Challenges in the Integration of Supply Chains in IBS Project Environment in Malaysia

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Abstract

The importance of the Industrialised Building System (IBS) was highlighted under the Strategic Thrust 5 of the Malaysian Construction Industry Master Plan (CIMP). However, the fragmentation and adversarial relationships among players in the IBS supply chain has been identified as the major obstacles in the IBS construction project delivery and environment. The main research will look into the challenges of IBS supply chains in the project procurement delivery. This paper will present the results from semi-structured interviews conducted on key IBS supply chain players with interesting outcomes which include the critical challenges on behavioural issues of attitude, relationship and communication.

Keywords: Construction environment; industrialised building system; integration and supply chain

1. Introduction

Nowadays, in the era of globalisation and innovation, construction project delivery and activities need highly technical techniques, skills and working practices that contribute towards a productive construction

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environment and sustainable development (Isnin et. al, 2012). Thus, the construction industry is highly concern on addressing the evaluation of manufactured product in relation to control sustainability and waste generation of the construction environment. In support of this, the Malaysian construction industry has introduced the IBS construction approach as being of significant importance on enhancing the construction controlled environment which transferred on-site to off-site manufacturing products. IBS requires a high level of coordination and integration of supply chains from the design, manufacturing and construction stages and involves relationships between many organisations and processes with the evolution of many specialised roles and embedded relationships. The success of IBS construction depends on the understanding of the factors that drive the construction success as well as the problems and challenges around it (Gibb & Isack, 2001). However, the fragmentation and adversarial relationships among players in the IBS supply chain has been identified as the main hindrance of the IBS construction project delivery. Difficult to integrate and establishing integration between IBS supply chain is attributed to the variety of professions and skills involved in the project delivery procurement practices (Faizul, 2006) the challenges in achieving successful delivery of IBS projects would be looking at encouraging integration through the supply chain integration, which may have a value-added impact on the success of IBS project implementation and delivery.

2. Literature review

2.1. Malaysia Construction Industry and IBS construction

The Malaysian economy expanded at a faster pace than forecasted, growing between 4.5% and 5.5% in 2013 as compared with the growth of 4.5% to 5% in 2012 and 5.1% in 2011 (Department of Statistics Malaysia, 2012). The fundamental growth of the Malaysian economy was supported by an increase of domestic demand. The positive growth was driven by the growth of the Services, Manufacturing and Construction sectors. The growth of the construction industry recorded an increase of 5.2% in 2010 with an expected growth of 11.2% in 2013. According to CIDB (2010), the use of IBS and innovation in the construction process also stimulated the growth of construction output and is seen as one of the most important sectors that contribute to the Gross Domestic Product (GDP) of a country. The construction supply chain links within the industry stimulates domestic demand and creates a significant effect on the Malaysian economy. According to Gibb (1999), the adoption of industrialisation and prefabrication in the construction process has always existed and looked upon as an ideal solution in innovation and enhancing construction environment.

The importance of IBS was highlighted under Strategic Thrust 5 of CIMP and the IBS Roadmap 2003–2010 (1st phase) and 2011–2015 that were developed to assist Malaysia in capitalizing on new technologies and IBS-related issues. A series of support mechanisms and government initiatives has been designed to educate the construction supply chains in order to improve IBS implementation and performance. However, the conventional construction process causes some challenges to IBS adoption (Blismas & Wakefield, 2008). The adoption of IBS has also made the conventional working practices and relationship amongst the players experience fundamental changes due to industrialised construction (Hsieh, 1997). IBS is a manufacturing process that needs earlier and consistent planning process amongst the players involved (Gibb, 2001). Thus, keeping in mind the importance of improving the integration of the supply chain in IBS implementation, its challenges should be analysed and established in order to persuade the construction industry to engage in a more systematic and strategic approach in IBS construction, especially in cases of fragmented supply chains.
2.2. The challenges of supply chain integration: an overview

