IBS ADOPTION ON GOVERNMENT AND PRIVATE PROJECTS IN MALAYSIA 2019

CIDB Technical Publication No. : 212

CIDB MALAYSIA

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MALAYSIA

PREFACE

The Malaysian construction industry has continuously pushed for the mass adoption of an Industrialised Building System (IBS) as it will reduce reliance on cheap foreign labour while creating skilled jobs for locals. IBS can also reduce construction costs and increase safety while sustaining the quality of construction projects. IBS is not an unfamiliar subject in Malaysia. In 1999, the IBS steering committee was formed, and the IBS Strategic Plan was published by the Construction Industry Development Board Malaysia (CIDB). In 2003, the first roadmap known as the IBS Roadmap 2003-2010 was developed, followed by the IBS Roadmap 2011-2015 and Construction Industry Transformation Programme 2016-2020. CIDB Malaysia has also set up a one-stop reference centre for IBS, which began operations in January 2007.

In 2008, a new circular was issued by the government that mandated the use of IBS in government projects worth RM10 million and above to achieve a minimum IBS score of 70. Since 2018, the Ministry of Housing and Local Government has mandated the adoption of IBS in private projects worth RM 50 million and above to achieve a minimum IBS score of 50. This report identifies the level of IBS adoption in Malaysia for both government and private projects in the year 2019, and the data is analysed using two methods of data analysis – primary data analysis and secondary data analysis.

The primary data in this report was collected using a survey questionnaire, which was distributed to 500 respondents, including building contractors registered with CIDB. The main objective of the primary data analysis is to pinpoint the level of IBS adoption in both government and private sectors. It was found that only 36.1% of government projects and 33.1% of private projects are using IBS. The IBS scores among government projects range from an IBS score of 20 to 70, while private projects have achieved IBS scores that range between 30 and 70.

For the secondary data analysis, the data was collected from the Implementation Coordination Unit (ICU) and the Construction Industry Development Board Malaysia (CIDB). The aim of the secondary data analysis was to identify the level of IBS adoption among government sectors according to states, IBS score and project values. The secondary data analysis only involved building and federal government projects. The government data was analysed from 2008 until 2019, however this report is focusing on year 2019. Overall, from year 2008 until 2019, 82.2% of the IBS projects has achieved more than 70 IBS score while 17.8% achieved less than 70 IBS score with highest percentage on year 2014. Focusing on 2019, 68.0% of the IBS projects has achieved more than 70 IBS score which Melaka has achieved fully percentage. Meanwhile, 32.0% achieved less than 70 IBS score which Sarawak is the highest percentage of 76.7%.

For project value more than RM 10 million, Melaka and Negeri Sembilan achieved fully percentage achieved more than 70 IBS score. Overall, 78.2% has achieved more than 70 IBS score in 2019 with most of the projects has value between RM 450 million to RM 600 million. Surprisingly, for project value less than RM 10 million, 43.1% has achieved more than 70 IBS score.

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EDITORIAL

This research was funded by the Construction Industry Development Board (CIDB) Malaysia and executed by the Construction Research Institute of Malaysia (CREAM). We would like to thank the editorial team for their contribution and support.

ABBREVIATIONS

CIDB	Construction Industry Development Board
IBS	Industrialised Building System
ICU	Implementation Coordination Unit
SME	Small Medium Entrepreneur
DOSM	Department of Statistics Malaysia
COVID-19	Coronavirus disease 2019
RM	Ringgit Malaysia
SBG	Segmental Box Girder
R&D	Research & Development
CREAM	Construction Research Institute of Malaysia
JPM	Jabatan Perdana Menteri
CIS	Construction Industry Standard
MS	Malaysian Standard


UNDER CONSTRUCTION

INTRODUCTION

INTRODUCTION

The Malaysian economy recorded 17.1% from a marginal growth of 0.7% in the first quarter of 2020. The performance during this quarter was the lowest recorded since the fourth quarter of 1998 (-11.2%) (DOSM), 2020). This was most likely due to the devastating effects of the COVID-19 pandemic. The construction industry plummeted by a staggering 44.5%, implying that this sector was highly affected during the pandemic.

The construction industry will give a multiplier effect to the material production sector, equipment, and other services sectors. According to Mohammed & Ahmad (2002), the growth of the construction industry can be seen from the following aspects:

i. Job opportunities
ii. Physical growth
iii. Construction Technology
iv. Increment of Land Value

IBS Chronicle in Malaysia

In the Malaysian construction industry, contractors are divided into categories or grades according to specific size brackets ranging from small contractors (G1-G3) to medium-sized contractors (G4-G5), up to the large (G6-G7) contractors. Due to the often unpleasant working conditions and the availability of cheap foreign workers, the majority of construction companies prefer to hire them over locals. In 2008, as part of the effort to reduce the dependency on foreign workers, the government initiated the implementation of the Industrialised Building System (IBS) to the construction industry. Every government project shall achieve at least 70% of the IBS component (CIDB, 2010). The chronology of IBS implementation is recorded in Figure 1.

The IBS Roadmap 2003 -2010 (CIDB, 2003) highlighted six (6) main IBS systems and components as shown in Table 1.

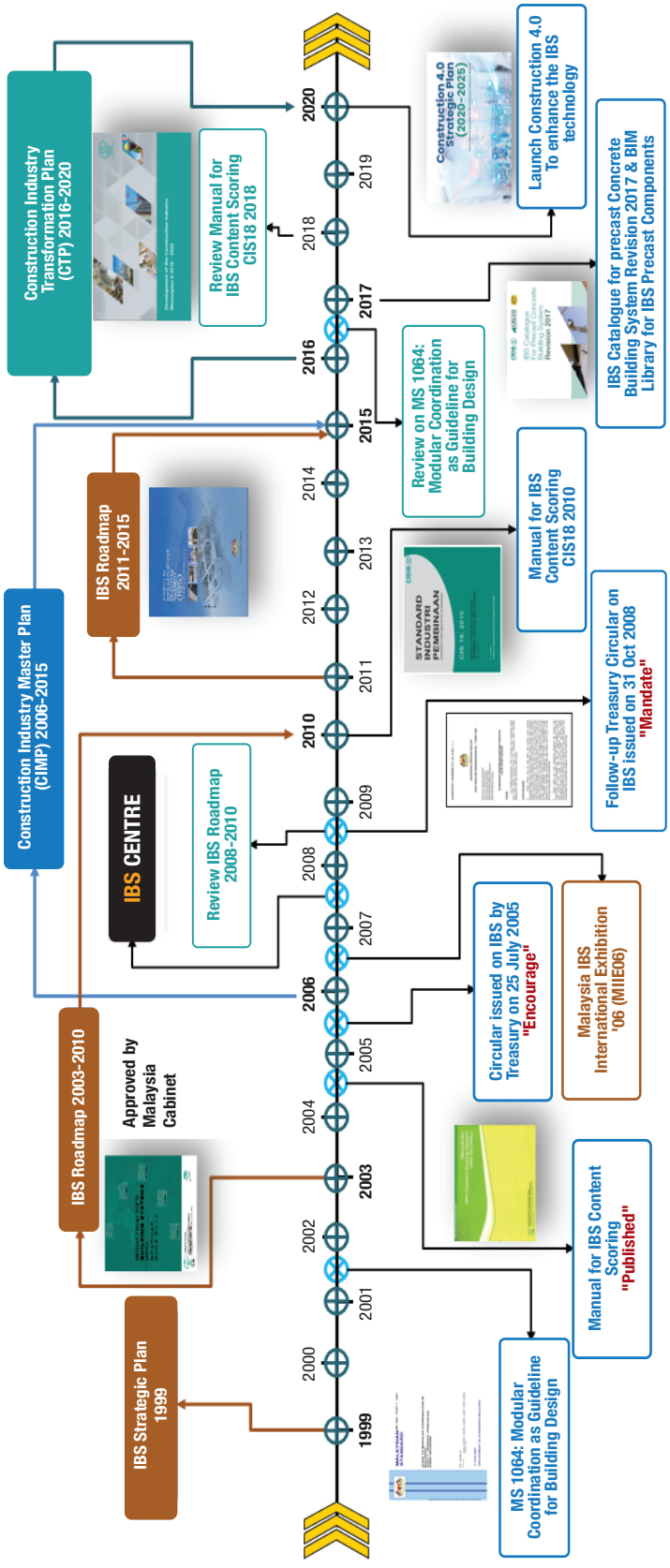


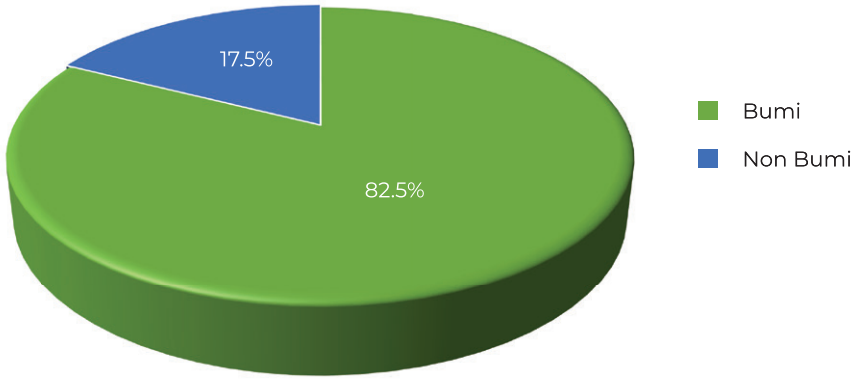
Figure 1: Chronology of IBS Implementation in Malaysia

Table 1: 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.
Metal Framing	Column Beam Roof truss	Commonly used with precast concrete slab, metal 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	To classify new systems introduced in the Malaysian construction industry that do not belong in the five main IBS in the CIDB's IBS classifications (2003), CIDB introduced the innovative system to classify new and innovative systems in the IBS approach.

Statistics of IBS Players in Malaysia

Statistics of IBS Contractors Registered with CIDB According to IBS System



Source: CIDB (October 2020)

Figure 2: Percentage of Bumi and Non-Bumi IBS Contractors

Figure 2 shows the percentage of Bumi and Non-Bumi IBS contractors in Malaysia. The majority (82.5%) of IBS contractors are Bumiputera contractors, while 17.5% of IBS contractors are Non-Bumiputera.

Table 2: Total Number of Bumi and Non-Bumi IBS Contractors Based on System and State

State	Total	B01: Precast Concrete System		B02: Metal Framing System		B19: Reusable Formwork System		B22: Blockwork System		B23: Timber Framing System	
		Bumi	Non Bumi	Bumi	Non Bumi	Bumi	Non Bumi	Bumi	Non Bumi	Bumi	Non Bumi
Selangor	**1,940**	340	86	1,024	264	35	18	129	18	19	7
W.P. Kuala Lumpur	**1,202**	187	70	543	289	20	19	56	10	6	2
Sarawak	**952**	271	185	266	145	16	8	42	12	7	0
Kelantan	**900**	353	15	404	27	6	1	86	2	6	0
Johor	**877**	131	15	556	89	19	1	52	1	13	0
Kedah	**701**	201	10	406	31	5	0	48	0	0	0
Pulau Pinang	**700**	110	4	464	85	1	2	29	2	3	0
Sabah	**666**	150	142	227	92	11	2	22	13	6	1
Pahang	**595**	85	7	429	42	4	1	24	1	2	0
Perak	**567**	145	13	275	40	9	2	63	3	16	1
Terengganu	**559**	89	3	406	30	8	0	10	0	12	1
Negeri Sembilan	**550**	231	9	221	35	4	0	46	0	4	0
Melaka	**387**	98	8	171	29	30	2	47	1	1	0
Perlis	**257**	62	2	164	7	1	0	19	0	2	0
W.P. Labuan	**20**	8	0	7	2	1	0	1	0	1	0
W.P. Putrajaya	**17**	8	0	8	1	0	0	0	0	0	0
Total	**10,890**	**2,469**	**569**	**5,571**	**1,208**	**170**	**56**	**674**	**63**	**98**	**12**

Source: CIDB (October 2020)

In the table above (Table 2), the total number of Bumi and Non-Bumi IBS contractors based on system and state are shown. Most (5,571) of the IBS projects using the Metal Framing System are by Bumiputera contractors, followed by 2469 IBS projects using the Precast Concrete System. Overall, the total number of IBS projects using these five systems is 10,890. The majority of the projects are implemented by Bumiputera contractors as compared to Non-Bumiputera contractors.

Total Number of IBS Consultants

Table 3 shows the total number of IBS consultants, which include engineers, architects, and quantity surveyors. Most of the IBS consultants are engineers, followed by architects and quantity surveyors. The majority are based in Selangor, followed by Wilayah Persekutuan Kuala Lumpur. Overall, there are 49 IBS consultants all over the country.

