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SUPPLY CHAIN TECHNOLOGY UTILIZATION IN MALAYSIA CONSTRUCTION INDUSTRY

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Abstract

Supply Chain Technology (SCT) utilization becomes a phenomenon in the construction industry nowadays. The uses of these technologies have shown an improvement in construction business process particularly in planning and designing processes. These improvements significantly affect the performance of Supply Chain Management (SCM) in construction industry. The construction industry is critical for national wealth creation particularly in the developing countries such Malaysia. However, about five percent of construction projects were not able to be completed due to various reasons. Therefore, there is a great interest to find out the level of utilization of SCT within the construction industry, which is believed as a main driver to improve the SCM performance and directly reflect to the construction project performance. The objective of this paper is to identify and highlight the issues and problems associated with the current SCM practices, particularly in the technology utilization among the major players in the Malaysian construction industry. To be more specifically, the type of application system that is being utilized in the Malaysian construction supply chain process will be identified.

Keywords: Supply chain technology, supply chain management, construction, rasch method, Malaysia

1.0 INTRODUCTION

In the new era of industry and technology, information technology (IT) is viewed as an enabler to the success of any organisation improvement activities, such as business process reengineering, total quality management and continuous improvement initiatives. Organisations should implement in an enterprise IT applications which not only integrate the internal processes, but are also ready for external processes integration. Generally, this study was designed to investigate the level of technology utilisation among the Malaysian construction related firms (categorised into contractors, developers and suppliers). More specifically, the overall objectives were to identify the type of application system that are being utilised in the Malaysian construction supply chain process, which could assist Malaysian construction related firms improvise their SCM practices.

In this study, SCM been defined as; "*the management of all processes and entities involved in managing the flows of materials, funds, human resources, equipment and information within an integrated network that consists of providers (suppliers), transformers (builders), and receivers (clients) with the objectives of improving customer satisfaction, delivery and quality of products, and reducing costs in the cooperative and collaborative environment.*"

This definition can be extended to the elimination of physical boundaries among the SCM partners in order to gain the same benefits through a win-win situation by imposing a collaborative and co-operative environment or

culture among suppliers, focal organizations and customers. In addition, it is believed that the success of this relationship can be supported by an extensive use of information and technology, and improvement in human resources and business processes. According to [1], technology utilization in SCM or known as Supply Chain Technology (SCT) is defined as; "*a technology or a system that is used in coordinating and integrating information flows electronically throughout the supply chain network of trading partners and customers in both directions so as to generate effective and efficient business transactions, quick access to information, allow better customer service, reduce paperwork, allow better communication, increase productivity and save time.*"

For the purpose of this paper, the objective is to identify and highlight the issues and problems associated with the current SCM practices, particularly in the technology utilization among the major players in the Malaysian construction industry and more specifically, to identify the type of application system that is being utilized in the Malaysian construction supply chain process.

2.0 REVIEW OF LITERATURE

2.1 Supply Chain Management in Construction

In the past manufacturing and construction compete mostly on product, service and price but in today's hypercompetitive environment company compete less on product and quality-which are often comparable and more on inventory turns and speed to market for achieve to this aim company should improve supply chain management and care about it more and more.

Until now, in construction, initiatives belonging to the domain of SCM have been rather partial covering a subset of issues (For example transportation costs) in a limited part of the construction supply chain (For example the construction site). In most cases, the issues are regarded from a main contractor's point of view [2][3]. The construction industry product is in the nature of an investment service where the customer wields great influence on the final product in relation to its physical aspects (dimensions, application of materials, etc.) and the value of logistic parameters (delivery date, project duration, etc.). In some cases, the customer selects the manufacturer (contractor), the suppliers of specialist parts and the material suppliers [4]. Longstanding, efficient supplier-contractor relationships are vulnerable to disruption in this context. [5] hold that construction SCM is increasingly seen as a set of practices aimed at managing and coordinating the entire chain from raw material suppliers to end customers. In the context of the current work, Construction SCM may be regarded as the process of strategic management of information flow, activities, tasks and processes, involving various networks of organizations and linkages (upstream and downstream) involved in the delivery of quality construction products and services through the firms, and to the customer, in an efficient manner.

