

Converting Small and Medium Sized Enterprise (SME) Contractor to Industrialised Building System (IBS) Installer

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Abstract: Conventional construction may be impeded by lack of trained labour, inclement weather, quality issues, inadequate site circumstances, time consuming and many more. Previous study has proved that the adoption of Industrialized Building System (IBS) offers the benefits in terms of speed, safety and quality as compared to conventional construction. Government has taken numerous measures to ensure the successful implementation of IBS through Construction Industry Development Board (CIDB), among others is conducting training programs such as IBS installer training programme. However, there are still many small and medium sized enterprise (SME) contractors are apprehensive about implementing the IBS system and prefer to stick with the traditional construction method. Therefore, this paper aims to propose the suitable strategies for converting SME contractors into IBS installer. The research objective is to identify the challenges in converting the SME contractors into IBS installer and to propose strategies for converting SME contractors into IBS installer. The quantitative data was collected using questionnaire and distributed to the contractors of IBS construction project. This research identified the current contractor's challenges and recommendation in improving strategies for converting SME contractors into IBS installer.

Keywords: Prefabrication, Conventional contractor, Installer, IBS project

1. Introduction

Conventional construction work is done at the site where it is to be located. Reinforcement steel and casting work are done after the installation of timber or plywood formwork. Conventional construction, sometimes known as cast in-situ, can be seen in the foundations, walls, frames, floors, and roofs. This method leads to the inflating of construction expenses due to the high cost of labour, raw materials, and transportation, as well as the amount of time it takes to complete the project (Mydin *et al.*, 2014). Therefore, as early as in year 1960's Malaysia has implemented Industrialised Building System (IBS) construction method in order to overcome the cost, time and quality issues faced by conventional construction method.

According to Bari *et al.* (2018), IBS is a construction process using prefabricated components and on-site installation and it is heavily recommended in Malaysia's construction industry to shorten construction time and the industry's dependence on foreign labour. This is also supported by Jabar (2018), that the IBS is potential solvers to increase total construction sector performance in terms of labour, cost effectiveness, quality, waste reduction, safety, and productivity. Mydin *et al.* (2014) stated that the IBS is a method of construction in which all components are created in a controlled environment and then transported, placed and assembled on-site with the use of minimal additional structures. Not only is that IBS effective at expediting the housing developments' construction, but it also increases the quality and affordability of home developments in which it is utilized. The components are manufactured in a systematic manner with the use of formworks, machines, and other types of mechanical equipment (Ismail *et al.*, 2012). In Malaysia, the construction industry is migrating away from conventional methods and toward a more organised and mechanised approach by IBS. Malaysia has started of implementing IBS to the development projects in order to overcome the issue of insufficient housing stock due to the various benefits offered by IBS for instance productivity enhancement in labour, efficiency, reduction in costs and an increase in labour quality. From an IBS perspective, there is broad consensus that contractors are among the diverse range of industry stakeholders, plays a crucial role in ensuring the effectiveness of the deployment of IBS. However, despite the recognition of its benefits, contractors have been slow to embrace IBS. For contractors, the construction industry is a well-established one with numerous deeply ingrained and culturally embedded practises, and thus anything perceived as novel or different encounters resistance (CIDB, 2012).

Additionally, this system has long been practiced abroad because it has many advantages, however the adoption rate in Malaysia is still low and below the national target set by CIDB (Saad *et al.*, 2022). The government has encouraged the implementation of this method, yet at the same time there are a lot of constraints faced by contractors to make it happen (CIDB, 2013). Among the constraint are high cost, lack of supply from the local market, lack of expertise in installation work, delivery to construction site, limited communication and so on. Contractors and developers in Malaysia agreed that the main issue is on the high-cost issue (cost increase by 12-13 percent), which prevents them from implementing IBS projects compared to conventional methods. The increase in cost is due to the factor of the overall cost of using IBS is higher than conventional methods due to the low number of suppliers causes demand to exceed supply, purchase of expensive molds, transportation costs, manufacturing of IBS components requires high-technology and expensive equipment (CIDB, 2013).

