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A Review of Supply Chain Management Issues in Malaysian Industrialised Building System (IBS) Construction Industry

[1]Mohd Nasrun Mohd Nawi, [2]Angela Lee and [3]Mohd Faizal Omar

[1]*School of Technology Management and Logistic, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia.*
[2]*School of Built and Human Environment, University of Salford, Salford, M5 4WT, UK.*
[3]*Department of Decision Science, School of Quantitative Sciences, College of Arts and Sciences, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia.*

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ABSTRACT

The construction industry is a complex and dynamic industrial sector. Malaysia, as a developing country, considers the construction industry as one main contributor of the country's Gross Domestic Product (GDP). Due to the combination of problems and issues that have recently arisen in current construction methods, such as time delay, rising costs in raw materials, lack of communication and coordination, inefficient management, and many other problems, the government has come out with a new solution through an industrialisation technology called Industrialised Building System (IBS). However, after five years of implementation in the Malaysian construction industry, the acceptance level of IBS is still below government expectation. Supply chain management (SCM) is very much covered in the more glamorous industrial sectors such as electronics and manufacturing, and has the potential for improving and solving these problems. In-line with investigating this effort, this research paper aims to provide alternative solutions in addressing these problems. A survey of the current industry and application of SCM that fits in this industry needs to be performed. This research hopes to answer these problems and help toward the betterment of the construction industry in order to enhance the implementation of IBS in the Malaysian construction industry.

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INTRODUCTION

The construction industry is one of the main contributors of the country's Gross Domestic Product (GDP), both directly and indirectly, through the many mega-projects and infrastructure that are implemented in the country. In Malaysia, the construction industry plays a very important role to provide adequate, quality, and affordable homes, facilities, and infrastructures as part of the development of the country. The Malaysian government has invested a large sum of money in the country's expenditure to transform the country from a developing into an industrialised country by the year 2020. Statistics show 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 an increase in population during this period (Yoke *et al.*, 2003). Based on the 9th Malaysia Plan report, the country is expected to construct 709,400 new housing units for its population, where 270,991 units or 38.2% are planned for the low and low-medium cost houses, whilst 438,409 units or 61.8% of these will be medium and high cost houses.

In line with this, the Malaysian government launched a new construction policy under the Construction Industry Development Board (CIDB), which shifted toward industrialisation programmes called the Industrialised Building System (IBS). The implementation of this policy is guided by the IBS Roadmap 2003-2010 (Hussein, 2007) and has become a viable solution for addressing the increasing housing demands (Nawi *et al.*, 2011; Trikha, 1999; Din, 1984). According to the IBS Roadmap 2003-2010 (CIDB, 2003a), the role of the contractor in the conventional construction method will shift from the previous actor as builder to the installer in the IBS project. As a consequence, main contractors become more and more reliant on other actors in the construction supply chain (e.g., suppliers and subcontractors) to ensure time delivery as well as meeting other

Corresponding Author: Mohd Nasrun Mohd Nawi, School of Technology Management and Logistic, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia.
E-mail: nasrun@uum.edu.my

project requirements (Faizul, 2006). Therefore, they need to revise their supply strategies and trading relations with these subcontractors and suppliers. All these scenarios are related to the supply chain management system and the reason why this research has to be generated in the Malaysian construction industry.

The overall mission of this research is to establish the best practice model for supply chain management of the Malaysian construction industry, where supply chain is known as a cross-functional approach to manage the coordination and collaboration among channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. Therefore, the primary objective of this study is to evaluate the current practice of supply chain management in the construction industry that could fit in the value chain system which would enhance the efficiency and quality of construction projects. To accomplish this mission, several specific objectives of the study were identified, as follows:

1. to identify and develop SCM best practice models from literature;
2. to compare the best practice SCM models above with the current SCM related activities in the Malaysian construction industry;
3. to highlight the gaps found (outcome of objectives 1 and 2);
4. to identify issues and problems, based on the gaps, associated with SCM practices in the Malaysian construction industry; and
5. to provide a model recommendation for improvement of SCM practices.

2 Literature Review:

2.1 Overview of the Malaysian Construction Industry and Supply Chain Issues:

In Malaysia, the construction industry has played a crucial role in the overall economic development. Over the last 20 years, this industry has been consistently contributing between 3% to 5% of the national GDP (Nawi *et al*., 2013; Hamid and Sarshar, 2003). The growth of the industry was further enhanced by the implementation of "Vision 2020" in 1991. This vision is the country's long-term goal which aims to transform the country into a developed and industrialised nation by the year 2020.

Issues such as delay, abandonment, or low quality outcomes of projects have become a common scenario in this industry. For example, delay is considered a major cause of construction claims and there have many construction projects that suffer from delay (Abdul-Rahman *et al.*, 2006). Delay is attributed by many factors stemming from either from owner, designer, or contractor. In the case of projects that do not achieve the owner expectations, the process of redesign by the consultant (designer) will happen, thus the completion of work by the contractor is also delayed. Orr and McKenzie (1992), Pardu (1996), Clarke (1999), and Hartman (2000) all agreed that lack of proper communication is one major reason for failure of many projects that do not meet the set expectations.

