

Supply Chain Management and E-Commerce Technology Adoption among Logistics Service Providers in Malaysia

Mohd Iskandar bin Illyas Tan and Iziati Saadah bt Ibrahim

Abstract—Logistics is part of the supply chain processes that plans, implements, and controls the efficient and effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer requirements. This research aims to investigate the current status and future direction of the use of Information Technology (IT) for logistics, focusing on Supply Chain Management (SCM) and E-Commerce adoption in Malaysia. Therefore, this research stresses on the type of technology being adopted, factors, benefits and barriers affecting the innovation in SCM and E-Commerce technology adoption among Logistics Service Providers (LSP). A mailed questionnaire survey was conducted to collect data from 265 logistics companies in Johor. The research revealed a high level of SCM technology adoption among LSP as they had adopted SCM technology in various business processes while they perceived a high level of benefits from SCM adoption.

Keywords— E-Commerce, Logistics Service Providers, Malaysia, Supply Chain Management.

I. INTRODUCTION

INFORMATION technology (IT) in supply chain management (SCM) has gained its importance recently due to its capability to reduce cost and increasing responsiveness in the supply chain. [1-5]. The use of IT is considered a prerequisite for the effective control of today's complex supply chain. And it is further justified with the trend of globalization as business spans beyond borders and the need to manage it centrally [6]. Therefore, effective SCM technology adoption allows rich information exchange, quick and reliable data availability and easy access to business partners [7]

In addition to excellence in business processes and focus on industry specific markets, E-Commerce is considered to be the new competitive weapons for the logistics industry [8]. A company's success is depending upon the use of internet technologies that are aligned with its organizational goals. In facts, institutionalizing a "click and brick" strategy is seen as a

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key to company's overall success in leveraging digital age technologies [9].

The E-Commerce adoption is said to be a contributors to the advancement of business processes and has become a crucial considerations in logistics field nowadays. It seems to be a considerable importance as logistics is seen as the backbone of E-Commerce operations [10]. The purpose of the study is to investigate the SCM and E-Commerce technology adoption as well as benefits of IT implementation among logistics service providers (LSPs) in Malaysia.

The remainder of the paper is organized as follows: Section 2 describes our literature review. Section 3 introduces our methodology as well as data collection while Section 4 presents our research results. In Section 5 we include our discussion and finally we draw our conclusions in Section 6.

II. LITERATURE REVIEW

In this section we present the definition of logistics, SCM and E-Commerce as well as their relationship among others that are very crucial for the logistics operations.

A. Logistics and SCM

Logistics is defined by the Council of Logistics Management as the process of planning, implementing and controlling the efficient and effective flow and storage of goods, services and related information from the point of origin to point of consumption for the purpose of conforming to customer requirements [11]. It includes inbound, outbound, internal, external movement and the return of material and goods as well as order fulfillment [12]. Fig. 1 shows the physical and information flows from raw material to the final distribution of the finished products defined by [13]. It starts with the procurement activity where the process of selecting the suppliers and draw a purchase agreement take place. It refers to raw material, components, imported material, bought-in parts and supplies bought from outside organizations to support the company's operations. It also involves the process of assigning task for the production process, sub-assembly as well as work in progress. Next is the material management activity where determination of quantities and time points for all items. The goal is to achieve the efficient material flows, delivery services and utilization of resources. Attention is directed to which items must new orders be planned, what quantity in the order must be stated

for each item, when must the order of each item delivered to stock, directly to production or directly to the customer.

B. Logistics Framework

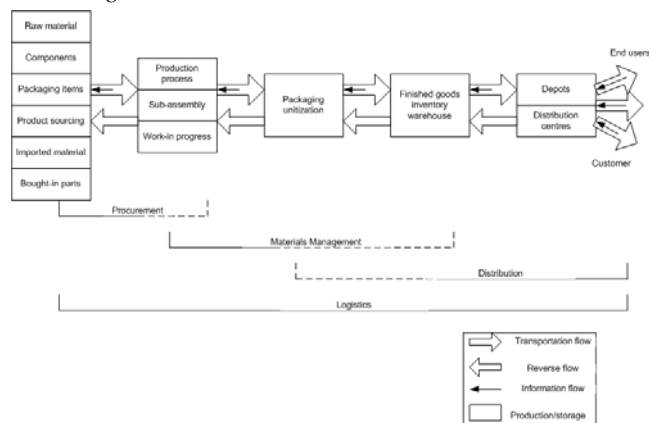


Fig. 1 Logistics framework

Final activity that involves in the logistics is the distribution process where the final receivers are the customers and end users. An additional and very important factor is that of reverse logistics where the flow of products and packaging back through the system.

