A review on the current issues and barriers of Industrialised Building System (IBS) adoption in Malaysia's construction industry

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Abstract. Malaysia considers the construction industry as one of the main contributors to its Gross Domestic Product (GDP). However, there are some unresolved issues arising from the ongoing and widespread adoption of the conventional method of construction such as the resultant fragmentation of the industry itself; delays in production and delivery time of unnecessary wastages and lack of sustainability practice. Malaysian Government has been continuously encouraging the industry to use, partly or if not wholly, the Industrialized Building System (IBS), which is considered to be an important part of sustainable construction initiative. IBS was introduced to Malaysia as the solution to issues related to dependencies of foreign workers, raising demand for affordable accommodations and improving image, quality and productivity of construction industry. However, the IBS adoption in Malaysia remains low. This paper presents the review of the current issues and barriers of IBS adoption in Malaysian construction industry.

1. Overview of Malaysian construction industry

The construction industry in Malaysia is generally divided into two areas, namely general construction, which comprises residential construction, non-residential construction and civil engineering construction; and special trade works, which comprises activities of metal works, electrical works, plumbing, sewerage and sanitary works, refrigeration and air-conditioning works, planting works, carpentry, tiling and flooring works and glass works. Malaysia's construction industries have a strong influence on the country's economy and accounted for about 4.6% of economic growth in 2007 [1]. In 2009 where the global economy had to pace itself against slow economic growth, the construction sector was the only sector that plotted positive growth during every quarter of the year in Malaysia. The Construction Sector registered a strong growth of 5.8% in 2009, and subsequently 8.7% for the first quarter of 2010 as against the overall GDP growth of 10.1% during the first quarter of that year [2].

The strong economic growth has created a high demand for construction activities in Malaysia. For example, the Malaysian government has targeted 4,964,560 unit houses to be built between the years

1995-2020 [3]. This figure does not include the number of other building construction such as schools and infrastructure. The demand and consequent shortfall in labour and skills attracted a huge number of foreign workers into the country to take up employment on site as unskilled labour doing manual jobs [4]. According to the Construction Industry Development Board (CIDB) of Malaysia, 69% (552,000) out of a total of 800,000 registered workers in the construction industry (as at June 2007) were the foreign workers [5]. Regardless of the over-dependency on foreign labours, the industry is still saddled with serious problems such as low product quality, low productivity, poor image, economic volatility, bureaucratic delays, lack of ethics, shortage of skilled manpower and lack of data and information [6]. Moreover, the OHS performance of the Malaysian construction industry is poor as evidenced by its high accident and injury rates, lagging behind other industries such as manufacturing.

In addition, the huge demand for construction projects, especially building construction, has fostered a new interest in Industrialised Building Systems (IBS) to replace the traditional approaches. These approaches could save on labour, cost and time of construction, and confer quality and durability [4, 7]. However, the main aim of IBS in Malaysia is to reduce the dependency on foreign labour and save the country's loss in foreign exchange [8].

The importance of IBS implementation is highlighted in the *Construction Industry Master Plan* (CIMP 2006-2015), under the *Strategic Thrust 5* [9]. The Government of Malaysia has emphasized the full utilization of IBS for government projects by the inclusion of not less than 70% IBS component (IBS Roadmap *2003-2010*, 2003). Further to this, the IBS Roadmap 2011-2015 aims to sustain the existing momentum of 70% IBS content for public sector building projects through to 2015. Further, this new Roadmap will also impact the private sector involved in "public-private- partnership" (PPP), through which the average 50% IBS score for private projects could be achieved by 2015 [10]. Further, in a recent Construction Industry Transformation Plan (CITP) 2016- 2020, the significance of IBS is highlighted under 'productivity' key component.

2. Current IBS adoption in Malaysia

The construction industry has led to embrace IBS as a method of attaining better construction quality and productivity, reducing risks related to occupational safety and health (OSH), alleviating issues for skilled workers and dependency on manual foreign labour and achieving the ultimate goal of reducing the overall cost of construction [11]. Apart from this, it offers minimal wastage, fewer site materials, a cleaner and neater environment, controlled quality, and lower total construction costs [12-14]. Already utilized in Malaysia since the 1960s, IBS is the way forward for the industry stakeholders to make leaps and bounds progress in the Malaysian construction industry [11].