The government through the bodies responsible for the construction industry such as the Ministry of Works (KKR), Public Works Department (JKR) and CIDB has offered various incentives in promoting the expansion of the use of IBS system to contractors registered in Malaysia. According to MIDA (2019), contractors who carry out the construction of buildings using the IBS system will get several benefits in the form of major tax relief such as a tax exemption of 70 percent to 100 percent for a term of five or ten years, investment tax allowance of 60 percent or 100 percent for five years, reinvestment allowance of 60 percent for fifteen consecutive years, and duty-free importation of raw

materials or components and machinery and equipment. Nonetheless, in the current situation, the development of the use of IBS among small and medium sized enterprise (SME) contractors is still very limited.

Many SME contractors are apprehensive about implementing the IBS system and prefer to stick with the traditional construction process. The challenges to apply knowledge on the installation of IBS system in the right way among SME contractors need to be identified to continue advocate for the usage of IBS, especially in the Klang Valley. Without this, it is impossible for an IBS-based construction to be implemented well and successfully achieve its objectives. The reason for this is that small-scale contractors are already familiar with the conventional system, and the technology works well for them in small-scale projects, therefore they are reluctant to convert to mechanized-based systems (Kamar & Hamid, 2011).

2. Literature Review

Industrialized Building Systems (IBS) is a method that incorporates manufacturing techniques into construction-related activities. This approach has the potential to shorten project duration and improve construction quality, while also lowering construction costs and waste (Mydin *et al.*, 2014, Trigunarsyah & Tuffaha, 2017). It is found that this approach is gaining popularity under different names in the construction industry for instance Modern Method of Construction (MMC) in the United States; Off-Site Construction (OSC) in the United Kingdom, Australia, and China; Pre-Fabrication in Singapore and Hongkong; and Industrialized Building System (IBS) in Sweden, Japan, and Malaysia. IBS is defined by the Malaysian Construction Industry Development Board (CIDB) as "a construction technique in which components are manufactured in a controlled environment on- or off-site, then transported, positioned, and assembled into a structure with minimal additional site work." Industrialized Building Systems begin with off-site production in a factory that produces prefabricated or precast components in modules or units. It continues with the transportation of modules or units from the factory to the construction site and concludes with the installation of modules or units to complete the building's construction (Trigunarsyah *et al.*, 2019). Construction of the IBS is easy to disassemble and relocate elsewhere. It shortens the raw material, energy, and time requirements by an immense amount, while conventional methods do not. The IBS gives designers ample flexibility in the design of the structure, making the structure versatile and malleable. Prefabricated construction units have a neutral look that can be easily incorporated with virtually any kind of building (CIDB, 2020).

According to Jalil and Shaari (2021) during the installation process there are two alternatives available, the first alternative is, the main contractors select the IBS manufacturers to supply and install however this alternative will increase cost. Meanwhile for the second alternative, the contractors are to conduct installation using their own labours and simultaneously will gain the cost saving. If the components are installed by the IBS manufacturers, the manufacturer will cover the warranty and responsible for defects. On the other hand, if the components are installed by main contractors' own labours, there are no warranty on components' installation are available. If defects occur, main contractor will do the rectification at their own cost. There are issues for IBS installation as they are not many IBS certified installers that available (Nawi *et al.*, 2011). Furthermore, the installation of each IBS type require their own standard, which require quality assurance and quality control checks on many aspects.

