The IBS Barriers in the Malaysian Construction Industry: A Study in Construction Supply Chain Perspective

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Abstract

Supply chain management is a management of network relationships of organisations in pursuance of business process and performance improvement, while Industrialised Building System (IBS) is an alternative construction method towards sustainable and improvement of construction performance and image. Both concepts are related with movement of innovation to enhance the project delivery and performance in terms of cost reduction, quality, work environment, relationships, and productivity. Many efforts have been done in order to implement IBS in the Malaysian construction industry; unfortunately the process of implementation had faced a lot of hindrances. These hindrances arising from the supply chain include miscommunication, lack of coordination, lack of integration, lack of trust and negative attitudes. This paper through literature review aims to highlight all of these barriers and examines how far it affects the process of IBS implementation. Suggestions on how supply chain management practice could be implemented more effectively to pursue IBS implementation will be concluded.

Keywords: supply chain management system, Industrialised Building System (IBS), Malaysian construction industry, project performance
1 Introduction

As a developing country, Malaysia is rapidly developing in every domain including construction. Public and private sectors have initiated the need for large and complex construction projects. Malaysia’s housing policy is geared towards meeting the objective of ensuring access to adequate and decent shelter to all citizens, particularly low-income groups.

It is predicted that between years 1995 to 2020, Malaysia will need a total of 8,850,554 houses, including 4,964,560 units of new housing, to cater for the increase in population during this period (Yoke et al., 2003). The statistics data will be more crucial by the increasing of immigration and natural disasters which create more demand for the housing. Unfortunately, only 1,382,917 units were constructed under the Sixth and Seventh Malaysia Plans. This means that another 3,581,643 units need to be built within the next twenty years to meet targets, and not 600,000 - 800,000 units as planned under the 8th Malaysia Plan. However, the increase of population as a by-product of modernisation has brought housing issues into new perspectives in Malaysia.

While the problem of housing grows more acute, Malaysia is struggling to meet its own housing needs, and is trying to do so through adopting new technology. The conventional construction method, which is commonly being practiced, is high cost and unable to respond to this huge demand in a short time with standard quality (Agus, 1997 and Senturer, 2001). Waleed et al., (1997) stated that to achieve the Malaysian Plan target using current conventional building systems, it will require an excessive workforce, since on average, only one house is completed per year per worker (one house/year/worker). The rising cost of labour is an important factor in increasing the total cost of the house. As stated by Friedman and Cammalleri (1993), the labour cost has increased to 30% of the construction cost as compared with 10% a few years ago.

2 IBS as an alternative solution

In an attempt to address these issues, the government, through its Construction Development Board (CIDB) Malaysia, actively promotes the adoption of a new or modern construction method system, entitled Industrialised Building System (IBS). Some researchers classify IBS as a process of total integration of subsystems, components and elements into one overall system which utilizes industrialized production, transportation, assembly and erection on site (Diaz, 1971; Junid, 1986 and Warszawski, 1999). Lessing (2005) specified IBS as a process of integrated manufacturing and construction under well-planned organization to improve quality through construction standardization and reduction of labour intensity. IBS also was identified as an industrialized production technique (Parid, 1997) and construction method (Badir & Razali, 1998) which components are manufactured under control environment either at site or factory, transported, positioned and assembled into a structure with minimum additional site works (Trikha, 1999). In this paper, IBS definition could be summarised as an innovative process of building construction using concept of mass-production of industrialised systems, produced at the factory or onsite within controlled environments, that includes the logistic and assembly aspect under a proper planning and coordination design process toward enhancing the end users desired values. According to IEM (2001), IBS has immense inherent
advantages in term of productivity, indoor quality, durability and cost. Buildings constructed by this method also have a short construction time and standard quality (Senturer, 2001).