Table 3: Total Number of IBS Consultants

State	Engineer	Architect	Quantity Surveyor	Total
Selangor	15	2	1	18
W.P. Kuala Lumpur	8	3	1	12
Sabah	3	0	2	5
Sarawak	4	0	0	4
Kedah	2	0	1	3
Negeri Sembilan	1	1	1	3
Johor	0	1	0	1
Kelantan	1	0	0	1
Terengganu	1	0	0	1
Pahang	1	0	0	1
Perak	0	0	0	0
Pulau Pinang	0	0	0	0
Perlis	0	0	0	0
Melaka	0	0	0	0
W.P. Labuan	0	0	0	0
W. P. Putrajaya	0	0	0	0
Total	**36**	**7**	**6**	**49**

Source: CIDB (October 2020)

Statistics of IBS Manufacturer and Supplier

The statistics regarding IBS manufacturers and suppliers according to Bumi and Non-Bumi contractors are stipulated in Table 4 below. Most of the manufacturers and suppliers are Non-Bumi, with a percentage of 71.7% and 85.2% respectively.

Table 4: Statistics of IBS Manufacturers and Suppliers

Manufacturer	Bumi	82 (28.3%)	**290**
	Non-Bumi	208 (71.7%)	
Supplier	Bumi	4 (14.8%)	**27**
	Non-Bumi	23 (85.2%)	
TOTAL			**317**

Source: CIDB (October 2020)

Table 5: Total Number of IBS Players Based on State, System and Bumiputera Status

State	Total	Precast Concrete System										Reusable Formwork System					Metal Framing System										Timber Framing System					Blockwork System					Innovative System				
		Precast					Onsite Precast					Formwork					Steel Structure					Metal Roof Trusses					Timber Frame					Blockwork					Innovative				
		M		S			M		S			M		S			M		S			M		S			M		S			M		S			M		S		
		Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH	Bumi	Non-Bumi	Bumi	Non-Bumi	JUMLAH
SELANGOR	**122**	5	17	-	-	**22**	2	5	-	-	**7**	1	21	-	7	**29**	3	8	-	-	**11**	1	6	-	-	**7**	-	-	-	-	**-**	4	8	-	1	**13**	6	17	4	6	**33**
JOHOR	**53**	1	22	-	-	**23**	3	1	-	-	**4**	1	1	-	-	**2**	1	4	-	-	**5**	1	3	-	-	**4**	-	1	-	-	**1**	-	4	-	-	**4**	-	9	-	1	**10**
SABAH	**23**	3	4	-	-	**7**	-	-	-	-	**-**	-	-	-	-	**-**	-	4	-	-	**4**	-	3	-	-	**3**	-	-	-	-	**-**	2	2	-	1	**5**	-	3	-	1	**4**
SARAWAK	**20**	3	2	-	-	**5**	-	1	-	-	**1**	-	-	-	-	**-**	-	5	-	-	**5**	1	2	-	-	**3**	-	1	-	-	**1**	2	-	-	-	**2**	-	3	-	-	**3**
NEGERI SEMBILAN	**19**	4	3	-	-	**7**	1	1	-	-	**2**	-	3	-	-	**3**	-	-	-	-	**-**	1	-	-	-	**1**	-	-	-	-	**-**	2	1	-	-	**3**	-	3	-	-	**3**
PERAK	**17**	1	2	-	-	**3**	-	1	-	-	**1**	-	-	-	-	**-**	1	-	-	-	**1**	-	2	-	-	**2**	-	-	-	-	**-**	1	-	-	-	**1**	3	4	-	2	**9**
KEDAH	**12**	3	1	-	-	**4**	-	-	-	-	**-**	-	1	-	1	**2**	-	2	-	-	**2**	-	1	-	-	**1**	-	-	-	-	**-**	1	-	-	-	**1**	1	1	-	-	**2**
MELAKA	**10**	1	2	-	-	**3**	-	1	-	-	**1**	-	-	-	-	**-**	1	1	-	-	**2**	1	-	-	-	**1**	-	1	-	-	**1**	-	2	-	-	**2**	-	-	-	-	**-**
P. PINANG	**9**	-	2	-	-	**2**	-	-	-	-	**-**	-	2	-	-	**2**	-	1	-	-	**1**	1	1	-	-	**2**	-	-	-	-	**-**	-	1	-	-	**1**	-	1	-	-	**1**
PAHANG	**8**	1	1	-	-	**2**	1	-	-	-	**1**	-	-	-	-	**-**	-	-	-	-	**-**	1	1	-	-	**2**	-	-	-	-	**-**	1	2	-	-	**3**	-	-	-	-	**-**
TERENGGANU	**8**	2	-	-	-	**2**	-	1	-	-	**1**	-	-	-	-	**-**	-	-	-	-	**-**	2	-	-	-	**2**	2	-	-	-	**2**	1	-	-	-	**1**	-	-	-	-	**-**
W.P. KUALA LUMPUR	**7**	-	-	-	-	**-**	1	1	-	-	**2**	-	-	-	-	**-**	-	-	-	1	**1**	1	-	-	-	**1**	-	-	-	-	**-**	-	-	-	-	**-**	-	1	-	2	**3**
KELANTAN	**7**	1	-	-	-	**1**	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**	1	2	-	-	**3**	-	-	-	-	**-**	1	-	-	-	**1**	2	-	-	-	**2**
PERLIS	**2**	1	1	-	-	**2**	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**
TOTAL	**317**	**26**	**57**	**-**	**-**	**83**	**8**	**12**	**-**	**-**	**20**	**2**	**28**	**-**	**8**	**38**	**6**	**25**	**-**	**1**	**32**	**11**	**21**	**-**	**-**	**32**	**2**	**3**	**-**	**-**	**5**	**15**	**20**	**-**	**2**	**37**	**12**	**42**	**4**	**12**	**70**

** M – Manufacturer*
S – Supplier

The total number of IBS players based on state, system and Bumiputera status are shown in Table 5. Most of the manufacturers and suppliers are from Selangor, followed by Johor and Sabah. Contrary to the number of IBS contractors, most of the manufacturers and suppliers are Non-Bumi players.

IBS Statistics: Contractors, Manufacturers & Suppliers and Consultants

Figure 3 shows the distribution of IBS players in Malaysia comprising contractors, manufacturers & suppliers, and consultants. Most of the IBS players in Malaysia are in Selangor, Kuala Lumpur and Johor Bahru.

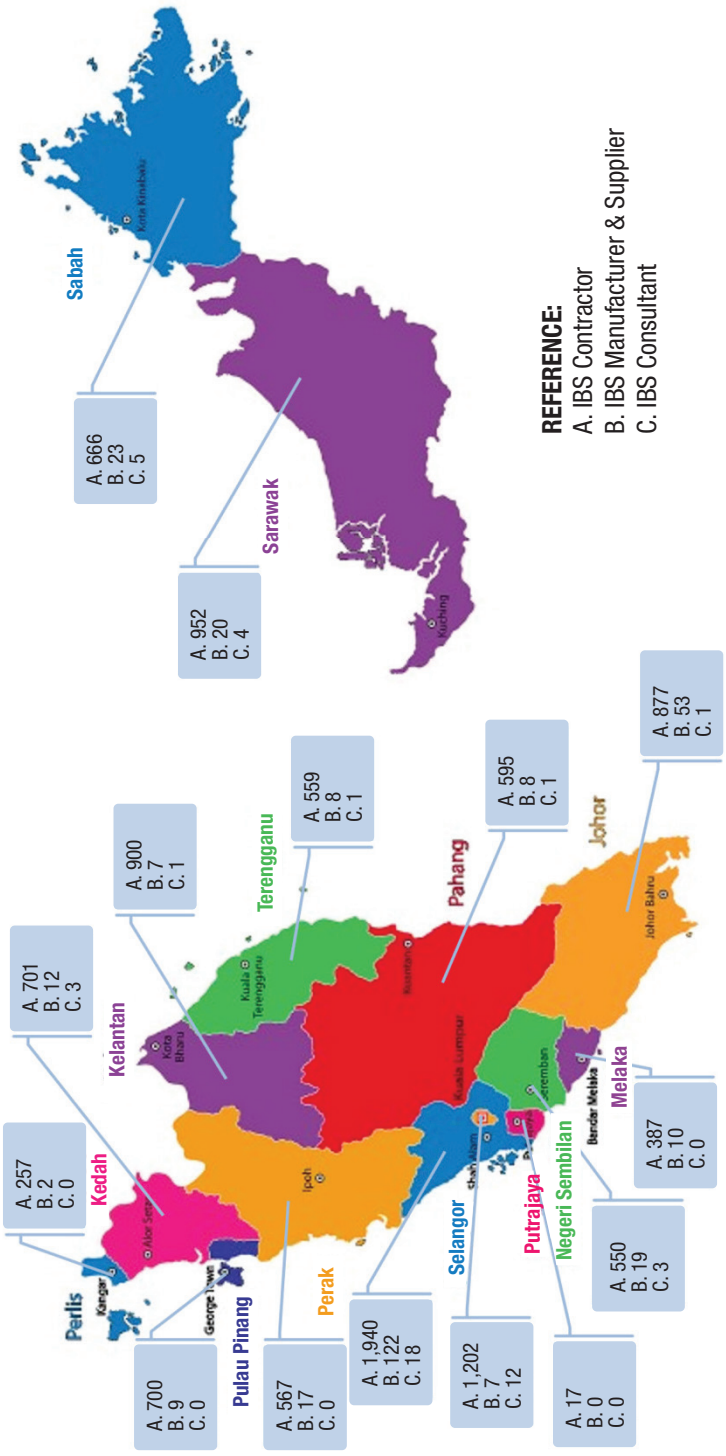


Figure 3: Map of IBS Player in Malaysia

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

This research employed quantitative research, which was carried out by survey questionnaire and secondary data. The data was analysed using descriptive statistics including frequency, percentage, mean and cross-tabulation analysis. Simple random sampling was used in this research, where the population comprised the contractors registered with CIDB Malaysia. The flow of sampling is as follows:

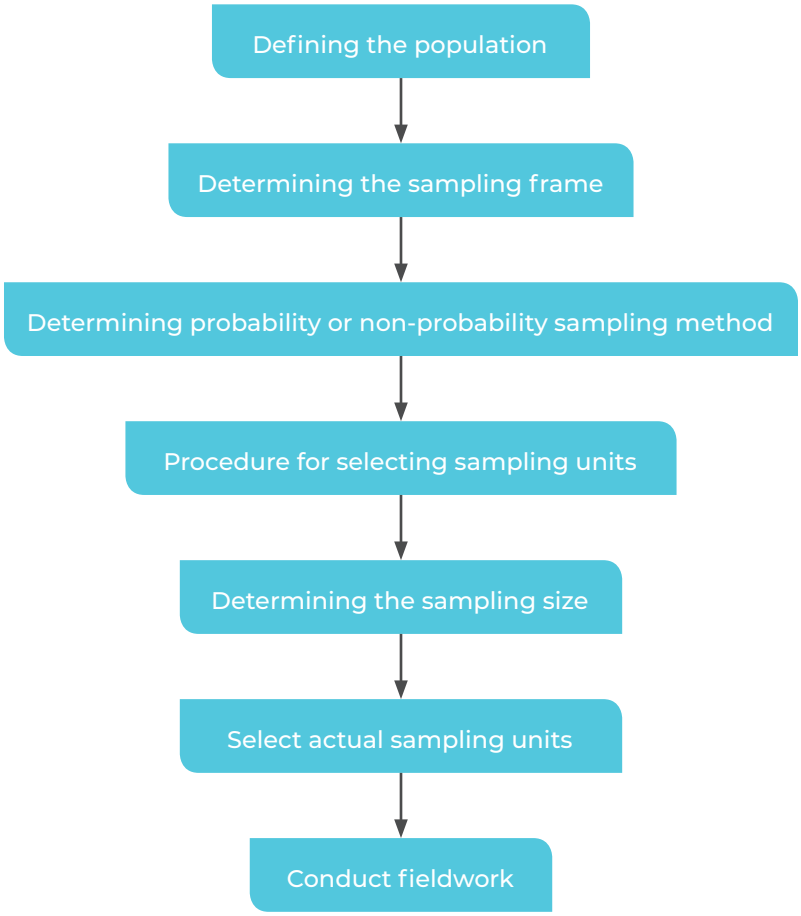


Figure 4: Flow of Sampling

The population in this research consists of contractors registered with CIDB Malaysia. The respondents are contractors who either have IBS projects or do not have IBS projects. Both types of respondents have either implemented government or private projects or both.

