

## Industrialised Building System in Construction Projects: A Study on Readiness

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**Abstract:** This study presents a review of readiness in the Malaysia Industrialised Building System (IBS). IBS has been introduced since 1960 and since then, there are many advantages that can be seen from the implementation of IBS in Malaysia. Although, construction player already know the advantages of IBS but at the same time, implementation of IBS in Malaysia is still in low phase. This study also highlights the obstacles of IBS implementation in Malaysia. Based on literature review there are several obstacles to IBS implementation which are awareness, cost issues, readiness, planning and implementation, negative perception incentive, directive and promotion, knowledge and project delivery and supply chain. Readiness is one of the obstacles and there is limited study of readiness issues for implementing IBS at present. This study is part of on-going Master research on key factor of readiness in IBS implementation. This conceptual study will explore why readiness is important to increase the level of IBS implementation. From the findings, further research into the factor of readiness is highly crucial to provide an insight to the construction industry players in making the transformation from conventional method to IBS a successful effort. Therefore, it is hoped that the finding of this research could assist construction player to ready for implement of IBS then, indirectly it can increase the level of IBS implementation in Malaysia.

**Key words:** Industrialised Building System (IBS), readiness, Malaysia construction industry, Modern Methods of Construction (MMC), building construction

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### INTRODUCTION

Industrialised Building System (IBS) is a term used by industry and governments in Malaysia for symbolize use the building construction industry in Malaysia. In other countries, IBS is also known by various terms such as Offsite Production (OSP), Offsite Manufacturing (OSM), Offsite Fabrication (OSF), Offsite Construction (OSC), Modern Methods of Construction (MMC), Modern Methods of Construction Housing, Modern Methods of Housing Building and many more.

IBS is defined as building construction techniques which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional research site (Treasury Circular Letter, 2008). The implementation of IBS gives a lot of benefit to the construction industry such as reduce unskilled researchers, reduce wastage and volume of building materials, increased environmental and construction site cleanliness and high quality control. This advantage also promotes a safer and more organized construction site and reduces the complementation time of construction (CIDB, 2003a, b).

Recognizing the enormous benefits and potential of IBS, the Government of Malaysia under the Ministry of Researchs through its agencies such as the CIDB and the Public Works Department have continually promoted the use of IBS. In line with this effort, CIDB Malaysia formed the IBS Steering Committee to bring all IBS-related issues in a frameresearch that could provide a guideline for feasibility of implementation of IBS.

### Literature review

**Introduction of IBS:** For both developed and developing countries' economies, the construction industry is very important. The construction industry has been considered as most complex and dynamic sector in Malaysia that required skilled labour, effective management and efficiency of design input (Nawawi, 2012). Usually, a building project involves many professional of some discipline such as developer, architect, contractors, consultants, construction managers, supplier and specialist. The advantages derived from IBS implementation are reducing the time of the construction process, the integration of sustainability strategies, reduce the wastage during construction and minimize the hazards and risk (Kamar *et al.*, 2009; Nawawi, 2012). Now a days,

the rapid growth in the implementation of technology has been a stimulus for the construction industry takes a step toward it. In order to develop as sustainable development in the construction process, the Malaysian government has taken the initiative to implement a new construction method called Industrialised Building System (IBS). IBS is an innovation process in building construction which is already known among construction player. The main concept behind the IBS is a specification with standard shape and dimension of building component through manufacturing and transport to site to form a building. Thus, IBS has been addressed as mass production of building component (Chung and Kadir, 2007). As stated in the Treasury Circular Letter, objective of IBS implementation in Malaysia is to increase the quality and productivity in construction projects, standardize the design, accelerate the construction period and reduce dependence on foreign labour.

After completion of the Tunku Abdul Rahman Public Housing Estate or known as the Pekeliling Flats in the early 1960's, Malaysian Construction Industry was started implement IBS in this country (CIDB, 2003a, b). The beginning implementation of IBS in Malaysia is when the ministry of housing and Local Government of Malaysia visited and evaluated housing development programmes in European Countries (Thanoon *et al.*, 2003). In the effort to improve the implementation of IBS, government had announced in Budget 2005 presentation so that the use of IBS have to increase from 30-50% in the construction of affordable housing including government building construction in year 2005. Even though the introduction of the IBS in Malaysia over 40 year ago, the level of acceptance is not widespread and the pace of implementation of the system is still in low phase (Yahya and Shafie, 2012).