Despite government's initiatives in promoting and encouraging the use of IBS, the IBS adoption in Malaysia remains low. In a press statement by the CIDB General Manager of the IBS & Mechanization Division, Technology Development Sector, Noraini Bahri stated that, as at 31st December 2015, only about 42% of public projects and 70% of private projects in Malaysia use modern Industrialised Building Systems (IBS) technology [14]. Furthermore, when the target of the IBS Roadmap 2011- 2015 is to have all public projects to obtain an IBS score of 70 or more, the IBS usage in public projects fell below expectations, with only 24% of public projects valued at above RM10 million have an IBS score of 70 or more. To date, as at May 2016, Works Minister, Datuk Fadillah Yusof said that about 69% of government projects used IBS, while the adoption rate by the private sector is still low around 14%, according to CIDB's study in 2014 [15].

3. Issues and barriers of IBS adoption

The issues and challenges that impede the adoption of IBS in Malaysia can be found in abundance from the existing literatures. The followings describe the barriers of IBS implementation that lead to low adoption of IBS in Malaysia.

3.1 Transition from conventional to IBS

Despite numerous IBS benefits, Malaysian contractors were perceived as not willing to make the transition to IBS and find it easier to stick to conventional construction method [14,16,17]. Changes from conventional construction method to IBS will have an influence on the design, manufacturing and site work as the result from an increased number of prefabricated elements and other innovative solutions used. This requires changes in the overall process such as synchronization of construction, manufacturing and design [18].

Factors like project management, rationalization, standardization, repetition, collaboration, IT, lean management, integration, supply chain partnering, planning, skills and training would be essential [19]. Apart from that, utilizing IBS means there was a necessity of specialized equipment and machineries requirements. Based on previous studies, lack of these equipment and machineries proves to be a major hurdle that hinders work in IBS-based projects [4,16].

Apart from that, the construction companies were exposed and trained in the traditional method of construction for decades and there was an availability of cheap foreign workers in Malaysia. Shifting to IBS seemed to be too complicated, unless the legislators impose a policy or strict governmental requirement on the use of IBS, or redefine the market by setting a mandatory quota for IBS projects. Therefore, a long term comprehensive policy and directive statement towards the industrialization of the building and construction sector should be pursued by the government for future business model in Malaysian's construction industry [20]. Small contractors were not willing to change to mechanized based on the IBS system because the conventional method perceived by them suited most of the small scale projects as usually undertaken by them [21].

3.2 Limited enforcement of IBS requirements

Despite massive government's initiatives to increase the utilization of IBS for every construction projects in Malaysia, the execution process was believed not strongly enforced. In 2008, in order to create sufficient momentum for the demand of IBS components, the use of IBS had been made mandatory for public buildings construction under Treasury Circular 7/2008 [18]. The significances of IBS inclusion for construction projects were highlighted in both IBS Roadmaps 2003-2010 and 2011-2015, however the adoption was still low.

Another requirement for mandatory IBS utilization for construction projects had been spoken up by the Works Minister, Datuk Fadillah Yusof recently, in which the government intends to make the adoption of IBS in construction projects compulsory in 2018. Datuk Fadillah Yusof quoted, "Ministry of Work intend to make the usage of IBS compulsory in 2018, with the assistance of local authorities, so that any proposed plans will use IBS in its construction." However, this particular initiative could only be realized if one of the strategies to IBS adoption is to include the IBS score as part of satisfactory conditions before the granting of development orders by local authorities. This is in line with the current CITP 2016-2020 main components, i.e. productivity, which will be driven by the adoption of new technologies, not only IBS but also BIM (building information modeling) to reduce waste and improve productivity [15].

3.3 Lack of IBS expertise in the market

Kamar *et al*., [18] revealed that the main attributes to the low IBS adoption by contractors mostly related to the organizational strategy and soft issues which underpin the capability of organization to implement IBS, for example higher capital cost, high capital investment, difficulties in achieving economies of scale and lack of knowledge in IBS . Technical factors such as level of IT, building regulation and code of standard were perceived as not significant.