CIDB has fully supported the government's efforts in increasing the use of IBS as a key ingredient in the country's construction industry. All the efforts made have given a very high impact in producing relevant contractors today. Various efforts have been made to train registered local contractors to fulfil their skills on the use of IBS. CIDB also plays an essential role in changing the opinion of SME contractors about the advantages of adopting IBS, which is particularly important. CIDB's efforts to

convert SME contractors to IBS Installers have translated into a series of intensive and effective training. Among the exercises implemented are IBS manufacturer & product registration program with the aim to compile a list of approved IBS producers for use by the Malaysian building and construction industries, IBS contractor training program, IBS installer training program and IBS professional training program.

2.1 SME Contractors in The Malaysian Construction Industry

SMEs are at the heart of the building sector in Malaysia, accounting for approximately 90 percent of the construction companies, while the remaining large contractors account for about 10 percent (Benjaoran *et al.*, 2012). According to the CIDB, the Malaysian contractor is split into categories depending on the size of the capital paid-in and the contracting ability as stated in Table 1. The grades from small (G1-G3) and medium-sized (G4-G5) contractors to big companies (G6-G7).

Table 1: Contractor's Grade and Category in Malaysia

Grade	Paid-up capital (RM)	Tendering Capacity (RM)	Category
G1	5,000	<200,000	Small Contractor
G2	25,000	<500,000	
G3	50,000	<1,000,000	
G4	150,000	<3,000,000	Medium-sized Contractor
G5	250,000	<5,000,000	
G6	500,000	<10,000,000	Large Contractor
G7	750,000	No limit	

In Malaysia, SMEs are commonly defined as entrepreneurs in G1 to G5 classes. Small and medium enterprises are key contractors for public or private projects of general interest and as sub-contractors or business contractors for major enterprises (Azman, 2014).

Conventional building methods are synonymous to SME contractor. This strategy is standard practise in the building sector in Malaysia. The usual building technique is craft-based. It entails the production and installation of prefabricated pieces on site, such as trusses, doors and windows, bricks, tiles etc (Mohamed *et al.*, 2018). This is a labour demanding process which calls for numerous onsite wet trades such as brick workers, plaster workers, carpenters, etc. Building might be hampered by the shortage of qualified work, bad weather, quality problems and unsuitable site conditions (Lou & Kamar, 2012).

2.2 Issues in IBS adoption by SME contractors

According to Ali *et al.* (2018), SME contractors in particular, favour the traditional way of building structures because of their hesitance to adopt an IBS system. Kamar *et al.* (2012), claimed that since SME contractors are already familiar with how the conventional system operates, it is easier for them to incorporate the technology with small scale projects and as a result, they are not interested in moving to a fully mechanised system. SME contractors are missing out on a vital aspect of the manufacturing process due to the fact that they lack of financial backup. In order to establish their own manufacturing plants, SME contractors must have very large capital investments. In this case, it will be difficult for them to implement the IBS system unless financial difficulties are overcome (Ali *et al.*, 2018). Spending on new machines and moulds as well as the salary of qualified people for installation is a substantial expense for precasters (Hui, 2007). IBS, viewed by the industry as a threat, became a liability for businesses, rather than an opportunity (CIDB, 2017). Pre-cast and in-contractor IBS system users do not appear to have an advantage over existing procurement and contracting systems. On the other hand, IBS manufacturers ask a substantial upfront payment prior to delivering components to the construction site. Contractors must continue pay suppliers even if clients defer payment until after the construction

project is complete (Dzulkalnine *et al.*, 2016). If payment is delayed, it will result delay in the delivery of components, which ultimately reduces the productivity of building projects (Kamar *et al.*, 2012), this practice burdened the SME contractors as they only have limited capital amount.

Many SME contractors would rather stick with the normal style of construction, rather than use the IBS approach (Ahmad & Osama, 2017). This supported the previous statement by Nawi *et al.* (2011) and Hamid *et al.* (2011). For SME contractors, it's simple to implement the conventional method because it's similar to the small-scale projects they work on. As a result, the new technology doesn't interest them. SME contractors have a lack of financial backup, which causes them to have insufficient capital to establish their own manufacturing plants. In this situation, it is the cost of moving forward with the IBS system that proves to be a significant barrier for SME contractors (Kamar *et al.*, 2009; Amin *et al.*, 2017). Big players in the IBS industry have shown themselves to be strong developers of successful IBS projects. This implies that an effective IBS system would be achievable as long as the parties involved had the capabilities required to do the work necessary to produce components for IBS, like the design, analysis, and manufacture of IBS components (Yunus & Yang, 2011).