2.1 History and development of IBS in Malaysia

The IBS agenda in Malaysia begun in the early 1960’s when the Ministry of Housing and Local Government of Malaysia visited a number of European countries and evaluated their housing development programmes (Thanoon et al., 2003). Following the successful visit, the government initiated an IBS pilot project in 1964 which aimed to speed up the delivery time, and to build affordable and quality houses.

Despite the introduction of IBS in Malaysia was over 40 years ago, the pace of implementation is still slow. The Malaysian government are concerned that uptake of IBS is low despite the plausible potential (Hamid et al., 2008). A survey conducted by the CIDB of Malaysia in 2003 revealed the adoption level of IBS stands at only 15% (CIDB, 2003b). However, in the last couple of years, the momentum has steadily increased and has gradually become part of the industry. Many private companies in Malaysia have teamed up with foreign experts from Australia, Netherlands, United States and Japan to offer pre-cast solutions (CIDB, 2003b). There are now a number of key IBS projects such as:

- 17 storeys flats along Jalan Pekeliling, Kuala Lumpur. Gammon/ Larsen Nielsen used a Danish system of large pre-fabricated panels (CIDB, 2003b).

- Housing project comprising 6 blocks of 17 storeys flats, and 3 blocks of 18 storeys flats was constructed at Jalan Rifle Range, Penang. Hochtief/ Chee Seng adopted the French Estoit System (Din, 1984).

- Taman Tun Sardon Housing project in Penang. An IBS pre-cast component and system was used in the project and was designed by the British Research Establishment (BRE) in 1978 for low cost housing in tropical countries.

- Perbadanan Kemajuan Negeri Selangor (PKNS): low cost houses and high cost bungalows project in Selangor (CIDB, 2003b). This project is under a state government development agency which acquired pre-cast concrete technology from Praton Haus International, Germany.

- The 36-storeys Dayabumi complex which was the first project to use steel structure (part of IBS) as a method of construction completed in 1984 by Takenaka Corporation, Japan (CIDB, 2003b).

- Further, full and hybrid IBS construction successful landmark projects can be found throughout Malaysia, such as, Bukit Jalil Sport Complex; Lightweight Railway Train (LRT); Petronas Twin Tower; and Stormwater Management and Road Tunnel (SMART Tunnel).
2.2 Adoption barriers of IBS in Malaysia

Early efforts by the government to promote usage of Industrialised Building Systems (IBS) as an alternative to the conventional and labour intensive construction method however has not made a headway. In an attempt to understand the poor diffusion of IBS, some researchers have investigated the barriers to effective IBS implementation in construction. Reconciling the relevant literature, these IBS barriers can be categorised into five main themes: cost and financial (Kamar et al., 2009; CREAM, 2007; Nawi et al., 2007a; IBS Steering Committee, 2006; Haron et al., 2005; and Thanoon et al., 2003), skills and knowledge (Kamar et al., 2009; CREAM, 2007; CIMP, 2007; Nawi et al., 2007a; IBS Steering Committee, 2006; IBS Survey, 2003; Nawi, et al., 2005; and Thanoon et al., 2003), procurement and supply chain (Kamar et al., 2009; Hussein, 2007; IBS Steering Committee, 2006; Chung, 2006; Faizul, 2006; Nawi, et al., 2005), perception from customers and professionals (Kamar et al., 2009; CREAM, 2007; IBS Review, 2007, Nawi et al., 2007a; and Nawi et al., 2007b) and lack of government incentives and promotion (CREAM, 2007; Nawi et al., 2007b; IBS Steering Committee, 2006; and IBS Survey, 2003). These issues specifically can affect the various stakeholders in the IBS value chain: either, manufactures designers, local authorities, contractors, suppliers or clients. As highlighted by CIDB (2009), improving procurement system and supply chain is the key to achieve IBS success in the Malaysian construction industry. Therefore, this paper will expose this problem specially on IBS supply chain design process in order to minimize that barrier appropriately.

