Supply Chain Management (SCM): Disintegration Team Factors in Malaysian Industrialised Building System (IBS) Construction Projects

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***Abstract*— Malaysia as a developing country, is driving for implementing a new or modern construction method called Industrialised Building System (IBS), as an alternative towards enhancing construction productivity. The level of implementation of IBS however is still below the Government target. One of the key barriers of its implementation is related to project delivery and supply chain issues. The majority of IBS project developments in Malaysia are still conducted using the traditional construction process approach, which has resulted in a failure to form effective teams and thus impacted on a number of issues such as delay, wastages, and lack of communication and coordination. This paper, through the use of industry workshops, aims to validate this issue and investigate how far it affects the process of IBS implementation. Suggestions on how an integrated approach in design and construction in order to minimise the fragmentation gaps will be concluded.**

***Keywords*—** *Industrialised Building System (IBS), Construction Industry, Supply Chain Management (SCM), Integration*

1. Introduction

The Malaysian government is currently driving the implementation of a new or modern construction method, the Industrialised Building System (IBS), as an alternative towards sustainable and improvement of construction performance. However, a recent IBS review revealed that the acceptance level of IBS is still below the government's target. One of the main reasons or barrier of low adoption of IBS in Malaysia is related to the process of project delivery and supply chain.

According to previous studies [1],[2] this issue also can be linked with the problem of disintegration among parties involved during the design stage of an IBS project. Disintegration or a lack of integration, will lead to issues commonly associated with project cost and time overrun, constructability problems, high number of change orders, reworks and low product quality. In the case of projects that do not achieve owner expectations, the process of redesign by the consultant (designer) will happen, thus the completion of work by the contractor is also delayed. [3-6] All parties agree that a lack of proper communication is one major reason for failure of many projects that do not meet the set expectations. This issue is related to how people, technologies, and processes have been effectively managed by these industry players starting from upstream to downstream of construction project supply chain management (SCM) activities. Therefore, to avoid these pitfalls, a thorough study is needed to be conducted to identify the appropriate strategy for exploring and investigating this issue in order to improve team integration process, which is anticipated to indirectly increase the level of IBS implementation in the Malaysian construction industry. This paper discusses the concept of supply chain and establishing or verifying the requirement factor for improving team integration in Malaysian IBS projects.

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2. Definition and Concept of Supply Chain Management (SCM)

The term of "supply chain" or "logistics network" is defined as a system of organisations, people, technologies, activities, information, and resources involved in moving a product or service from the supplier to the customer. 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" [7].

Supply chain management (SCM)'s concept is originated and flourished from the manufacturing industry. 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 as efficiently as possible. SCM had first perceptible signs in the Just In Time (JIT) delivery system as part of the Toyota Production System [8]. The aim of this system is to regulate supplies to the Toyota motor factory just in the right-small-amount, just on the right time with the main goal being to decrease inventory drastically, and to regulate the supplier interaction with the production line more effectively [9]. The applications of supply chain management techniques in manufacturing environments have saved hundreds of millions of dollars while improving customer service [10].

3. Research Methodology

A validation workshop was conducted successfully at the Grand Seasons Hotel, Kuala Lumpur. The centre provided the facilities for the five hours workshop session. This validation workshop was jointly organised and supported by the Technology and Innovation Development Sector (SPTI) of CIDB, the IBS Centre, the Construction Research Institute of Malaysia (CREAM), the University Sains Malaysia (USM) and the University of Salford.

It was attended by 52 participants who represented various disciplines in the IBS construction industry, such as contractors, designers (or consultants), government agents, manufacturers and academic researchers. Due to issues of confidentiality and anonymity, it was decided that the names of the participants in this study would were not to be disclosed. The list of the workshop participants and their background profile is shown in table 1 as below.

Table 1: Profile of the participants

Group	Position held	Experience	Discipline/ Company	Code
A	Innovation Manager	7 years	Government	A1
	Quantity Surveyor	8 years	Contractor	A2
	Project Manager	13 years	Designer	A3
	Senior Design Engineer	10 years	Manufacturer	A4
	Quantity Surveyor	5 years	Client	A5
	Architect	10 years	Designer	A6
B	Managing Director	17 years	Manufacturer	B1
	Senior Quantity Surveyor	12 years	Contractor	B2
	Deputy Director	16 years	Government	B3
	Principle/BIM Manager	18 years	Designer	B4
	Senior Project Manager	13 years	Contractor	B5
	Assistant Senior Director	19 years	Client	B6
C	Head Deputy Director (Public Works Dept)	23 years	Government	C1
	Design Manager	7 years	Contractor	C2
	Director (IBS Centre)	23 years	Government	C3
	Contract and Procurement Manager	11 years	Designer	C4
	Director of ICU	21 years	Government	C5
D	Design & Production Engineer	8 years	Manufacturer	D1
	C&S Engineer	5 years	Designer	D2
	Quantity Surveyor	5 years	contractor	D3
	Project Manager	8 years	Client/Developer	D4
	Operation Manager	9 years	Manufacturer	D5
E	Green Building Facilitator	26 years	Designer	E1
	Senior Project Engineer	15 years	Manufacturer	E2
	Architect	6 years	Designer	E3
	Project Manager	12 years	Contractor	E4
	Quantity Surveyor	7 years	Client/Developer	E5
F	Project	13 years	Client/Devel	F1