A common misunderstanding and negative connotation associated with IBS is the result of past failures and an unsightly architectural design (Jabar *et al.*, 2018). Pre-fabricated mass construction is often connected with problems such as poor quality, leaks, abandoned projects, unsightly appearances, and many more. Because of their inferior architectural design, pre-fabricated concrete buildings have left a negative impression on the general population (Jabar *et al.*, 2015). Many contractors are hesitant to use IBS because they are concerned about being rejected by the customers. Even construction professionals are not convinced that IBS technology will hold up under construction, and, therefore, are concerned about potential problems post-construction. Customer perspective will aid in the development of a better understanding of IBS and consequently, a greater demand for IBS manufacturer.

According to the government's current policy, IBS must be used in public projects of RM10 million or more, while private projects are encouraged to do so (Hamid *et al.*, 2011). As a result, many SME contractors continue to use the traditional technique of construction on projects valued at less than \$5 million. On the other hand, in the corporate structure, IBS contractors are subsidiaries of larger holding companies. These companies will combine their design and manufacturing operations under one roof. Typically, the organisations positioned themselves as "one-stop shops," offering a whole variety of IBS treatments to clients (Kamar *et al.*, 2012). Due to the way these corporations conduct business, a monopoly has developed in the existing IBS industry, limiting the prospects for other contractors especially SME's.

3. Research Methodology

This research applied a quantitative research method. Questionnaires are used to collect data to achieve the objective on determine the perception of small contractors in converting to IBS installer, identify the challenges in converting the small contractors into IBS installer and propose strategies for converting small contractors into IBS installer. Questionnaires were disseminated via online due to the Malaysian movement control order (MCO). The target respondents from G1 – G5, contractors were identified through the contractor's registration with CIDB, the contractors were contacted by a phone call to inform them about this survey and later an email consist of the questionnaire were sent to them. From 120 respondents contacted, the researcher only managed to get 52 replies which makes 43% response rate. The data collected were analysed using manually using Microsoft Excel with the formulation of Average Index.

4. Results and Discussion

The questionnaires were distributed to the SME contractors (grade G1-G5). Figure 1 shows the distribution of the contractors according to their grade. The majority of contractors who responded were from G3 grade contractors with a value of 36.4 percent (18 respondents). Following by G2 grade contractors with a percentage of 26.9 percent (14 respondents), G1 grade contractors with a rate of 15.4 percent (8 respondents), and G4 grade contractors with a percentage of 13.5 percent (7 respondents). G5 contractors are the respondents who responded the fewest, contributing 9.6 percent (5 respondents).

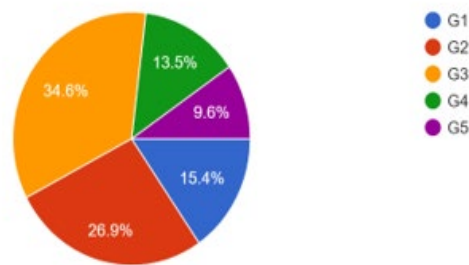


Figure 1: Response rate by contractors according to the grade registration

4.1 Challenges of SME contractors

The questionnaire contains fifteen (15) items designed to identify the challenges of SME contractors in converting to IBS installer. The respondent scored the potential on a scale of 1 to 5, with 1 indicating strong disagreement and 5 indicating strong agreement. The results can be seen as per Table 2.