Fig. 2 shows a simple supply chain that can be broken into three major parts: upstream, internal and downstream as defined by [14]. The upstream supply chain includes the activities of a manufacturing company with its suppliers and their connections with their suppliers. The supplier relationship can be extended to the left in several tiers, all the way to the origin of the material. The major activity is procurement.

The internal supply chain includes all in-house processes used in transforming the inputs received from the suppliers into the organization's output. It extends from the time the inputs enter an organization to the time that the products go to the distribution outside of the organization. The major concerns are production management, manufacturing and inventory control.

The downstream supply chain includes all the activities involved in delivering the products to the final customers. Attention is directed at distribution, warehousing, transportation and after-sale service.

C. Logistics and E-Commerce

E-Commerce is defined by [15] as technology-mediated exchanges between parties (individuals, organizations or both) as well as the electronically based intra- or inter-organizational activities that facilitate such exchanges. Following [12] E-Commerce also can be defined as the process of buying, selling, transferring or exchanging products, services or information via computer networks, including the Internet.

D. Relationship between SCM and logistics

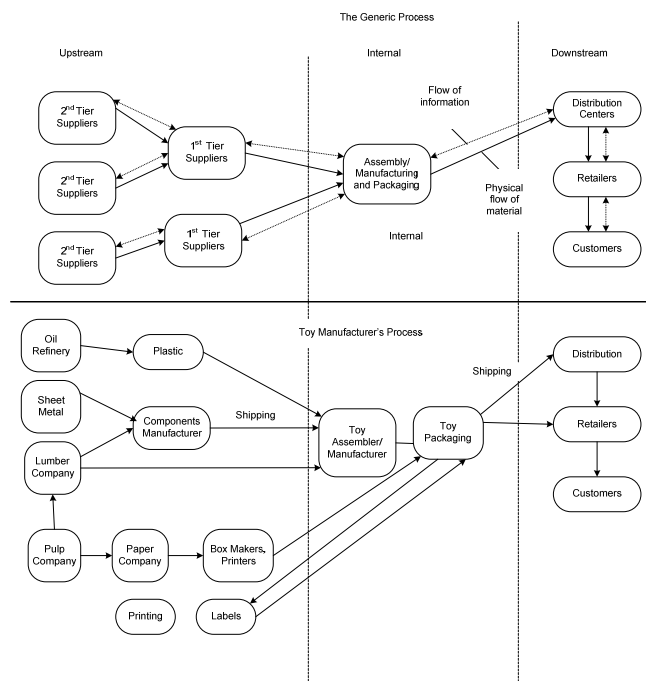


Fig. 2 A simple supply chain processes

E-Logistics is the use of Web-based technologies to support the material acquisition, warehousing and transportation processes. E-Logistics enables distribution to couple routing optimization with inventory tracking information [14].

E-Logistics is a mechanism of automating logistics processes and providing an integrated end-to-end fulfillment and supply chain management services to the players of logistics processes. Those logistics processes that are automated by e-logistics provide supply chain visibility and can be part of existing E-Commerce systems in an enterprise [16].

On the other hand, according to [17] E-supply chain management (E-SCM) is the collaborative use of technology to enhance Business-to-Business (B2B) processes and improve speed, agility, real-time control, and customer satisfaction. It involves the use of information technologies to improve the operations of supply chain activities like procurement as well as the management of the supply chains like planning, coordination and control.

In contrast, E-SCM is not about technology change also but also involves changes in management policies, organizational culture, performance metrics, business processes and organizational structure across the supply chain [14].

Another E-Commerce technology that is currently being used to support logistics activities is the Business-to-Business (B2B) application. More effective and efficient supply chain can be achieved by eliminating one or more intermediaries. B2B can act as an enabler that offers distinct competitive advantage. B2B e-marketplace provides companies with high

supply chain power and high capabilities for online interactions.

