

SUPPLY CHAIN INTEGRATION CHALLENGES IN PROJECT PROCUREMENT IN MALAYSIA: THE PERSPECTIVE OF IBS MANUFACTURERS

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Industrialised Building System (IBS) involves relationships between various organizations, with the evolution of many specialised roles and embedded relationships. A good supply chain integration practice will lead to good integration among players. However, the fragmentation and adversarial relationship scenario in the IBS Malaysian construction industry leaves supply chain players with noticeable difficulties in terms of competitiveness and efficiency in integration. Although efforts have been undertaken to enhance the IBS practice in Malaysia, establishing integration between IBS players is still a major hindrance due to the lack of supply chain procurement practices. To realise the government's aspiration to transform the Malaysian construction industry into a modern construction system, and to realise the implementation of the IBS Roadmap and Construction Industry Master Plan 2006–2015, a good supply chain integration approach should be fully established. The purpose of this research is to identify the challenges of IBS supply chain integration as regards the existing project procurement they currently undertake. The methodologies are based on a thorough literature review and on the qualitative method using semi-structured interviews, which were conducted among IBS manufacturers in Malaysia. Communication and information, specifically, lack of planning and early involvement, financial matters, knowledge and understanding, risk liability, and attitude and relationship are among the challenge factors that hinder the successful integration among IBS players. These challenge factors require considerable attention in the process of pursuing greater integration within supply chains in the Malaysian construction industry. The findings will assist in pursuing greater integration and collaboration within the supply chains, and improving IBS project delivery in the Malaysian construction industry.

Keywords: industrialised building system, integration, procurement, supply chain.

INTRODUCTION

The Malaysian construction industry has recently been geared by the Malaysian Construction Industry Master Plan to improve its productivity performance. In relation to this, the industry has been persuaded to employ the innovative approach of Industrialised Building System (IBS) in order to steer it toward the right direction. This growing interest in IBS has also been experienced across the globe. In the UK construction industry, IBS has been put forward as a channel to indulge a desire for innovations and changes necessary in working and thinking (Gibb, 1999; Nadim and Goulding, 2010). The same transformation has also been experienced in Sweden, Hong Kong, and Singapore (Lessing *et al.*, 2005; Wong *et al.*, 2004; Dulaimi *et al.*, 2001). Blismas and Wakefield (2009) opined these transformations contribute

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numerous advantages to most parties in the construction process in Australia and internationally. These advantages accelerate the impetus of IBS implementation in the Malaysian construction industry.

IBS is deemed to be characterised by its great degree of repetitiveness and mass production with high intensive technology. It necessitates good integration and a working culture that will take place in multidisciplinary supply chains to plan, design, manufacture, and construct. The supply chains of IBS involve relationships between many organisations and processes, with the evolution of many specialised roles and embedded relationships. Moreover, IBS enables the optimisation of local manufacturing capabilities in order to stimulate better implementation compared to conventional construction (Rashid, 2009).

According to Pan *et al.* (2008), the procurement method arrangement has also been utilised as a mediator and a means of controlling integration between supply chains. Although IBS has been recognised as driving efficiency and much endeavour has been taken to boost IBS implementation in Malaysia, establishing IBS supply chain integration still encounters major hindrance due to the lack of supply chain procurement practices (Kamar *et al.*, 2009; Faizul, 2006). An integrated supply chain approach was thus suggested by Vrijhoef and Ridder (2007) as a solution.

Supply Chain Management (SCM), the basic principle of which is based on "integration", has been recognised as a tool for achieving better integration among the construction players. Good supply chain integration initiatives will lead to good integration among players. These initiatives have the potential to minimise the barriers of interfaces among construction supply chains. In short, the present study aims to reveal the challenge factors that hinder the successful integration between manufacturers and other related IBS chain players. The findings, in turn, could serve as a guide to decision makers in identifying key challenge areas for future integration improvement, which will accelerate the momentum of IBS project delivery performance and highlight challenging issues that will convince the industry of the necessity to develop an appropriate integration framework able to accommodate these issues.

IBS IN MALAYSIA

The early developments in IBS occurred and took place in the, 1960s. Thanoon *et al.* (2003) noted, while making a remark about the success of European countries, that IBS in Malaysia was initiated in two pilot projects in Jalan Pekeliling, Kuala Lumpur, and Rifle Range, Penang, with a series of 17- and 18-story flats. Throughout the period, IBS was anticipated to change and to be used in a broader scale. A few developments were invented in the use of IBS. Then, the importance of IBS was highlighted under Strategic Thrust 5 of CIMP, and the IBS Roadmap 2003–2010 (1st phase) and 2011–2015 were designed to assist Malaysia in capitalizing new technologies and IBS-related issues. A series of supports and initiatives have been designed to educate the construction supply chains in order to move IBS implementation forward and improve IBS performance.