Table 2: SME contractor's challenges on IBS

No	Challenges	Average Index	Rank
1.	Cheap foreign labour has attracted contractors to continue using conventional construction methods.	4.37	1
2.	Accustomed to the conventional system, and it suits their initiatives well because of this familiarity.	4.31	2
3.	Inexperience in IBS technical knowledge	4.25	3
4.	Limited number of IBS suppliers	4.25	3
5.	Requirement for skilled labour	4.21	4
6.	Shortage of qualified worker	4.21	4
7.	Reluctant to learn new knowledge.	4.19	5
8.	Lack of knowledge from the beginning - the IBS course rarely offered to undergraduate students.	4.19	5
9.	Monopoly by big player in IBS industry	4.17	6
10.	Delayed payment and resolving contractual issues in IBS	4.12	7
11.	Lack of interest on the part of clients and decision makers makes less opportunity	4.12	7
12.	Lack of information among approving authorities	4.10	8
13.	Lack of financial capabilities	4.06	9
14.	High cost of the plant/factory.	4.06	9
15.	Lack of educated professionals	4.00	10

Discussion has been made on the top five (5) most significant challenges. Cheap foreign labour has attracted contractors to continue using conventional construction methods is the top challenges (Average index 4.37) for the SME contractors. Malaysia's deployment of IBS is plagued by the problem of low-skilled foreign workers. Unemployment in Malaysia's construction industry has been blamed in large part on the country's reliance on cheap foreign labour. Contractors favour using inexpensive immigrant labour over mechanical systems because it is more readily available and easier to get (Waris *et al.*, 2014). As supported by Taksiah *et al.* (2011).

The second challenges identified is the contractors has grown accustomed to the conventional system, and it suits their initiatives well because of this familiarity (Average Index: 4.31). SME contractors would rather stick with the normal style of construction, rather than use the IBS approach (Ahmad & Osama, 2017). For smaller contractors, it's simple to implement the conventional method because it's similar to the small-scale projects they work on. As a result, the new technology doesn't interest them.

The next challenge is inexperience in IBS technical knowledge (Average Index: 4.25). According to Nawi *et al.* (2018) the failure to keep up with IBS construction technology is as detrimental as ignorance in the field. Finding the appropriate solutions for IBS technical concerns such as joint, standardisation, dimensioning, and certification, as well as other related technical issues, is critical to preventing discouragement among SME contractors to adopt. To encourage open IBS systems, guidelines or catalogues for each system and new construction methods must be produced as a reference for the Malaysian construction sector.

Limited number of IBS suppliers (Average Index: 4.25) or in other word the scarcity of IBS vendors further impedes IBS adoption in Malaysia. As of November 2017, CIDB had registered a total of 263 suppliers and manufacturers nationally (CIDB, 2018). This figure is deemed small in comparison to the number of projects in RMK 11. There are only a few IBS suppliers in a tiny market, resulting in a monopoly and expensive material pricing. It caused difficulties for SME contractors since they have limited capital to invest.

Requirement for skilled labour (Average Index: 4.21) is the last top five challenges to be discussed here. IBS requires skilled labour as well as appropriate training. IBS required specialist skill workers to accomplish the installation process which depends more on machine-oriented skills (Hamid *et al.*, 2008; Kamar *et al.*, 2007). However, most of the available skill workers are still lack of appropriate technical skills and knowledge (Theong *et al.*, 2018), and it is difficult to attract new workers and train them with new IBS skills (Abdullah *et al.*, 2015). It is costly and time consuming for SME contractor to fulfil this requirement for labourers.

4.2 Strategies for converting SME contractors to IBS installer

Twelve (12) strategies based on literature search has been listed and analysed. The finding from the analysis as shown in the Table 3. It is noted that all the listed strategies are important as several strategies were grouped at the same rank which made only six (6) most significant strategies. The discussion of the most significant strategies will only be done for the top five (5) listed strategies.