Nowadays, enterprises are facing an environment changing at an increasing rate which forces them to adapt to change by introducing new approaches to business management. In the logistics area, a significant degree of innovation has been observed because of the increasing complexity and dynamics of markets. However, the construction industry has been slower than other industries in adopting new management strategies and there is relatively little evidence of the application of good logistics practices in this area. Empirical experiences addressing SCM in construction are reported [6] and, since the construction industry is the largest industrial sector in the world, accounting for approximately 10% of the global gross productive effort [7], it seems that there is a great potential for improving. The Supply Chain Management (SCM) in the construction can be seen as the network of installations resources and activities that provides added value to the final customer, in the functions of project design, contact management, acquisition / provision of materials and services, production and delivery of raw material and management of the installations/resources [8].

Finally, the application of supply chain management (SCM) philosophy to the construction industry has been widely investigated as an effective and efficient management measure and strategy to improve the performance of construction, which has suffered from high fragmentation, large waste, poor productivity, cost and time overruns, as well as conflicts and disputes for a long time, and to address adversarial inter organizational relationship of organization by increasing number of construction organizations and researchers.

2.2 Technology Utilization of SCM in Construction

In the supply chain management (SCM) aspects, information system applications are amongst the tools that have been utilised in order to improve organisation competitiveness [9]. The use of technology creates a clear view in managing product, service, information and cost flows from suppliers to OEMs and finally to customers, before it goes back to suppliers in

the complete cycle, which could benefit these players in the supply chain. Process technology is the technology that is used to support the processes in the organization, either primary processes (such as production processes) or supporting processes (such as human resources development processes) [10]. These process technologies could be unique to a particular functional area in the organization or broadly accepted by all organizations in the supply chain, such as the implementation of Manufacturing Resources Planning (MRP II). Process technology is important to accelerate processes in supply chain activities, such as procurement, production and distribution, which could improve the quality and delivery time to customers and it is believed that the operating cost could also be reduced [11].

In the new era of industry and technology, information technology (IT) is viewed as an enabler to the success of any organization improvement activities, such as business process reengineering, total quality management and continuous improvement initiatives [12],[13]. Organizations should implement in an enterprise IT applications which not only integrate the internal processes, but are also ready for external processes integration, such as implementation of Electronic Data Interchange (EDI) or Enterprise Resources Planning (ERP). The utilization of multiple communication channels such as network and information technology can improve the performance and effectiveness of communication as well as to enhance the relationship between suppliers and customers [14].

As listed by [15], among benefits from implementation of technology resources in the supply chain are: a) Integrating a worldwide enterprise with its global supply chain network, b) Linking the multiple tiers of a supply chain, c) Speeding up information flow from and to organizations across the supply chain, d) Breaking down barriers between organizations in the supply chain, and e) Converting the large amount of data flowing in the supply chain into useful collaborative information.

Furthermore, the use of technology, especially information technology (IT) and information and communications technology (ICT), can be leveraged and integrated in all these aspects such as high fragmentation, large waste, poor productivity, cost and time overruns, as well as conflicts and disputes for a long time, since it can facilitate efficient information flow as well as monitor the performance and relationships between each entity in the supply chain.

In the context of this study, issue related to technology utilization that been investigated is to identify the type of application system that been used in the supply chain players in the construction industry, namely project planning (Critical Path Method (CPM), Primavera, Artemis and Microsoft Project), resources planning (MRP, MRP II, ERP), inventory management (WMS, JIT, CPFR, VMI), tracking system (RFID, Bar coding), planning system (SCP, APS), relationship management (CRM, SRM), E-Business (EDI) and decision support / expert system.

3.0 METHODOLOGY

This research employs quantitative approach with main intentions were to align with an effort to add a formal theory to the body of knowledge that explains, predicts and controls the SCM phenomenon. The quantitative approach was identified with several paradigms termed as positivism, logical empiricism, and realism. For that, field or real world verifications were performed to test and thus prove or disprove the theory, which led the focus back to the research issues when the researchers tried to analyze the findings.

The above strategies outlined for Quantitative research had helped bring about ample information that cross-refers Technology Utilization practices in view of SCM in the Malaysian construction industry which led to a great assistance for the research team to work to achieve the project objectives.

The quantitative approach is identified with several paradigms termed as positivism, logical empiricism, and realism. In this case, the main intention would always be aligned with an effort to add to the body of knowledge by building formal theory that explains, predicts and controls the phenomenon of interest. Respondents for the survey conducted in this study cover all categories of players in the Malaysian construction industry that are Contractors, Developers and Suppliers, based on several sources such as CIDB Database and REDHA Directory. Data gathering was carried by distributing guided structured questionnaires during the two seminars where 60 and 100 participants were invited, respectively. However, from the two events, a total of 45 responses were received (8 and 37 responses, respectively). In addition, research team members were then sent to all over Peninsular Malaysia to obtain additional questionnaire responses later yielded 13 responses. At the end, in total, 58 sets of questionnaires were collected, and after reviewing the responses from all respondents, 53 were judged to be appropriate for further analysis of which, 28 were contractors, 14 suppliers, and 11 developers.