Several government initiatives can also be seen through a series of developments, starting from the provision of IBS in annual national budgets. In the 2005 budget, policies were outlined to give full exemption of levy imposed by CIDB for housing projects with an IBS content of more than 50%. In the 2006 budget, IBS

manufacturers were given Accelerated Capital Expenditure with a maturity period of three years on moulds.

Then, in the Ninth Malaysian Plan Report and Treasury Circular, it was stated that public projects must adopt or contain an IBS construction approach of up to 70% in its projects. This was further enhanced by the establishment of the National IBS Secretariat as the coordinator through the Ministry of Works, and an IBS Centre as a one-stop centre to streamline the Malaysian construction industry toward industrialization.

IBS has been utilised in various ways in the Malaysian construction industry since its early developments. In other countries, it has been recognised by other terms such as Modern Methods of Construction, Off-Site Manufacturing, Off-Site Construction, and Prefabrication. Various approach definitions of IBS have existed in literature over the past years. Leesing *et al.*, (2005) revealed that the definitions represent a process. Elliot (2003) agreed with the previous authors about the representations of IBS definitions, but posited additional definitions which represent the technical methods and philosophic approach to the building industry. In line with the research undertaken, IBS is emphasised largely as a construction process and an approach on manufactured components off- or on-site which involves supply chain practices.

IBS SUPPLY CHAIN: INTEGRATION AND CHALLENGES IN PROJECT PROCUREMENT

Lately, the Malaysian construction industry has initiated many actions to improve construction performance. IBS as an innovative approach has been introduced by the Malaysian government in an attempt to enhance project delivery performance. Unfortunately, although many actions and support have been introduced, IBS implementation and usage is much lower and below target as intended (CIDB 2003). As highlighted by Abd Shukor *et al.*, (2009), supply chain and procurement is the root of the problem in both industry and IBS. Furthermore, they disclosed that IBS players have not been very successful in their attempts to find the right solutions to the challenges encountered.

Establishing integration is still the greatest challenge in IBS due to the lack of supply chain procurement practices (Kamar *et al.*, 2009; Faizul, 2006). Blismas and Wakefield (2009) supported this idea, and stated that delivering a successful IBS approach requires managing the entire supply chain. Thus, supply chain integration in any situation is very important (Mentzer *et al.*, 2001). The focus of SCM in the current research is supply chain integration, a term associated with the construction process because it is characterised by fragmentation. Various terms have been offered to Supply chain (SC) and integration. Samaranayake (2005) asserted that SC as the linkages of companies. Meanwhile, Simchi-Levi *et al.* (2007) and Lin and Shaw (1998), defined SC as the interdependence of activities or process and Mabert and Venkataramanart (1998) opined SC as a network of facilities or organisations. The term 'integration' itself according to Baiden *et al.*, (2003) as a cooperation and working together. Jaafari and Manivong (1999) defined as a merging of different disciplines and organisations. In addition, Fergusson (1993) in her review explained integration as a flow coordination. Meanwhile Vincent and Kirkpatrick (1995), defined as a sharing of knowledge, data and information.

In the context of this research, supply chain integration could be summed up and viewed as "bringing together a series of different organisations consisting of IBS key players (client, designer, contractor and specialist/manufacturer) which are linked by a flow of practices, information, financial and contractual relationships. This is to allow them to work together towards design and construction practices within the context of the project procurement delivery arrangement approach with the same common goals and objectives." Therefore, highlighting the perception on challenges by different players in the IBS construction supply chain is vital.

Many researchers have argued that competition in the construction industry is no longer among individual organizations, but rather between their supply chains (Edum-Fotwe *et al.*, 1999). Thus, IBS construction project delivery should look into the issues of supply chain integration in order to improve project delivery. The contribution of different players in construction supply chains depends on the nature and the contractual arrangement in place (Edum-Fotwe *et al.*, 2001). Research done by Baiden *et al.*, (2006) within the context of procurement routes revealed that the practices and arrangement of players help integrate the activities of various players, but the vital factors in all procurement methods are the management and integration of the supply chain (Khalfan *et al.*, 2005). Thus, according to Hall *et al.* (2000), procurement routes appear as one of the enablers of supply chain integration because they provide the formal links within which supply chain integration is accomplished and prolonged.

Transformation from on-site to off-site environment just moves, more often than not, the challenges and difficulties to the factory environment. This scenario permits the IBS manufacturer to manage difficult activities more effectively (Gibb, 1999). Quantitatively analysed perception among supply chains revealed that there is a range of procurement stages that have prominent problems, making it difficult to integrate the supply chains (Abd Shukor *et al.*, 2010). To achieve effective integration, an assessment of the challenges faced by manufacturers in supply chain integration has to be conducted in the context of the Malaysian IBS construction project delivery.