Industrialised Building System (IBS) is the term created by construction industry in Malaysia to describe the adoption of construction industrialisation and the use of prefabrication of components in building construction. The definition of Industrialised Building System (IBS) is miscellaneous and it depends on the position and philosophy of the author. In Treasury Circular Letter, IBS is defined as a system or method in which the components are manufactured in factories or construction-site which is in control, transported and installed with minimal use of researchers on construction sites. According to Nawati *et al.* (2011), IBS is an innovative process of building construction using the concept of mass-production of industrialised system, produced at the factory or onsite within controlled environments that

includes the logistic and assembly aspect using proper planning, coordination and enhancing value to end users.

Hamid *et al.* (2008) defines IBS as a construction process that utilises techniques, product, components or building systems which involve prefabricated components and on-site installation. IBS is defined as a construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site research. The same concept is used repeatedly to describe the characteristics of IBS. Kamar (2011) classified IBS is a manufacture of structure components for the construction of a building rather than doing on site and use IBS as a term to represent those terminologies in the Malaysian construction industry.

**Obstacles to IBS implementation:** Despite the well documented benefits and strong support from the Malaysian government, the take-up for IBS was not as high as anticipated (Hamid *et al.*, 2008). Low labour costs in Malaysia could perhaps be the root cause of the problem (Kamar *et al.*, 2009; Hamid *et al.*, 2008). Although, members of the industry are open to the idea, a major proportion of industry stakeholders in the private sector are indifferent, perhaps due to resistance to change and insufficient funds and information to support the feasibility of change (Kamar *et al.*, 2009; Hamid *et al.*, 2008). The summary of the obstacles in Malaysian IBS implementation is illustrated in Table 1.

**Awareness:** According to Rahman and Omar, the IBS implementation in Malaysia is still in low phase because of the lack of awareness program to understand client needs and giving correct information on IBS. Clients with a good knowledge and awareness of IBS benefit will surely encourage appointed designers to design a building, according to IBS (Kamar *et al.* 2009).

**Cost issue:** This has led to a “chicken or egg” situation among construction industry professionals and builders (Kamar *et al.*, 2009; Nawati, 2012). Cost is the major barrier to IBS implementation because in general, the contractors are likely to maintain tight control over the budget and schedule to guarantee profit margin (Kamar *et al.*, 2009). According to Nawati (2012), some industry player's experiences, indicated that construction using IBS is more expensive due to the fierce competition from builders sticking to the traditional/conventional building method. Therefore, cost comparison analysis tools are important in the decision making process for choosing IBS over the conventional method.

Table 1: Obstacles in IBS Implementation

Authors	Awareness	Cost issue	Readiness	Planning and implementation	Negative perception	Knowledge	Incentive, directive and promotion	Project delivery and supply chain
Thanoon <i>et al.</i> (2003)		×				×	×	
Hamid <i>et al.</i> (2008)				×			×	
Rahman and Omar	×	×	×		×	×		
Kamar <i>et al.</i> (2009)	×	×		×	×	×	×	
Mohamad <i>et al.</i> (2009)	×		×			×		
Nawi <i>et al.</i> (2011a, b)		×			×	×	×	
Kassim and Walid (2013)	×							
Razak and Awang		×			×	×		×

**Planning and implementation:** IBS design needs to be addressed and plan from the design stage to be successfully adopted through the integration of pre-caster, designer and contracting firm. A lot of IBS project in Malaysia is not cost effective as it is proposed to be an alternative design to traditional method. The IBS application has to be incorporated during the design stage and the changing in design, requires a lot of further adjustment will raise the initial time and cost (Kamar *et al.*, 2009).

**Negative perception:** The poor architectural design caused the old pre-fabricated buildings have given the bad impression about pre-cast concrete. Therefore, clients are often in doubt of using IBS because of fear of customer rejection (Kamar *et al.*, 2009) observed that the term IBS is often misinterpreted with negative image due to its past failures and unattractive architecture.

