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Strategies in Promoting Industrialised Building System (IBS) among Contractors

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Abstract: In Malaysia, the introduction of the Industrialized Building System (IBS) using precast concrete elements has been implemented since1966, when the government launched two projects involving the construction of Jalan Pekeliling, Kuala Lumpur and Jalan Rifle Range in Penang. Effective construction operation, higher efficiency, cost savings, reduction of foreign labour, quicker and better quality control of construction are the main advantages of IBS. However, over the course of 54 years, the implementation of IBS in Malaysia was just 30% of the private project. The objective of the research is therefore to investigate the level of understanding of IBS among contractors. In addition, other research goals, such as the review of strategies to promote the IBS framework effectively and the examination of the effectiveness of strategies for the adoption of IBS among contractors. In this study, literature research through reading journals, articles, internet, and academic investigation had been carried out. This research study is necessary to develop the strategies of enhancing the adoption of IBS among contractors. The data were analysed by both qualitative and quantitative method. Interview and questionnaires were used for data collection purpose. The qualitative results were analysed by listing out the respondent's answer while the quantitative results were analysed via SPSS There are 40 respondents from questionnaire and 19 respondents from interview question. The level of understanding of IBS profesionals are high.Life Cycle Cost (LCC) are the most effective method that found in this research.

Keywords: Framework, Malaysia, Adoption, IBS

1. Introduction

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Industrialised Building System (IBS) is the term coined by the industry and government to describe the adoption of industrial construction and the use of prefabrication of components in building construction. IBS is characterized as a construction technique in which components are manufactured in a controlled environment (on or off site), transported, placed and installed into a structure with minimal additional site work (Hamid *et al*., 2011; CIDB, 2007; CIDB, 2005 and CIDB, 2003). The Construction Industry Development Board of Malaysia's IBS Roadmap has introduced the most important, feasible and realistic concept of IBS in Malaysia CIDB (CIDB, 2003).

1.1 Research Background

The Government of Malaysia has made significant efforts to promote the use of IBS as an alternative construction tool. Since IBS' first project in 1966, there has not been an absolute description of IBS (Hamid *et al*., 2011). This research will use the CIDB concept to categorise the construction structure of the house. particularly in terms of efficiency and productivity, to improve the construction industry because a valuable solution, it become more feasible and visible in Malaysia. IBS is more than implementing the construction project by prefabricated techniques with a wider context and open-minded understanding. IBS is not new to the construction industry in the construction sector. Contractors play a very vital role for being benchmarking of IBS technologies (Theong *et al*., 2018). Therefore, the need to undertake the questions raised by the industry player is crucial especially involving in IBS.

1.2 Problem Statement

According to Hanafi & Nah (2015) the implementation of IBS has been recognized as an important step in the construction industry. Despite the shift in strategy, promotion and profit that can be accomplished through adoption of the IBS construction industry, it is being hindered and still in its early stages Khalil *et al* (2016). IBS increases the capacity of the industry relative to conventional methods. Efficient and successful implementation of IBS in Malaysia's construction industry can offer a variety of benefits compared to the traditional process. Abedi *et al*. (2011a) conventional construction methods that have shown by Oleiwi *et al* (2010) to be more time consuming , costly and hazardous. According to Mohd Nawi *et al* (2011) although the IBS system improves project efficiency, reduces rectification work and lowers overall construction costs, the trend in IBS use in Malaysian construction projects are still below the national target.

However, based on previous studies conducted by Theong *et al*. (2018), Kamar *et al*.(2012), Mohamed *et al*. (2018). It is shown that the contractors only familiar with conventional method of construction compared to the IBS method. This is due to the short of expertise and experience of IBS contractors. The lack of experience in structural analysis and the design of prefabricated components further discourages the application of the IBS system based on studies of Hanafi & Nah (2015), Kamal & Flanagan (2012) which found that one of the key problems facing Malaysia construction contractors is the ability to absorb new information and technology in the construction process. By Khalil *et al* (2016) there are only a small number of IBS-based contractors in Malaysia who can conduct IBS work. This issue is highlighted again by Zakaria *et al* (2012) the local contractors prefer conventional construction rather than IBS. Since the IBS method is more economical than traditional construction.