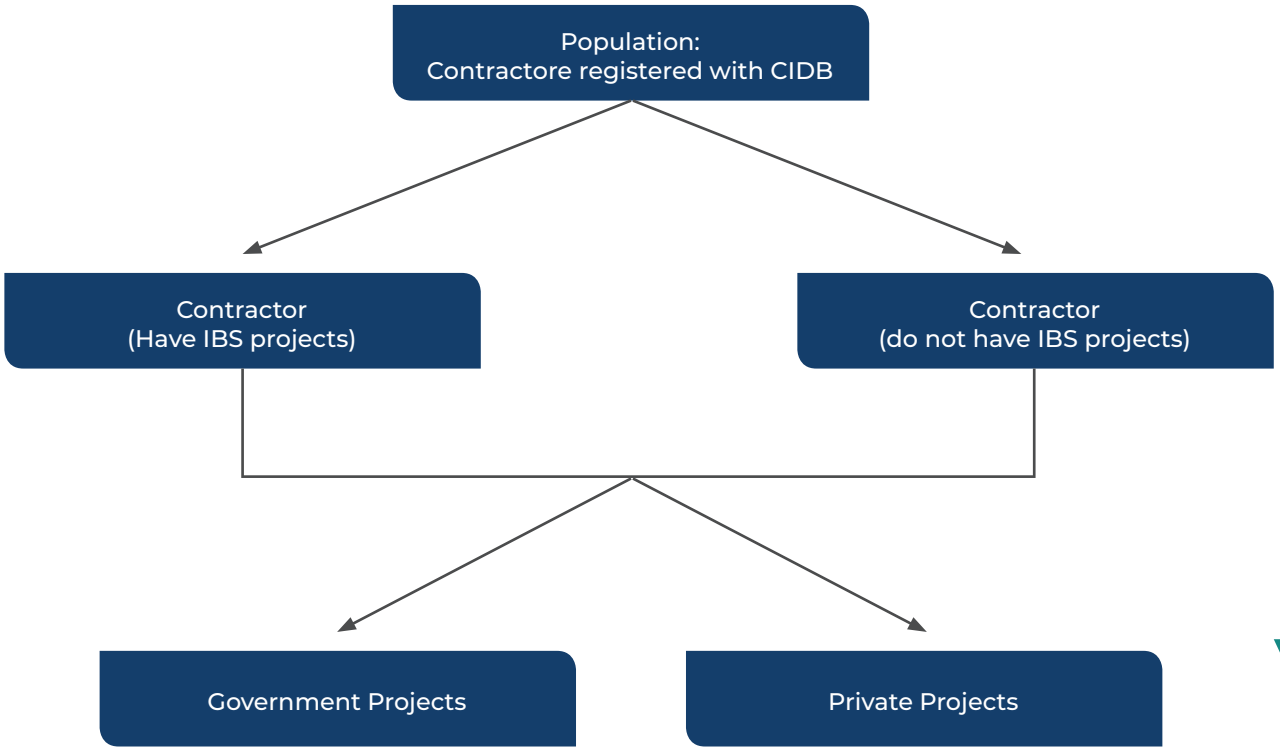


Figure 5: Sampling Framework

SECTION 1:
SECONDARY DATA ANALYSIS (GOVERNMENT PROJECT)

SECTION 1: SECONDARY DATA ANALYSIS (GOVERNMENT PROJECT)

This section portrays the secondary data analysis gained from the Implementation Coordination Unit (ICU) and Construction Industry Development Board (CIDB) Malaysia. The ICU data are concerned with government projects, while the CIDB data are related to the numbers of contractors, manufacturers, installers, etc. The data was analysed to know the level of IBS adoption among the government sectors according to state, IBS score, project value, etc. The government project data was compiled according to the actual year the project started. The analysed data involved building projects and federal government projects only.

1.1 IBS Adoption for Government Projects from 2008 to 2019

1.1.1 Overall IBS Adoption from year 2008 to 2019

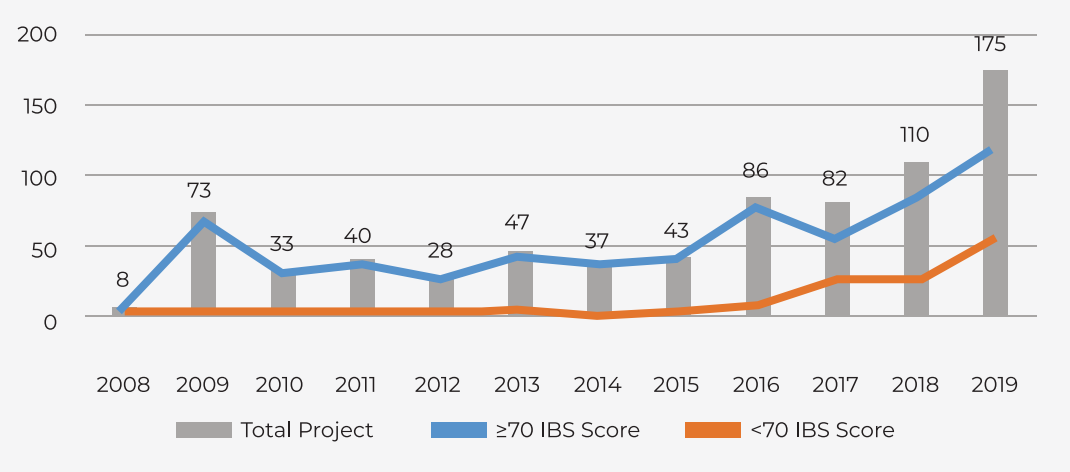


Figure 1.1: Government IBS Projects According to IBS Score from 2008 to 2019 (All Project Value)

Figure 1.1 shows the IBS projects in the government sector from 2008 until 2019 for all project value. The highest number of IBS projects was in 2019 with 175 projects, followed by 2018 with 110 projects.

Table 1.1 shows the total number of IBS projects according to IBS score from year 2008 to 2019. Beginning in 2005, all government projects have achieved an IBS score of more than 70 and with a high percentage, except in 2019. The highest percentage was achieved in 2014 at 100.0%, where 37 IBS projects achieved an IBS score of more than 70.

Table 1.1: Total Number of IBS Projects According to Score from 2008 to 2019 (All Project Value)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
≥70 IBS Score (626)	7	71	31	38	26	42	37	40	77	54	84	119
% ≥70 IBS Score (82.2%)	87.5	97.3	93.9	95.0	92.9	89.4	100	93.0	89.5	65.9	76.4	68.0
<70 IBS Score (136)	1	2	2	2	2	5	0	3	9	28	26	56
% <70 IBS Score (17.8%)	12.5	2.7	6.1	5.0	7.1	10.6	0	7.0	10.5	34.1	23.6	32.0
Total Projects (762)	**8**	**73**	**33**	**40**	**28**	**47**	**37**	**43**	**86**	**82**	**110**	**175**

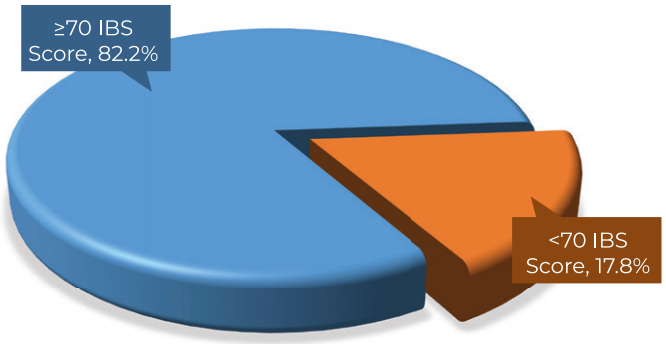


Figure 1.2: Overall Percentage of IBS Adoption According to IBS Score (All Project Value 2008-2019)

Figure 1.2 shows the percentage of IBS adoption in the government sector according to IBS score. Overall, 82.3% of government projects achieved an IBS score of more than 70, while 17.8% of government projects achieved an IBS score of less than 70.

1.1.2 IBS Adoption for Project Value More than RM 10 Million According to IBS Score from 2008 to 2019

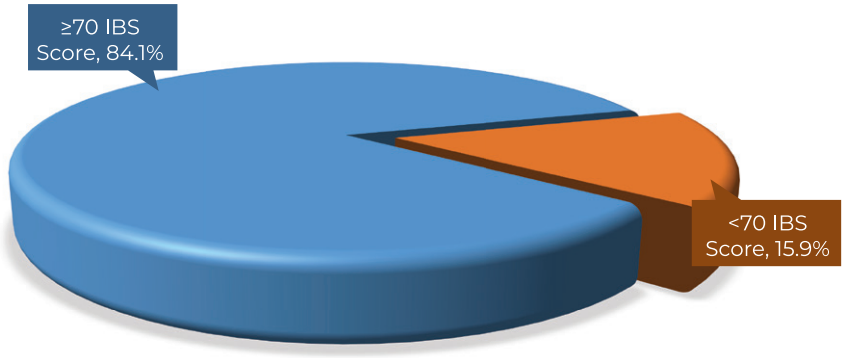
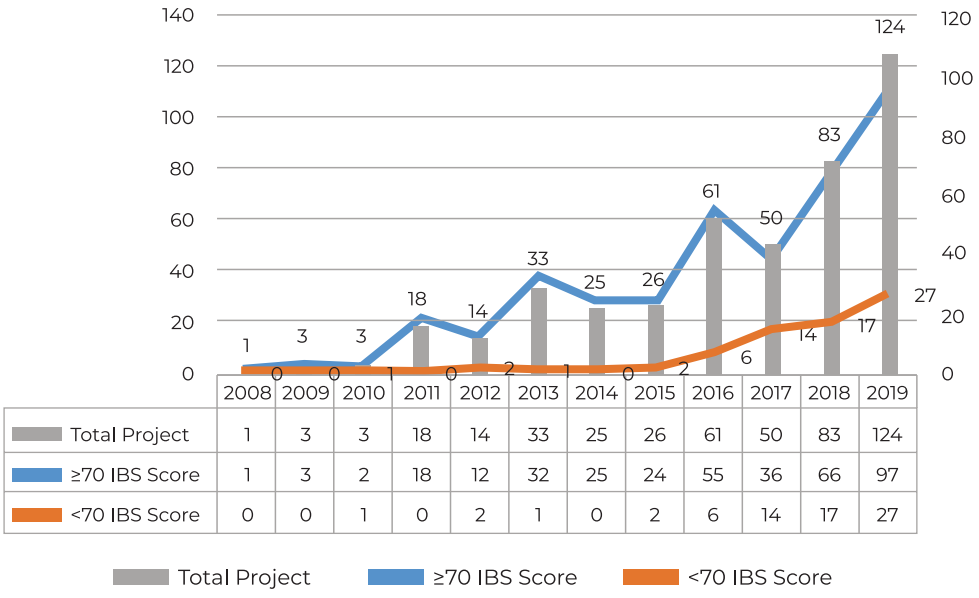


Figure 1.3: Overall Percentage of IBS Adoption for Project Value More than 10 Million According to IBS Score (2008 – 2019)

Figure 1.3 shows the percentage of IBS projects for project value more than RM 10 Million and above from 2008 to 2019. Overall, 84.1% of the IBS project has achieved 70 and more IBS score while the balance of 15.9% achieved less than 70 IBS score.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Project	1	3	3	18	14	33	25	26	61	50	83	124
≥70 IBS Score	1	3	2	18	12	32	25	24	55	36	66	97
<70 IBS Score	0	0	1	0	2	1	0	2	6	14	17	27

Figure 1.4: Overall IBS Adoption for Project Value More than 10 Million According to IBS Score (2008 – 2019)

Figure 1.4 illustrates the number of IBS adoption for project value more than RM 10 million according to IBS score from 2008 until 2019. The total number of IBS projects value more than RM 10 Million is 441 from 2008 until 2019. Majority (97) of the projects achieved more than 70 IBS score is in 2019 followed by 66 projects in 2018. Meanwhile, for projects achieved less than 70 IBS score, the greatest number of projects are also in year 2019 and 2018.

Table 1.2 shows the number and percentage of government project for value of project more than RM 10 Million based on state from 2008 until 2019. Overall, most of the IBS projects come from Sabah with 66 projects. However, for projects achieved more than 70 IBS score, it was recorded that Melaka and Kedah is the highest percentage. While for projects achieved less than RM 10 Million, Sarawak recorded the highest projects followed by Sabah.

