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THE BARRIERS OF INDUSTRIALISATION BUILDING SYTEM (IBS) ADOPTION IN MALAYSIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Industrialized Building Systems (IBS)refer to various pre-fabricated construction methods. IBS components are constructed separately beforehand, and they are assembled on-site afterwards. In Malaysia, IBS has improved building quality, productivity, occupational safety and health concerns, and reduced construction costs. However, the adoption of IBS in the construction sector remains low due to limited modernization of construction procedures and methods. To fully implement IBS, efforts must be made to change current construction methods and train employees with specialization skills, such as coordination and installation. Thus, the aim of this research is to study the barrier of IBS adoption in Malaysian construction industry. The research objective for this study is to determine the main barriers of IBS adoption in Malaysian construction industry. The approach used for data collection for this study is quantitative method. The questionnaire were distributed to the IBS practitioners. The findings from this research revealed that the barriers of IBS adoption in Malaysian construction industry are lack of skill labour, high labour cost and high capital cost. This study will be beneficial to improve the level of IBS implementation in Malaysia.

Keywords: *Barriers, Industrialised Building System, Construction Industry, Implementation*

INTRODUCTION

Nowadays, technology is changing and developing around the world at a rate and pace never experienced before. Construction is one of the main sectors that contribute to Malaysia economic. In Malaysia, the construction industry is divided into two categories: general construction, which includes residential, non-residential, and civil engineering construction; and special trade works, which includes metal, electrical, plumbing, sewerage, and sanitary works, refrigeration and air-conditioning works, planting works, carpentry, tiling and flooring works, and glass works (Mohd Amin et al., 2017).

The construction industry in Malaysia is a significant contributor to the country's economic growth, with the industry divided into general and special trade works. Sustainable construction, which is Industrialised building system (IBS) method had been introduced including designing, tendering, site planning and organisation of material selection, recycling, and waste minimisation. The first strategic plan for IBS had been introduced in IBS Roadmaps 2003 -2010 and IBS Roadmap 2011 -2015 (Abdul Rahim & Latif Qureshi, 2018; Nasrun et al., 2015).

Since the introduction of this roadmap, government had set that every public projects need to implement at least 70% of IBS material and method of construction in the project. IBS is an automated manufacturing process that utilizes precast elements and is aimed at improving building quality, productivity, occupational safety and health concerns, and reducing construction costs. The government of Malaysia has urged the construction industry to adopt the IBS, which can produce a high volume of houses at an affordable price, particularly low-cost houses.

Government agencies such as Jabatan Kerja Raya (JKR) and Construction Industry Development Board (CIDB); as well as researchers, have played crucial roles in educating the key players of the construction industry through policies, financial incentives, strategy guidelines, workshops, and seminars to raise the awareness of end users and clients. The Industrialised Building System (IBS) was introduced by the Ministry of Housing and Local Governments in the 1960s to assess European municipalities' housing development plans (Hassim et al., 2009; Mydin et al., 2014).

However, the adoption of IBS in Malaysia's construction sector remains low due to limited modernization of construction procedures and methods. This lack of modernization requires significant efforts to change current construction methods and train employees with specialization skills, such as coordination and installation. Despite the global recognition of IBS, the adoption of IBS in Malaysia remains low due to limited modernization of construction procedures and methods.

LITERATURE REVIEW

Industrialised Building System in Malaysia

The government of Malaysia has urged the construction industry to adopt the IBS, which can produce a high volume of houses at an affordable price, particularly low-cost houses. Government agencies such as Jabatan Kerja Raya (JKR) and Construction Industry Development Board (CIDB); as well as researchers, have played crucial roles in educating the key players of the construction industry through policies, financial incentives, strategy guidelines, workshops, and seminars to raise the awareness of end users and clients. The Industrialised Building System (IBS) was introduced by the Ministry of Housing and Local Governments in the 1960s to assess European municipalities' housing development plans (Hassim et al., 2009; Mydin et al., 2014).

In 1964, the government initiated two pilot projects using the IBS method, proving its quality in terms of cost, time, and building quality. Since then, IBS has gained popularity in countries like Singapore, Sweden, Germany, Japan, and the United Kingdom (Hassim et al., 2009).In 1963, Government of Malaysia sent architects from Public Works Department (PWD) to several European countries to study and explore the concepts of IBS construction. The representative of Malaysia had also visited Western nations such as Germany, Denmark, and France to gather information related to construction industry (Mydin et al., 2014).