According Khalil *et al* (2016) many small contractors have not been able to implement IBS in their construction business. Financial problems have been the greatest obstacle for small contractors to move forward. The less effective use of IBS in Malaysia construction industry is due to the lack of willingness on the part of the players to move from the conventional system. They tend to use traditional building methods because they are not persuaded of the lack of experience and skill in IBS. However, the adoption of IBS into contractors will bring significant developments in Malaysia's construction due to its cost savings and time savings.

1.3 Research Questions

(i) How was the level of understanding IBS among contractors in Malaysia?

(ii) What are strategies of promoting IBS system effectively?

1.4 Research Objectives

This section should include research objectives of the study.

(i) To investigate on the level of understanding IBS among contractors in Malaysia.

(ii) To examine the most effective strategies in promoting IBS.

1.5 Scope of the Study

The scale of the research study set for data collection is as low as the implementation of IBS in Malaysia. This study was conducted to establish the view of local contractors about the implementation in IBS construction project. Therefore necessary to conduct research is important to achieve the objectives designed for this study and answer the questions raised. Quality answer and data will be collected through interview or questionnaire.

1.6 Significance of the Study

This study is for the building industry, project managers, site managers, contractors, consumers, suppliers and government. The most significant of this study is the benefits of IBS in reducing construction time, reducing the reliance of foreign workers and reducing the overall cost of the project. Therefore, IBS would also improve the quality of the buildings. The use of IBS also encourages a healthy and systematic working environment and makes the site cleaner and closer.

2. Literature Review

2.1 History and Development of Industrialised Building System (IBS)

The IBS agenda in Malaysia started at the beginning of the 1960's from the Ministry of Housing and the local government of Malaysia visited a number of European countries and examined their housing development programmes Thanoon & Sapuan (2015).However, given that the initial form of IBS was introduced in Malaysia more than 40 years ago, it is not generally accepted and the pace of implementation of the method is still slow.The Malaysian government are concerned that uptake of the IBS is low Nasrun *et al* (2010).

A survey conducted by the Malaysia CIDB in 2003 reported that the IBS level of adoption was just 15% Rahim & Qureshi (2018), CIDB(2003). However, in the last fews years, the adoption of the IBS has gained momentum. Gradually, a niche ahs been created in the sector, Government declared that all public projects RM10m and above must include a certain percentage of the IBS IBS Workshop (2011).

2.2 Classification of Industrialised Building System (IBS) components

The first is percast concrete framed buildings consisting of pre-cast concrete columns, beams, slabs, walls, "3D" elements (Hamid *et al*, 2011). For example, balconies, staircases and toilets. The second is steel frame system, which is a common option and commonly used in the fast-track construction of skycrapers. Othuman *et al* (2014). Next is block work where conventional bricks have been revolutionized by the usage of interlocking concrete masonryunits (CMU) and lightweightconcrete blocks CIDB (2003). Formwork method is considered to be one of the "low-level" or the " least prefabricated" as the system usually requires site casting Hamid *et al* (2011).

Finally, the timber frame system is the classification of providing fascinating designs, from dwelling units to buildings requiring strong aesthetic values Othuman *et al* (2014) and Hamid *et al* (2011).

2.3 Advantages in implementation of IBS

Rahim & Qureshi (2018) found that modular design can reduce construction time and waste but at the same time high initial costs and lack of technical expertise are the major obstacles to the implementation of IBS. Since IBS is faces with many challenges such as low quality and lack of skills and technology, the focus should be on improving the use of IBS rather than maximising it use Hamid *et al* (2011). The following are the advantages classified as tables, including the findings. Table 1 shows the advantages of IBS Oliewy *et al* (2009).

Table 1: Advantages of IBS (Oliewy *et al*., 2009)

No.	Advantages	Findings
1.	Time Saving	IBS or prefabrication system is good because it reduces construction time.
2.	Reduction of labour	Reduce on-site labour, includes higher mechanization due to a repeatability mechanism.
3.	Reduction of remittances by internationa labour	Reduces the remittances by international labours.
4.	Reduction of cost	IBS can be cheaper than using conventional approaches, as it reduces labour costs, and the repeated use of device formwork provides substantial cost savings.
5.	Efficient construction process and higher productivity	IBS can help to increase the quality of construction process allowing for high productivity.
6.	Quality improvement	IBS will providing higher quality goods, as promised by a high level of industry experience.
7.	Wastage reduction	IBS provided minimum waste and less materials on site as it allows offsite or prefabricated parts produced in factories,resulting in a safer and cleaner environment.
8.	Flexible design	IBS has provided flexibility in the design of precast components as well as in the construction so that different systems can build their own prefabrication construction methods.

