sdn. Bhd.
- 493. YPM Realities Sdn. Bhd.
- 494. Yu Tee Construction
- 495. Yudan Corporation Sdn. Bhd.
- 496. Zam's Enterprise
- 497. Zekba Construction & Trading Sdn. Bhd.
- 498. Zira Enterprise
- 499. ZJH Gemilang Sdn. Bhd.
- 500. ZM Global Trading
- 501. ZR Bina Jaya Enterprise