IBS requires high construction precision [22]. Studies had indicated that the availability of cheap foreign labour which offsets the cost benefit of using IBS was the root cause of the slow adoption in the past. As long as it was easy for the industry to find foreign workers, labour rates would remain low and builders would find it unattractive to change into simplified solutions such as IBS [11]. Furthermore, many local authorities were not fully familiar with modular co-ordination and

standardization concept related with IBS design and assembling procedure. This had slowed down building approval and caused unnecessary delay in the development process. Due to the lack of knowledge and awareness, these local authorities tend to misunderstand IBS guidelines adding to further delays in approval [23].

According to Sasitharan *et al.* [22], IBS required high skilled workers compared to the 139 conventional construction methods. Under this system, the demand for on-site manual labor particularly carpenters, bar benders and concreters becomes less. The system demands more machine-oriented skills, both on sites and in factories. Thus, this leads to a transformation requiring the restructuring of human resource in an organization in terms of training and education

Generally, Malaysia is still lacking of skilled workers. As such, more intensive training programs are needed in the specialized-IBS-skills-training like integrating or assembling system. However, these special needs require more time and investment [17].

In an IBS project, the role of the contractor is shifted from being a 'builder' to becoming an 'assembler' on site [22]. This requires contractors to be equipped technologically with IBS knowledge and skills. The needs are made more imperative if the contractors were to promote their IBS products and compete in the industry. From July to September 2002, the situation was suddenly worsened when many trained foreign workers were forced to leave the country after a wide spread crackdown on illegal foreign workers [17]. The 'new batches' of foreign workers did not possess the required skill in IBS and had to be retrained [17].

3.4 Cash flow problems for contractors

In IBS approach, payment and procurement mechanism needs to be reviewed to tailor to IBS activities which are reliable and for safer payment and procurement [23]. Change in construction methods and processes from conventional to IBS will affect the change in the mode of payment and any related clauses in the contract. At this time, there is no security of payment designed for IBS projects and contractors need to deposit to manufacturers, which resulting in cash flows issues [9, 24]. The existing procurement structures had constrained the contractors by requiring them to have a high upfront financial capital to be able to procure IBS components from the suppliers.

Besides, Nawi *et al*. [25] discussed about the problematic payment issues that plagued with IBS implementation in Malaysia. Current practice of payment for IBS project is perceived as not suitable to the nature of IBS project itself, which affects the productivity and development progress of the project. According to Nawi, Mydin, Nursal, Nifa, & Bahaudin (2015), IBS system was based on prefabrication process where the contractors need to purchase construction component from the manufacturers and this concept required them to have a strong cash flow [25]. In the current practice of IBS project, the awarded contractor would be paid by the client an initial payment between 10% and 25% of contract value [25]. However, the manufacturing company would require 75% of the capital in order to manufacture the IBS components before delivering the components to the construction sites [24].

Unfortunately, small contractors do not have strong financial funding to follow this concept. To deal with this situation, some of the contractors required a bond from a financial institution as a guarantee [25]. Besides that, some contractor would only pay 75% of the cost to the manufacturer after the components were delivered on site [24]. Both of the situations were unfair to both parties.

This is in agreement with a study by Fateh *et al*. [26] who conducted a series of interviews with several clients, contractors and manufacturers, and found that the main issue that led to low adoption of IBS was due to no standard form of contract to tailor IBS construction in Malaysia. Therefore, it is recommended for the construction industry to have a standard form of contract for IBS which is different from traditional design and build project, and suit IBS specific activities and construction processes.

A study by Meynagh *et al*. [20] revealed that most contractors strongly agree that supply chain and method of procurement as primary factor contributes to the success of IBS project. Therefore, it is crucial for legislators and construction actors, to establish a good relationship and collaboration among

the project members from the moment when the project starts up to the completion to ensure the smooth running of supply chain.

