[CON 4] TECHNOLOGY BARRIERS OF INDUSTRIALIZED BUILDING SYSTEM (IBS): THE MALAYSIAN CASE

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ABSTRACT

Industrialized Building System (IBS) is an alternative construction method that was introduced to improve the productivity of the Malaysian construction project. The implementation of IBS in the Malaysian construction industries not only could reduce the time of construction process, but it also can provide better site management, reduce labour intensity, improve the quality and the efficiency of construction. Even though the implementation of IBS had been introduced since 50 years ago, however the level of its uptake is still far away from the ideal objectives of the Government. Therefore, this research had been carried out in order to analyse and explore this issue deeper by identifying the definition of IBS, the categories of IBS and the technology barriers of IBS that occurs in the Malaysian construction industries. For additional information, the scope of this study was focused in both areas of Kedah and Perlis. In order to investigate the problem, this research had been generated to identify the barriers of IBS implementation by using a qualitative research approach which is face – to – face interview technique. The data that had been obtained from the interviews had been analysed using the content analysis technique. As for conclusion, the technology barriers of IBS in Kedah construction projects such as cost issues and design factors had been identified and discussed.

Keywords: *Malaysian construction project, industrialized building system, technology barriers*

INTRODUCTION

The construction industry plays a major role in enhancing the growth of the economy, in addition of increasing the efficiency, productivity, quality and upgrading the living standard of Malaysian construction industries (Roadmap, 2003 – 2010; Khan *et al*., 2014). In order to achieve these objectives, the Government is in efforts of promoting the implementation of the Industrialized Building System (IBS) in Malaysian constructions industries. IBS is a construction method that can utilize the techniques where the products or components were manufactured under controlled environments, whether on – site or off – site, delivered, and assembled into the construction works (CIDB, 2003). In a wider scope, there are a lot of terms about IBS that had been introduced according to their preferences such as Modern Method of Construction (MMC), Prefabricated / Pre – fab construction and Off – Site Construction (Goulding *et al*., 2014).

IBS has six categories which are pre – cast concrete systems, formwork systems, steel framing systems, prefabricated timber framing systems, block work systems and innovative systems (Azman *et al*., 2013). The introduction of IBS in Malaysia by the Government has by far contributes a lot of advantages to the Malaysian construction industries such as waste minimization, speed up the completion time, increase the quality of the construction work, cost effectiveness, and optimize efficiency (Abedi *et al*., 2011; Nawi *et al*., 2011; Nawi *et al*., 2014). However, there are technological barriers that occurred in the implementation of IBS that is in need to be overcome in order to enhance the usage of IBS in construction industries.

PROBLEM STATEMENT

Industrialized Building System (IBS) was introduced in the Malaysian construction in the early 1960s by the Government. There are a lot of advantages acquired from the implementation of IBS in Malaysian construction industries. However, the implementation of IBS in Malaysian construction industries is still far away from the Government objectives (Roadmap, 2003 – 2010).

A lot of researches had been executed in order to identify the technology barriers that exist in the implementation of IBS for Malaysian construction industries. The technology barriers that intercept the implementation of IBS are readiness, knowledge, cost issues, negative perception, and awareness. Although the previous researches had found the barriers of IBS in the construction industries, but it was not focusing in the area of Northern of Malaysia especially in Kedah (Nawi & Nifa, 2007). The implementation of IBS in Kedah is still less compared to South Malaysia (CREAM, 2013). Thus, this study was carried out to determine the technology barriers in the implementation of IBS in Kedah construction industry.

The main purpose of this study is to provide a guideline for the construction industries in Kedah so they could improve the implementation of IBS by being exposed to the technology barriers involved. Besides, it is very important for everyone who is related or interested to involve with the IBS industry to have the knowledge of the technology barriers that they might confront during the implementation of IBS.

In the other hand, the aim of this research is to investigate the technology barriers of IBS in Kedah construction industry. In order to achieve the aim of this study, there are several objectives that need to be fulfilled which determining the barriers of IBS implementation in the first-hand, thus the solution to enhance the implementation of IBS in the construction industries can be identified and applied without any barricades.