Barriers of IBS in Malaysia

Industrialised Building Systems (IBS) are construction methods where building components are mass-produced in a factory or on-site under strict quality control, reducing on-site activity. This method reduces additional site work and enables off-site construction, which is crucial for providing housing with enhanced quality, output, safety, and efficiency. IBS is a modern system that utilizes precast elements from six specialisation groups, aiming to achieve better construction quality, productivity, and reduced overall costs. It is a crucial approach for enhancing housing quality, productivity, and overall cost reduction.

The barriers of adoption of IBS are not only for the contractor, but also for the designing team who is involved in projects that implement IBS method of construction. The barriers of IBS adoption are due to the internal factor and external factor that affect to the implementation of this method to Malaysian construction industry.

Table 1 : Preliminary list to the barrier of IBS adoption in Malaysian Construction Industry

BARRIER	AUTHOR	FREQUENCY
INTERNAL FACTORS		
Higher capital cost	[1][2][3][4][5][6][7][8]	8
Lack of knowledge and experience	[1][5][6]	3
Poor Design flexibility	[1][3][7][8]	4
Shortage of supplier and manufacturers	[1][5][6]	3
Lack of skilled labour	[1][2][5][8]	4
High transportation cost	[1][3][5][6]	4
Increase of needs of plant and machinery	[1][8]	2
Lack of quality inspection standard	[1]	1
The ability to use latest technology ICT	[6][7][8]	3
High labour cost	[2][5][6][7][8]	5
Poor project management	[4][8]	2
Lack of awareness of clients and developer	[3]	1
Lack of exposure	[5][7]	2
Negative perception towards IBS	[6]	1
EXTERNAL FACTORS		
Lack of government policy Support	[1][6][8]	3
Lack of incentives	[1][5][8]	3

Note: [1] Sun et al., (2020), [2] Akmam Syed Zakaria & Amtered El-Abidi (2021), [3] Yunus et al., (2019),[4] Akmam Syed Zakaria et al., (2018), [5] Hadi et al., (2017), [6] Ali et al., 2018), [7] Zairul, (2022), [8] Mohd Amin et al., (2017)

High Capital Cost

One of the internal barrier in implementing IBS in the Malaysian construction industry is cost issues, particularly for small contractors who lack the capability to handle high capital costs, particularly in machinery and equipment (Massofia Md. Ali et al., 2018). The most significant aspect affecting building costs is the repeatability and uniformity of components, followed by applicability, precision, and urgency of job completion. These components are called "Project-IBS characteristics" (Shamsuddin et al., 2017). Other criteria include quantity ordered, government incentives, and supply stability of construction materials. The manufacturing cost is the most important cost element for IBS projects, with contractors receiving 10% initial payment and 25% of contract value. Manufacturing companies typically require at least 75% of the capital to start manufacturing IBS components before delivering them to construction locations (Mohd Amin et al., 2017; Sun et al., 2020).

High Labour Cost

The implementation of IBS technology in the Malaysian construction industry significantly improves project performance, particularly in cost factors. However, labour costs are increasing compared to conventional methods. The industry relies on foreign labour, which costs less (Akmam Syed Zakaria & Amtered El-Abidi, 2021). Adopting IBS technology will increase labour costs, as proper training and techniques are required for IBS material installation (Mohd Amin et al., 2017). Clients should strive for cost certainty in construction activities, as the reduction in flaws from IBS manufacturing helps contractors avoid costly alterations during the project's finishing phases (Akmam Syed Zakaria & Amtered El-Abidi, 2021).

Lack of Skilled Labour

Based on Ali et al., (2018), most of general workers in Malaysia are not expose with IBS method since they are mostly practicing conventional method on site. To use IBS method can be implemented on the construction project, general workers must be familiar with the method first to ensure the quality and productivity of the project. To avoid any mistake, modular construction requires an amount of skilled labour for manufacturing fabricated and IBS material as well as jointing the material onsite. Many contractors avoid for adoption of IBS method as the cost to send their labour for training is high and many small contractors cannot afford to pay the wages for the large amount of the skilled labour (Mohd Amin et al., 2017). Hence, most of these contractors reluctantly to adopting IBS as their method of construction.

Poor Design Flexibility

According to Sun et al. (2020), IBS method of construction presents high-level modularization and standardization, leading to underdeveloped design flexibility. This is due to the limited design of factory-made IBS materials, which can cause damage to the design. Civil and structural engineers have experienced negative experiences due to poor design, with poor jointing between pre-cast and in-situ elements causing damage (Ali et., al., 2018). Additionally, the IBS method lacks aesthetic value, as every building must have its own aesthetic value to showcase its specialty. The IBS method limits the design process, as most IBS materials are delivered in standard sizes, making it difficult for designers to choose alternative sizes without incurring additional costs (Ali et al., 2018).