**Knowledge:** Previous studies have indicated that most local professionals and contractors lack technical knowledge and experience of IBS (Nawi *et al.*, 2014a, b; Kamar *et al.*, 2009; Hamid *et al.*, 2008). IBS is the method that needs to high construction precision. Therefore, IBS is not a popular choice among the design consultant. This is because of lack of knowledge among industry players (Hamid *et al.*, 2008). One of the reasons why the level of IBS implementation is still in low phase is lack of knowledge in structural analysis and design of prefabricated components among civil engineers and those related to construction. The level of skill required of IBS researchers is more demanding compared to conventional construction method.

**Incentive, directive and promotion:** Since, the IBS Roadmap was endorsed by the Malaysian Government, there are still no specific IBS building regulations or standard guidelines for contract documents or procurement systems in terms of tendering, design, construction and operation of a project (Nawi, 2012). However, a lack of structured information will not only affect construction professionals because of

misunderstanding and misinterpretation of regulations but also for authorities in terms of project approval (Kamar *et al.*, 2009). According to lack Hamid *et al.* (2008), the lack incentive training among existing construction professionals was also identified as being a potential hurdle to the widespread adoption of IBS.

**Project delivery and supply chain:** Majority of IBS manufacturers, are located in industrial areas and it will directly increase component logistics and transportation costs in a construction project budget if the construction site is located far away in a rural area, especially in the north and east coast regions of Malaysia (Nawi *et al.*, 2011, 2012, 2014a, b). These problems also need for improvement in communication and integration among the relevant IBS players such as designers, contractors and manufacturers, more so at the design stage (CIDB, 2003a, b).

**Readiness:** Readiness is one of the barriers in order to increase the implementation of IBS in Malaysia (Kamar *et al.*, 2009). The readiness is important for current IBS implementation which is there are not cover the whole implementation process and not all practitioners could accept its implementation, especially company and personnel with less experience in handling IBS project (Mohammad *et al.*, 2009).

Based on a literature review, most of the obstacles in the implementation of IBS are rooted than issues of readiness (Kamar *et al.*, 2009; Mohamed *et al.*, 2009; Nawi, 2012). For example the awareness, knowledge and cost issues caused by the lack of readiness among industry players, if they are ready to implement the IBS indirectly, they will aware the importance of IBS, knowledge of IBS will enhanced and it will reduce the cost issues because they've been really understanding the IBS and have been willing to implement it.

**Readiness:** According to Oxford Dictionary, readiness can be defined as the state of being fully prepared for something or willingness to do something. This definition is followed by the use of ordinary language the term

'readiness' which connotes a situation that is both psychologically and behaviourally ready to take action which is willing and able. Readiness can be described at any level of analysis and can happen to the individual, group, unit, department or organizational level (Weiner, 2009; Walinga, 2008) identifies the definition of readiness as a preparation in term of mental and physical to deal with experience or action and at the same time ready to achieve the goal and objective.

Readiness can be seen with attitude of organisation members and their intention to the need of change and ability of organisation to make the successful changes. (Susanto, 2008). The organisational change process is always problematic to the organisation particularly when the change is due to the introduction of new technology. Readiness is one of the criteria of change management process which is when the organization is ready for change process; the change implementation will be easier (Susanto, 2008). This statement supported by Weiner (2009), the researcher noted that the change management experts have emphasized the importance of establishing organizational readiness for make the change. Holt also pointed that readiness is one of the important element in the involvement of employee as an initiatives to support the change.

As highlighted earlier, readiness is one of the factors that contribute in obstacle during the effort to increase the implementation of IBS in Malaysia. Parallel with importance of readiness that has been generally discussed earlier, the study of readiness in IBS implementation is very significant to construction industry in Malaysia.

**Readiness in IBS:** IBS has been introduced since 1960 and since then, there are many advantages that can be seen from the implementation of IBS in Malaysia. Although, construction player already know the advantages of IBS but at the same time, implementation of IBS in Malaysia is still in low phase. Accordingly, many researchers come out with the study of the factors that influenced the implementation of IBS in Malaysia. However, there are also obstacles faced during the development of the IBS in Malaysian construction industry. This obstacle have caused issues in the implementation, then it had to be resolved in order to ensure the implementation of IBS in Malaysia in line with developed countries.