3. Research Methodology

3.1 Research Design

Creswell (2009) defined research as a systematic method and strategy for conducting research through data collection and data analysis. The aim of the research is to design the data has been collected able to address the research questions. Three primary type of research analysis are qualitative method, quantitative methods and mixed methods which are the combination of quantitative and qualitative methods.

3.2 Data Collection

3.2.1 Primary Data

Generally, primary data typically collected through the distribution of questionnaires and creation of interviews in order to gain input from the targeted respondents. The approach used to test the questionnaire of this study was to expose it to a variety of experts. Suggestions to improve the questionnaire have been checked and discussed respectively. The questionnaire was delivered and distributed through e-mail and whatapps. The data collected on IBS in Malaysia was processed and analysed using Statistical Package for Social Science (SPSS) software program.

3.2.2 Secondary Data

Literature review is the secondary data obtained through reviews of books, journal articles, internet, newspaper, magazines, theses and dissertations, conference proceedings, studies and documentaries. In addtion, library research also examines ways to access secondary data. For example, browsing the website of the UTHM library website which is Tunku Tun Aminah library.

3.3 Data Analysis

The data obtained from questionnaire survey were analysed by using Statistical Package for the Social Sciences (SPSS) software. Descriptive analysis was performed in this study using SPSS tools. The respondents are all IBS professionals. They were chose because of their knowledge and experience in IBS construction.

4. Results and Discussion

4.1 Results

A total of 120 samples were distributed according to the sample size. Data were collected through an online survey questionnaire. Upon collecting the data, only 44 sets of questionnaire were responded. The percentage of response rate is 36.67%. For the interview, there are 19 respondents respond.

4.2 Demographic Information

(a) Demographic Information for Questionnaire Survey

According to the questionnaire survey, the demographic of the respondent included age group, gender, highest qualification and experience in IBS industry as shown in Figure 1.

Figure 1: Demographic Information (Questionnaire Survey)

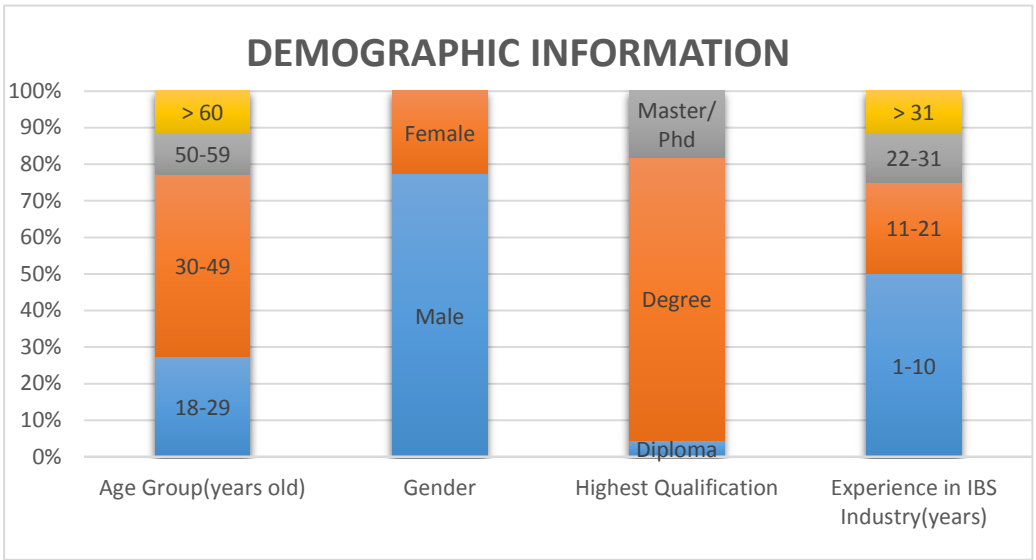
The sample collected through the distribution of questionnaire, 27.3% of respondents are between 18 – 29 years, 50.0% of them are 30 – 49 years, 50 – 59 years of respondent are 11.4% and lastly 60 years and above are 11.4% also. Female response rates are 22.7% percentage meanwhile male recorded 77.3% response rates higher than female. Therefore, majority of respondent participated in this survey are male gender. Background of respondents in terms of highest academic qualifications. Majority of respondents are degree holders with highest response rates of 77.3% followed by 18.2% of either master/phd holder followed by 4.5% response rate for diploma holders. Therefore, majority of respondent highest qualification is a degree level for this survey. 44.0% of the respondent have 1–10 years working experience which recorded the highest percentage, follow by working experience between 11 – 21 years with 22.0%. Next, working experience more than 31 years recorded 10.0 % and between 22 –31 years which has 12.0%.