In today’s global businesses, with regard to the development of technology and characterised by its great degree of repetitiveness and mass production, off-site manufacturing or IBS has been widely adopted across the globe. Therefore, the understanding and interpretation of IBS is very important prior to its implementation. However, even with the introduction and establishment of IBS in the Malaysian construction industry, it appears that the implementation of IBS is still low compared to other developed countries. Even with much support, encouragement and guidance in Malaysia, the usage of IBS is currently much lower than what it could have been. These problems demonstrate that although the introduction of IBS has promised to solve and improve the current construction process, these practices have been facing a difficult task to establish integration and cooperation between parties involved (CIDB, 2007). Abd Shukor et. al. (2009) conducted a research to identify the key problems in the construction industry in general and IBS in particular. They classified the possible problems into 16 significant themes and revealed that both the industry and the IBS players had not been very successful in their attempts to find the right solutions to the challenges encountered whilst indicating that the supply chain and procurement to be the root of most problems.

Among the challenges encountered were communication in terms of flow of information, conventional mindsets, problems in terms of coordination between various works and funding factors which includes problems in the process of payments. Abd Shukor et al. (2009) also revealed that there is a range of procurement stages that presents prominent problems which make it difficult to integrate people. Dainty, Briscoe, & Milllett (2001) claimed that the challenges that obstruct the integration of the supply chain between the main contractor and SME are namely attitude related issues, financial/cost related issues, programming/time-related issues and quality of information issues. Moreover, CIDB (2007) highlighted poor knowledge and unfamiliarity with IBS concepts and its benefits as one of the factors hindering integration among IBS players.

Therefore, the establishment of the IBS provision in the integration of the construction supply chains must take place. The challenges of integration between the Client and the main contractor in IBS project procurement delivery need to be assessed in relation to the working practices in the current project procurement delivery arrangements approach to ensure cooperative working relationships that will lead to supply chain excellence. Based on the above literature, the challenges of integration supply chain found in the literature review are summarised in Table 1.

Table 1. Supply chain integration challenges

| Challenges                                                                 | References                                                                                     |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Lack of Trust, Mutual Suspicion, Hidden Agenda, Respect Others, Lack of common purpose, Lack of Project Goals, conflict objectives, Absence of the project goals | Wilding & Humphries (2009); Ward & Holti (2006); Olsson (2000); Ahmed et al. (2002); Saad et al. (2002); Jone & Saad (2003); Wong et al. (2004); Benton & Mchenery (2010); Olsson (2000) |
| Different Culture & Procedure, Mindset, Blame culture, resist Innovation, Resist change, Traditional role thinking | Akintoye et al. (2000); (Awad & Nassar, 2010); Matipa & Siamuzme (2005); Ahmed et al. (2002); Saad et al. (2002); Jone & Saad (2003); Wong et al. (2004); Benton & Mchenery (2010); Ward & Holti (2006); Olsson (2000); Nicolini et al. (2001); Shelbourn et al. (2007); Ahmed et al. (2002) |
| Lack of Commitment from seniors managers, P.Manager Planning              | Akintoye et al. (2000); Brown (1999); Suhol & Peter (2004)                                      |
| Adversarial contractual relationship, Long time to establish relationship, Lack of guidance creating alliances, Incompatible Collaborative capability, Too dependent on Mutual Agreement | Jone & Saad (2003); Wong et al. (2004); Benton & Mchenery (2010); Brown (1999); Matipa & Siamuzme (2005); Wilding & Humphries (2009); Saad et al. (2002) |
### 3. Methodology

Research methodology paves the way into managing research methods appropriately and guides the researcher on methods to be applied to collect and analysed data. According to Sekaran (2003), a well-designed research methodology will produce reliable results, conclusion, and value of research outcomes. As the researcher needs detailed understanding and knowledge based on experience on the factors preventing integration in IBS projects, interviews were conducted, specifically looking at Universiti Teknologi MARA (UiTM) IBS projects (project handled by UiTM) as case studies in comparison with other IBS public projects (projects which are not handled by UiTM) to generalise the findings, qualitative approach with a case study design has been identified as the appropriate approach for this study. This is because of the richness of data required to comprehensively provide an in-depth picture of the interaction (Baiden, 2006). A multiple-case study design has been selected in this particular study. UiTM IBS project is selected as one case study and another two IBS public projects have been selected in comparison to the UiTM IBS project. The choice is based on the robustness of the design and enhanced results generalisation it offers using replication logic, and not sampling. The researchers look for similar relationships with all case studies and match the pattern of similarities to confirm and generalise the findings. Structured and standardised processes, collection and methods of analysis were used for cross-case comparisons. Using multiple embedded case studies is a means for triangulation of data sources to give strong findings.