TECHNOLOGY BARRIERS IN INDUSTRIALIZED BUILDING SYSTEM (IBS)

According to Kamar et al. (2009) and Mohamad et al. (2016), the adoption and implementation of IBS in Malaysia are immerse and plausible because of the amount of encouragement from the Government sector itself. However there are several hurdles that occurred in adopting and implementing the usage of IBS as the construction methods in Malaysian construction industries. From the previous studies, the barriers

in IBS implementation are summarized and can be divided into seven parts which are readiness, cost issues, awareness, knowledge, incentive, directive, and promotion from the Government, project delivery and supply chain. The technology barriers of IBS are illustrated in Table 1 below.

Table 1
Technology barriers in the implementation of IBS

Author \ Barriers	Readiness	Cost Issues	Awareness	Negative perception	Knowledge	Incentive, directive and promotion	Project delivery and supply chain
Thanoon et al. (2003)	x	x			x	x	
Din et al. (2007)		x				x	x
Kamar et al. (2009)	x	x	X	x	x		
Mohammad et al. (2009)	x		X		x		
Nawi et al. (2011)		x		x	x	x	X
Kassim & Wahid. (2013)				x	x		X
Ramli et al. (2016)		x	X	x			X

Unfortunately, there is actually lack of researches of technology barriers in the implementation of IBS in Kedah construction industry. The research could determine the technology barriers that occur in IBS so the proper solutions can be identified in order to enhance the implementation or the use of IBS in Kedah construction industry.

RESEARCH METHODOLOGY

In order to achieve the objectives of this study, the focus will be on the determination of technology barriers of IBS in Kedah construction industry and to identify the solutions to overcome the barriers occurred. In this study, the interview sessions will be carried out based on the objectives of the study in order to gain information and input. The analysis of data will be based on the respondents' experiences that they had encountered along their years involving in IBS. In short, the respondents in this research include the contractor G7 that have experiences in the IBS projects. The interview sessions will be conducted in the area of Kedah because of the lack of study in Kedah in terms of technology barriers of implementation of IBS in the construction industry. This study uses qualitative research approach which is face – to – face interview technique in the data collection process. The methodological framework for this study was shown in Figure 1.