(b) Demographic Information for Interview

Results presented that percentage of 19 respondents from different big and small construction company have answered the given interview survey based on age group and job position as shown in Table 1.

Table 1: Demographic Information (Interview)

No	Section	Category	Frequency	Percentage (%)
1	Age Group	a) 1-10 years old	7	36.84
		b) 11-21 years old	5	26.32
		c) 22-31years old	5	26.32
		d) above 31 years old	2	10.53
2	Job position	Civil Engineer	3	15.79
		Principal Engineer	3	15.79
		Senior Engineer	5	26.32
		Project Manager	5	26.32



	Quantity Surveyor	3	15.79

4.3 Questionnaire Survey Analysis

(a) Research objective 1: To investigate on the level of understanding IBS among contractors in Malaysia.

Figure 3 shown 2 respondent with 4% stands for neutral with this statement. 16 respondents with 32 % agree and 26 respondents with 52 % strongly agree that IBS provides highly aesthetic end-product through the process of controlled prefabrication and simplified installation knowledge with the highest mean score 4.55. (Kamar *et al*., 2014) explained IBS is one of construction methods by which components are produced in factories in controlled environments, shipped to construction sites and installed in minimum structures.

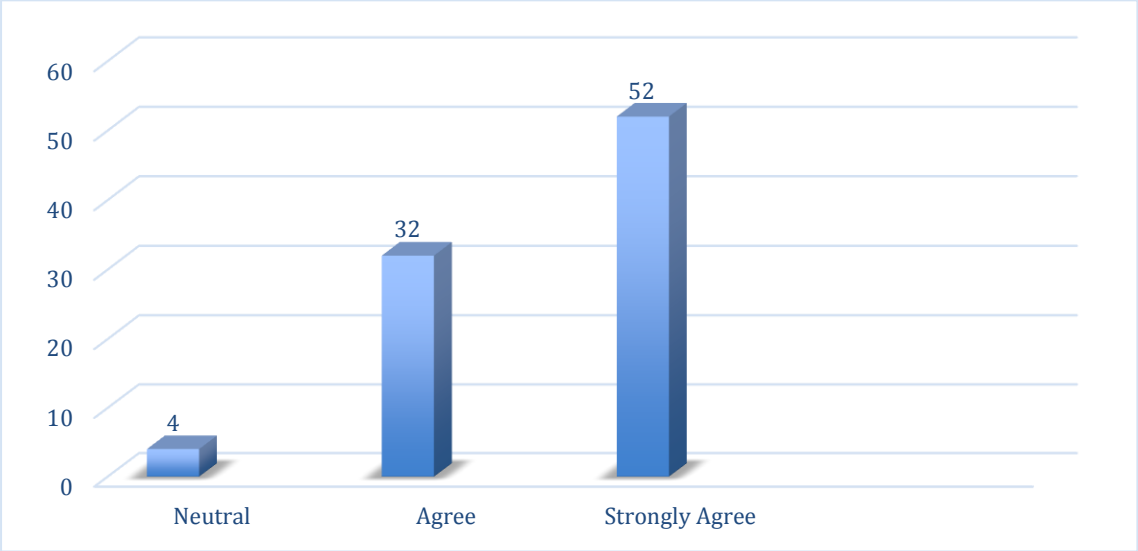


Figure 3: IBS provides highly aesthetic end-product through the process of controlled prefabrication and simplified installation

Figure 4 shown 4 respondents with 8% strongly disagree while 14 respondents with 28% of disagree. Next, 13 respondents with 26% stands for neutral, 4 respondents with 8% agree and 9 respondents with 18% strongly agree that using performance measurement to measure contractor's satisfaction can help to improve their satisfaction level of IBS with the lowest mean score 3.00.