In order to analyse those data, one of the viable tools is the Rasch Measurement Model (RMM) due to its suitability in addressing all the

problems that were encountered during our research, as well as overcome the barriers such as understanding the response structure, issue of non-linearity, unidimensionality, and construct operationalization and internal consistency of terms. This method works by applying a simple mathematical model which constructs abstract linear measures from the concrete raw data. Rasch analysis procedure for this research is done by the application of WINSTEPS which is one of the Rasch-Model computer programs. This software is selected as it is more convenient and powerful.

In general, the study was undertaken to illustrate the Technology Utilization in view of the differences in the LOA and LOP in the Malaysia construction industry. From the preliminary review, RMM operation reveals that the construction players can then be categorized into 5 categories of adopters as described in as shown in Table 1:

Table 1 Description of Level of Adoption (LOA)

Category Name	Description
High Adopters	Persons of this group is observed to view the practices as very important and thus find it very easy to adopt
Good Adopters	Persons of this group is observed to view the practices as important and thus find it easy to adopt
Moderate Adopters	Persons of this group is observed to view the practices as more or less important and thus find it more or less easy to adopt
Low Adopters	Persons of this group is observed to view the practices as less important and thus find it less easy to adopt
Poor Adopters	Persons of this group is observed to view the practices as not important and thus find it not easy to adopt

Meanwhile, in terms of intensity levels of SCM practices, the SCM practices can be categorized into 4 main categories as shown in Table 2 below:

Table 2 Description of Level of Practices (LOP)

Category Name	Description
Common	High percentage of dimensions involved are practiced
Reasonably Common	Reasonably High percentage of dimensions involved are practiced
Fairly Common	Low percentage of dimensions involved are practiced
Not Common	Very low percentage of dimensions involved are practiced

4.0 ANALYSIS AND FINDINGS

Total respondents involved in this survey were 53 which could be categorized into contractors (28), developers (14) and suppliers (11). From the survey, it was identified that, in general, respondents involved in this study are attached to the following attributes:

Table 3 Demographic data

No.	Items	Mean		Separation	
		P	I	P	I
1	Contractors	0.04	-1.20	4.16	0.00
2	Developers	0.46	-1.20	5.42	0.00
3	Suppliers	-0.18	-1.20	5.54	0.00
4	Total No. Of Respondents	0. 11	-1.20	5.05	0.00

Referring to Table 3, the demographic data shows that the overall Person Mean of 0.11 logit indicates that there is 47.25% likelihood that Technology Utilization is adopted by respondents in their construction activities. On the other hand, the overall Item Mean of -1.20 logit indicates the logit point is located toward the lower half of the Logit Ruler which means that most of the items surveyed are easy to be implemented or are being implemented by the respondents with the likelihood (level of practice) of 76.85%.

Based on the analysis, it is found that only 1.87%, of the industry players represented by the Developers category is capable to be a Good Adopter in one of the applications, which is Microsoft Project. On the other hand, through the results, it shows that Technology Utilization is unlikely to be implemented by other players in this industry. This result reflects the nature of industry itself where most of the jobs are still in the conventional manner except the use of Microsoft Project for Project Planning activities. The exploitation of ICT application is really needed in order for construction industry players to grab more opportunities that provided by these application in terms of smoothing the information flow, integrating and coordinating supplier and customer, responsive to customer demand and improving supplier and customer relationship. In addition, through the use of these applications, these players could collaboratively work in some phases of construction life cycle. Therefore, as a recommendation, the benefit of using these applications should be highlighted to the SC players along with the support in terms of training and services in order for facilitate the players to adopt those applications in their organizations.

In brief, comparing the Respondents Person mean (52.75%) with the mean of measured items, 3.73% likelihood, it can be directly translated that the respondents have difficulties in responding to the tasks entrusted to them which turns Technology Utilization to be not a common practice among the construction fraternity.