III. RESEARCH METHODOLOGY

In this section we detailed out the survey conducted in September 2009 in Johor. The following subsections describe the samples involved, instrumentation as well as the phases involved in the data collection.

A. Sampling

In this research, the sample is the LSPs that consist of logistics companies in the state of Johor, which located in the Southern region of Peninsular Malaysia. There were several reasons associated with the selection of Johor for the data collection activities. Firstly, Johor is rapidly attracting more foreign direct investment compare to any other state in this region and it is where the Southern Industrial and Logistic Clusters (SILC) located. Beside than being the logistics hub of the country, Port of Tanjung Pelepas (PTP) has been given the priority as a gateway to the Iskandar Development Region (IDR). Moreover the port has recently awarded the 'Excellence in Logistics Asean' dubbed as Malaysia's largest container terminal and primarily a transshipment hub for South East Asia that handles 95 percent of the cargo movement through the port.

Quota sampling technique is chosen as the researcher's ease of access to the whole sample population [18]. Furthermore it guarantees the inclusion of type of people needed for the study [18]. The respondents include the logistics manager or the personnel responsible for the logistics operations in the organization because they tend to adopt such technologies and it was envisaged that interesting results could be obtained.

Table I shows the size of population for LSP categorized by the logistics association from three different states in Malaysia taken from 2009 Malaysian Logistics Industry Directory.

TABLE I
POPULATION SIZE FOR LSP IN MALAYSIA

State	Association	No	Percentage
Johor	Johor Freight Forwarders Association (JOFFA)	241	34.6
	Johor Port Shipping & Forwarding Association (JPSFA)	85	
Penang	Penang Freight Forwarders Association (PFFA)	138	14.6
Selangor	Selangor Freight Forwarders & Logistics Association (SFFLA)	478	50.7
Total		942	100

Even though the total number of LSPs in Johor is 326 which represent the second highest in Malaysia, there were only 265 logistics companies included in the final survey. This is due to some companies that were registered under both Johor Freight Forwarders Association (JOFFA) and Johor Port Shipping & Forwarding Association (JPSFA) at the same time. With regards to that difficulty researchers opted to choose only one association for the respective companies in

order to avoid any redundancy when sending the questionnaires.

B. Instrument Development

Table II shows the outline of questionnaire used for the survey, which shows the different sections, subsections as well as the source where the original questions were taken from.

TABLE II
QUESTIONNAIRE STRUCTURE

Section	Subsection	Source	Reference	No of Questions
A Logistics Operation	Transportation		New	2
	Order Handling	Shyam K Madanan	Benchmarking the Effectiveness of Logistics Management, NDL/HIDC Logistics Questionnaire	3
	Warehousing	Banta Global Turnkey Group	Court of Expert – Inventory Benchmark Study	3
	Inventory Management	Banta Global Turnkey Group	Court of Expert – Inventory Benchmark Study	1
	Logistics Partners Relationships	Patterson, K. A., C. M. Grimm, et al. (2003)	Adopting new technologies for supply chain management	1
B Supply Chain Technology	Supply Chain Technology Adoption	Patterson, K. A., C. M. Grimm, et al. (2003)	Adopting new technologies for supply chain management	2
	Benefits of Supply Chain Technologies	Patterson, K. A., C. M. Grimm, et al. (2003)	Adopting new technologies for supply chain management	1
C E- Commerce Technology	E-Commerce Technology Adoption	Brah, S. A. and H. Y. Lim (2006), Molla, A. and P. S. Licker (2005), Tan, J., K. Tyler, et al. (2007).	The effects of technology and TQM on the performance of logistics companies, eCommerce adoption in developing countries: a model and instrument, Business-to-business adoption of	2

		eCommerce in China	
D	Demographic	Patterson, K. A., C. M. Grimm, et al. (2003)	Adopting new technologies for supply chain management.
			3
Total			18

Respondents were required to complete the survey that had the following major sections:

- Section A measured the logistics operation that consists of five subsections, which include questions for transportation, order handling, warehousing, inventory operations and logistics partners relationships.
- Section B related to supply chain technology that consists of two subsections, which include questions for supply chain technologies adoption and benefits of supply chain technologies.
- Section C measured the E-Commerce technology adoption, which includes the expansion and current status of E-Commerce implementation.
- Section D related to demographics information such as company details, contact person information, number of employees, total revenues earned and entire mode of operations.