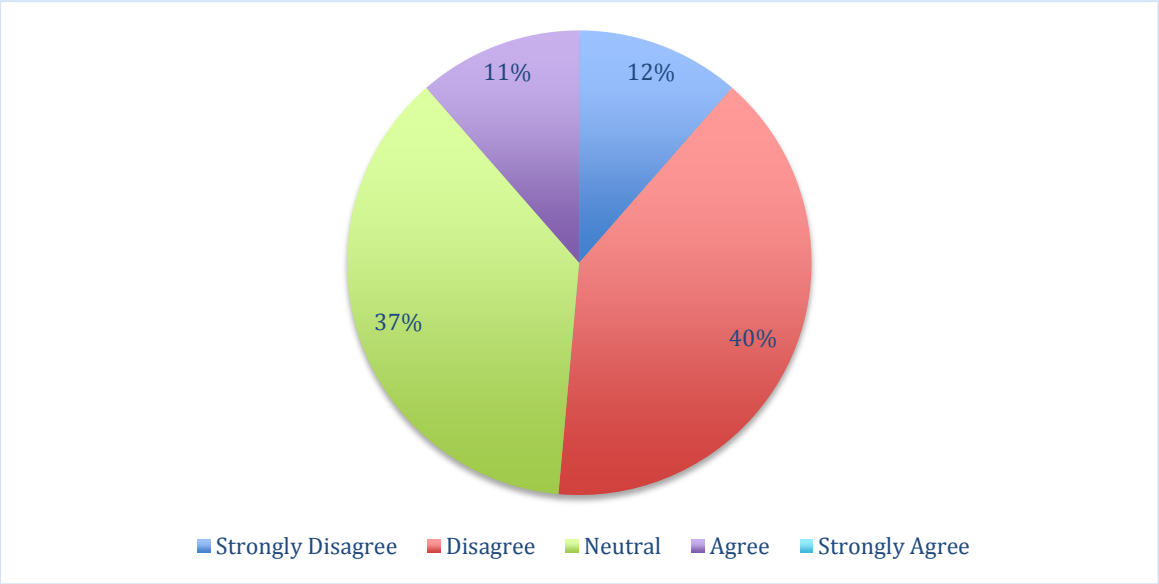


Figure 4: The usage of performance measurement to measure contractor's satisfaction can help to improve their satisfaction level of IBS

(b) Research objective 2: To analyse the strategies of promoting IBS effectively.

Based on Figure 5, from the most effective strategies, introduction of Life-Cycle Costing (LCC) and adopting intensive training courses from management level rank with the same which is 25%. Research fund like startup capital to contractors from the government with 20.5%. While, big contractors need to be initiatives to the small contractor with 15.9%. Introduce IBS into e-governmental portal with least percentage 11.4%. From the results above, the implementation of Life-Cycle Costing (LCC) are the most effective strategies to promoting IBS. The implementation of Life Cycle Costing (LCC) leads to a clearer and more accurate cost estimate, including the projection of the actual costs of building operation, thereby providing a better baseline for decision-making Siti Mazzuana Shamsuddin (2017). LCC has benefited in the construction sector, but its realistic implementation is slowing down. There are many phases involved in the building life cycle, from the design stage to the demolition stage. Whereas, the construction industry is involved in the operation and has to be managed before the building has reached its disposal, as well as the life expectancy for higher life cycle costing (LCC).

In addition, the effective strategies, research fund like startup capital to contractors from the government with 32.6%. Adopting intensive training courses from management level with 25.6%. Introduction of Life-Cycle Costing (LCC) with 23.3 %. Introduce IBS into e-governmental portal with 11.6% and big contractors need to be initiatives to the small contractor which is 7% only.

Furthermore, the moderate strategies, big contractors need to be initiatives to the small contractor and introduce IBS into e-governmental portal rank with the same which is 23.3%. Introduction of Life-Cycle Costing (LCC) with 20.9%. Adopting intensive training courses from management level with 18.8% and research fund like startup capital to contractors from the government with 14%. This is especially true among small contractors. As moving towards mechanised and industrialised systems requires a high level of capital expenditure in heavy machinery and mechanised construction facilities, it is unlikely that small contractors will turn to an unfamiliar system to protect their projects, which are mostly small-scale growth.