	Manager		oper	
	Principle/Contract Manager	15 years	Designer	F2
	Design Manager	14 years	Manufacturer	F3
	M&E Engineer	5 years	Contractor	F4
G	Principal/Project Planner	13 years	Designer	G1
	C&S Engineer	7 years	Government	G2
	M&E Engineer	9 years	Manufacturer	G3
	Project Manager	13 years	Contractor	G4
	Construction Manager	16 years	Contractor	G5
H	Design and Production Manager	15 years	Manufacturer	H1
	Quantity Surveyor	13 years	Contractor	H2
	C&S Designer	10 years	Designer	H3
	M&E Engineer	7 years	Designer	H4
	Area Manager	21 years	Manufacturer	H5
	Prof./Quantity Surveyor	15 years	Government/ Designer	H6

Due to time constraints, only Group A was selected and volunteered to present the findings from their group discussion to all the workshops' participants; however, notes were taken and were analysed from each group discussion for the purpose of this analysis. The remaining groups however were welcome to affix or argue the points presented during the open (or general) discussion in the end of presentation session. The issues raised from Group A discussions and presentation is presented in the following findings section.

4. Findings and Discussion

This section discusses the findings from the verification phase of the requirement to improve team integration in Malaysian IBS projects. During this verification stage, all the other workshop groups (7 out of 7) had the same opinion with that of Group A, that the traditional design process that is being practiced in Malaysian IBS projects is currently is unsuited, thus leading to great variation in the design process including measurement and specification or cost of a project. A representative from group C (C4) for example, highlighted that;

*'**The characteristics of construction projects are fragmented, diverse and involve many parties. IBS manufacturers and contractors are currently involved only after the design stage. This lack of integration among relevant players in the design stage has resulted in the need for a plan redesign and additional costs to be incurred if IBS is adopted'***

This statement was supported by groups B and D. According to them (presented by B6 & D2), the detail design of IBS Mechanical and Electrical (M&E) works are usually done only after the architectural design is finalised and approved by the client. They further explained that pursuing progress of the project execution, the architectural and structural works are tendered out and awarded first with the M&E works intended to be procured later. Furthermore, participants from group H (H5) declared that in practice this was always followed with poor monitoring of the progress of M&E design works. The participant of group D (D1) further explained that;

'The design of practice has worsened by inefficient coordination of design integration between the architectural, structural and M&E detailing which inevitably results in delays in the procurement and execution of the M&E works for the project'

However, the representative from group F (F3) with experience in IBS design argued that the poor monitoring of M&E design works is not the main cause of the problem. According to him, the main issue of this problem is; what is the specific procedure for controlling the design process and who is the right person to undertake that responsibility. The participant then suggested that the project facilitator should undertake an audit and sign work off at the end of each design stage so as to make sure that what has been specified by the client has been built into the design and is documented accordingly.

In addition, participants from group E, F and G agreed that poor design coordination strongly affected the progress of IBS projects. The groups further addressed that design errors and discrepancies or incompatibilities with detail design, coupled by inadequate breakdown in pricing and poor estimation of M&E works were the common issues that occurred in Malaysian IBS projects. According to them, both of the problems required additional work and time in order to redesign or reset the system, or even scope of the project works.

The participants from group H (H3) also added that design team coordination is really important to avoid wastage and eliminate rework (e.g. reconstruct or rebuilding) on site. The representative further stressed that design integration and realisation are critical because the construction team could not simply reconstruct or demolish a defect panel on site due to the additional cost to rectify the problem. He admitted that:

'Poor coordination of data and information sharing during construction stage causing unnecessary delays to allow for reworks or adjustments in most of IBS projects in Malaysia'

5. Conclusion

This paper presented the findings from the validation of the issues in IBS project delivery, focusing on the supply chain integration. The validation process assessed the issue of disintegration and communication process among stakeholders involved during the design of IBS construction project in Malaysia. The process involved an industrial workshop which was attended by multidisciplinary Malaysian IBS stakeholders. The findings of the workshop verified that current Malaysian IBS projects need an effective integrated design team framework in order to improve team integration practice, thus, indirectly it will help overcome the issue of lack of integration among stakeholders involved during the design stage of Malaysian IBS projects.

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References

[1] Othman, Mohd Zainudin, et al. "A Strategy towards Team Integration Practice for Improving the Design and Construction Process in the Malaysian Industrialized Building System Projects." *International Review of Management and Marketing* 6.8S (2016).

[2] Nawi, Mohd Nasrun Mohd, et al. "Qualitative Analysis on the Barriers of Industrialised Building System (IBS) Uptake in Malaysian Construction Projects." *Advanced Science Letters* 21.6 (2015): 2134-2138.

[3] Orr, A. J., and P. McKenzie. "Program and Project-Management in BT." *British Telecommunications Engineering* 10 (1992): 297-302.

[4] Pardu, W. "Managing Change in A Project Environment", *CMI*, Vol. 6, 1996.

[5] Clarke, Angela. "A practical use of key success factors to improve the effectiveness of project management." *International journal of project management* 17.3 (1999): 139-145.

[6] Hartman, Francis T. *Don't park your brain outside: A practical guide to improving shareholder value with SMART management*. Project Management Inst, 2000.

[7] Nelson, M. L. *The Applicability of the Integrate to Innovate (i2i) model in Supply Chain Management (SCM) in Facilities Management (FM)*. Diss. PhD Thesis, University of Salford, UK, 2004.

[8] Shingo, Shigeo. *Non-stock production: the Shingo system of continuous improvement*. CRC Press, 1988.

[9] Vrijhoef, Ruben, and Lauri Koskela. "Roles of supply chain management in construction." *Proceedings IGLC*. Vol. 7. 1999.

[10] Arntzen, Bruce C., et al. "Global supply chain management at Digital Equipment Corporation." *Interfaces* 25.1 (1995): 69-93.