

A Feasibility Study of Supply Chain Management (SCM) in Industrialized Building System (IBS) from Contractor's Perspective: A Case Study

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Abstract: The success of a construction project is evaluated through parameters of quality, cost and time. Construction companies use modern tools and technologies to enhance the quality, cost and time in their supply chain. However, the fragmented situation in the construction has left the Industrialized Building System (IBS) supply chain troupes with obvious problems in term of effectiveness. Although, efforts have been undertaken to increase the IBS practice in Malaysia, the challenges of integration among the players have increased from IBS. The main study is to justify the importance of IBS to the economy and the issues in the Supply Chain Management (SCM) integration system of IBS in Malaysia. The aim of this study is to determine current opinion related to the key factors of IBS and SCM effectiveness from contractor's perspective. The methodologies are based on detailed literature review, questionnaire, interviews and survey via e-mail which were conducted among the contractors who used IBS in their projects. Through literature review the definition, approach, development of IBS in the construction industry was studied. The results of the pilot study indicated that the importance of IBS to a company is an added value. The issues in the SCM integration system of IBS in Malaysia are price offered for IBS commercial conventional is the issue in the supply chain integration system of IBS. This result is determined by using Relative Important Index (RII) calculation. By analyzing the pilot study, the results indicate that the advantages of SCM are still far from being fully understood and recognized. To conclude the relationship between contractors and other IBS players influence the implementation of the SCM concept. Furthermore, SCM integrated with IBS can be remarkably effective in each quality stage in order to reduce the time and expenses.

Key words: Industrialized building system, supply chain management, contractors, SCM, RII, IBS

INTRODUCTION

IBS essentially can be defined as a process to produce building component which in large scale production, either on or off-site, erected or transported in to a structure at the site with minimum work (Jabar *et al.*, 2013). The importance of Industrialized Building System (IBS) now a days as was stressed under the strategic thrust: innovative through R&D to adopt a new construction method in Malaysian construction industry master plan 2006-2015 which has been published to chart the future direction of the Malaysian construction industry (Plan, 2006).

Although, IBS approach can improve construction industry by reducing cost, reduce wastage and speedier the time however, there is some issue arise regarding on

the flow of product to the site. Thus, to make sure the IBS product delivery on time to the site, the project delivery should be planned very well. Good planning in the aspect of manufacturing, transportation and erection at the site is needed for IBS project.

In an era of globalization and innovation, high-advanced technical methods, practices and skills are needed for construction project delivery and activities that can contribute concerning a productive and efficient construction development. A good management can contribute a good project. Before starting the project, project planning is crucial part towards a major output. The IBS roadmap took an action to move forward, IBS provides faster work completion. IBS can assure valuable advantages in local construction situation but industrial players still have not understood new innovative

management and IBS procurement. Supply Chain Management (SCM) is the basic principle which is rarely based on 'integration' method but can benefit the organization of the company. Management may be defined as "the art and science of controlling people, equipment, materials, money and schedule to complete a specified project on time and within approved cost". The organization of individuals can organize human activities to achieve common objectives.

In current economy globalization, managing whole supply chain has become crucial to the successful completion of a construction project. Competitiveness of worldwide market resulting in an increment of supply chain integration make it imperative for the construction to change (Mohammad *et al.*, 2014). When the project implemented innovatively and speedily, it will be more effective on the strategy to manage economic demand through construction. Furthermore, Malaysia must be globally competent and competitive to be a productive and high-income nation (Mohammad *et al.*, 2014). This requires the Malaysian government to embark on initiatives and embrace IBS as an innovative approach.

This study is structured in to three parts. The first part is the review covers a wide-ranging of literature an overview of IBS approach, Malaysian history and development of IBS in SCM integrated with IBS, IBS supply chain: barriers and challenges and supply chain risks and tactics. The second part discusses the methodologies implemented to gather data including the progress of development of the questionnaire. This questionnaire survey is involved construction project where they have still in progress to finish their project or completed project. Various construction projects will be surveyed in terms of SCM practices. The specific party that will be involved in the collection of data is contractors either main contractors or any sub contractors who involved in the project. The final part includes the analysis of data discussed and conclusion derived from the literature review and case study.