2.3 IBS supply chain barrier

Studies by Potts (1995) identified that a shortage or late supply of information, equipment, and materials on site are among the factors that contribute to the problem of delay in construction industry. This problem is worsened by the situation where the construction site locating too far from manufacturers or suppliers area. According to the IBS Manufacturers Directory by the CIDB (2008), majority of IBS manufacturers are located in industrial areas (such as Klang Valley, Seremban and Butterworth). This situation indirectly will increase the logistics and transportations cost for the construction project especially in the rural areas such as Northern Region and East Coast of Malaysia (Chung, 2006 and Nawi et al., 2005). Consequently, the contractor will have to bear extra expenses for transportation cost in delivering the product.

Problem related to manufacturer’s requirement is identified as one of the hurdles of IBS adoption in the Malaysian construction industry (Fikri, 2005). In current practice, before a project is started, the awarded contractor will be paid around 25% of total amount of project as an initial payment by the client. In IBS projects, however, the problems that exist are normally associated with financial standing that is faced especially by local contractors. They do not have sufficient fund as well as inconsistent in pumping money or capital to the projects. As highlighted by Fikri (2005) and Nawi et al., (2005) IBS manufacturers are usually required to pay about 75% advance payment before able to proceed for a delivery to the construction site. In this case, normally the contractor will apply for a bond from financial agency (such as bank) as a guarantee source of finance for the company. Unfortunately some contractors, especially who are new in the field, failed to acquire a bond thus
affect the project development process. This factor is being identified as one of the greatest hindrance of IBS adoption in Malaysian construction industry.

Practically, most of the IBS project deliveries still apply the traditional approach. It begins with an architect who gets the information from the client, produce an architectural design, to be given to the structural engineers. Upon completing the structural design, the engineer then passes the detail specification to the quantity surveyor for costing purposes and bill of quantities before passing it to main contractor who then take action for further discussion with manufacturer especially in term of building components production and the assemble process. This practice allows the manufacturers and contractors to be involved only after design stage. This supply chain process creates problems such as delay, increase in lead time, and late supply of material (Jha and Iyer, 2006; Baiden et al, 2006; Smith et al., 2004; Vrijhoef and Koskela, 1999; Evbuomwan and Anumba, 1998; and Gunasekaran and Love, 1998). Furthermore, IBS method has been heavily criticised in as it hinders effective communication, lacks of understanding among participants, team building and the design and construction team (Kamar et al., 2009; Hamid et al., 2008; CIMP, 2007; Nawi et al., 2007b; and Che Mat, 2006). This traditional approach known as ‘over the wall’ syndrome is shown in Figure 1. This wall affects each discipline’s ability to effectively communicate thus cause a problem to the process of communication especially among multi disciplines in organisation (Evbuomwan and Anumba, 1998).

As mentioned by Mendelsohn (1997), the reality of construction is that probably 75 percent of the problems encountered in the field are generated in the design phase. Studies in the manufacturing industry also have shown that approximately 70% of costs associated with a project are committed during the design phase (Prasad, 1996). These problems are related to the constructability concept in term of sharing information or knowledge process among project supply chain stakeholders. As defined by Construction Industry Institute, CII (1986), constructability is an optimum use of construction knowledge and experience in the conceptual planning, detail engineering, procurement, and field operations phases to achieve the overall project objectives.

In addition, the barrier to IBS is also allied to constructability issue in terms of technical part during the design-manufacture-construction stage. It is because; most of the IBS design process deals with
offsite production through the concept of design for pre-assembly and pre-fabrication process. Some of the IBS previous studies identified that, the weakness of existing IBS construction method is still in its cumbersome connections and jointing methods which is very sensitive to errors and sloppy work (Thanoon et al., 2003 and Nawi et al., 2007b). For an example, poor jointing of prefabricated walls with other prefabricated or in-situ elements may cause water seepage problems, especially for high-rise buildings during the rainy seasons in Malaysia (Fikri, 2005 and Nawi et al., 2007b). This problem is further enhanced by the implication for the choice of finishes besides the use of low quality and unsuitable product as well. As a result, high moisture movement, incompatible with the other materials with which they were in contact, has led to tiles coming off the walls. All of these issues are underpinned by poor communication and integration among relevant players such as designer, contractor and manufacturer in the design stage (CIDB, 2009) thus resulted the need for plan redesign and incur additional costs if IBS is to be adopted (Kamar et al., 2009; Hamid et al., 2008; CIMP; 2007 and IBS Review, 2007).