The study by previous researchers identified others factor that contributed to the problem of delay, either at the site which can cause shortage or late supply of information, equipment, and materials (Potts, 1995); lack of funds or other resources (Abdul-Rahman *et al.*, 2006), and lack of communication and coordination between parties or players (Nawi *et al*., 2013; Nawi *et al*., 2009; Che Mat, 2006). Other causes of delay are attributed to improper management of materials, hampered by lack of an explicit and detailed model of the project materials management process (Naief, 2002) and due to lack of skillful management where less attention is paid to resources allocation, e.g. human, financial, and material resources (Frimpong *et al.*, 2003). These issues are basically related to how people, technologies, and processes have been effectively managed by these industry players starting from upstream to downstream activities.

2.2 History of Supply Chain Management (SCM):

The concept of SCM originated and flourished from the manufacturing industry. SCM had first perceptible signs in the Just In Time (JIT) delivery system as part of the Toyota Production System (Shingo, 1988). 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 (Vrijhoef and Koskela, 1999). The applications of supply chain management techniques in manufacturing environments have saved hundreds of millions of dollars while improving customer service (Arntzen *et al.*, 1995).

2.3 Definition and Concept of 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. 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 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.

Sources	Definitions
Gattorna and Walters (1996)	"A loop that starts and ends with the customer, where through the loop flow all materials and finished goods, all information and all transactions"
Bechtel and Jayaram (1997)	"SCM is related to the flow of materials and information, from initial sources to the transformation process before delivery to the end-users."
Lambert *et al.* (1998)	"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"
Mentzer *et al.* (2001)	"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"
CLM (2004)	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.

2.4 Definition of Industrialised Building System (IBS):

Industrialisation is a process of social and economic change whereby a human society is transformed from a pre-industrial to an industrial state (CIDB, 2003a). It is a part of a wider modernisation process through the technology system. There are a few definitions of Industrialised Building System (some of the researchers called it mass production or off-site construction) which have been progressively developed over many years by the previous and current researchers. According to Chung and Kadir (2007), IBS was defined as a mass production of building components either in a factory or at the site according to the specification with standard shape and dimensions, and transport to the construction site to be re-arranged according to a certain standard to form a building. While IBS is defined as a construction process that utilises techniques, products, components, or building systems which involve prefabricated components and on-site installation (CIDB, 2001), the components of IBS are manufactured either in a factory, on or off site, positioned, and assembled into place with minimal additional site work (CIDB, 2003a). According to Dietz (1971), IBS is defined as a total integration of all subsystems and components into the overall process while fully utilising industrialised production, transportation and assembly techniques. Whiles Parid (1997) defined IBS as a system which uses industrialised production techniques either in the production of components or assembly of the building, or both. Others definitions of IBS are highlighted in Table 2.

Table 2: Definitions of IBS.

Sources	Definitions
Lessing *et al.* (2005)	"An integrated manufacturing and construction process with well planned organisation for efficient management, preparation and control over resources used, activities and results supported by the used of highly developed components."
Trikha (1999)	"A system in which concrete components prefabricated at site or in factory are assembly to form the structure under strict quality control and minimum in situ construction activitiy."
Warszawski (1999)	"A set of interrelated element that act together to enable the designated performance of the building"
Esa and Nurudin (1998)	"A continuum beginning from utilising craftsmen for every aspect of construction to a system that make use of manufacturing production in order to minimise resource wastage and enhance value end users."
Junid (1986)	"An industrialised process by which components of a building are conceived, planned, fabricated, transported and erected on site includes a balanced combination between the components of software (elements provide a prerequisite to create the conducive environment for IBS to expand) and hardware (three groups of elements: frame or post and beam system; panel system; and box system). "

2.5 Classification of IBS:

There are five main groups of IBS identified by CIDB (2003b). The categorisation of the groups is based on the structural classification used in the Malaysian construction industry. There are:

- ***Pre-cast Concrete Framing, Panel, and Box Systems:***

o Pre-cast column, beam, 3-D components (balconies, staircases, toilets, lift chambers), permanent concrete formwork.

- ***Steel Formwork Systems:***

o Tunnel forms, beams and columns moulding forms, permanent steel formwork.

- ***Steel Frame System****:*

o Steel beams and columns, portal frames, roof trusses.

- ***Prefabricated Timber Framing Systems****:*

o Timber frames, roof trusses.

- ***Block Work System****:*

o Interlocking concrete masonry units (CMU), lightweight concrete block.