METHODOLOGY

The research methodologies employed were literature review and qualitative semi-structured interviews. Literature review was the first phase of the research. Secondary data were derived from relevant books, journal articles, theses and dissertations, conference proceedings, and reports. To identify the challenges that prevent integration, the second phase approach adopted was to explore the perspectives of a variety of IBS key players (clients, contractors, and manufacturers). However, only the perspectives of IBS manufacturers are presented in this paper because all interviews were still ongoing as this paper was being written. Therefore, the data presented in this paper are only a portion of those collected, and the conclusions presented here are based on interim findings.

The second phase involved the collection of primary data through semi-structured interviews. A semi-structured interview approach was employed due to the need for rich data for exploring viewpoints and gaining an initial understanding of the problems (Maxwell, 1996). This could facilitate identifying the integration challenges and achieve the aims of the research. All interviews were recorded and transcribed verbatim, with each interview lasting approximately 90 minutes. Respondents of the qualitative semi-structured interviews were selected from the IBS public projects

provided by the Public Works Department which were involved with precast components. Respondents were selected on the basis of their experience on IBS and their interactions with other IBS players in the project. Letters were posted and e-mailed to the IBS manufacturers. Follow-up telephone calls were then made for the interview arrangements. Five (5) manufacturers who were involved in an IBS public project agreed to be interviewed.

Respondents were asked for information on their basic background, their position in the company's organisation, and the basic characteristics of their projects. Table 1 illustrates the details of the respondent's current positions, experience, product of IBS components, procurement adopted, and project categories. Majority of the interviewees were in the manager/management and head technical level, were experienced, and interacted with other IBS players in the project. Their designations and work experience portray their knowledge of the challenges that hinder integration between them and other related IBS chain players in project procurement delivery. This indicates that the data obtained are quite reliable and accurate. Results revealed that the majority of the interviewees undertake precast concrete framing, panel, and box as the most familiar types of IBS involvement, and that traditional procurement and design and build procurement are the common types of procurement used in IBS in the Malaysian construction project.

Table 1: Current post, experience and project characteristics

Company	Current Post	Experience (years)	Product of IBS components	Types of procurement	Project Categories
A	Sales and Marketing Manager Project Engineering	10	Precast Concrete	Design and Build	Educational Buildings
B	Managing Director	15	Precast Concrete	Traditional	Commercial Buildings
C	Executive Design Engineer	3	Precast Concrete	Design and Build	Educational Buildings
D	Manager Precast Concrete Marketing	15	Precast Concrete	Design and Build	Residential Buildings
E	Technical Head	16	Precast Concrete	Design and Build Traditional	Hospital Residential Buildings

FINDINGS AND DISCUSSION

A combination of literature review and analysis of results was used to arrive at the findings. Based on the results of the interviews, the perceived challenges to their integration are presented below.

Communication and Information: Lack of Planning and Early Involvement

All the respondents were of the view that the specialist/manufacturer should come in before the architect comes out with their detail design. This is to avoid a mismatch of

the design capabilities of the designers and the manufacturing capabilities. Lack of early involvement will hinder the communication and the flow of detailed information among them, and will thus affect the performance of the project. The result supports the statement by Simchi-Levi and Kaminsky (2000), who indicated that, within a supply chain, a manufacturer may have great knowledge and capability on the product related; however, if neither party shares information, this will lead to inefficiencies in decision making as well as increase lead times and cost. Design, manufacturing, and construction are elements in IBS which cannot be separated, and must thus be integrated in the supply chain. The respondents opined that all the information and layout details should be planned at the early stage. By doing this, their input on the system is guaranteed to be incorporated and harmonised with that of the architect, as well as the design and requirements of other designers. Additionally, to take full advantage of IBS delivery, a project-wide strategy must be agreed and applied at an early stage in the project which will necessitate obtaining relevant information (Gibb, 1999). This scenario is always fed by a hierarchic tendering system. However, one of the respondents raised that under the design and build procurement, under the contractor's responsibility, they have to say their opinion and work together initially.

Financial matters

Financial issues appear to be important matters for the manufacturers. More than half of the respondents claimed that they are very keen on the capability and commitment of the contractor and the client on the payment mechanism. The challenge for them is to ease their financing costs and cash flow because IBS is seen as incurring high initial and set-up costs (Blismas and Wakefield, 2009). Many manufacturers will also require some payments to be made once they have fabricated the components (Gibb, 1999). The respondents who experienced the design and build procurement pointed out that they need a direct payment system from the client in order to avoid disputes and conflict. However, they have to follow the rules even though it is not fair and breeds an unhappy working culture in order to protect their relationship and business trust.