The less effective strategies, adopting intensive training courses from management level with 23.3%. Research fund like startup capital to contractors from the government with 20.9%. Big contractors need to be initiatives to the small contractor, introduction of Life-Cycle Costing (LCC), introduce IBS into e-governmental portal are the same with 18.6%.

The least effective strategies, introduce IBS into e-governmental portal and big contractors need to be initiatives to the small contractor with the same 34.9%. Adopting intensive training courses from management level with 14%. Research fund like startup capital to contractors from the government with 9.3%. Introduction of Life-Cycle Costing (LCC) with 7%.The least effective strategies are introduce IBS into e-governmental portal and big contractors need to be initiatives to the small contractor However, the Government has declared that all public ventures RM10m and above must contain a certain proportion of the IBS (IBS Workshop, 2011). Government has made efforts to encourage IBS.

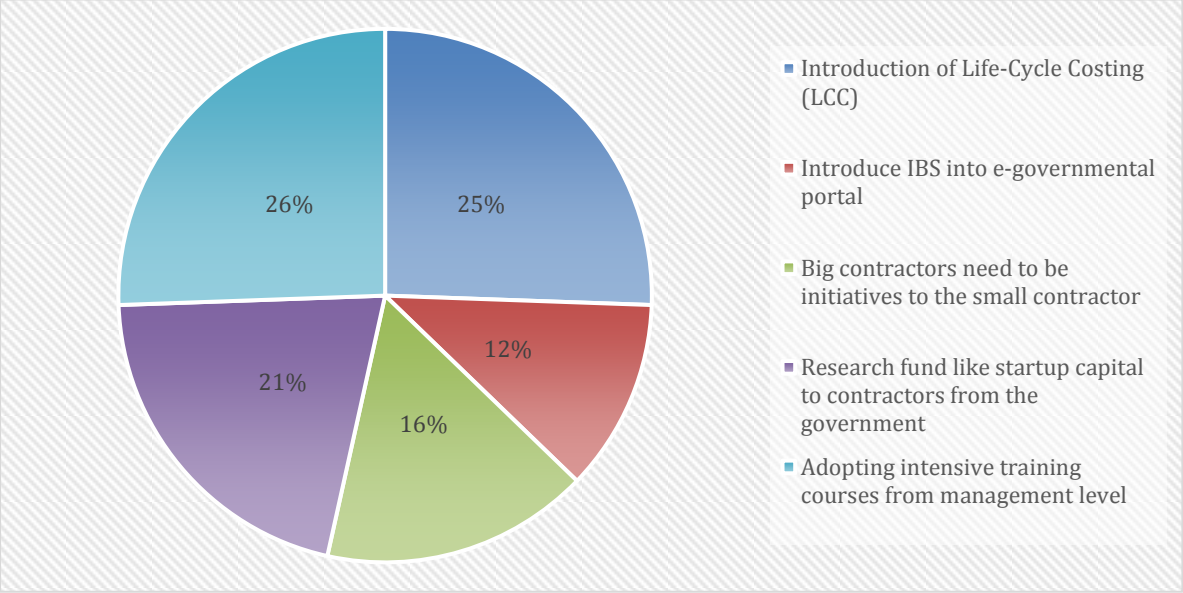


Figure 5: The most effective strategies

4.3 Interview Analysis

(a) Analysis the current type of construction methods practised in company, and the advantages and disadvantages of IBS construction method.

Based on the results, there are 3 type of construction methods practised in company which are conventional method, IBS method and combine construction method. The advantages of conventional method is flexible design and less initial cost. The disadvantage of conventional method is take time and the process of slow construction work compared to IBS method. The advantages of using IBS Precast Wall Panel are fast construction work. In addition it included high IBS Score Index compare to other IBS. The disadvantages of IBS method are initial cost very high, overall cost very economic and required high skill workers. Some of the company are using combine construction method which is conventional and IBS method. For example Hybrid method because this method save time, cost and quality for the project life cycle. Sometime small company prefer conventional because more profit since less profit on IBS as monopolize by supplier. Both

construction method have their own advantages and disadvantages related to construction time, quality and cost.