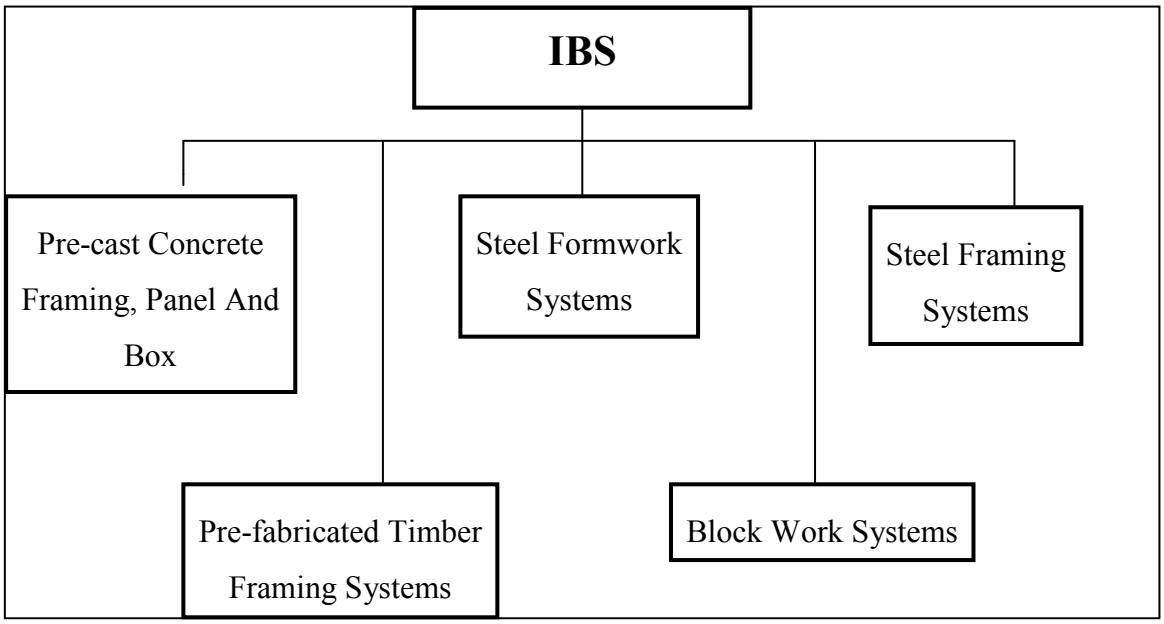

Fig. 1: Graphical group of IBS.
(Source: CIDB, 2003a).

3 Research Methodology:

According to Remenyi *et al.* (1998), research methodology refers to the procedural framework within which the research is conducted and there are many factors to be considered when choosing an appropriate research methodology. This study will be carried out using a combination of research methods involving both exploratory method and field survey approaches. The exploratory work will be done through focus group study, based on structured and semi-structured questionnaires of selected relevant participants as well as extensive literature search through the various academic databases. However, this on-going research is still at the initial stage, therefore, the information presented in this paper is primarily based on the thorough review of the relevant literature within the scope of supply chain management. Wisconsin (2008) identified that a literature review is a "critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles". There are six elements of a literature review comprising a list, a search, a survey, a vehicle for learning, a research facilitator, and a report (Bruce, 1994). Through the literature review, the definition, concept, history, application, and related issues of Supply Chain Management (SCM) and Industrialised Building System (IBS) in the construction industry is examined and highlighted. All the data and information gathered directly from libraries, articles, books, and other printed materials searched from the Internet. This literature review is very important and helpful in the process of developing for the theoretical sections of the actual research.

4 Findings and Discussion:

This paper has covered the current situation of the construction industry in Malaysia, the government initiative, and related issues faced by the players within the industry. SCM involves the integration of three key flows across the boundaries of the companies in a supply chain – product/materials, information, and

finance/cash whereas this concept can be applied and focus to the management of construction activities on site instead off-site. Successful integration or coordination of these three flows has produced improved efficiency and effectiveness for companies. The key factors for a successful implementation of SCM include inventory, cost, information, customer service, and collaboration relationship management. Focusing on the management of these factors is critical to the implementation of a supply chain strategy. Apart from that, this research will make some investigation into the transformation from the old supply chain model to the new supply chain model with the main aim of enhancing the application of the IBS method for the Malaysian construction industry.

5 Conclusion and Further Research:

This study will not only improve the competency of the key players in the construction industry, but will also contribute to the development of best supply chain management practice that is crucial for the success of this industry. As mentioned in introduction earlier, IBS is one of the new construction methods as introduced by the government to enhance the value, quality, and productivity performance of the Malaysian construction industry. However, the plans and strategies of implementing the IBS technology should be emphasised more, especially in the aspect of communication or coordination among construction players which not only involving the general coordination on design, procurement and delivery timelines but have to concentrate also on the detailed manufacturing and logistics issues. A part from that, the study of the level of the technology and skill of readiness among contractor companies (or better known as Small and Medium-sized Enterprises - SMEs) must be put as a priority for future study too.

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