Based on the RMM analysis, referring to the intensity level of technology utilization in their construction activities, there are only 1.89% of respondents, representing Developers' category, who are capable of practicing a minimum of one type of application system. On the other hand, 98.11% of construction players are unlikely to observe the utilization of technology in the construction industry. Furthermore, it is out found that only Microsoft Project is likely to be the only application system considered by a minimum of one player in the construction industry - which is related to the use of Microsoft Project for Project planning activity. Meanwhile, the other items are unlikely to be utilized in the construction industry by its players. In term of Project planning system utilization among SC players, the result shows that most of the players use Microsoft Project as a tool in project planning activities. It is believed that high utilization of Microsoft Project in the project planning is due to its availability to users, easy to use and low cost of purchase. However, this result is contrary to [16] who revealed that most construction professional are more likely to use Primavera rather than Microsoft Project as their project management software in construction industry due to its capability as a full feature project management software.

The utilization of IT applications is considered low (Low LOA) even though it has been described as a technology that could facilitate the flow of information and manage linkages between supplier and customer in the supply chain. It is believed that the lack of knowledge and awareness towards these applications is the reason that contributes to the low utilization percentage in the Malaysian construction industry. This situation described that due to the nature of industry itself, the lack of awareness and exposure to this application prevent them from overcome the performance deficits and exploiting new opportunities. In addition, Technology Utilization also Not Commonly (NC) practiced by the construction players in Malaysia with the LOP of only 6.60%.

5.0 CONCLUSIONS

The construction industry is blessed by high intensity of state of the art equipment and technology throughout the entire supply chain, either locally produced and maintained or externally supplied. This enormously helps propagate the industry productivity and efficiency levels.

Most of the respondents agreed that the appropriate technology (i.e. information technology) would help enhance supply chain practices by enabling flexibility in procurement process which would ultimately lead to higher customer satisfaction. But unfortunately, at present, sharing the same system among all entities involved throughout the value chain is still considered an unfavorable move.

The focus of technology development in the construction industry has traditionally been on the materials and construction equipment, which would affect the construction process. Higher technology used in projects would normally mean savings in cost and time. However, in the context of the construction supply chain, the technology involved in facilitating the supply chain would be related to the information and communication technology (ICT), and information technology (IT). This is evident in various aspect of the

supply chain, because through the use of ICT and IT, companies are able to enhance their collaborative activities, keep all parties up-to-date regarding the progression of the project, and also help their partners in planning ahead to that any problems that crop up during the running of the project can be resolved early and thus not affect the project time period.

In relation to the technology utilization in managing the construction supply chain, more specifically the use of ICT, there is a lack of implementation of ICT in leveraging its benefits for the improvement of the supply chain. This becomes more critical, especially in the earlier phases of a construction project, where communication is the key in laying down a solid foundation for all the players to contribute toward a successful project. During the planning stage, many project management software (such as Primavera, Artemis, and Microsoft Project) can be used to chart out the course of the project, and these software packages can be used to monitor the progress of the project as well. Resources planning, inventory management, tracking and id system, planning system, relationship management, e-business, and decision support system applications can be used by the supply chain players to improve the management of their supply chain, throughout all the phases. Therefore, the skill in using such software is paramount and thus training and incentives for promoting these software and IT/ICT usage should be implemented by the governing bodies and learning institutions.

Coping with the ever advancing ICT development would also be another way of improving information dissemination and collaborative practices. Through the use of such technologies, organizations can be in close contact with their partners, even though geographically they may be far apart. The sharing of databases and information systems would mean that all players involved within a particular project would be informed well in advance of any changes or modifications being made during the course of the project. This would lead to a better management by all parties, since they are well informed and can adjust to the uncertain environment better, especially when it comes to financial matters of the project. A transparent financial database would, perhaps, make it easier for the entire supply chain, and its players, to work toward achieving the maximum profit for all players, rather than the selected few.

While most of the IT software used by companies was basically project management software (like Microsoft Project Management) and desktop publishing suites (like Microsoft Office) in running the daily administrative and clerical activities during the life of the project, other potential software should be explored. From the communication perspective, e-mail is now an essential communication tool, and the digital communication industry has further improved its infrastructure to provide services which link email system with mobile phones, and thus provide an integrated system by which, potentially, all employees involved within a specific project can be made aware of the current up-to-date information about their project. In line with this is the video conferencing software and can also be integrated in mobile phones with the ever increasing speeds of broadband. Webcams and virtual reality software can all be employed in monitoring and communicating information, not only to players within the supply chain, but also to potential clients and stakeholders who have vested interests in the project. Taking these technologies another step further is to provide a shared or online database, which may contain information ranging from financial to materials to human resource. With this shared knowledge, all players within the supply chain would be able to act proactively in order to minimize any problems for the duration of the project.

Once there is alignment between the parties that are involved in the demand and supply of such skills, only then can the construction industry players move forward to be more competitive in the face of global competition.

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