Increased practitioner awareness and education programmes and establish a regular meeting for academicians and allied practitioners involved in IBS shared the highest most recommendable strategies (Average Index: 4.35). The awareness by practitioner such as the client, consultant, local authorities are crucial in order to ensure the IBS is implemented in the project they involved. Industry practitioners should develop mechanisms for capturing and disseminating innovations, lessons learned, and best practises from successful countries and organisations in order to accelerate our learning curve on IBS and chart our course forward. The government should establish a regular meeting for academics and allied practitioners involved in IBS to exchange information and experience, create new methodologies,

and provide guidance on IBS promotion and implementation. Additionally, an internet portal was proposed for disseminating international trends, products, and procedures related to the IBS.

Table 3: Strategies to Convert SME Contractors to IBS Installer

No	Strategies	Average Index	Rank
1.	Increased practitioner awareness and education programmes.	4.35	1
2.	Establish a regular meeting for academicians and allied practitioners involved in IBS	4.35	1
3.	Make IBS campaigns and seminars mandatory for contractors, engineers, developers, and architects.	4.33	2
4.	Increased efficiency in educating the public about IBS through training and seminars	4.31	3
5.	Provide IBS installer with flexible financing and tax reductions.	4.29	4
6.	Increase government incentives to reduce the expense of utilising IBS	4.29	4
7.	Increase the publishing on IBS book and journal.	4.29	4
8.	Increase IBS forum for all stakeholders in the construction industry and IBS practitioners to build network, share ideas, and learn about the latest state of IBS technology.	4.19	5
9.	Encourage the creation of numerous other suppliers in order to avoid monopoly.	4.19	5
10.	Increase IBS-related courses in local Universities	4.19	5
11.	Reduce reliance on foreign workers and prioritize local workers who have adequate skills and knowledge in IBS	4.19	5
12.	In order to better support contractors in adopting IBS, a better understanding of the characteristics and what is involved in IBS is required.	4.13	6

Make IBS campaigns and seminars mandatory for contractors, engineers, developers, and architects (Average Index: 4.33) fall in the 2nd place ranking. Government projects are already required to employ IBS and are only exempt in a limited number of circumstances, such as facility renovations or upgrades. The government, on the other hand, no longer enforces attendance at mandatory IBS campaigns and stakeholder seminars. This is viewed as a loophole in terms of the IBS project's implementation. The majority of stakeholders already have a basic understanding of IBS, although this is not the case. As a result, the idea to require contractors, engineers, developers, and architects to attend IBS campaigns and seminars should be implemented. Additionally, the government may provide additional incentive points toward the Continuous Contractor Development Program (CCD) to stakeholders who participate in government-sponsored campaigns and seminars.

Next is increased efficiency in educating the public about IBS through training and seminars (Average Index: 4.31). The Government through its governance body, such as CIDB should increase in championing IBS through various initiatives. These include increasing seminars to promote IBS to the public, providing support for training, and encouraging its use in construction projects. In short, there is an immediate need to improve IBS uptake through marketing, awareness campaigns, and education (Jabar *et al.*, 2015).

The last strategy to discuss here, is to provide IBS installer with flexible financing and tax reductions (Average Index: 4.29). Innovative materials and systems require imported technologies, which are frequently prohibitively expensive and difficult to obtain for small business. Incentives from the government or private sector to commence extensive IBS implementation remain insufficient, resulting in substandard implementation of IBS initiatives. On the one hand, government incentives, tax exemptions, and local authority regulations can all help SME contractors feel more positive to implement IBS.

5. Conclusion

Several challenges have been identified and ranked according to its important. The identified challenges should be taken into account when considering on the transformation of SME contractors into IBS installer. Meanwhile, it is found that all twelve (12) listed strategies has been rated as importance since several strategies shared the ranking place thus it made the listed strategies up to rank no. six (6) only. Therefore, it is recommended that all the strategies should be given consideration in the effort of converting SME contractors to IBS installer.

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