Several studies have revealed that the barrier in implementation IBS in Malaysia are negative perception, readiness issues, cost and equipment, poor planning and regulations, poor knowledge and awareness issues

(Kamar *et al.*, 2009; Nawi *et al.*, 2011; Kassim and Walid, 2013; Mohamad *et al.*, 2009) studied the acceptance and awareness level, problem and strategies of implementing IBS in Malaysia. Their study revealed that survey on general readiness to implement IBS which covered in term of mentality is technically, financially capable and if the client required.

Based on a literature review, most of the obstacles in the implementation of IBS are rooted than issues of readiness (Kamar *et al.*, 2009; Mohamed *et al.*, 2009; Nawi, 2012). However, the previous studies did not involve the element of readiness. There is limited study conducted on readiness in-depth which is important as a guideline to successful IBS implementation. Thus, a comprehensive study to identify the key factor of readiness is needed to be undertaken in order to enhance the IBS development projects in Malaysia. Knowledge and ability is the most important which need to be considered as element of readiness (Thanoon *et al.*, 2003).

The beginning of a transformation begins with the knowledge because that it very important for the success of the transformation. Majority of the construction players in Malaysia have knowledge about IBS (Kamar *et al.*, 2009; Yahya and Shafia, 2012). However, there is still a problem arise which is the lack of knowledge on IBS and it makes the obstacle to IBS implementation. According to Hiatt knowledge was highlighted as first step on understanding how to change, training and education on new skills and the process of learning new tools, behaviours and processes.

For the element of ability, the technology and skilled researcher is one of the most important aspects that should be undertaken. The limited of technology availability also generally discourage the IBS implementation (Hamid *et al.*, 2008; Kamar *et al.*, 2009). If to compare the level of skilled researcher between conventional construction methods, IBS is more demanding and still lacks of skilled researchers in Malaysia (Nawi *et al.*, 2011a, b). In addition, the IBS specialized skill need the intensive training which requires more time and investment (Thanoon *et al.*, 2003). Therefore, this ability of an organization is factor needs to be emphasized as a major step in readiness implementation of IBS.

From the discussion above, can be seen the several key factor can be usefully as a guideline to industry player to improve the implementation of IBS. At the same time, the qualitative method important to informal setting that natural reflects the reality of what happened in the real setting.

## MATERIALS AND METHODS

This study is part of on-going Master research on key factor of readiness in IBS implementation among the contractor. It is still at an initial stage and the information presented in it is primarily based on the review of relevant literature review. This study has been divided into three parts. The first part deals reviews the overall concept of IBS. The second part is reviews the readiness in generally and the last part is explore the readiness in IBS due to limitations on resources and time as well as considering the overall perspective of the research, the scope of the study will be focused on the key factor of readiness and the development of the initial frameresearch of readiness. The terms, definitions and classifications of IBS will be used throughout the research to represent the concept of industrialisation, although there are a lot of other terms which have been used elsewhere.

## RESULTS AND DISCUSSION

This research will involve the Malaysian construction stakeholders and only focus on the perspective of contractors registered under class G7. Class G7 contractors are the largest and highest tier of contractors in Malaysia with no tendency limit and having paid up capital worth more than RM 750,000.00. They must achieve at least 5 year's experience in construction to be listed as G7 contractors. Being large, capable in terms of finance and experience and employing a larger group of professionals, class G7 contractors are the most likely group to adopt IBS in their projects. With their prominence in the Malaysian construction industry, the class G7 contractors will influence the overall practitioners within the industry to change to IBS.

## CONCLUSION

This study has described the aim to explore the key factor of readiness in Malaysian IBS. It will also determine the applicability of the proposed model for Malaysian IBS contractor perspective. At present, there is a lack of appropriate guidance for IBS Malaysian construction practitioners on how to understand the readiness issues in successful implementation of IBS and how they can achieve continuous improvement (Kamar, 2011; Yahya and Shafia, 2012). Most research in Malaysia promotes the benefits of IBS (Hamid *et al.*, 2008) but fail to succinctly develop guidelines on what is the key factor of readiness and how the element of readiness will increase the level of implementation of IBS in Malaysia. Based on the discussion above, the key factor of

readiness is important as a guideline to construction industry players in making the transformation from conventional method to IBS a successful effort. This study has described the importance of identifying the key factor of readiness in IBS which will be studied more extensively in the ongoing research.