Furthermore, IBS involves factory-produced building components where their material on-site (precast component) is prepared at the manufacturing site. However, payment is only made once the materials are already on-site; the contractor is paid 75% for the materials on-site in their progress payment. This scenario is not fair to the manufacturers. They pointed out that precast components cannot be stored on-site because these are huge and heavy. Once transported to the site, the materials must be sent as close as possible to their intended position to avoid double handling of the IBS components. Therefore, both respondents under the design and build procurement and the traditional procurement claimed the need for a new payment mechanism for IBS project delivery. To improve IBS project delivery and enhance their working relationship, the client should trust that the contractor will undertake their tasks and responsibilities, or that there will be a win-win situation between them through the improvement of their payment method. This idea is also supported by Blismas and Wakefield (2009), who revealed that IBS players need more reliable payment mechanisms and contracts. They added that if they conventional methods are changed to IBS, then the payment mechanism for IBS should be duly reviewed

Knowledge and Understanding

All the respondents reckoned that everyone, especially the designer, should be familiar with and understand the IBS manufacturing system. They should fully

understand the way of working, the layout dimension, and the limitation of the system employed. One of the respondents claimed that "the IBS does not limit the idea of the architect...but they are not creative enough...they have the knowledge but it is not common to them...the culture of IBS is not common to them." Respondent C claimed that is not the knowledge per se, but the most important things are being well trained, experienced, and capable because these will entrench the integration among them. Lack of knowledge or understanding of IBS by other players will hinder the interaction between the manufacturer and its supply chain, whether in traditional procurement methods or design and build project delivery. This is supported by the research done by Blismas and Wakefield (2009), who asserted that the strong theme for the drivers and the constraints in offsite manufacturing concern both skills and knowledge.

Risk Liability

Two out of five respondents pointed out the challenges on risk liability. These are problems on design and supervision issues between the structural engineer and the specialists/manufacturers because structural elements are designed by IBS specialists/manufacturers. This is supported by Hallowell and Toole (2009) who pointed out that the manufactured component must have a proper engineering design because each component has a direct impact on the performance of the final structure. However, respondent A, who experienced design and build procurement, claimed they have to compromise and trust one another in order to hinder transferring risk to the manufacturer.

Attitude and Relationship matters

Attitude and relationship matters are one of the factors that challenge manufacturers to be integrated among the IBS supply chain. More than half of the respondents claimed that the designers still retain the attitude and mentality of designing using the conventional process, and the respondents felt that the designers were reluctant to change. For example, the culture of the designer remains on conventional design; for instance, the size of an IBS beam is supposed to be 600–400, but they still design it at a size of 100–150 which encloses the steps. The designers take for granted other peoples' capabilities and hard work. Furthermore, respondent who had experienced the traditional procurement claimed that some of the designers only cater to certain types of product components in order to fulfill their design requirements, even though they can adjust their design concept to make things easier and more economical. However, under design and build, the manufacturer claimed that the contractor has a responsibility to the design. They—the manufacturers—can raise problems directly to the contractor because they had initially worked together at the early stage. This is supported by CIDB (2010), revealed that there is a critical need to manage design and manufacturing differently from the traditional way because IBS is different and it needs a different mindset along with the right environment. This attitude affected the time to design and deliver the IBS project. Rethinking the old processes is now critical if the industry is to move forward.

INTERIM CONCLUSIONS AND FURTHER RESEARCH

This paper has presented the results to date on the challenges faced by IBS manufacturers on the integration of the IBS supply chain with regard to the existing procurement methods they undertake. The interim results revealed that the challenges which hinder the successful integration of the manufacturer with the IBS supply

chains involved are established through communication and information, specifically lack of planning and early involvement, financial matters, knowledge and understanding, risk liability, and attitude and relationship. Research findings also confirm that IBS manufacturers, whether procured through Design and Build procurement or Traditional procurement, face slightly similar challenges. This is justified because there are various supply chain arrangements in Design and Build procurements that might influence the integration and the performance of the IBS project delivery.

The application of IBS in the Malaysian construction industry can be used as part of a strategy to speed up the construction process and gain the IBS benefits. The emergence of IBS to increase innovation and involvement of the manufacturer elevates the importance of integration. Thus, the issue of better integration is important to address within IBS construction. Finally, the study presented in this paper is part of an ongoing research, which will eventually attempt to further enhance the practices and implementation of Supply Chain Integration in relation to procurement systems, particularly in the IBS project delivery in Malaysia. Such developments augur well in support of the government's aspiration to move toward a more efficient IBS construction approach.

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