Towards this process to run smoothly and successfully, the authority should consider the requirement of early integration and collaboration of specialist and knowledge holders such as contractors, manufacturers and suppliers to deliberate the design process at an earlier stage (Gil et al., 2001; Dowlatshahi, 1999; and Dowlatshahi, 1998). It is because the Malaysian current practice is still based on the traditional approach in the project delivery process. Some independent studies (e.g., Ireland 1985; ASCE 1991; Russell et al., 1993) also confirmed that integrating construction knowledge into design processes greatly improves the chances of achieving a better quality project, able to complete in a safe manner, within schedule, and for the least cost. Based on the literature review, the main approaches to improve project performance through early involvement of contractor and manufacture can be categorised into several major themes such as using an alternative procurement approach; using a partnering approach; and applying new management philosophy originating from other industries like Supply Chain Management (SCM), Value Management, Lean Construction and Concurrent Engineering. In this paper, the study however was limited on SCM as a collaboration tool to pursue IBS implementation in Malaysian construction industry.

### 3 Supply chain management

#### 3.1 Definition and Concept of SCM

The term of supply chain is defined as “the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders” (Soroor and Tarokh, 2006a). Further definition of supply chain has been defined as “the network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer” (Christopher, 1992), or simply as a system through which organisations deliver their products and services to their customers (Poirier and Reiter, 1996). Nelson (2003) defined supply chain as a “complex network or system of interconnected and interdependent individuals, groups, companies, organisations and relationships whose goal is to satisfy and add value to their particular customer.”
The term Supply Chain Management (SCM) was developed in the 1980s, to express the need to integrate key business processes, from end-user through the original suppliers. Generally, the SCM term reflects the process of planning, implementing, and controlling the operations of the supply chain to be as efficiently as possible. SCM spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption (Udin et al., 2006). The other definitions of SCM are given in Table 1 below.

### Table 1; Definitions of SCM

<table>
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<tr>
<th>Sources</th>
<th>Definitions</th>
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<tbody>
<tr>
<td>Gattorna and Walters (1996)</td>
<td>“A loop that starts and ends with the customer, where through the loop flow all materials and finished goods, all information and all transactions”</td>
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<tr>
<td>Bechtel and Jayaram (1997)</td>
<td>“SCM is related to the flow of materials and information, from initial sources to the transformation process before delivery to the end-users.”</td>
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<tr>
<td>Lambert et al., (1998)</td>
<td>“SCM is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders”</td>
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<td>Mentzer et al., (2001)</td>
<td>“SCM is defined as the systematic, strategic coordination of the traditional business functions and tactics across these business functions within a particular company and across businesses within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole”</td>
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<tr>
<td>CLM (2004)</td>
<td>SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. It also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers and customers. In essence, SCM integrates supply and demand management within and across companies.</td>
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### 3.2 SCM benefits

Nowadays, the construction is moving to the appointment of integrated supply chains to improve collaboration, integration, communication and coordination between stakeholders in the construction supply chain. All stakeholders or parties have a long term objective to work together to deliver added value to the client. The long term relationships enable the power of supply chain management to be fully realised and thus, the integration of supply chain management is recognised as one of the process improvement areas which is vital in the development of construction projects.