## REFERENCES

- CIDB., 2003a. A survey on the usage of industrialised building system in Malaysian construction industry. Construction Industry Development Board, Kuala Lumpur, Malaysia.
- CIDB., 2003b. Industrialised building system (IBS) roadmap 2003-2010. Construction Industry Development Board (CIDB), Kuala Lumpur, Malaysia.
- Chung, L.P. and A.M. Kadir, 2007. Implementation strategy for industrialised building systems. Ph.D Thesis, University of Technology, Malaysia, Johor Bahru, Malaysia.
- Hamid, Z.A., K.A.M. Kamar, M.Z.M. Zain, M.K. Ghani and A.H.A. Rahim, 2008. Industrialized Building System (IBS) in Malaysia: The current state and R&D initiatives. Malaysian Constr. Res. J., 2: 1-11.
- Kamar, K.A.M., 2011. An investigation into the critical success factors of industrialised building system (IBS) contractors: The Malaysian case. Ph.D Thesis, University of Salford, Greater Manchester, U.K.
- Kamar, K.A.M., M. Alshawi and Z. Hamid, 2009. Barriers to industrialized building system (IBS): The case of Malaysia. Proceedings of the BuHu 9th International Conference on Postgraduate Research (IPGRC), January 29-30, 2009, University of Salford, Greater Manchester, U.K., pp:1-16.
- Kassim, U. and L. Walid, 2013. Awareness of the industrialized building system (IBS) implementation in Northern Malaysia-A case study in Perlis. Procedia Eng., 53: 58-63.
- Mohamad, M.I., M. Zawawi and M.A. Nekooie, 2009. Implementing industrialised building system (IBS) in Malaysia: Acceptance and awareness level, problems and strategies. Malaysian J. Civil Eng., 21: 219-234.
- Nawi, M.N.M., 2012. Development of a framework of critical success factors (CSFs) for effective integrated design team delivery in Malaysian IBS project. Ph.D Thesis, University of Salford, Greater Manchester, UK.
- Nawi, M.N.M., A. Lee, K.A.M. Kamar and Z.A. Hamid, 2011. A critical literature review on the concept of team integration in Industrialised Building System (IBS) project. Malaysian Constr. Res. J., 9: 1-17.

- Nawi, M.N.M., A. Lee, K.A.M. Kamar and Z.A. Hamid, 2012. Critical success factors for improving team integration in Industrialised Building System (IBS) construction projects: The Malaysian case. *Malaysian Constr. Res. J.*, 10: 44-62.
- Nawi, M.N.M., K. Radzuan, N.A. Salleh and S.H. Ibrahim, 2014. Value management: A strategic approach for reducing faulty design and maintainability issue in IBS building. *Adv. Environ. Biol.*, 8: 1859-1864.
- Nawi, M.N.M., W.N. Osman and A.A.I. Che, 2014. Key factors for integrated project team delivery: A proposed study in IBS Malaysian construction projects. *Adv. Environ. Biol.*, 8: 1868-1873.
- Susanto, A.B., 2008. Organizational readiness for change: A case study on change readiness in a manufacturing company in Indonesia. *Intl. J. Manage. Perspect.*, 1: 50-61.
- Thanoon, W.A.M., L.W. Peng, M.R. Abdul Kadir, M.S. Jaafar and M.S. Salit, 2003. The experiences of malaysia and other countries in industrialised building system in Malaysia. *Proceeding of the IBS Seminar International Conference on Industrialised Building Systems*, September, 10-11, 2003, Kuala Lumpur, Malaysia, pp: 255-261.
- Walinga, J., 2008. Toward a theory of change readiness: The roles of appraisal, focus and perceived control. *J. Appl. Behav. Sci.*, 44: 315-347.
- Weiner, B.J., 2009. A theory of organizational readiness for change. *Implementation Sci.*, 4: 67-67.
- Yahya, M.A. and M.N.S. Shafie, 2012. Level of acceptance towards industrialised building system (IBS) in Malaysia. *Int. J. Sustainable Constr. Eng. Technol.*, 3: 96-103