#### 3.1. Research context and case study selection

The selection of cases is based on the aim and objectives of research and within the specified research context. In principle, this study aims to uncover the integration challenges of IBS supply chain between the clients and main contractors. The unit of analysis will look into IBS projects as the project setting and the interaction and integration of IBS supply chain players within the context of working practices of project procurement delivery. Careful selection of cases is important for the research to ensure that the respondents are clients and contractors who have the experience using IBS as their method of construction. This will improve the reliability of the data obtained from this study. The scope specifically concentrates on the perspective of the clients and the main contractors. This is done to draw attention to

| Power imbalance                             | Saad et al. (2002) |
|---------------------------------------------|--------------------|
| Communication, Sharing ideas, Lack of openness and opportunistic behaviour, Lack of Open book | Akintoye et al (2000); Wilding & Humphries (2009); Saad et al. (2002); Shelbourn et al (2007); Saad et al. (2002) |
| Procurement systems                         | Jone & Saad (2003); Wong et al. (2004); Benton & Mchenry (2010); Matipa & Siamuzwe (2005); Furgues & Koskela (2009); Dainty et al. (2001); Nicolini et al. (2001) |
| Lack of Contribution of SC (Ignorance of SC) | Jone & Saad (2003); Wong et al. (2004); Benton & Mchenry (2010); |
| Client Wishes difficult to understand, Client lack of roles, Long procedure, Client responsibility | Matipa & Siamuzwe (2005); |
| Conflict in project information             | (Li, Guo, Skibniewski, & Skitmore, 2008); Ahmed et al (2002); Suhol & Peter (2004) |
| Absence of code of practice, Professional indemnity | Nicolini et al. (2001) |
| Selfish interest, Morale & Motivation, Ownership, individualism | Furgues & Koskela (2009); (Shelbourn, Bouchlaghem, Anumba, & Carrillo, 2007); Suhol & Peter (2004); Saad et al. (2002); Krisilia et al (2007) |
the key role of the clients as the project implementer and initiator and the main contractor for the success of IBS implementation and also their roles in SCM as the integrator of numerous supply chains whether from the upstream or downstream line in IBS project delivery (Pryke, 2009).

3.2. Data collection techniques

In the case study, semi-structured interviews were designed and used to obtain detailed, complex answers from the interviewees, to clarify unclear answers. The clients and the interaction chain with their main contractors were examined in depth. All of the semi-structured interviews were carried out with selected respondents who are the director or senior managers for that particular organisation. An interview schedule was prepared, based on literature. A series of semi-structured interviews was carried out to refine and document their experience on challenges factors in improving integration of supply chain within IBS working practices in IBS project procurement delivery. All interviews were conducted with individual respondents, lasting approximately 45 to 60 minutes and were recorded and transcribed verbatim.

3.3. Data analyses

The analysis is based primarily on cross-case analysis and pattern matching technique. Content analysis and cognitive mapping techniques are used for analysing qualitative data supported by the Nvivo software. The content analysis is used to identify concepts by developing codes, whereas cognitive mapping is used to explore relationships among concepts by illustrating the visual presentation. Upon completion of the interviews, verbatim transcriptions were produced and the data was analysed using the software Nvivo 9. This software was used as a tool to organise the data and code it under thematic headings. Nvivo software enables researchers to explore, browse documents and analyse the content of interview transcripts.