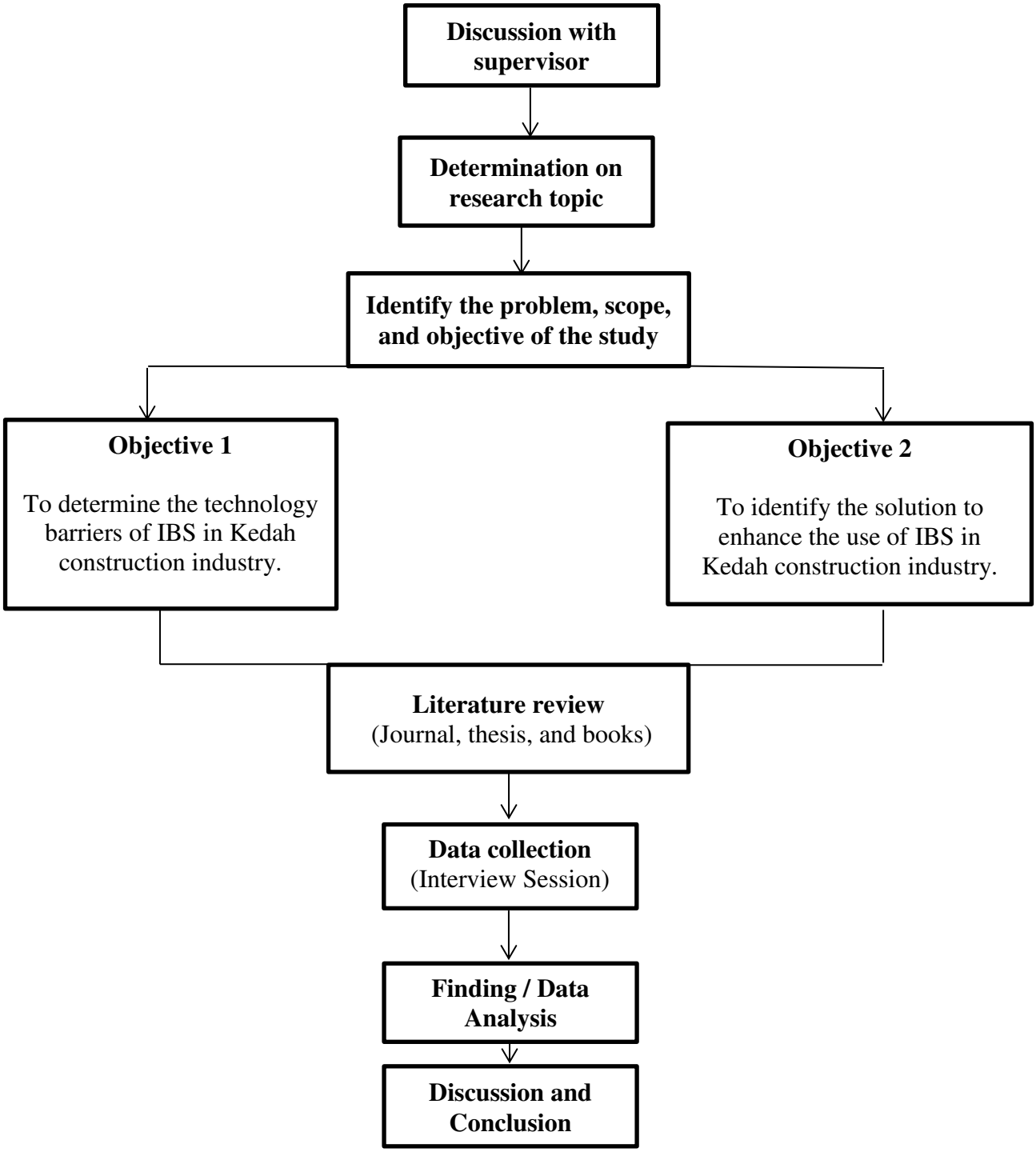

Figure 1
Research process flow chart

DATA ANALYSIS

The aim or the objectives in this study is to determine the technology barriers that had occurred in the implementation of IBS in Kedah. The information was gathered from the respondents through the interview. Besides, the solutions to enhance the

implementation of IBS also had been achieved through the interview and will be analysed using content analysis technique in order to get the result.

Selection of the respondent

The targeted respondents in this research are the contractors who have the experiences in IBS projects. The interview sessions were executed between the researchers and the respondents, thus had managed to collect data and gain the information from the respondents. The respondents were chosen among the contractor G7 in Kedah and from their experiences, they had being asked to give opinions for the technology barriers that exist in the implementation of IBS in construction industry. The respondents' profile was shown in Table 4.

Table 2
Respondents' profile

Name	Position	Experience	Company Discipline	Location	Gender
R 1	Project Manager	16 years	Contractor	Alor Setar	Male
R 2	Project Manager	7 years	Contractor	Alor Setar	Male
R 3	Project Manager	3 years	Contractor	Changlun	Male

Analysis of finding

In the matter of the technology barriers occurred during the IBS implementation, the question was:

"Based on your experiences in IBS projects, what can you conclude about the technology barriers of IBS?" was asked in order to gain information regarding to the technology barriers in IBS implementation. Table 5 shows the summary of the findings about the technology barriers based on the respondents' experiences in the projects of IBS.

Table 3
Technology barriers

Barriers \ Respondent	P 1	P2	P3
Readiness	√	√	√
Cost issues	√	√	√
Awareness			
Negative perception			√
Knowledge			
Project delivery and supply chain		√	√
Skilled worker	√		√
Design	√	√	√

Regarding the initiatives or methods that need to be taken to overcome the barriers identified in question 1, the question: "In your opinion, what is the solution to overcome the technology barriers of IBS implementation?" was asked so the solutions for the technology barriers that stated in question 1 can be identified.

In this regard, all respondents had agreed that the solutions to overcome the barriers should be taken and applied immediately in order to implement the IBS in Kedah

construction industry. Respondents P1 and P2 had suggested that the enforcement by the Government is, foremost, needed to overcome the technology barriers. According to the respondents that have experiences in IBS project (P1), it was stated that;

> ***"The Government should create a policy where all projects are compulsory to use IBS in construction works, not only in Government projects." – Respondent P2***

In addition, respondent P1 also had suggested that the Government should encourage the contractors to involve in Construction Industry Development Board (CIDB) programs to gain more information and have more exposure on IBS. According to respondent P1, CIDB promotes a lot of incentives for the contractors who want to involve in IBS projects.