Poor Project Management

IBS project management is unique from traditional project management due to its complexity and contentious concerns (Zairul, 2022). It requires a capable project manager to ensure timely progress and avoids risks associated with high initial investment and uncertain returns on investment (Mohd Amin et al., 2017; Zairul, 2022). The Malaysian construction sector lacks adequate risk management measures due to a lack of knowledge knowledge (Rashidi & Ibrahim, 2012). Unknown

risks in IBS initiatives can lead to separate hazards and project failure. Inefficient management and inadequate integration can hinder a business's ability to become technology oriented. Inadequate coordination of industrialized technologies like modularization, automation, and mechanization is crucial for successful IBS initiatives (Rashidi & Ibrahim, 2012).

Lack of Government Policy

Next the external barrier to the adoption of IBS in Malaysian Construction Industry is due lack of government policy support. Government support is crucial for long-term planning development in industries (Mohd Amin et al., 2017). Despite government initiatives to increase IBS use in Malaysian construction projects, the implementation process is not strictly enforced. In 2008, in accordance with Treasury Circular 7/2008, IBS was made obligatory for public buildings, but adoption remains low (Mohd Amin et al., 2017). The Green Technology Master Plan Malaysia aims for 100% IBS adoption for both public and private projects, but the target score remains low due to low adoption. Current regulations, policies, and government factors do not motivate contractors to adopt IBS technology in construction (Al-Aidrous et al., 2023).

Lack of Incentives

The widespread adoption of modular construction has been hindered by a lack of economic incentives from governments, such as fiscal subsidies, tax breaks, and preferential financing. These schemes are insufficient to overcome the perception of higher costs (Sun et al., 2020). Mandatory laws, on the other hand, have the potential to attract more stakeholders into the modular building industry (Mohd Amin et al., 2017; Sun et al., 2020). Investment in IBS projects is limited to clients and contractors, especially small contractors. In Budget 2006, a tax benefit called Accelerated Capital Allowance (ACA) was announced, allowing IBS producers to receive reimbursement for costs incurred during mold procurement. This tax advantage is expected to encourage firms to invest more in IBS, but many contractors were unaware of the announcement (Hadi et al., 2017).

METHODOLOGY

The data collection and analysis procedures were divided into four phases. In the first phase, the preliminary review was obtained. Then, in conjunction with the questionnaire update, literature review was conducted to gain a better understanding. Thirdly, a questionnaire survey was administered to the corresponding IBS practitioners. Finally, data analysis was performed to supplement the preliminary set of data collected with the perspectives of the respondents on the barriers of IBS adoption in Malaysia Construction Industry. The research focuses on consultants in Klang Valley using a quantitative method to collect data. The study will involve 328 firms, including IBS practitioners in Klang Valley. However, the number of respondent

receive was only 205 respondent had answer the questionnaire due to the limitation of time.

There are hree methods were used analysed the data obtained; Frequency analysis to summarize the respond received from the respondent, mean analysis helped to identify the variations from the data average and to rank, and descriptive analysis to identify the barriers to IBS adoption.

The questionnaire design is divided into two (2) part:

Demographic and barriers. Likert scale is most common method used in research for respondent state the level of significance based on their experience. Five points of Likert scale indicates that: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree

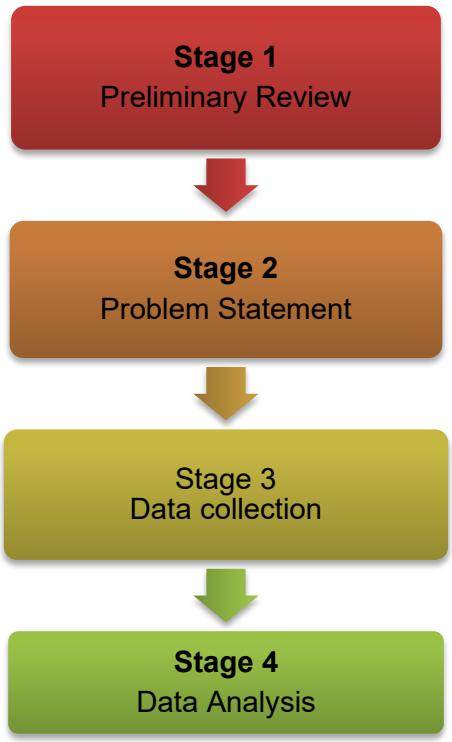

Figure 1 : Research Methodology Stage

FINDINGS AND DISCUSSION

Table 2 : Ranking of the barriers to IBS adoption

Variable	Mean	Rank
Lack of skilled labour	4.63	1
High labour cost	4.6	2
Higher capital cost	4.59	3
The ability to use latest technology	4.57	4
Lack of awareness of clients and developer	4.52	5
High transportation cost	4.5	6
Poor design flexibility	4.49	7
Lack of knowledge and experience	4.44	8
Poor project management	4.4	9
Lack of quality inspection standard	4.37	10
Shortage of supplier and manufacturers	4.37	10
Lack of investment	4.34	12
Increase of needs of plant and machinery	4.31	13
Negative perception towards IBS	4.21	14
Lack of government policy support	4.08	15
Lack of exposure	3.88	16

Table 2 indicates the barrier of IBS adoption to the means value and the ranks for the variables. Based on the response receive from the questionnaire distributed, many of the respondent strongly agree that lack of skilled labour is the first rank of barrier toward IBS adoption in Malaysia construction industry. The next of barrier is due to the high labour cost and high capital cost.

The lack of skilled labor (4.63) in the Malaysian construction industry is a first rank barrier to the adoption of the industrialized building system (IBS) in the industry. This is due to the high cost of labor, which is a significant resource in every construction project. Contractors are reluctant to pay for the high number of skilled labor, leading them to stick with the conventional method (Mohd Amin et al., 2017). Additionally, they are reluctant to send their workers to receive training and courses related to IBS construction, as they need to spend a lot of money on that, especially from SME contractors (Sun et al., 2020).

The second highest barrier to IBS adoption is high labor cost (4.60), which is related to the lack of skill labour. Contractors are reluctant to change from the conventional

method due to their dependency on foreign labor, which offers lower wages and makes them save a lot on wages (Akmam Syed Zakaria & Amtered El-Abidi, 2021). As IBS construction requires skill labour, which costs higher than foreign labor, most contractors choose to stick with the conventional method method (Mohd Amin et al., 2017).

The third highest barrier to IBS adoption is high capital cost, with an average of 4.59. IBS construction usually requires a large amount of money at the initial stages after the letter of award received, with a 10% initial payment and a 25% contract value. The manufacturing company typically needs at least 75% of the capital to begin producing IBS components, which becomes a barrier for small contractors, who rely on payment from the client for financing for new projects (Akmam Syed Zakaria et al., 2018b; Mohd Amin et al., 2017b).

The second least barrier is lack of government policy and support, with a mean of 4.08. Government policy support has been highlighted in Treasury Circular 7/2008, IBS roadmap 2011-2015, and GTMP 2017-2030 (Mohd Amin et al., 2017). The response shows that the government's efforts to encourage the practice of IBS construction are near to success.

The least barrier to IBS adoption is lack of exposure, with a mean of 3.88. The application of IBS has already been introduced in university level, and most students from constructed-based courses are familiar with IBS and modular construction. This indicates that the government and authorities are working to improve the level of awareness towards IBS practice in the community.
In summary, the barriers to IBS adoption in the Malaysian construction industry stem from the cost, knowledge, and limited resources. The lack of skilled labor, high labor cost, and high capital cost are the most barriers that influence to IBS adoption in the Malaysian construction industry.

CONCLUSION

Malaysia has long promoted IBS to tackle shortage of local skilled workers, housing unaffordability and provide an efficient and sustainable method of construction. However, this study revealed that the level of IBS implementation from the overall construction projects is extremely low. This research conducted a thorough review of IBS barriers in Malaysia construction industry. Subsequently, a list of 16 barriers was examined using a survey questionnaire. The data obtained were supported with previous literature with the barrier to the IBS adoption in Malaysian construction industry as the responds received by the questionnaire. The most data obtained gather from this study are highlighted as the most contributed barrier to IBS adoption

are lack of skilled labour (4.63), high labour cost (4.60), high capital cost (4.59), the ability to use latest technology (4.57) and lack of awareness of clients and developer (4.52) Based on the data analysis analys, all the barriers that listed in table 2, the data had achieved the mean score in average of 3.41-4.20 and 4.21-5.00 which means that the entire barriers listed in this section is faced by the practitioner teams and construction teams. Future research should be focusing on the solution to the barrier of IBS adoption. Moreover, further study can be focusing to the rural area such as Sabah and Sarawak with the same variable for barrier. Therefore, more information will be gain and the data obtained can be compared with the existing variables and the respondent agreement.

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