In order to critically compare and review the case studies, the three cases have been identified, examined and categorised into UiTM case and School cases (Refer Table 2). For the purpose of simplifying the analysis for this research, the three case studies and 6 respondents will be coded. UiTM and School cases will be coded as UiTM1 and SCH2 & SCH3. The 6 respondents are coded with numbers 1 to 3, with the letter ‘C’ for Clients and ‘MC’ for Main Contractors. The coding of 6 respondents is tabulated as follows:-

Table 2. Assigned Code for Respondents

| CASE STUDIES | SCHOOL |
|--------------|--------|
| UiTM         | UiTM1  |
|              | SCH2   |
|              | SCH3   |
| C1           | MC1    |
|              | C2     |
|              | MC2    |
|              | C3     |
|              | MC3    |

4. Findings

After analysing the data from the cases individually, the cross case analysis is carried out. Its purpose is to identify any similarities and differences in the challenges of improving integration in IBS project procurement delivery. In challenges, there are eight (8) sub factors which are Attitude and Relationship, Communication and Information, Contractual and Procurement, Financial Matters, Guidelines and
Requirements, Lack of Skills and Knowledge Understanding, Technical Matters and Risk and Conflict Liability (Refer Figure 1).
5. Discussion: challenge factors

5.1. Attitude and relationship

The fact that the emphasis on attitude and relationship are inadequate was stressed by a significant number of sources within Case study 1 (UiTM) and Case study 2 (School Projects). In both case studies, the necessity of attitude and relationship is important due to long-term integration, commitment, respect and responsibility among team members. Generally, attitude of the clients were criticized by the main contractor as one of the factors that challenge the integration between IBS supply chains. For example, the client’s pride and arrogance based on their role as owner of the project. Therefore, there is no respect, understanding and commitment amongst IBS players. Furthermore, the majority of the main contractors interviewed felt that the clients were unwilling to change their old mindsets and refused to switch from the conventional process. This is supported by Kamar et al. (2010) who revealed that there is a critical need to manage the design and manufacturing differently from the traditional way as IBS is different and needs a different mindset along with the right environment. This attitude problem impacts the time in designing and delivering the IBS project. Rethinking the old processes is now critical if the industry is to move forward (Kamar et al., 2010).

5.2. Communication and information

The findings showed that there were issues in communication and information. Most of the interviewees highlighted that communication problems form an important part of the challenges they face in the IBS construction supply chain. Some of the clients complained that miscommunication and disputes between clients and contractors under design and build gave impacts on the quality of communication and information and consequently, affects their integration. Hostility between members of
the project causes problems arising from the lack of cooperation between the contractor and consultant. Problems include inaccurate design information, reluctance to accept other members’ opinion, inaccurate data, late updating of the required information and late submission to the local authority. This indirectly influences the quality of their IBS project delivery. Developing efficient communication throughout the tiers of the supply chain will ensure superior and reliable flow of information (Briscoe & Dainty, 2005). However, MC3 did not state any difficulties in terms of communication and information flow especially from the manufacturers because they did not outsource the manufacturing of the components.

5.3. Contractual and procurement

On a positive note, interviewees identified that there are always difficulties when it comes to contractual and procurement matters. On behalf of contractors, the clients claimed some of them do not always comply to the contract. This is because they think it is too complicated and make their work more difficult. Conversely, the main contractors mentioned the difficulties understanding the client’s objectives and needs at the early stages. This is supported by Love, Skitmore, and Earl (1998), who stated that the client must be clear of their objectives and specific needs as to ensure the success of the procurement method. However, for the school projects, the difficulties on D&B procurement understanding is due to the changes to the original concept of design and build where the client pays direct fees to the consultants.

5.4. Finance

Financial and contractual issues appeared to be important matters for the main contractors as well as to the client. The main contractors in the case study 1 and case study 2 claimed that there are always issues in payment. However, most of the payment issues were overcome because they will still be paid by the client. Therefore, in order to improve IBS project delivery and enhance their working relationship the client should trust the contractor to undertake the task and responsibilities through improvement of their method of payment. This is also supported by Blismas and Wakefield (2009) and (Kamar, Hamid, & Alshawi, 2009) who revealed that IBS players need more reliable payment mechanisms and contracts. They added that if conventional methods are changed to IBS; the payment mechanism should be duly reviewed.