Table 1.2: Total Number of IBS Projects According to State and IBS Score for Project Value More Than 10 Million (2008 – 2019)

Year	Johor		Kedah		Kelantan		Melaka		Negeri Sembilan		Pahang		Perak		Perlis		Pulau Pinang		Sabah		Sarawak		Selangor		Terengganu		Wilayah Persekutuan		Multi-state	
IBS Score	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70	≥70	<70
2019	**11**	3	5	2	9	**4**	6	0	6	0	**7**	1	8	1	4	**1**	5	1	9	6	**4**	3	10	3	7	**1**	5	1	1	0
2018	**7**	2	4	0	4	**2**	2	0	1	2	**10**	3	7	0	1	**0**	2	0	9	4	**5**	2	7	0	1	**1**	5	0	1	1
2017	**12**	1	0	0	1	**2**	1	0	1	0	**1**	0	4	1	0	**0**	1	2	7	6	**2**	1	3	0	3	**0**	0	1	0	0
2016	**6**	0	4	0	7	**0**	2	0	5	0	**6**	3	3	0	0	**0**	2	0	9	2	**1**	1	5	0	2	**0**	2	0	1	0
2015	**0**	1	3	0	2	**0**	1	0	1	0	**2**	0	2	0	0	**0**	2	0	9	0	**0**	1	0	0	1	**0**	1	0	0	0
2014	**3**	0	4	0	2	**0**	0	0	2	0	**4**	0	2	0	0	**0**	1	0	1	0	**1**	0	2	0	2	**0**	1	0	0	0
2013	**6**	0	4	0	0	**0**	1	0	0	0	**1**	0	2	0	1	**0**	1	0	2	0	**4**	1	6	0	0	**0**	4	0	0	0
2012	**1**	0	3	0	1	**0**	0	0	0	0	**1**	0	0	0	0	**0**	1	0	1	0	**0**	2	1	0	0	**0**	2	0	0	0
2011	**3**	0	2	0	4	**0**	0	0	0	0	**3**	0	1	0	0	**0**	0	0	0	0	**1**	0	2	0	0	**0**	1	0	1	0
2010	**0**	0	0	0	2	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	1	0	0	0	**0**	0	0	0	0
2009	**0**	0	0	0	1	**0**	0	0	0	0	**1**	0	0	0	0	**0**	0	0	1	0	**0**	0	0	0	0	**0**	0	0	0	0
2008	**0**	0	0	0	1	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0
Total	49	7	30	2	34	8	13	0	16	2	36	7	29	2	6	1	15	3	48	18	18	12	36	3	16	2	21	2	4	1
%	87.5	12.5	93.8	6.3	81.0	19.0	100	0	88.9	11.1	83.7	16.3	93.5	6.5	85.7	14.3	83.3	16.7	72.7	27.3	60.0	40.0	92.3	7.7	88.9	11.1	91.3	8.7	80.0	20.0
Grand Total	56		32		42		13		18		43		31		7		18		66		30		39		18		23		5	

1.2 IBS Adoption for Government Projects in Year 2019

1.2.1 Overall IBS Adoption in Year 2019

Table 1.3 shows the total number of IBS projects for all project value according to state and the IBS scores for 2019. From the table, it is seen that Melaka is the highest (100.0%) projects achieved more than 70 IBS score followed by Pahang with 92.3%. Meanwhile, Sarawak shows the highest (76.7%) projects achieved less than 70 IBS score. Overall, 68.0% of the projects achieved more than 70 IBS score and 32.0% achieved less than 70 IBS score.

Table 1.3: Total Number of IBS Project According to State (All project Value, 2019)

State	Total Project	≥70 IBS Score	% ≥70 IBS Score	<70 IBS Score	% <70 IBS Score
Sarawak	30	7	23.3%	23	76.7%
Sabah	21	11	52.4%	10	47.6%
Johor	15	11	73.3%	4	26.7%
Kelantan	14	9	64.3%	5	35.7%
Pahang	13	12	92.3%	1	7.7%
Selangor	13	10	76.9%	3	23.1%
Perak	11	10	90.9%	1	9.1%
Kedah	11	9	81.8%	2	18.2%
Pulau Pinang	9	7	77.8%	2	22.2%
Terengganu	9	7	77.8%	2	22.2%
Melaka	8	8	100.0%	0	0.0%
Negeri Sembilan	8	7	87.5%	1	12.5%
Perlis	6	5	83.3%	1	16.7%
Wilayah Persekutuan	6	5	83.3%	1	16.7%
Multi-state	1	1	100.0%	0	0.0%
	175	**119**	**68.0%**	**56**	**32.0%**

1.2.2 IBS Adoption for Project Value More than RM 10 Million According to State

Table 1.4 shows the total number of IBS projects according to state for project value of more than RM 10 Million for the year 2019. On 31st October 2008, the government gazetted that all the government projects with a value of more than RM 10 Million must achieve an IBS score that is above 70. Overall, 78.2% of the projects achieved more than 70 IBS score while another 21.8% achieved less than 70 IBS score. Melaka and Negeri Sembilan recorded highest percentage (100.0%) which all the projects achieved more than 70 IBS score. Meanwhile, for projects achieved less than 70 IBS score, it shown that Sarawak and Sabah has the highest percentage with 42.9% and 40.0% respectively.

Table 1.4: Total Number of IBS Projects According to State for Project Value over RM 10 million, 2019

State	Total Project	≥70 IBS Score	% ≥70 IBS Score	<70 IBS Score	% <70 IBS Score
Sabah	15	9	60.0%	6	40.0%
Johor	14	11	78.6%	3	21.4%
Kelantan	13	9	69.2%	4	30.8%
Selangor	13	10	76.9%	3	23.1%
Perak	9	8	88.9%	1	11.1%
Pahang	8	7	87.5%	1	12.5%
Terengganu	8	7	87.5%	1	12.5%
Kedah	7	5	71.4%	2	28.6%
Sarawak	7	4	57.1%	3	42.9%
Melaka	6	6	100%	0	0.0%
Negeri Sembilan	6	6	100%	0	0.0%
Pulau Pinang	6	5	83.3%	1	16.7%
Wilayah Persekutuan	6	5	83.3%	1	16.7%
Perlis	5	4	80.0%	1	20.0%
Multi-state	1	1	100%	0	0.0%
	124	**97**	**78.2%**	**27**	**21.8%**

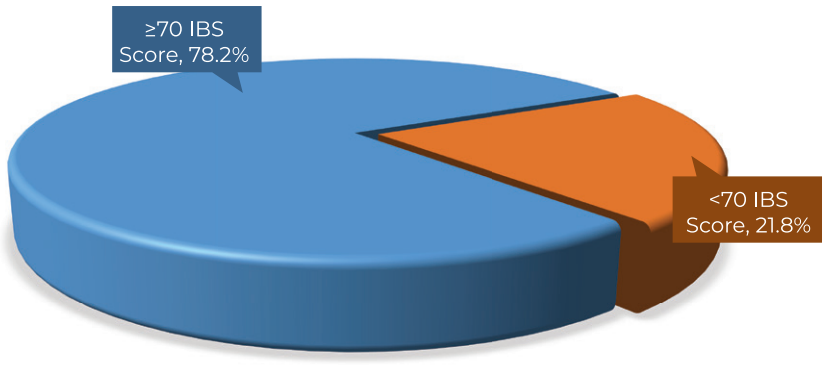


Figure 1.5: Percentage of IBS Project Value over RM 10 Million According to IBS Score

Figure 1.5 shows the percentage of IBS project value that is more than RM 10 million according to the IBS score. Overall, 78.2% of IBS projects achieved an IBS score over 70, while 21.8% did not achieve an IBS score over 70.

1.2.3 IBS Adoption According to Project Value (Project Value Over RM 10 Million in 2019)

Table 1.5 shows the total number of IBS projects whose value is more than RM 10 Million. From the table, it is shown that the largest IBS project is for value between RM 10 Million until RM 50 Million. Fully percentage for projects achieved more than 70 IBS score is for project value between RM 450 Million until RM 600 Million. However, for projects achieved less than 70 IBS score, the project value is between RM 250 Million until RM 300 Million.

Table 1.5: Summary Project Value for Project Over RM 10 million, 2019

Project Value, RM	Total Project	≥70 IBS Score	% ≥70 IBS Score	<70 IBS Score	% <70 IBS Score
10,000,000 - 50,000,000	83	73	88.0%	10	12.0%
50,000,001 - 100,000,000	23	14	60.9%	9	39.1%
100,000,001 - 150,000,000	5	2	40.0%	3	60.0%
150,000,001 - 200,000,000	5	3	60.0%	2	40.0%
200,000,001 - 250,000,000	3	2	66.7%	1	33.3%
250,000,001 - 300,000,000	1	0	0.0%	1	100.0%
300,000,001 - 350,000,000	0	0	0.0%	0	0.0%
350,000,001 - 400,000,000	2	1	50.0%	1	50.0%
400,000,001 - 450,000,000	0	0	0.0%	0	0.0%
450,000,001 - 500,000,000	1	1	100%	0	0.0%
500,000,001 - 550,000,000	0	0	0.0%	0	0.0%
550,000,001 - 600,000,000	1	1	100%	0	0.0%

1.2.4 IBS Adoption According to Project Value (Project Value Less Than RM 10 Million in 2019)

Table 1.6 shows the total number of IBS projects with a value less than RM 10 Million based on the state. Total number of IBS projects is 51 with most (23) of the projects come from Sarawak. Fully percentage of projects achieved more than 70 IBS score are from Pahang, Kedah, Melaka, Perak and Perlis. Johor, Kelantan and Terengganu recorded the highest percentage of projects achieved less than 70 IBS score.

Table 1.6: Summary Project Value for Project Less Than RM 10 million, 2019

State	Total Project	≥70 IBS Score	% ≥70 IBS Score	<70 IBS Score	% <70 IBS Score
Sarawak	23	3	13.0%	20	87.0%
Sabah	6	2	33.3%	4	66.7%
Pahang	5	5	100%	0	0.0%
Kedah	4	4	100%	0	0.0%
Pulau Pinang	3	2	66.7%	1	33.0%
Melaka	2	2	100%	0	0.0%
Negeri Sembilan	2	1	50.0%	1	50.0%
Perak	2	2	100%	0	0.0%
Johor	1	0	0.0%	1	100%
Kelantan	1	0	0.0%	1	100%
Perlis	1	1	100%	0	0.0%
Terengganu	1	0	0.0%	1	100%
Selangor	0	0	0.0%	0	0.0%
Wilayah Persekutuan	0	0	0.0%	0	0.0%
Multi-state	0	0	0.0%	0	0.0%
	51	**22**	**43.1%**	**29**	**56.9%**

1.2.5 IBS Adoption According to Project Value (Project Less Than RM 10 Million in 2019)

Figure 1.6 shows the percentage of IBS adoption for project values less than RM 10 Million according to the IBS score. From the chart, 56.9% of the IBS projects have an IBS score under 70, while the balance of 43.1% achieved more than 70 IBS score.

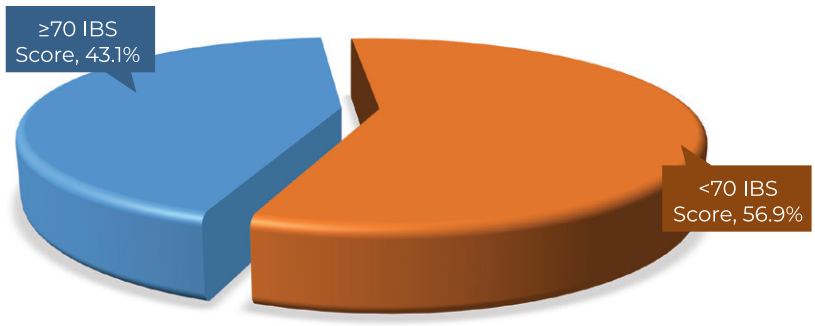


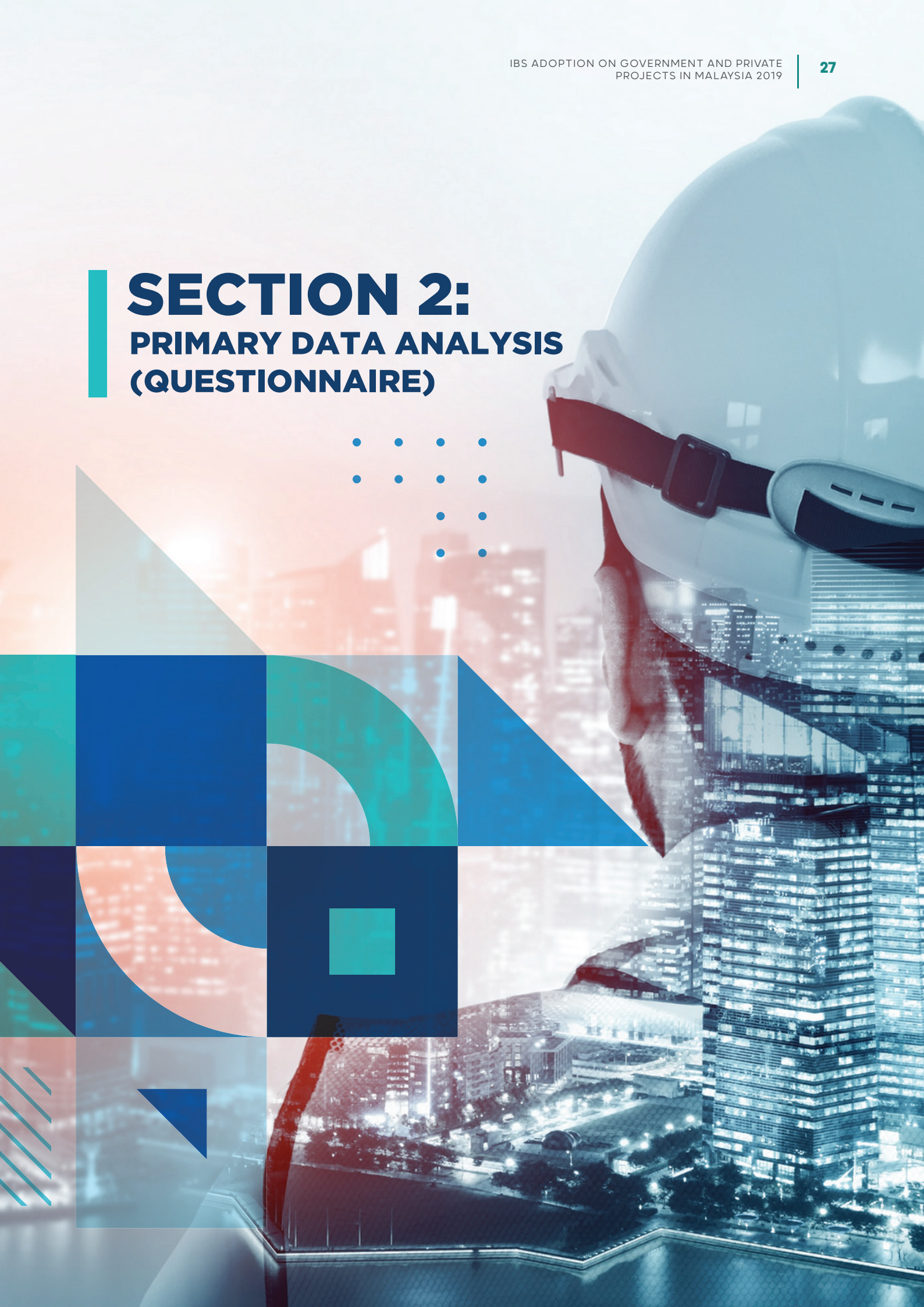
Figure 1.6: Percentage of IBS Adoption for Project Value less than RM 10 Million

Table 1.7 shows the total number of IBS projects for project value less than RM 10 Million. Majority (11) of the project value is ranging between RM 7 Million until RM 8 Million. However, for projects achieved more than 70 IBS score, most (100.0%) come from project value ranging from RM 9 Million and above. It is expected that most of the project for value less than RM 10 Million does not achieve 70 IBS score as shown in the table.