(b) Awareness of Industrialized Building System (IBS) the need of implement IBS construction method.

In overall, there are majority of the respondents has stated that Malaysia need to implement IBS as construction method. Therefore, this can be justified that the awareness towards IBS can lead to implementation of IBS in construction field. The key objective of encouraging the use of IBS is to ensure that factors such as improving efficiency, productivity and decreasing the reliance of unskilled workers and reducing costs can be well clarified and understood (Mohd Nawi *et al*., 2015).

(c) The need of improvement in IBS construction method and suggestion to improve the implementation of IBS.

There were a few suggestions of good practices that were suggested to improve the implementation of IBS. Respondent from CIDB described that clients, consultants and contractors need to create a solid basis and coordinate with each other in the conduct of new construction projects, in particular those involving IBS. Others respondents provided different of view to improve the implementations it should be available throughout all level of construction, not only available on big volume construction. Besides that, more education and awareness for the targeted customers to understand and accept IBS. Next, seeing every contractor at least need to complete 1 IBS method in their project then only can renew their licence.

(d) Main advantage IBS

In general, cost and time saving were considered the main benefits for implementation of IBS. In other words, IBS can expedite construction works, the structure element strength also higher compared with cast in-situ because IBS casted in factory thus we can control the quality of basic materials used also the environment.

(e) The improvement incentive and awareness to improve contractors' practices in the implementation of IBS in the construction industry.

In general, all respondents saw that a greater emphasis is improving motivation and understanding as it will help to strengthen the activities of contractors in the implementation of IBS in the construction industry. Incentive means dollars and cents, everybody looking forward for it, not only the Contractor. Awareness may be just a slight affection. Next, Incentive and awareness is an important initiative to exposing the contractors for adopting the new construction technology method.

Besides that, Education is important was suggested by respondent 2. It is important for the contractor to be really skilled and understand the way IBS works because to implement IBS on a construction site requires smart planning. IBS is a prefabricated structural element and requires skilled manpower to operate on a construction site especially if the construction used combination system such as IBS and conventional systems as stated by Respondent 9. One of the statements mentioned by respondent 15 was Government play vital role particularly. CIDB should organise more awareness on training, consultancy services and also adopted as course structure in University. For example, for all players involved in construction industry.

(f) The adoption of IBS in company

The adoption of IBS in company are agreed by majority of respondents. Respondent 16 mentioned the implementation of IBS depends on project. Good volume as suggested by respondent

19. Apart from that, Respondent 18 will use the IBS as construction method but very much subjected. In addition, respondent 17 stated that not relevant because he is consulting. Under Strategic Thrust5, efforts to encourage IBS have been highlighted: innovate through R&D to implement a new construction process (CIMP, 2006).

(g) To identify seminar or promotional campaign by CIDB in company

Most of the respondent stated that no any seminar by CIDB held in their company because respondent 3 indicated that they are not involved any training industry and respondent 4 pointed out that they have attend some course about IBS system.Partially respondent have held the seminar in their company. Respondent 11 stated that they have awareness program for professional like Architect, Engineer and Quantity surveyor. Respondent 12 also held the seminar with CIDB and they have the same concept to introduce IBS to the construction industry. Next, respondent 13 mentioned that previous company has held the seminar by CIDB. 6 respondents out 19 respondents no opinions on this statement.

5. Conclusion

The objective of this research project was to establish strategies to effectively promote the IBS framework for the stakeholders of the IBS industry in Malaysia. The goal was accomplished through the instrument namely questionnaire survey and interview. The first objectives of this research is to examine the level of understanding of IBS in the perspective of contractors. This research has found that the respondent has higher understanding and awareness about using IBS as construction method. A contrast in terms of expense, speed of construction and efficiency between traditional and IBS. In addition, the second objective is to analyse the strategies of promoting IBS effectively. Based on the respondent's response, the top three strategies of promoting IBS effectively are implementation of Life-Cycle Costing (LCC). The introduction of Life Cycle Costing (LCC) leads to a simpler and more precise cost estimate, including a forecast of the real costs of building operation, providing a stronger basis for decision-making. The second approach is a research fund such as start-up funding for government contractors. The third is adopting intensive training courses from management level. It is the same with previous researcher studies, where time, cost and quality were important for promoting IBS.

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