Besides Government enforcements, respondent P1 and P3 had suggested that beginner contractors who want to involve in IBS project should consider doing a joint venture with another contractors or other companies. This is due to huge investment needed to own manufacturing plants; beginner contractor cannot afford to invest by themselves. Respondent P1 further expressed;

> ***"In terms of cost issues, freshman contractor can do a joint venture with another contractor by building a team according to their expertise field"- Respondent P1***

Meanwhile, respondent P3 argued that, the technology barriers of IBS can be overcome by a good coordination between the clients and consultants. According to respondent P3, clients and consultants have to have a discussion together to achieve agreement about construction methods that will be use. Furthermore, respondent P3 expressed that;

> ***"The technology barriers can be reduced by enhancing cooperation skills between the clients and consultants especially in term of decision making" – Respondent P3***

From the following statement, it can be concluded that government enforcement is very effective to be applied to overcome the technology barriers in the implementation of IBS, aside from the cooperation and strong bond needed in clients -consultant relationships and also by doing a joint ventures.

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DISCUSSION AND CONCLUSION

According to the findings, the technology barriers such as readiness, cost issues, awareness, negative perception, knowledge, incentive, directive and promotion, project delivery and supply chain had been compared between the respondents and literature review of this study.

Table 4
Technology barriers between respondents and literature review

Barriers \ Respondent	P 1	P2	P3	Literature Review
Cost issues	√	√	√	√
Skilled worker	√		√	
Design	√	√	√	

According to Table 4, there are three main technology barriers that had occurred in the implementation of IBS in Kedah construction industry. Those are the barriers that were highlighted by the respondents based on their experiences with IBS projects. IBS implementation in Kedah construction industry contributes to cost issues in term of logistics, prices of mold and payment for the workers. In addition, respondent P1, P2, and P3 had strongly agreed that cost issues are the barrier to IBS implementation. For logistic, the cost issues arise especially in transporting and delivering the component to the construction sites. Respondents also stated that they need to find the most suitable lorry and cranes to deliver heavy components of IBS which had costed them a lot. Meanwhile, the prices in designing new mold are very expensive and it depends on the designs that are demanded by the clients. In terms of payment of the worker, the company needs to hire and pay the outside expertise that has high skills in IBS. It will be very costly because the cost for local expertise can be used for the projects. This cost issue is supported by Thanoon et al. (2003), Din et al. (2007), Kamar et al. (2009), Nawi et al. (2011) and Ramli et al. (2016) in the previous research.

In the other hand, lack of skilful worker is actually one of the technology barriers in the implementation of IBS. Respondent P1 and P3 had agreed that skilful workers can affect the implementation of IBS in Kedah construction industry. According to the respondents, lack of skilful workers had cause a time wasting in construction. This is because the contractors need to train the beginner workers and it surely will take a lot of time, so the existence of expertise of IBS could make the work easier especially in implementing IBS. This new barrier is actually one of the newest barriers in the implementation of IBS in Kedah construction industry. Meanwhile, respondent P2 beg to differ by completely argued the otherwise, which in order to implement IBS, skilful and experienced workers are unnecessary because the component is ready to be jointed together with the workers with average skill.

Moreover, from the interviews, respondent P1, P2, and P3 agreed that designing is the most obvious barriers in the implementation of IBS. According to them, the barrier of design could be explained when the mold had to be redesign according to the need of the construction projects. To prove this statement, all respondents had agreed that it surely required a huge amount of cost in order to design a new mold. It will be worthy if the mold can be reuse for countless times such as repetitive buildings, but if the scale of the project is very small it will be unworthy. This is because the mold will be used about two or three times only for a small project. This barrier is very new as it had never occurred in previous researches before in the implementation of IBS.

From the discussion, it can be concluded that there are three main technology barriers that were provided and stated by the respondents based on their experiences in IBS

projects. From the choices of barriers, cost issues and design are the two main barriers that were highlighted by the respondents. It is actually the most crucial barriers in the implementation of IBS that is obtained from the findings. As for the solutions to overcome the cost issues, the scales of the projects play an important role in reducing the cost. This is because for small projects, IBS component is very expensive and there is no return on profits if the usage of the IBS method is proceed, but if the project is in huge scales it will be reasonable to use. As for the contractors, they can gain profits from it. In the other hand, the design should be standardized for use and as for the panel, it should be in light concrete to ease the delivery process.