Table 1.7: Total Number of IBS Projects with Value less than RM 10 Million

Project Value, RM	Total Project	≥70 IBS Score	% ≥70 IBS Score	<70 IBS Score	% <70 IBS Score
< 1,000,000	8	4	50.0%	4	50.0%
1,000,001 - 2,000,000	1	0	0.0%	1	100.0%
2,000,001 - 3,000,000	6	5	83.3%	1	16.7%
3,000,001 - 4,000,000	3	0	0.0%	3	100.0%
4,000,001 - 5,000,000	7	4	57.1%	3	42.9%
5,000,001 - 6,000,000	5	4	80.0%	1	20.0%
6,000,001 - 7,000,000	6	0	0.0%	6	100.0%
7,000,001 - 8,000,000	11	3	27.3%	8	72.7%
8,000,001 - 9,000,000	2	0	0.0%	2	100.0%
9,000,001 - 9,999,999	2	2	100.0%	0	0.0%

SECTION 2:
PRIMARY DATA ANALYSIS (QUESTIONNAIRE)

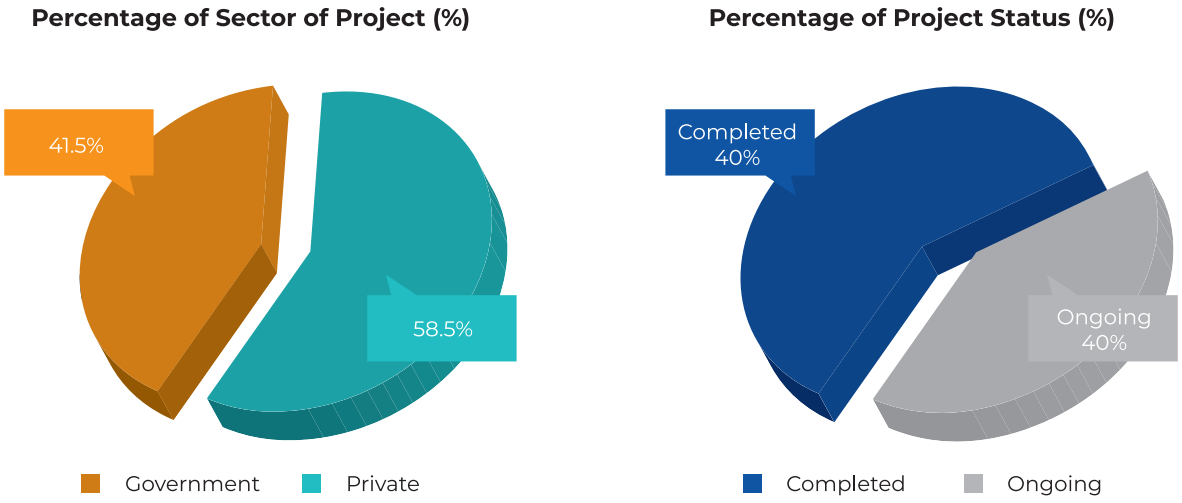


SECTION 2: PRIMARY DATA ANALYSIS (QUESTIONNAIRE)

This section involves the analysis of a survey questionnaire for 500 respondents including building contractors registered with the Construction Industry Development Board (CIDB) Malaysia. The questionnaire was distributed to gain responses regarding the IBS adoption in both government and private sectors.

2.1 IBS Adoption Survey Analysis

2.1.1 Percentage of Sector of Project with Project Status



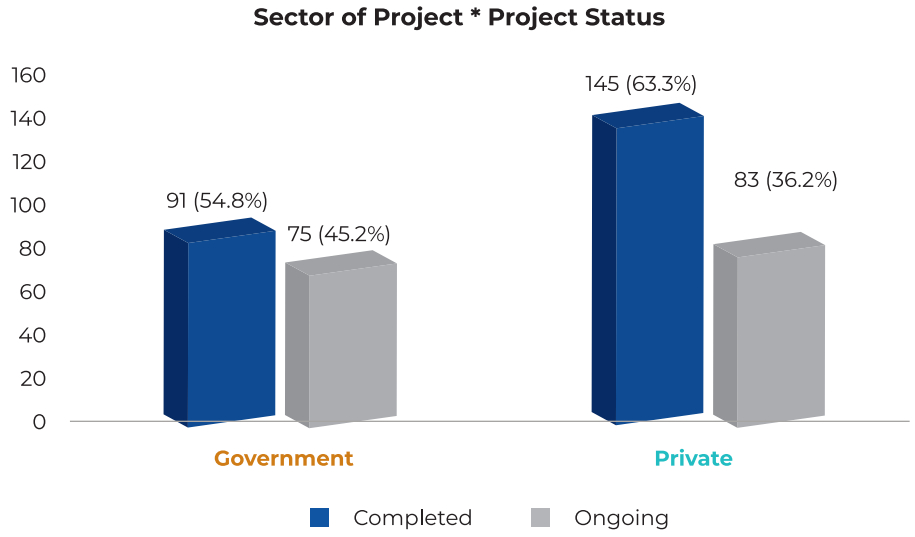


Figure 2.1: Percentage of Projects by Sector with Project Status

Figure 2.1 shows the percentage of projects by sector and the corresponding project status. The project sectors are divided into government and private, while the project status is either completed or ongoing. The results show that most of the projects are private projects, with 63.3% completed projects and 36.2% ongoing projects. For government projects, 54.8% are completed, and 45.2% are ongoing.

2.1.2 Project Sector using IBS

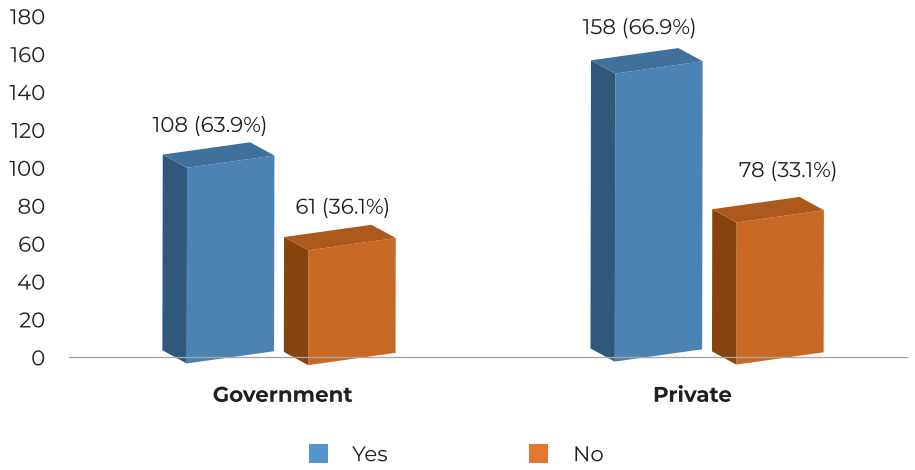


Figure 2.2: Project Sector Using IBS

Figure 2.2 shows the percentage of project sectors that use IBS. Overall, 36.1% of government projects use IBS, while about 33.1% use IBS in private projects.

2.1.3 Project Sector with IBS Score and Project Status

The IBS Score according to project sector and project status is depicted in Table 1. The IBS score for government projects range from IBS scores of 20 to 70. Most of them come from completed projects. Only one project has a 20 IBS score and 40 IBS score in ongoing projects, while most of them scored a 30 IBS score with 9 completed projects and 4 ongoing projects. For the 50 IBS score, 5 projects are completed projects while 2 projects are ongoing. The IBS score of 70 has5 projects, of which 4 are completed projects and 1 is still ongoing.

The IBS score for private projects ranges from an IBS score of 30 to 70. Only one project achieved an IBS score of 70 for a completed project. 23 projects scored an IBS score of 30, of which 6 of them are completed projects and 17 are ongoing projects. 4 completed projects and 8 ongoing projects scored an IBS score of 50.

Table 2.1: Project Sector with IBS Score and Project Status

Sector	IBS Score	Completed	Ongoing	Total
Government	20	0	1	1
	30	9	4	13
	40	0	1	1
	50	5	2	7
	70	4	1	5
Total		**18**	**9**	**27**
Private	30	6	17	23
	50	4	8	12
	70	1	0	1
Total		**11**	**25**	**36**

2.1.4 Project Value According to Project Sector and Project Status

Table 2.2 shows the percentage of project value according to project sector and project status. In the government projects, 20.1% of completed projects have a project value less than RM 1 million. 21.3% completed projects have a project value of more than RM 1 million and less than RM 10 million. For projects of RM 10 million and above, 14.0% are government projects. Ongoing projects show that 11.0% of the government projects have a value less than RM 1 million, 17.1% have a project value of RM 1 million and above and less than RM 10 million, and 16.5% have project value RM 10 million and above in completed projects.

In private projects, 19.6% have a project value of less than RM 1 million of completed projects, 32.0% have a project value of RM 1 million and above, and less than RM 10 million and 12.4% have a project value of RM 10 million and above in completed projects. For ongoing projects, 7.1% have a project value less than RM 1 million, 12.0% have project value of RM 1 million and above and less than RM 10 million and 16.9% have a project value of RM 10 million and above.

Table 2.2: Project Value According to Project Sector and Project Status

		Government		Private	
	Project Value	Frequency	Percentage (%)	Frequency	Percentage (%)
Completed	< RM 1 million	33	20.1	44	19.6
	≥ 1 million and < RM 10 million	35	21.3	72	32.0
	≥ RM 10 million	23	14.0	28	12.4
Ongoing	< RM 1 million	18	11.0	16	7.1
	≥ 1 million and < RM 10 million	28	17.1	27	12.0
	≥ RM 10 million	27	16.5	38	16.9
TOTAL		**164**	**100.0**	**225**	**100.0**

2.1.5 Project Value According to Project Sector and IBS Usage

The project value according to project sector and IBS usage is illustrated in Table 2.3 below. Only 31.5% of government projects with a project value of less than RM 1 million used IBS in their project, while 33.3% of the IBS projects have a project value between RM 1 million and RM 10 million. 46.0% of government projects with a value of more than RM 10 million used IBS.

For private projects, 25.8% of the projects that used IBS have a project value of less than RM 1 million. 21.6% of the IBS projects have a project value of RM 1 million and above and less than RM 10 million and 59.1% have a project value above RM 10 million using IBS.

Table 2.3: Project Value According to Project Sector and IBS Usage

Project Sector	Project Value	Using IBS		Total
		No	Yes	
Government	< RM 1 million	37 (68.5%)	17 (31.5%)	54
	≥ 1 million and < RM 10 million	42 (66.7%)	21 (33.3%)	63
	≥RM 10 million	27 (54.0%)	23 (46.0%)	50
Private	< RM 1 million	46 (74.2%)	16 (25.8%)	62
	≥ 1 million and < RM 10 million	80 (78.4%)	22 (21.6%)	102
	≥ RM 10 million	27 (40.9%)	39 (59.1%)	66

2.1.6 Project Value with IBS Score

The Table below (Table 2.4) represents the project value with the corresponding IBS Score. For projects with a value less than RM 1 million, 12 projects have an IBS score of less than 70, while only 2 projects have an IBS score of 70. 9 projects have an IBS score less than 70 for project values between RM 1 million and RM 10 million, and only 3 projects have an IBS score of 70. The majority of the projects have a project value of more than RM 10 million at 35 projects, while only 1 project scored an IBS score of 70.

Table 2.4: Project Value with IBS Score

Project Value	IBS Score				
	20	30	40	50	70
< RM 1 million	1	9	1	2	2
≥ 1 million and < RM 10 million	0	5	0	4	3
≥RM 10 million	0	22	0	13	1

2.1.7 Percentage of IBS System Usage

Table 2.5 and Figure 2.3 show the percentage of IBS System usage in the respective projects. Most (50.2%) of the IBS system usage is precast concrete system, followed by the metal framing system (24.7%). 9.4% are from the blockwork system, 9.0% are timber framing system, and 6.0% are from the reusable formwork system. The remaining 0.7% are from the innovative system.