5.5. Guideline and requirements

As shown in the analysis, the guidelines and work requirements are a source of distress to the clients and main contractors. Based on the case study results, in general, government has introduced a policy for the use of not less than 70% IBS components in government projects. As a result of the 70% of the team members have to follow the requirements and guideline even though it would effect the quality of the works and performance. This is highlighted by respondent C1 ‘Based on the circular, issued by the Ministry of Education (MOE), and we have to use IBS with 70% score..this quite difficult to achieve’. The government also took the lead in 2008, by mandating it for all public sector projects. This is also supported under the Treasury Circular SPP 07/2008 by stressed that projects must attain no less than 70% IBS-content under. This policy aims to build up momentum and to establish demand for IBS components, thus bringing the cost down.

5.6. Lack of skill and knowledge

The result show that the majority of the respondents be it the client, or the contractors themselves did not understand or were familiar with the process and components of IBS. Some of the clients claimed that
there were difficulties to obtain coordination drawings and this was made worse when others parts came over to match their services. In addition, the main contractors stated that there are limited specialists/manufacturers in the market and even though they are experts, they do not have any experience in handling big volumes. Thus, they fail to advise suitable solutions for the right type of design component. Lack of knowledge or understanding of IBS will hinder interaction between IBS supply chains. This is supported by Blismas et Blismas and Wakefield (2008) and Blismas and Wakefield (2009) asserting that the strong drivers and constraints in offsite manufacturing both concern skills and knowledge.

5.7. Technical

Technical matters do give influence such as insufficient duration of the construction period and planning a package of continuous works. As highlighted by respondent C2, ‘if you use the same system is also a problem on site, due to IBS have limited supplier’s production. So the problem is there and concurrent work and limited period will disturb our planning’. The conversion of construction process, from conventional to Industrialised products, requires careful planning on technical matters especially the coordination of the manufactured product.

5.8. Risk and conflict liability

Risk liability between structural designers and specialists/manufacturers are very important in the manufacture of components. Hallowell and Toole (2009) pointed out that the manufactured components must have proper engineering design because each of these components has a direct impact on the performance of the final structure. Clients mention the difficulties in coordinating the design and supervision issues between the contractors’ structural engineer and specialists/manufacturers since most of the structural elements are designed by IBS specialists/manufacturers. He further explained that even though under Design and Build procurement, the contractor is the leader, they have difficulties in working together and coordinating with their team. This is due to conflicts in their scope of works that result in poor coordination. This has been supported by Thanoon., Peng, Kadir, Jaafar, and Salit (2003) who found that IBS implementation has been heavily criticised due to lack of coordination among parties involved.

6. Conclusion

The research reports on the data gained based on the findings to date through literature review and case studies on the challenges faced by Clients and Main contractors in improving integration of the IBS supply chain with regards to the procurement methods that they undertake. Based on the case study, the involvement and arrangement of IBS supply chain varies depending on the outsource or in-house procurement. Analysis of literature, data gained from the case study and interviews led to the following conclusion. The present study has found that both Clients and main Contractors must have good knowledge in IBS; aligned with excellent practices to achieve quality IBS construction approach. The information given by respondents were supported by Tam, Tam, and Ng (2007), which revealed that a lack of knowledge discourages further implementation of the IBS system. Adequate knowledge and skills are generally the major issues and drivers of IBS implementation (Blismas & Wakefield, 2009). Its application involves a considerable degree of coordination, adjustment in the manufacturing process, and the interfacing aspects of components; thus a great degree of integration must exist among various relevant parties (Warszawski, 1999). In addition, limited sharing of knowledge and good practices has inhibited the take up offsite technologies with the sector (Pan, Gibb, & Dainty, 2008). Similarly as experienced in UK, (Holti, Smalley, & Smith, 2006) addressed the significant barriers exist to the within
the UK construction industry are the lack of knowledge and information, lack of trust and negative attitudes. The results of the study will hopefully provide an insight into the improvement integration of IBS supply chain and become the foundation to originate the strategy for successful decision making in improving further integrated supply chain in IBS project procurement in Malaysia and enhancing construction environment.

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