As a conclusion, the Malaysian Government has to increase the encouragement and support for the implementation of IBS in construction work to improve the productivity and its efficiency. Besides, there are a lot of incentives that had been introduced by the Government in promoting IBS, however, the implementation of IBS is still few in construction industry, especially in Kedah construction industry. Even though there are a lot of advantages such as time consuming construction work, reducing wastage, cost minimization and more but the acceptance of IBS still cannot be competed with conventional systems. Besides, there are also a lot of difficulties and barriers that contractors need to confront in implementing IBS in construction industries. From the findings, cost issues and the design are the most crucial barriers in the implementation of IBS. That is why for future researches, it is suggested for the cost issues and design to be given further analysis with detailed information because both issues had become the major barriers in the implementation of IBS in Kedah construction industry.

REFERENCES

Abedi, M., Fathi, M.S., & Mirasa, A.K. (2011). Establishment and development of IBS in Malaysia. *International Building and Infrastructure Technology Conference (BITECH).*

Azman, M.N., Kamar, K.A.M., Nawi, M.N.M. (2013). Review Industrialised Building System in Reducing Waste of Construction Industry. *Journal of Science and Technical Education, 2.*

CIDB (2003). IBS Roadmap (2003 – 2010), *Construction Industry Development Board Malaysia (CIDB),* Kuala Lumpur, Malaysia.

CREAM (2013). Research on IBS Adoption in Government and Private Project in Malaysia, 2013.

Din, M.I., Bahri, N., Dzulkifly, M.A., Norman, M.R., Kamar, A.M., & Hamid, Z.A. (2007). The adoption of Industrialised Building System (IBS) construction in Malaysia: The history, policies, experiences and lesson learned.

Goulding, J.S., Pour Rahimian, F., Arif, M. and Sharp, M. (2014), "New offsite production and business models in construction: priorities for the future research agenda", *Architectural Engineering and Design Management*, 11(3), 163-184.

Kamar, K.A.M., Hamid, Z.A., & Dzulkalnine, N. (2012, April). Industrialised Building System (IBS) construction: Measuring the perception of contractors in Malaysia. In *Business Engineering and Industrial Applications Colloquium (BEIAC), 2012 IEEE* (pp. 328-333).IEEE.

Khan, R. A., Liew, M. S., & Ghazali, Z. B. (2014). Malaysian construction sector and Malaysia vision 2020: Developed nation status. *Procedia-social and behavioral sciences*, *109*, 507-513.

Mohamad, D., Ramli, M.Z., Danuri, H.N., & Sapuan, W.K. (2016). Demand of the industrialized building system (IBS) implementation in Malaysian government projects.

Nawi, M.N.M., & Nifa, F.A.A. (2007). A Preliminary Survey of The Application Of Industrialised Building System (IBS) In Kedah and Perlis Malaysian Construction Industry. *Conference on Sustainable Building South East Asia*, *Malaysia.*

Nawi, M.N.M, Lee, A., & Nor, K.M. (2011). Barriers to implementation of the industrialised building system (IBS) in Malaysia. *The Built & Human Environment Review*, *4*.

Nawi, M.N.M. (2012). *Development of A Framework of Critical Success Factors (CSFs) For Effective Integrated Design Team Delivery in Malaysian IBS Projects* (Doctoral dissertion, University of Salford).

Nawi, M.N.M., Haron, A.T., Hamid, Z.A., Kamar, K.A.M., & Baharuddin, Y. (2014). Improving Integrated Practice through Building Information Modeling – Integrated Project Delivery (BIM-IPD) for Malaysian Industrialised Building System (IBS) Construction Projects, *Malaysia Construction Research Journal (MCRJ), 15*(2), 29-38.

Ramli, M.Z., Hanipah, M.H., Zawawi, M.H., Abidin, M.Z.Z., Zainal, N.A., & Halim, N.S.A. (2016). Cost comparison on industrialized building system (IBS) and conventional method for school construction project.

Thanoon, W.A., Peng, L.W., Kadir, M.R.A., Jaafar, M.S., & Salit, M.S. (2003, September). The Experiences of Malaysia and other countries in industrialised building system. *In Proceeding of International Conference on Industrialised Building Systems.*

Mohamad, M.I., Zawawi, M., & Nekooie, M.A. (2009). Implementing Industrialised Building System (IBS) In Malaysia: Acceptance and Awareness Level, Problems And Strategies. *Malaysian Journal of Civil Engineering*, *21*(2), 219-234.

Kassim, U., & Walid, L. (2013). Awareness of the Industrialized Building System (IBS) Implementation in Northern Malaysia – A Case Study in Perlis. *Procedia Engineering*, *53*, 58-63.