Literature review: Now a days, the Malaysian government is encouraged to advance and implement innovative approaches. In Malaysia CIMB reported the requirement for value and performance construction industry had been debated (CIDB, 2003). Having roles to improve productivity and construction process was identified by CIMB in approaching innovation through IBS and its supply chains. In the UK, the Egan Report "Rethinking Construction" focused on standardization, factory production and supply chain association induce construction processes' growth. Nevertheless, noticeable

difficulties in terms of efficiency and competitiveness caused construction industry leaves the players of IBS supply chain.

Realizing these situations, the Malaysian government has blazed a trail enhancing IBS Roadmap as the tactical plan for construction to advance (CIDB, 2010). The focus of the subject matter of IBS roadmap is to accomplish the industrialization in the construction sector. To make sure the roadmap masterplan is succeeded, the government should arrange an IBS centre flowline for the construction industry on the road to act upon government's call for the adoption of IBS. Implementation of IBS may provide speedier work of project completion, since the components are being manufactured off-site and transported to the site for installation purpose. Due to this situation, there is various relationship involvement from many expert roles in the organizations which required good collaboration and relations among the parties.

The construction of a large industrial project may involve complex process and many parties. These parties involved included: the client, the main contractor, designer, surveyor, subcontractor or supplier where this supply chain among the parties may vary for every different project depending on the nature of the construction and the way that procurement normally operates. This is also why management of the activities is important in SCM to ensure the best value and a sustainable competitive benefit are given to customers. With the increase of technology and competition, many companies turning to SCM as a central part of strategic competence to create competitiveness. Scheduling the activities at the site enables the contractor to control and avoid project delays. Underestimation of the quantity of work needed and the high levels of uncertainty are the causes of delay of projects and these will affect the cost. This can cause compression on the projects and additional cost because of tasks being carried out are out of order and amendment (Arantes *et al.* 2015). Construction SCM offers new methods to lessen the cost of the project and increase the consistency of work and rate of construction at the site.

According to Mohammad *et al.* (2014), many of case studies proved that SCM has become main achievement factor in bringing IBS approach to success with the arrangement of procurement system being used as a medium tool and as "integration control" among parties (Arantes *et al.* 2015). This new management practice for working should be associated with the current trend in the construction industry in Malaysia to have an innovative and competitive scene.

SCM and IBS integration: SCM introduces new road of business and relationship management among supply chain players. SCM also defined as “multiple relationships” management which contracts with entire business progression quality and represents a new technique of business management and association with supply chain players Shukor *et al.* (2011). In this research, SCM is defined based on (Shukor *et al.*, 2011) definition. According to Shukor *et al.* (2011) SCM can be considered as “an integrated and collaborated supply chains whether upstream or downstream, inter or intra-organization with the same goals and objectives for long-term relationship integration”. Therefore, the vital things are the understanding and analyzing of SCM before application.