Table 2.5: Percentage of IBS System Usage

IBS System	Frequency	Percentage (%)
Precast Concrete System	134	50.2
Reusable Formwork System	16	6.0
Blockwork System	25	9.4
Timber Frame System	24	9.0
Metal Frame System	66	24.7
Innovative System	2	0.7
Total	**267**	**100.0**

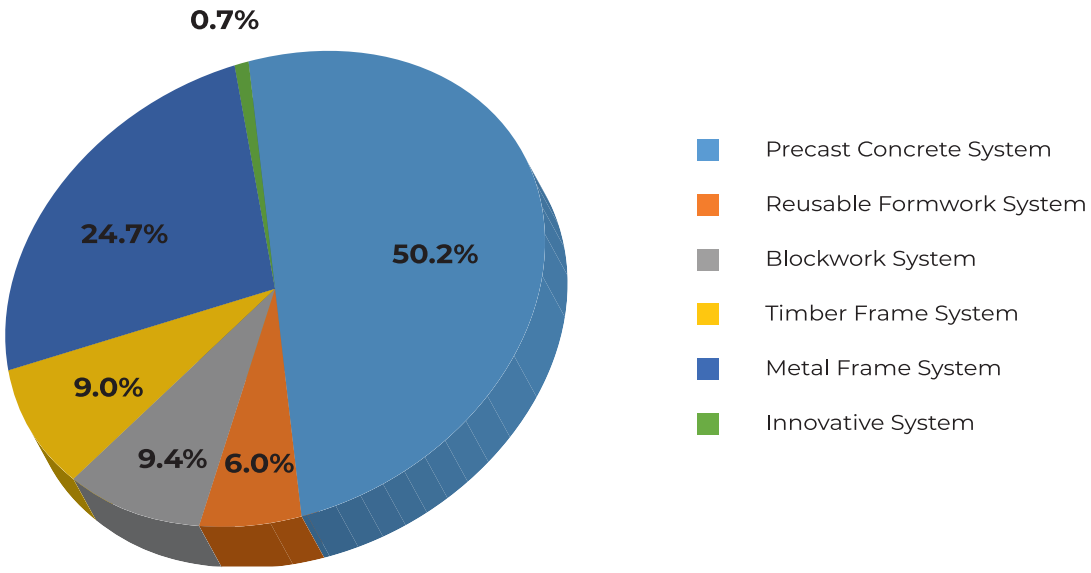


Figure 2.3: Percentage of IBS System Usage

2.1.8 Percentage of IBS System Usage According to Project Sector

The percentage of IBS System usage according to project sector is described in Table 2.6 below. In both sectors, most of the IBS system usage is the precast concrete system, followed by the metal framing system.

Table 2.6: Percentage of IBS System Usage According to Project Sector

Sector	IBS System						Total
	Precast Concrete System	Reusable Formwork System	Blockwork System	Timber Frame System	Metal Frame System	Innovative System	
Government	67 (57.8%)	9 (7.8%)	11 (9.5%)	9 (7.8%)	19 (16.4%)	1 (0.9%)	116
Private	69 (44.2%)	10 (6.4%)	14 (9.0%)	14 (9.0%)	48 (30.8%)	1 (0.6%)	156
Total	**136**	**19**	**25**	**23**	**67**	**2**	**272**

2.1.9 Percentage of IBS Component Usage

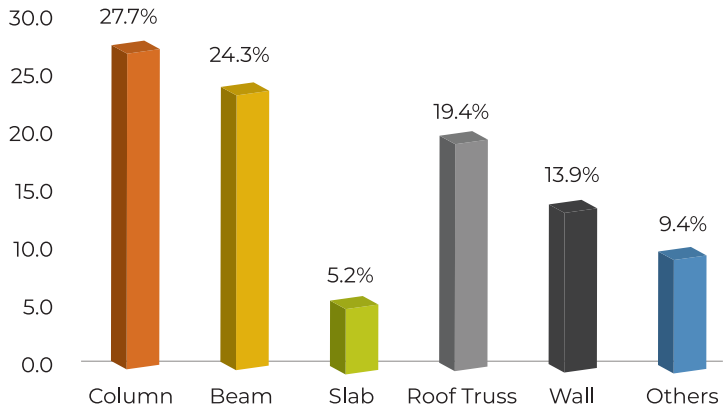


Figure 2.4: Percentage of IBS Component Usage

Figure 2.4 shows the percentage of IBS component usage for both sectors. The most common (27.7%) component usage is Column, followed by Beam at 24.3%. Roof truss usage is at 19.4%, followed by wall at 13.9%. The least used component is slab with 5.2%. Others as mentioned in the survey are Beam, drainage system (u-drain & box culvert), frame, modular mobile space, Pier/ Large Diameter column, precast beam & U-beam, precast u-girder, segmental box girder (SBG), staircase, steel structural works, structural system, and wall cladding.

2.1.10 IBS Usage According to Number of Projects and Project Status

IBS usage according to number of projects and project status is illustrated in Table 2.7 below. The number of projects range from no project (0) to10 or more projects. The total number of projects that are not using IBS for both government and private sectors is 258 projects. A total of 61 government sector projects use IBS is 61, where most (27) of them are for 1 to 2 projects. For the private sector, 40 projects are using IBS. The total number of projects using IBS is 139 projects. Overall, 167 projects are government projects, while another 228 projects come from private projects. The Total number of projects is 397.

Table 2.7: IBS Usage According to Number of Project and Project Status

Using IBS	No. of Project	Project Status		Total
		Government	Private	
No	None	41	77	118
	1 to 2 projects	42	36	78
	3 to 5 projects	16	30	46
	6 to 9 projects	6	9	15
	10 or more	1	0	1
	Total	**106**	**152**	**258**
Yes	None	2	1	3
	1 to 2 projects	27	40	68
	3 to 5 projects	22	28	50
	6 to 9 projects	5	5	10
	10 or more	5	2	8
	Total	**61**	**76**	**139**
Total	None	43	78	121
	1 to 2 projects	69	76	146
	3 to 5 projects	38	58	96
	6 to 9 projects	11	14	25
	10 or more	6	2	9
	Total	**167**	**228**	**397**

2.1.11 Percentage of Manufacturing Capacity

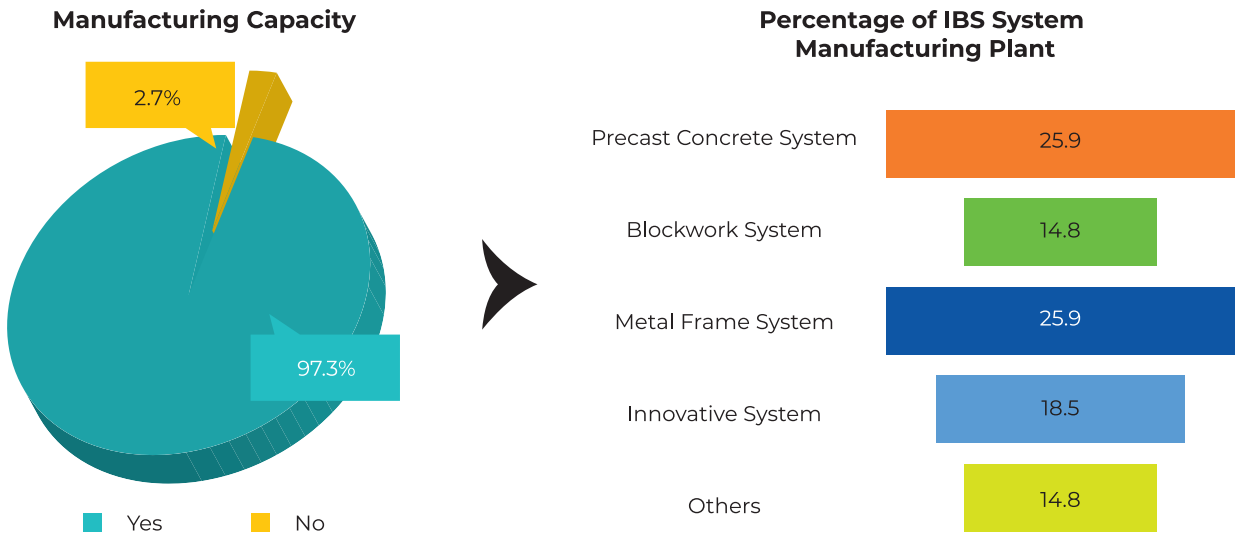


Figure 2.5: Percentage of Manufacturing Capacity with IBS System Usage

As illustrated above, Figure 2.5 represents the percentage of manufacturing capacity with IBS System usage. The majority (97.3%) mentioned that they do not have manufacturing capacity, while the balance of 2.7% has manufacturing capacity. The IBS systems for those having manufacturing capacity mostly (25.9%) come from the precast concrete system and metal framing system. 18.5% are the form innovative system, and the remaining 14.8% are from the blockwork system and other systems, respectively.

2.1.12 Readiness to Implement IBS

Table 2.8 shows the percentage of readiness to implement IBS. For the Technical Skill & Expertise part, the majority are not ready in terms of capacity of project manager or engineer, and IBS installation operator in conducting IBS projects. Besides that, most of them do not have enough machinery and equipment at the construction site to conduct IBS projects.

However, in terms of knowledge and experience, most of the respondents have exposure to IBS, understand the system used in IBS projects well, and how it is implemented. They also understand the IBS scoring system.

In terms of commercial drivers, most of the respondents are ready to include IBS in the procurement process, and have intentions to use IBS for future projects. However, one of the items which IBS perceived as a core competency within the company is considered unacceptable for the majority (64.5%) of respondents.

Table 2.8: Percentage of Readiness to Implement IBS

	Yes	No
Technical Skills & Expertise		
Does your company have enough project managers or engineers to conduct IBS projects?	33.6%	66.4%
Does your company have enough IBS installation operators to conduct IBS projects?	25.9%	74.1%
Does your company have enough machinery and equipment (*at the construction site*) to conduct IBS projects?	20.6%	79.4%
Knowledge & Experience		
Have members of your staff had any training or exposure to IBS?	68.0%	32.0%
Do you understand each system used in IBS projects well and how it is implemented?	61.1%	38.9%
Do you understand the IBS scoring system?	50.7%	49.3%
Commercial Drivers		
Is IBS perceived as a core competency within your company's business?	35.5%	64.5%
Was IBS considered during the procurement process?	56.5%	43.5%
Does your company intend to use IBS more frequently in future projects?	61.2%	38.8%

2.1.13 Benefits of Using IBS

Table 2.9 demonstrates the benefits of using IBS with mean and ranking. The benefits of IBS are divided into six (6) categories, which are time, cleanliness & neatness, better product quality, cost, social benefits, and productivity. In the Time category, the higher mean (4.06) goes to 'off-site production can start while the construction site is under earthworks' and followed by 'Faster completion due to advance off-site production by simplified installation process' (4.01).

There are four items in the category Cleanliness & Neatness. The highest mean (4.08) was scored by safety and health on site assurance, followed by the Just-in-Time concept for material delivery (4.03). Besides that, ranked at number 3 (3.98) is the reduction of waste materials at site, and the lowest mean (3.92) goes to the reduction on construction material at site.

There are 3 items in the Better Product Quality category. The highest mean (3.84) is for 'skilled worker with specific scope of works improves efficiencies and reduces errors during manufacturing process,' followed by 'Unaffected by weather element due to controlled environment of casting area' (3.76). The lowest mean (3.75) is 'High quality-controlled products due to controlled environment in factory with strict quality assurance, better material selection and using high mechanized technology'.

In the Cost category, there are four items, where the highest mean (3.83) is 'Reducing on-site workers significantly reducing labour cost for contractors,' followed by 'Minimizing cost of transferring waste material due to quality control during manufacturing process and reducing waste material' with a mean of 3.70. Third place (3.64) goes to 'Cost efficiency through repetitive usage of moulds for different types of projects,' and the lowest mean (3.49) is 'Reduced maintenance cost for end-users'.

The highest mean (3.89) in the category of Social Benefits is 'Sustainable construction due to parts of construction activity being transferred into factory based within controlled environment,' followed by 'Provide safer working environment' with a mean of 3.86. 'Environmental protection through reduction of waste at construction site' comes in at third place with 3.79, and the lowest mean (3.50) goes to 'less dependency on foreign labour'.

The last category is Productivity, where the highest mean is 4.02, which is 'increase of productivity,' followed by 3.89 in 'Reducing work trade on site'. Third place (3.72) goes to 'Faster overall project completion', and the lowest is 3.50 for 'reduced unskilled labour'.

Overall, the highest ranking is in the category of Cleanliness & Neatness, with 4.08 for the item 'safety and health on site assurance', and the lowest mean is 3.49 in the Cost category for the item 'reduced maintenance cost for end-users'.