Person (1999) noted that by implementing SCM as an integrative part in business strategy, the client and contractor could get some benefits such as being able to reduce their supplier base; establish and nurture relationships with suppliers; organise training programmes to encourage a cooperative approach to problem solving; as well as develop system for rating suppliers performance on quality, speed and prices. Further conducted study in Hong Kong construction industry indicated that the concept of supply-chain in construction makes subcontractors and suppliers more responsive to the
needs of the company (main contractor) and complies with the requirements of the projects (Wong and Fung, 1999). According to them, the development of strong relationships with main contractor will secure the supply of the services or material and control the quality and cost from subcontractors/suppliers.

Adoption of SCM in construction project, such traditional procurement related issues like miscommunication and lack of integration among design and construction teams could be reduced significantly (Love et al., 2004). For example, the involvement of suppliers (as expertise about design and procurement issues) at an early stage in the construction project will improve project performance through a reduction of wastage in schedule, cost and adversarial relationship issue (Person, 1999). Furthermore, this concept has a potential to minimize the barriers of information flow within the traditional separated of design and production process which has been criticised since 50 years ago (Simon Report, 1944; Banwell, 1964; Latham, 1994; and Egan, 1998). Love et al., (2004) indicate that there have been endless calls to “bridge this gap” by creating a seamless supply chain whereby the interface between various phases of project’s life cycle are integrated with one another. The example of a seamless supply chain model that offer a collaborative working arrangement in a concurrent approach is illustrated in the Figure 2 below. This model encourages disciplines with desperate goals to work collectively and result in a better understanding of one another goals; ultimately the team becomes customer focused (Karma et al., 2000). According to Love et al., (2004), this model also attempts to eliminate individual’s role ambiguity through the use of multi-disciplinary ‘entity’ team relationship. Another greater number of this model is to enhance a degree of interaction between team members and thus contribute to an effective communication process in the project. While, in the beginning of project, a facilitator will be assigned in order to ensure all the processes will run smoothly as planned. Therefore, a high degree of production lead time, wastage, redesign and a de-motivated workforce will be avoided efficiently.
4 Conclusion

This paper has briefly reviewed the IBS (or offsite) principles and practices in Malaysian construction industry. Although, the introduction of IBS construction is considered a good potential solution to improve quality through construction standardization and reduction of labour intensity, it still faces
some barriers in its process of implementation. Problem with project supply chain process (e.g. lack of integration in design, construction and production process) was identified as part of the IBS adoption barrier in the Malaysian construction industry. The key of IBS success could be achieved by improving procurement system and integration supply chain in the Malaysian construction industry (CIDB, 2009). In this paper, SCM as an emerging concept in the construction industry has been proposed as a new approach towards assimilating a symbiotic project team entity. One of the examples of SCM collaborative teamwork models in the construction industry is called a seamless project supply chain management model (Love et al., 2004). This horizontal structure organisation model has been designed with aim to stimulate collective learning and teamwork through the implementation of Total Quality Management (TQM) philosophy. This approach implies that individuals and groups work together concurrently rather than sequentially to design and develop both product and process and to ‘jointly’ identify material and equipment required for production (Love et al., 2004). This proposed SCM model for integrating design and production processes in construction however, requires further development and improvement in several areas before it can be applied in the IBS industry include;

- To identify the criteria or issue relating to the selection of project team member (stakeholders) process in offsite (IBS) project

- To identify stakeholder’s role and responsibility in offsite project particularly into the issue of design integration process

- To explore how architects and engineers can utilise Quality Function Deployment (QFD) in integrated and systematic way as noted by Love and Sohal (2002). This technique, however was not currently being used by practitioners to assist them during the design process even several previous researchers demonstrated that QFD is effective in construction (Karma 1999; Abdul–Rahman et al., 1999; Evbuomwan and Anumba, 1998; and Mohamed, 1995)

- To develop a format for client project briefing at the beginning of offsite project to include the issue of lack of integration during design, construction and manufacturing stages

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