Many definitions have been proposed to SCM over the previous years. ‘Integration’ is the main point and basic principle of SCM. The concentration of the study is about supply chain integration which is seldom implemented in construction activity. However, SCM is crucial in the delivery activity of product or services. That was why to approach SCM integration also its goal and missions, Malaysia needs to enhance supply chain players and establish common integration understanding concepts that lead to IBS construction performance (Shukor *et al.*, 2011). In Malaysia, the implementation of CIMP² can solve all the issues in today’s constructions method. The greater implementation and involvement of IBS approach was introduced through CIMP for improving the productivity of construction industry. Since, the IBS Roadmap (Mohammad *et al.*, 2014) was introduced in Malaysia, the innovation development of Malaysian construction industry adopting IBS has gained its popularity. A crucial element to achieve effective delivery of IBS projects is by focusing on the management and supply chain integration encouragement which could have an additional value effect on the successful implementation of IBS project. In the current situation, competition in the construction trade is between their supply chains (Shukor *et al.*, 2011). Because of this issue, the organization should work on integrating supply chain instead of performing task single-handedly to enhance the competition (Shukor *et al.*, 2011). In addition, they should work in good cooperation (Shukor *et al.*, 2011) which can assist the supply chains to focus on shared goals, lead to benefits for individuals, organizations and nation. The supply chain integration should gain successful in construction projects delivery and earn profitability (Shukor *et al.*, 2011). To be cleared, the supply chain integrated is needed for a mechanism to achieve goals.

In the context of this research, supply chain integrated with IBS project can be added up and viewed as bringing together IBS key players and linked it together by practices-flow towards the construction practices within delivery procurement for them to achieve same goals and objectives in an organisation (Shukor *et al.*, 2011). An evaluation of the challenges faced by the contractor in the industry should be conducted in the context of IBS construction projects in Malaysia. This is to ensure the integration of supply chain can be achieved.

MATERIALS AND METHODS

This study used several methods and approach to obtain the data and information to achieve the goals of this research. The planning needs to be constructed as by setting up the issues and problems of research that are intending be done and followed with the objectives, scope of the study and the definitions of the research which related to SCM integrated with IBS from contractor’s perspective in Penang area.

Method of collecting data and information: Data was observed and collected directly from the first-hand experience. In this study, several methods were used. The methods are:

Questionnaire: The questionnaire is intended to get the data in a practical way in which to learn the actual situation that has occurred in the study area. Questionnaires were distributed to target groups, namely the contractors in Penang area. Furthermore, these questionnaires were also distributed to users, namely, parties involved in the IBS project. From the data collected, some suggestions on improving the effectiveness of SCM integrated with IBS were gained.

Interview: Interviews were conducted to gain direct information about the research. The interview sessions included all relevant parties that are directly involved with IBS project. Each data can help in identifying the type of IBS components adopted in their project, the importance of IBS and the issues of SCM.

Survey via e-mail: This method was used to justify the importance of IBS to the economy and the issues in the SCM integration system of IBS in Malaysia and to determine current opinion related to the key factors of IBS and SCM effectiveness from contractor’s perspective. The survey was e-mailed to all contractors in Penang area. Their email accounts were obtained from CIDB under the registered contractors.

Data analysis: Questionnaires were sent to the contractor’s companies in Penang who apply IBS system in their projects. This study involved construction projects that used IBS, regardless whether the projects are still in progress or have already been completed. The respondents were asked to answer the questions given. Respondents were required to respond to part 2 and 3 regarding the contribution to the national economy and issue of supply chain integration system of IBS in Malaysia respectively by rating (5 Likert scales) their level of agreement from 1-5 (1 No extent; 2-Very Small extent; 3-small extent; 4-Large extent; 5-Very large extent):

$$RII = \sum_{k=1}^n \frac{n(i) x_i}{N \times 5} \quad (1)$$

Where:

n (i) = No. of respondent with scale, i (i = 1, ..., 5)

N = Total number of respondent

According to the scale, the questionnaire rating follows Relative Important Index (RII) ranking technique as “the 5-point scale described previously and converted into relative important indices for each factor”. The equation below is applied from the Relative Important Index (RII) ranking technique (Kometa *et al.*, 1994).

RESULTS AND DISCUSSION

There are 5 respondents that had responded to the questionnaire as shown in Table 1 and 2. Table 1 and Fig. 1 show the respondent’s current position, experience in their current position and types of IBS component they adopt in their project, respectively.

Table 1 shows that majority of respondents are in the highest position in their company together with experiences more than 5 years. Most of their company adopt pre-cast concrete framing, panel, box system and steel formwork systems. Following the interpretation of total scale, the analysis of data indicates the contribution of IBS to the national economy and the issue of supply chain integration system of IBS in Malaysia.