A study by Dzulkalninea *et al.* [26] revealed that there were five (5) issues related to payment for IBS contractors, as below:

- Cost
  The cost incurred for the implementation of IBS was to set up the factory. The IBS contractor needed more than 30% of the up-front payment. The payment was based on work progress for the conventional and it did not applicable when it came to IBS project. Besides that, there was an issue of high prices in terms of production cost which comprised of buying new equipment, machinery, technology and training for the manpower [27].
- Difficulty in securing timely and adequate financing
  The difficulty of financial funding for the IBS contractor was because of the progress work payment. The payment for the IBS contractor could not be treated the same way as the conventional project because the initial cost was not the same. It was essential for the IBS contractor to receive the initial payment from the client to sustain their business [27].
- Lack of integration at design stage
  In terms of the integration at the design stage, respondents mentioned that sometimes it was related to the payment issue to the IBS contractor. At this stage, it was important for each party to be responsible and had good cooperation to ensure that the payment could be made on time based on the right design [27].
- Difficulty to get loans from the financial institution
  Some of the respondents mentioned that dealing with the financial institutions for loan application ware not the main problem for the IBS contractor. As long as the documents were fully-completed, the financial institution would be able to approve the loans. As for now, there were few financial institutions would be able to provide loans for the construction industry such as EXIM Bank, SME Bank and others [27].
- Increment of material prices
  Most of the respondents explained that the increment of the material prices would directly affecting the production cost. The high cost of material would increase the initial cost of production. One of the respondents revealed that the material prices increase in every three (3) months that had made them difficult to sustain the equilibrium of the profit [27].

These factors had caused the IBS business to be much more risky as it needs extra capital for investment as compared to the conventional method. Therefore, it was very hard for new companies to compete for opportunities with international competitors which were stronger in terms of financial capability, technology and specialization [23]. In addition, contractors prefer not to use IBS as they find it was easier to stick to the traditional construction method [17, 25]. Adopting a new system means that more time needed to be allocated for training of human resources, specialized equipment and machineries, also the need to have a substantial and sustained budget. Based on previous studies, lack of these superior equipment and machineries proved to be the major hurdle that hinders work in IBS-based projects [23, 25].

3.5 Industrialization objective

In Malaysia, the introduction of IBS was primarily to reduce over-dependency on foreign labour. It differed from other developed countries such as Australia, where the main objective of IBS was to cater the housing demand due to the increasing number of migrants each year. The idea of having an offsite housing production was considered a success as the housing-assembling productivity had been increased and the issues were excellently solved. It was also reported that the gap between demand and supply for housing in Australia had reached up to the crisis proportions. This had led to more houses to be prefabricated in the modular unit in the factory. As in 2014, the demand for prefabricated

houses was increased from less than 1% in 2004 (Sarah Backhouse, Chief Executive Officer at prefabAUS). It was predicted that the demand of prefabricated houses would rise between 10% and 20% in the next 10 years [28].

IBS in Malaysia had been established, introduced and applied in the construction industry to deal with a growing demand for affordable housing, solving issues associated with foreign workers and improving quality, efficiency and productivity of construction industry. Nowadays, IBS had evolved and implemented in hybrid construction projects to build national landmark as significant valuable national assets [29].

Malaysian IBS contractors needed to benchmark IBS technologies, learn from the lesson and adapting the best practices from other countries. Construction industrialisation is a worldwide agenda. IBS was already successfully adopted in Finland, Sweden, Japan, Germany and Singapore where offsite technologies had eventually modernised and improved the construction industry [11]. The government should launch a forum on a regular basis for the academicians and associated practitioners who are actively involved with the IBS technology for exchange of information and experiences, development of new techniques and advice on promotion and implementation of IBS. An online portal was also suggested to disseminate international trends, products and processes associated with the IBS [23].

4. Conclusion

This paper had identified and discussed the barriers in IBS adoption in the Malaysian construction industry. The level of IBS adoption in the construction industry was still low even though the government had seriously promoted and encouraged the use of IBS in order to have a better practice in the construction industry. The issues and barriers that impeded the adoption of IBS had been discussed and mainly revolves around the lack of expertise, the transitional shift from conventional construction to IBS, cash flow problems for contractors, limited enforcement of IBS requirements and industrialization objective. Despite the negative perspective concerning IBS method, this does not mean the future for adoption of IBS method by the prospects would be low. Future research is sought for more investigation to be done for the qualitative stakeholders' perspectives on the factors that impede the IBS adoption in the construction industry.

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