Table 2.9: Mean and Ranking of Using IBS

Benefits of using IBS	Mean	Ranking
A. Time		
Off-site production can start while the construction site is under earthworks	4.06	1
Faster completion due to advance off-site production by simplified installation process	4.01	2
B. Cleanliness & Neatness		
Safety and health on site assurance	4.08	1
Systematic components storage and timely material delivery (Just - in - Time Concept)	4.03	2
Reduction of waste materials at site	3.98	3
Reduction of construction material at site	3.92	4
C. Better Product Quality		
Skilled worker with specific scope of works improves efficiencies and reduces errors during manufacturing process	3.84	1
Unaffected by weather element due to controlled environment of casting area	3.76	2
High quality-controlled products due to controlled environment in factory with strict quality assurance, better material selection and using high mechanized technology	3.75	3
D. Cost		
Reducing on-site workers significantly reducing labour cost for contractors	3.83	1
Minimizing cost of transferring waste material due to quality control during manufacturing process and reducing waste material	3.70	2
Cost efficiency through repetitive usage of moulds for different types of projects	3.64	3
Reduced maintenance cost for end-users	3.49	4
E. Social Benefits		
Sustainable construction due to parts of construction activity being transferred into factory based within controlled environment	3.89	1
Provide safer working environment	3.86	2
Environmental protection through reduction of waste at construction site	3.79	3
Less dependency on foreign labour	3.50	4

Benefits of using IBS	Mean	Ranking
F. Productivity		
Increase of productivity	4.02	1
Reduce work trade on site (i.e. Welding, carpentry, etc.)	3.89	2
Faster overall project completion	3.72	3
Reduce unskilled labour	3.50	4

2.1.14 Challenges of IBS Adoption

Table 2.10 shows the mean and ranking for challenges of IBS adoption. The highest mean (4.24) is high cost of IBS components, followed by difficulty in obtaining financial support from bank for IBS project in second place. The challenge in IBS adoption ranked third is the additional cost in hiring special equipment and machinery in implementing IBS. In fourth place are two items that have the same mean of 3.42, which are lack of on-site specialized skills for assembly and erection of components and lack of standardization on IBS and availability of quality control. Lack of IBS knowledge and awareness among developers and clients is ranked fifth, followed by lack of people with IBS project management skill and knowledge in sixth place. The lowest mean is for the item lack of IBS design knowledge among designers and architects at3.36.

Other challenges faced by the respondents are the aesthetic faults in the post construction stage. Besides that, the economic issues in Malaysia discourage contractors from getting involved in the IBS Business. Some of the small contractors do not implement IBS because IBS is usually used by a higher grade of contractors (G5-G7). Major challenges in IBS adoption are high cost for initial set up such as land, machinery, skilled works, utilities etc. Moreover, there is a lack of potential joint venture companies to enter a partnership with.

In terms of knowledge, IBS requires technical knowledge from early construction until the end of construction, especially during the installation stage. Some of the respondents also mentioned the lack of raw material supply. The issue of transportation also arises due to the size of precast units.

Table 2.10: Challenges of IBS Adoption

No.	Challenges that hold back the adoption of IBS among contractors	Mean	Ranking
1.	High cost of IBS components	4.24	1
2.	Difficulty in obtaining financial support from bank for IBS project	4.17	2
3.	Additional cost in hiring special equipment and machinery in implementing IBS	4.01	3
4.	Lack of on-site specialized skills for assembly and erection of components	3.42	4
5.	Lack of standardization on IBS and availability of quality control	3.42	4
6.	Lack of IBS knowledge and awareness among developers and clients	3.38	5
7.	Lack of people with IBS project management skill and knowledge	3.37	6
8.	Lack of IBS design knowledge among designers and architects	3.36	7

2.1.15 Recommendation of IBS Adoption

Table 2.11 shows the recommendation from respondents for IBS adoption. The highest mean (4.02) is to have regular promotion and widespread information about IBS implementation and its benefits through seminars, workshops, awareness programs, etc. Ranked second at a mean of (3.95) is to provide fast approval for IBS projects, followed by provide IBS training to the construction workforce, with a mean of 3.93. In fourth place is to reduce stamp duty for buyers who purchase an IBS house (3.57), followed by a mean of (3.54) in fifth place, which is to mitigate the additional cost of using IBS method of construction with non-cash incentives. The second last mean at 3.49 is to make it compulsory for every building construction plan to adopt IBS, followed by standardising IBS products through the standardisation exercise, with a mean score of 3.46.

Table 2.11: Recommendation of IBS Adoption

No.	Effective ways in increasing IBS adoption among contractors	Mean	Ranking
1.	Regular promotion and widespread information about IBS implementation and its benefits through seminars, workshops, awareness programs, etc.	4.02	1
2.	Provide fast approval for IBS project	3.95	2
3.	Provide IBS training to the construction workforce	3.93	3
4.	Reduce stamp duty for buyers who purchase an IBS house	3.57	4
5.	Mitigate the additional cost of using IBS method of construction with non-cash incentives	3.54	5
6.	Compulsory for every building construction plan to adopt IBS	3.49	6
7.	Standardising IBS products through the standardisation exercise	3.46	7

Other recommendations suggested by respondents are described in Table 2.12:

Table 2.12: Other Recommendations

Category	Comments
Quantity	• IBS needs a lot of quantity. No design available and more to customer need.
Market Price	• Control market prices of raw materials.
Enforcement	• Enforcement by relevant authorities to use IBS System in projects.
Incentive	• Give more incentives for contractors who implement IBS system. • Introduce special tax exemption for potential buyers for IBS projects. • Provide incentives for new IBS Entrepreneurs.
R&D	• Improve R&D for ways to simplify method to procure precast components. • To promote R&D of IBS to all parties in construction.
Cost	• In costing, IBS convenience more than conventional. Lower worker cost. Maintenance is better and more strengthens.
Financial	• Increase credit facility products for contractor. • Provide financial support for contractors to venture into IBS. • Provide monetary support/initiative to indulge contractors.
Promotion	• To promote IBS to all parties in construction.
Transportation	• Size of precast units to be catered by the transport.

2.2 Conclusion and Recommendations

This study aims to assess the implementation of IBS in Malaysia for both government and private projects in 2019. The objective of the study is to measure the level of IBS adoption and readiness among the contractors in Malaysia. Besides that, this study clarifies the industry players' perception on using IBS in current and future situations. The methodology used in this study is a quantitative method with a combination of primary and secondary data collection. The primary data was obtained from a survey questionnaire to the contractor, while secondary data are collected from ICU and CIDB Malaysia. Data gained from the ICU was solely on IBS projects for the government sector, with focus on the distribution of IBS score.

2.2.1 IBS Adoption in Government and Private Projects in Malaysia, 2019 (All Project Value)

Overall, IBS adoption in Malaysia based on the actual data from ICU is that 68% of the government projects achieved an IBS score of more than 70, while only 32% of the IBS projects achieved an IBS score of less than 70.

Meanwhile, from the survey questionnaire, only 36.1% of government projects use IBS, and 33.1% of private projects. To make a comparison, a study done in 2013 shows a higher percentage of IBS adoption in government projects with 61%, and a considerably lower amount of IBS adoption in private projects at 14%. Conversely in 2017, only 10.7% of government projects had adopted IBS, whereas adoption of IBS in private projects increased to 21%.

Year	Government	Private
2013	61%	14%
2017	10.7%	21%
2019	36.1%	33.1%

Based on the data from ICU, Sarawak show the lowest percentage of IBS score achievement of 70, while Melaka recorded the highest percentage of achievement of 70 IBS score.

2.2.2 Project Value Using IBS

Data from the ICU shows that 78.2% of government projects achieved an IBS score of more than 70 for projects with a value of more than RM 10 million, while 21.8% of government projects did not achieve an IBS score of 70. Meanwhile, for projects valued at less than RM 10 million, only 43.1% of the government projects achieved an IBS score of 70 IBS, while 56.9% did not achieve the targeted IBS score.

The survey questionnaire analysis shows that government projects valued at less than 1 million make up 31.5%, projects with value between RM 1 million and RM 10 million comprise 33.3%, and projects that cost more than RM 10 million make up 46%. In private projects, 25.8% of the projects have project value less than RM 1 Million, 21.6% of the project have a project value between RM 1 million and RM 10 million, and the remaining 59.1% have a project value of more than RM 10 million. Most of the projects adopted the precast concrete system, where the majority of the components are columns. IBS projects range mostly from 1 to 2 projects for each respondent.

2.2.3 Manufacturing Capacity

The majority of the respondents still perceive that they do not have enough manufacturing capacity, with only 2.7% of them having manufacturing capacity. Precast concrete system and metal framing seem to be the most favourable system to manufacture.

2.2.4 Readiness in IBS

The respondents do not seem ready to implement IBS in terms of technical skills and expertise and commercial value. Companies are not ready to provide the skilled workers for IBS projects such as project manager, operators, installers, and many more positions related to IBS requirements. The same applies to commercial value, where most of them are not ready to involve IBS in the procurement process and core competency for business. However, they intend to use IBS for their next projects, and it seems that most of them have been exposed to knowledge about IBS.

2.2.5 Benefits and Challenges of IBS Adoption

The major benefit of IBS has been described by the respondents as the aspect of safety and health on site assurance. From this statement, it demonstrates that the respondents' main concern is on the aspect of safety and health of the worker. Meanwhile, the biggest challenge in IBS adoption is usually about the high cost to implement IBS projects. High costs in IBS projects normally occur in the early stages of construction, which is in the planning stage. At this stage, readiness in terms of capital cost, machinery, training of skilled workers, mould preparation and other related costs is required.

2.2.6 Recommendation

The implementation of IBS can be successful if the government enforces all government and private projects to use IBS. To start with, projects valued at more than RM 10 million for private projects and government projects should cover all project value ranges. Besides that, promotion of IBS implementation should be done regularly. Guidelines on the implementation of IBS should be introduced to all industry players to give them an idea of how to start up in the IBS industry. Motivation to use IBS can be done through the injection of incentives to the implementers. Financial support should be provided consistently for all players, especially SME players.

2.2.7 Recommendation for Future Research

To improve the research on IBS adoption in the future, it is recommended to include IBS scores for private projects. All the project details submitted to CIDB should include the IBS score for easy tracking of IBS score trends achieved by the projects. Besides that, all data from government and private projects should be integrated through Big Data analytics to ensure that all data is accurate and ensure ease for references purposes.

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12 AZRB Sdn Bhd
13 Long Stay Construction Sdn Bhd
14 Lakarbina Gomogi
15 P.A.Jaya Enterprise
16 Lim Hoo Seng Construction Sdn Bhd
17 SP Puncak Teguh
18 MK Kelana Sdn Bhd
19 Segmen Efektif Sdn Bhd
20 Empayar Interaktif Sdn Bhd
21 Haba Stress Engineering
22 Hong Hap Construction Sdn Bhd
23 LE Renovation & construction
24 Vessix (M) Sdn Bhd
25 Azz Niaga Resources
26 Ideacon Venture
27 Milsuy Enterpise
28 Mekar Enterpise
29 Pemimpin Saujana (m) sdn Bhd
30 CA Maju Enterprise
31 EPC Pesona Sdn Bhd
32 Proma Wahyu Sdn Bhd
33 Awada Enterprise
34 CWM Group Sdn Bhd
35 Vproof Specialist Sdn Bhd
36 Alang Seri Enterprise
37 Chow Enterprise
38 PRR Resources Sdn Bhd
39 Pintas Tegas Sdn Bhd
40 KSKPS Holdings Sdb Bhd
41 Bahagia Interior Sdn Bhd
42 Barisan Impian Sdn Bhd
43 Afaracop Sdn Bhd
44 Suang Lee Hardware Trading Sdn Bhd
45 Koperasi Peneroka Felda Nitar Dua Mersing Berhad
46 Winpy Construction Sdn Bhd
47 N.S. Seng Corporation Sdn Bhd
48 MZA Integrated Resources
49 Homware Consortium
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53 Reaplite Industry Sdn Bhd
54 Geocon Engineering Sdn Bd
55 SN Akmida Holdings Sdn Bhd
56 Bahagia Interior Sdn Bhd

57 Anthosma Landscape Sdn Bhd
58 Bendang Makmur Sdn Bhd
59 Projalma Sdn Bhd
60 Me Gemilang Padu Sdn Bhd
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72 Powertage Sdn Bhd
73 Reenas Trading
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89 millivest sdn bhd
90 Karier Jaya Enterprise
91 SPM Builders Sdn Bhd
92 RZ Duta Trading
93 C-Elevetor Technology (M) Sdn Bhd
94 D7 Holdings Sdn Bhd
95 Gun Brothers Construction
96 Ever Sign
97 Zeliyan Resources
98 GT Front Construction
99 NNA Bright Side Enterprise
100 SW Target Enterprise
101 LHE Engineering & Services
102 Syarikat Ubom & Sons
103 Bryano Resources Sdn Bhd
104 Abacon Enterprise
105 Impian Juta Ventures
106 Chow Sew Yee
107 JT Gemilang Sdn Bhd
108 Sinlexon construction & decoration (KL)Sdn Bhd
109 XLY Geotech Sdn Bhd
110 Fong & Sons Construction co.
111 Ari Lighting Sdn Bhd
112 JCBina Engineering Sdn Bhd
113 Home Vision Construction Sdn Bhd
114 Trillion Prospect Sdn Bhd
115 Excel Sparkle Construction sdn bhd
116 Grand Capital Builder Sdn Bhd
117 SV Construction
118 Liang Chooi Tsang construction