Data gathered from the survey were analyzed using the highest scale as described in Table 3. Most the respondents strongly agreed that value added in IBS industry contributed to the national economy. Value added is the development of a company gives to its product or service before offering the product to customers. Value-added products or services are worth more because they have been improved or had something added to them. Besides that, the respondents disagree that the growth of the conventional industry is one of the

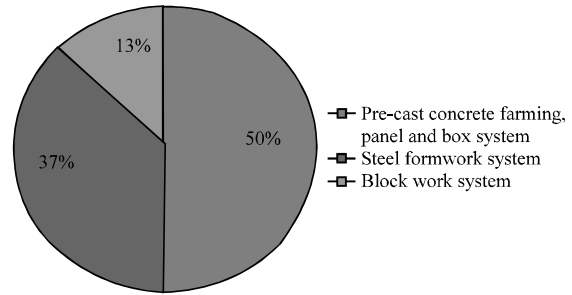


Fig. 1: The percentages of IBS components adopted by contractor’s company

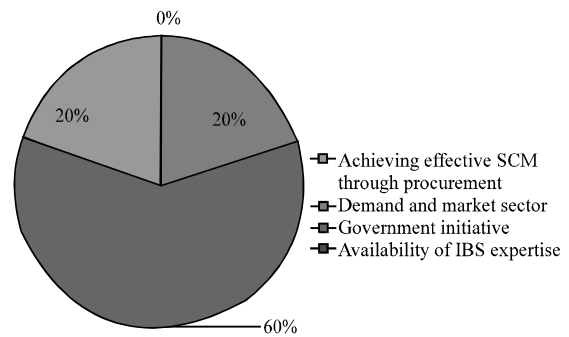


Fig. 2: The opinion of respondent on key factor of effectiveness SCM and IBS

key factors that contribute to the national economy. In addition, respondents strongly agreed that the acceptability of the price offered for IBS commercial conventional is the issue in the supply chain integration system of IBS in Malaysia. In addition, there is also the less agreed that difficulties comply with the requirements from the government related to IBS conventional; the government policy related to IBS conventional; problem or difficulties dealing with IBS commercial conventional organization/agencies and transporting/logistic which has been considered as issues in the IBS supply chain integration in Malaysia.

For the key factors of IBS and SCM effectiveness from contractor’s perspective, the majority of the respondents stated that demand and the market sector are the major factors as disclosed in Fig. 2. Less demand in the market of IBS product can affect the effectiveness of IBS and SCM.

Most of the respondents suggested that IBS should improve its reliability and product demonstration for customer’s satisfaction. However, all respondents stated that they would buy IBS product because it is reliable and cost saving to their company.

Table 1: Respondent's current position, experience and types of IBS component adopted

Respondents	Current post	Experience (years)	Type of IBS component
A	Project's executive	4	Pre-cast concrete framing, panel and box system
B	Assistance quantity surveyor	15	Block work systems
C	General manager	9	Pre-cast concrete framing, panel and box system steel formwork systems
D	Senior project manager	12	Pre-cast concrete framing, panel and box system steel formwork systems
E	Project manager	7	Pre-cast concrete framing, panel and box system steel formwork systems

Table 2: Contribution to the national economy and issue of supply chain integration system of IBS in Malaysia and its relative important index