119 Bendang Makmur Sdn Bhd
120 TNP Global Enterpise Sdn Bhd
121 SHR Enterprise Sdn Bhd
122 Merco Design Sdn Bhd
123 SQS builder Sdn Bhd
124 Usaha Perkasa Dagangan Sdn bhd
125 MBM Development
126 APT Assets Sdn Bhd
127 Low Ah Lek Enterprise
128 Emaslink(holdings) Sdn Bhd
129 Harta Bina & Trading
130 Sanmai Services Management Sdn Bhd
131 Arah Teknik Enterprise
132 Tuck Fai Contractor
133 Yi Yang Construction Sdn Bhd
134 Elegance Dynasty sdn bhd
135 SZS Homeland Sdn Bhd
136 Benacon Sdn Bhd
137 Technic-Delta M & E Engineering Sdn Bhd
138 Syarikat Seng Brothers Construction
139 Mudajaya Corporation Berhad
140 Farjuna Construction
141 Sri Aura Prima Resources
142 S E S tiling & Construction Sdn Bhd
143 Chuan Ho Engineering Trading sdn bhd
144 Chong Brothers Construction
145 crest builder sdn bhd
146 Luxury Eight Sdn Bhd
147 TorchEmpire Sdn Bhd
148 Zera Ratio Enterprise
149 BHT Global Construction Sdn Bhd
150 Millimetre Design Sdn Bhd
151 Adil Bina Enterprise
152 Afima Jaya Enterprise
153 AFS Bina Sdn Bhd
154 Ahib Bina Sdn Bhd
155 Ahlan Naubah Enterprise
156 AKS Bina Corporation Sdn Bhd
157 Al Falah Cemerlang Resources
158 Alaf Bina Dagang Sdn Bhd
159 Alam Jitu Bina Sdn Bhd
160 Aquatech Pools Sdn Bhd
161 Arm Construction & Trading
162 Arm Maju Jaya Enterprise
163 Arzek teknik Sdn Bhd
164 Awaja Enterprise
165 Azi Dagang
166 Azmi Bersama Enterprise
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169 Bina Conso Sdn Bhd
170 Bina Jaya Mantap Sdn Bhd
171 Bina Puri Sdn Bhd
172 Bina Tamshah Sdn Bhd
173 BK OOI Construction
174 Bumi Kejora Sdn Bhd
175 Bilang Nombor Sdn Bhd
176 Ehsan Bumi Construction Sdn Bhd
177 CBH Heng Enterprise
178 Cendekia Teknik Sdn Bhd
179 CWT Construction Sdn Bhd
180 Deep rocks Sdn Bhd

181 E Dern Construction Sdn Bhd
182 Fajar Bina Resources
183 Fazda Cekap Enterprise
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186 Golden Pasific Construction
187 Gs Buil Art Sdn BHd
188 Hasrat Teknik (M) Sdn Bhd
189 Heap Seng Utara Enterprise
190 HEC Building Construction
191 Heng Ho Engineering Sdn Bhd
192 HFM Daya Bina Sdn BHd
193 HS Builders Sdn Bhd
194 IBZ Bina Sdn Bhd
195 Ideacon Ventures
196 Ilmar engineering
197 Infinity Decoration Sdn Bhd
198 Inno Maju
199 Intan Saujana Construction
200 Intra Reka Land Sdn Bhd
201 Ismalegacy Enterprise
202 Java Ikhlas Sdn Bhd
203 K.E.P Teknikal Sdn Bhd
204 Kejuruteraan RI
205 Khalisya Maju Jaya Sdn Bhd
206 KKC Teknik Enterprise
207 KSKPS Holdings Sdn Bhd
208 L&L Renovation Work
209 Lebuh Maju Sdn Bhd
210 Liang Chooi Tsang Construction
211 Line Utama Enterprise
212 LY Mentari Enterprise
213 Juta Ribuan Sdn Bhd
214 Misuy Enterprise
215 MSR Supply & Trading (M) Sdn Bhd
216 MT Maju Construction
217 Munniz Corporation Sdn Bhd
218 Nazrine Maju Sdn Bhd
219 Nurhas Sdn Bhd
220 Nusa Murni Electrical & Trading
221 OCS Construction Sdn Bhd
222 Onn Tat Construction
223 Pan-Millennium Dotcom Sdn Bhd
224 Pasir Raja Gemilang Enterprise
225 Pembinaan Alam Setia
226 Pembinaan Voon & Rakan-Rakan Sdn Bhd
227 Perangsang urus Sdn Bhd
228 Perniagaan Naem
229 Perniagaan Razo Maju Sdn Bhd
230 PFI Bina Sdn Bhd
231 Pintas Tegas Sdn Bhd
232 Prismagro Enterprise
233 Qul Trading & Transportation resources
234 Rafta Bina Sdn bhd
235 Rimba Warisan SDn Bhd
236 S&N Teguh Bina
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238 Santun tegas Sdn Bhd
239 Sbar Bina Sdn Bhd
240 SeniBina Jaya Sdn Bhd
241 Seri Bumi Makmur sdn Bhd
242 SHRM Enterprise

243 SI Bina
244 Silang Bina Sdn Bhd
245 SM Construction Sdn Bhd
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247 Sp Bina Jaya Sdn Bhd
248 Summit Kinabalu Sdn Bhd
249 SZS Homeland Sdn Bhd
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305 Fook Yu Electrical & Building Contractor Sdn Bhd
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324 Kerjaya Prospek (M) Sdn Bhd
325 Kimlun Sdn Bhd
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329 Kuda Mas ENterprise
330 Landasan Kapital (M)sdnBhd
331 Lantera Hijau Enterprise
332 LKM engineering & Construction Works
333 LMW Development Sdn Bhd
334 Low Kuang fat
335 M.H Kayangan Enterprise
336 Magong Enterprise
337 master Coordinates Sdn Bhd
338 MB World Builders Sdn Bhd
339 MF Multi Tech Enterprise
340 Milsuy Enterprise
341 Mj Top Builders Sdn BHd
342 Mok Kim Loy Holdings Sdn Bhd
343 MRN Enterprse
344 Musthofa Enterprise
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346 Nanga Kemalih Enterprise
347 Olkendu Enterprise
348 Panca Delima Enterprise
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351 Pembinaan Titis Jaya Sdn Bhd
352 Permai Ihsan Sdn Bhd
353 Proasia Construction
354 Q Global Resources
355 Rafza Maju Enterprise
356 Renovare construction Sdn BHd
357 Rezky Q
358 Rifqi Jaya Enterprise
359 Right Leap Sdn Bhd
360 Rimba Warisan Sdn Bhd
361 Rumpun Damai Nursery
362 Sasaran Teguh Enterprise
363 Seri Wajamas Aset Sdn Bhd
364 Serita Maju Sdn Bhd
365 Shai Maju Enterprise
366 Sinar Impian Construction Sdn Bhd

367 Sinlele Enterprise Sdn Bhd
368 SNZ FIre Entreprise
369 Sri Cahaya Enterprise
370 Summerville Landscape sdn bhd
371 Sure Intergroup Sdn Bhd
372 SW Target Enterprise
373 Syarikat Bintang Jaya
374 Syarikat Katilina Enterprise
375 Syarikat Razima Enterprise
376 Syarikat Sinaran Enterprise
377 T & Civil Construction Sdn Bhd
378 Temasek Land Sdn Bhd
379 Tenaga Utama Enterprise
380 Tiew Beng Sun Construction
381 Tuck Fai Contractor
382 Turntech Construction
383 WCT Berhad
384 Wong Hook Choon
385 Wong & Sons
386 Yida Construction & Hardware Enterprise
387 Zek Utama Enterprise
388 Zuraha S Enterprise
389 Bandar Rimbayu Sdn Bhd
390 Bangi Heights Development Sdn Bhd
391 Benway Development Sdn Bhd
392 Berkeley SDn BHd
393 Perbadanan Kemajuan Pertanian Negeri Pahang
394 Core Precious Development Sdn Bhd
395 Cosmowealth Housing Development Sdn Bhd
396 Eco Ardence Sdn Bhd
397 GLM Emerland west (rawang) Sdn Bhd
398 GProperty Construction Sdn Bhd
399 Harta Ceria Bhd
400 Hartawan Megajaya Sdn Bhd
401 Hillpark Resources Sdn Bhd
402 Ivory Gleaneary Sdn Bhd
403 Kampar Lakeside Sdn Bhd
404 Kemajuan Tong Tor Sdn Bhd
405 Knowledge Vision Sdn Bhd
406 Lifetime Property Sdn Bhd
407 Luster Venture Sdn Bhd
408 Majestine Development sdn bhd
409 MTT Shipping Sdn BHd
410 Must Ehsan Development Sdn Bhd
411 N Kay Enterprise
412 Nursajaya Greens Sdn Bhd
413 Peck Seong Realty Sdn bHd
414 Paragon Pinnacle Sdn Bhd
415 Paramount Property (Sepang) Sdbn Bhd
416 Parkland City sdn Bhd
417 PB Realty Sdn Bhd
418 PDMC Property Sdn Bhd
419 Pembinaan KA Dinamik Sdn Bhd
420 Pembinaan Tetap Teguh Sdn Bhd
421 Perumahan Kinrara Berhad
422 Renofajar Sdn Bhd
423 Segar wangi Sdn Bhd
424 Setia Fontaines Sdn Bdh
425 Setia Ecohill 2 Sdn Bhd
426 Shinyou Elevator MFG Sdn Bhd
427 Soonsiang Sdn Bhd
428 Starwatt Realty Sdn Bhd

429 Sunrise MCL Land Sdn Bhd
430 Sunway PKNS Sdn Bhd
431 Taman Gunong Hijau Sdn Bhd
432 TT Dotcom sdn bhd
433 Tunas Land Sdn Bhd
434 Wahon Construction Sdn BHd
435 Wisdom Infinity Sdn Bhd
436 Worldwide property management Sdn Bhd
437 SYT Rasmart Enterprise
438 Yat Seng Construction Sdn Bhd
439 Mofa Jaya Enterprise
440 MN Power Services
441 Ekuiti Hemat Sdn Bhd
442 Majlis Perbandaran Seberang Perai
443 Tenaga Nasional Berhad
444 Federal Oat Mills Sdn bhd
445 Genting Malaysia Berhad
446 Majlis Perbandaran Subang Jaya
447 Puncak Mega Bina
448 Paragon Pinnacle Sdn Bhd
449 Majlis Bandaraya Johor Bahru
450 Aliena Sya Enterprise
451 Syarikat Tenaga Emas Jaya
452 Majlis Perbandaran Subang Jaya
453 Sasaran Teguh Global (M) Sdn Bhd
454 Builder Sdn Bhd
455 Kock Chin Electrical Works
456 Amsteel Mills Sdn Bhd
457 Badan Pengurusan Bersama Monterey, Eco Santuari
458 Pelabuhan tanjung Pelepas Sdn Bhd
459 Perbadanan Pahang
460 Malaysia Airports Sdn Bhd
461 Felda Palm INdustries Sdn Bhd
462 Webest Sdn Bhd
463 Majlis Perbandaran Seremban
464 Paduwan Realty Sdn Bhd
465 Johor Corporation
466 Savillls (KL) Sdn Bhd
467 Majlis Perbandaran Klang
468 Jabatan Kerja Raya Melaka
469 Milure Solution
470 Sri Manjung Specialist Centre Sdn Bhd
471 Majlis Perbandaran Pasir Gudang
472 JKR Negeri Sembilan
473 Majlis Bandaraya Johor Bahru
474 Dewan Bandaraya Kuala Lumpur
475 Malaysia Airport Sdn Bhd
476 Jabatan Pengairan dan Saliran sarawak
477 MAjlis Bandaraya Petaling Jaya
478 perbadanan Bekalan air pulau pinang sdn bhd
479 Syarikat Air Melaka Berhad
480 Karthi Electrical Engineering Sdn Bhd
481 Majlis Perbandaran Perak
482 Ibu Pejabat Kerja Raya
483 Jabatan Kerja Raya Pulau Pinang
484 Dewan Bandaraya Kuala Lumpur
485 Pejabat Daerah Segamat
486 Alliance Builder Sdn Bhd
487 Majlis Bandaraya ISkandar Puteri
488 Webest Sdn Bhd
489 Azi Dagang
490 Awang Bin Bajar

491 Exec Strategy Engineering Sdn Bhd
492 YC Building Material
493 Trek Development Sdn Bhd
494 Awal Indah Enterprise
495 Soon Lian enterprise
496 Zoo bee Garden Bonsai Centre
497 Kota Jauhar Enterprise
498 Hamdan Enterprise
499 Fossan Development Sdn Bhd
500 Samin Bina Sdn Bhd

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