Questions	Opinion	Total scale	Relative Important Index (RII)
IBS industry are contributing positively to economy in terms of	Value-added	22	0.88
	Employment	17	0.68
	Technical skills development	19	0.76
	Local entrepreneurial capacity building	19	0.76
	Growth of the conventional industry	15	0.60
Increase the employment level	Foreign exchange saving	18	0.72
	Develop a technical skill	20	0.80
Build local entrepreneurship capacity	Improve level of expertise	19	0.76
	Enhance growth of conventional industry	19	0.76
Lower operation cost	High profitability	19	0.76
	Complementary of skills and resource	19	0.76
	Attractive financial package and low paid-up capital	18	0.72
Less pollution	Cheaper than the new conventional	18	0.72
	Reduce cost of destructing the non-function conventional	20	0.80
	Increase use of recyclable material	20	0.80
Human resource	Environmentally beneficial material	19	0.76
	Conserve landfill used	16	0.64
	Contribution to Gross Domestic Product (GDP)	20	0.80
Materials	Competitive advantage	20	0.80
	Availability supply of materials	19	0.76
Bringing in new technology in to the local conventional method	Encourage the transfer of knowledge regarding conventional process	20	0.80
	Improve the skill and knowledge of workers	20	0.80
Improve the ecology of construction industry	Encourage new player/manufacturer in to the construction industry	19	0.76
	Increase in the demand for human resource development and education	19	0.76
Increase the safety of conventional	Less accident	20	0.80
	Less cost associated with accidents	20	0.80
Contribute to the global environment	Value added to the local industry	20	0.80
	Generate extra income to produce	20	0.80
Benefit to the procedures	Contribute to the environment	20	0.80
	Market niche	18	0.72
Positive demand market for construction industry than conventional method	Competitiveness	20	0.80
	View IBS commercial as better than conventional	20	0.80
Increase the awareness of the IBS	Create a culture that will encourage creativity	19	0.76
	Tax and incentive	19	0.76
Act on IBS			

Table 3: Issues in supply chain integration system of IBS in Malaysia

Questions	Opinion	Total scale	Relative Important Index (RII)
Policy	Difficulties to comply requirement from the government related to IBS conventional	14	0.56
	Difficulties dealing with process of licensing the IBS conventional	15	0.60
	The extent of government has any policy related to IBS conventional	14	0.56
Marketing	The extent of problem to sell your IBS commercial conventional	16	0.64
	The extent acceptability of the price offered for IBS commercial conventional	17	0.68
Safety	The extent of safety for IBS commercial conventional	15	0.60
Coordination between the parties involved	The extent of using any representative to deal with all the parties involved in IBS commercial conventional	16	0.64
	The extent of problem or difficulties dealing with these organization/agencies related to IBS commercial conventional		
	MITI	14	0.56
	MIDA	14	0.56
	CIDB	14	0.56
	JKR	14	0.56

Table 3: Continue

Questions	Opinion	Total scale	Relative Important Index (RII)
Standard of conventional produced	The extent of performance of the IBS commercial conventional has the same standard as new conventional	16	0.64
After sales service	The extent of any after sales service	16	0.64
	The extent of satisfaction of the after sales services provided by IBS commercial conventional	16	0.64
Cost	To what extent the IBS commercial conventional will need maintenance cost compare with conventional	15	0.60
Bureaucracy	To what extent you experience bureaucracy problem related to IBS commercial conventional	16	0.64
IBS process	Finding material sources	15	0.60
	Preparation of materials	16	0.64
	Casting and fabricate	15	0.60
	Inspection	16	0.64
	Packaging	15	0.60
	Transporting/logistic	14	0.56
	Delivery	15	0.60
	Installation	15	0.60

CONCLUSION

This study aimed to get an overview and opinion of the contractor's SCM integration with IBS. In addition, based on the respondents, it can be concluded that the value added in IBS industry may contribute to the national economy. However, the key factors and acceptance of the price offered for conventional commercial IBS is an issue in integrating IBS supply chain in Malaysia. The main factor in the effectiveness of IBS and SCM are contractors; the perspective of demand and market sectors. Due to many concern on time duration, cost and quality of work, SCM integrated with IBS can improve all the problems on the factors. Most respondents agreed that the government should provide support for the development of IBS in Malaysia. This is because IBS integration of SCM will always bring good results to the construction industry.

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