C. Pre-Testing

The questionnaire was pretested by 10 academicians from two different departments from local university in Johor. Of these numbers, three were female respondents while the rest were male respondents. Based on the feedback from the pre-testing questionnaire was refined and the revised final questionnaire was developed.

D. Actual Study

In September 2009, a mailed questionnaire survey was conducted to the selected sample. A covering letter explaining the purpose of the study; assuring the secrecy of respondents and their organization and a self-addressed, stamped envelope were enclosed to facilitate the return of the completed questionnaires. A second wave of reminder was made to a random sample of non-respondents through mailed postcards and the number of response was significantly increased. By final count, 75 valid responses were received with a response rate of 28.3 percent for logistics companies.

IV. RESULTS

In this section we present the initial results and analysis of the formal survey that had been carried out previously.

A. Final Reliability

The reliability was checked by examining the Cronbach's α coefficient. As shown in TABLE III the Cronbach's α coefficients range from 0.77 to 0.95, higher than the

recommended 0.70 level indicating acceptable level of reliability.

TABLE III
RELIABILITY ANALYSIS FOR LSP

Main Construct	Constructs	No of Items	Cronbach Alpha
Logistics Operations	Inventory Management	8	0.777
	Logistics Partner Relationships	4	0.910
	Level of SCM Technology Adoption	5	0.923
SCM Technology	Duration of SCM Technology Adoption	5	0.958
	Benefits of SCM Technology Adoption	16	0.863
E-Commerce Technology	Level of E-Commerce Technology Adoption	15	0.818

To conclude, the construct from the questionnaires is suitable for measuring the instruments that we intend to measure. This showed that the instrument was sufficiently reliable and could consistently capture true score variability among respondents.

TABLE IV shows the mean and SD scores specifically for all the items measuring level of SCM technology adoption among LSP. It can be appreciated that order management tops the list (3.03) followed by manufacturing (3.00) respectively for the level of SCM adoption at LSP. This suggests that among the logistics functions order management has been seriously implement SCM technology by LSP companies.

B. Supply Chain Management Technology Adoption

TABLE IV
LEVEL OF SCM TECHNOLOGY ADOPTION

Logistics Functions	LSP Mean \pm Std
Inventory Management	2.87 \pm 1.388
Manufacturing/Operations	3.00 \pm 0.715
Order Management	3.03 \pm 0.616
Transportation	2.58 \pm 1.020
Warehousing	2.92 \pm 1.145

TABLE V portrays the mean and SD scores for each of the item measuring duration of SCM technology being adopted by LSP. The mean score of 4.00 with a SD of 1.116 implies that the majority of LSP companies have consistently agreed that they have implemented SCM technology for more than a year with transportation represents the highest rate.

V. DISCUSSION

This section discusses the results of the survey specifically on the level of SCM and E-Commerce technology adoption and their anticipated benefits.

A. SCM Technology Adoption and Its Perceived Benefits

We observed interesting findings with regards to relating SCM technology adoption with the benefits. We found that

LSP are more eager to adopt SCM technologies for competitive advantage. As LSP are providing more than one service and their business processes are expanding, SCM technology could be a potential feature to improve on the information flow between supplier and customer.

TABLE V
 DURATION OF SCM TECHNOLOGY ADOPTION

Logistics Functions	LSP Mean ± Std
Inventory Management	3.61 ± 1.054
Manufacturing/Operations	3.07 ± 1.301
Order Management	3.43 ± 0.860
Transportation	4.00 ± 1.116
Warehousing	3.81 ± 1.011

1:Not Implemented	2: Within last year	3: 1-3 years ago	4: 3-5 years ago	5: More than 5 years ago
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Depending upon the nature of their services at present, LSP are adopting SCM technology in various business processes such as inventory management, transportation and warehousing. Besides that, LSP do not see a need to adopt SCM technology in manufacturing and order management. This shows that there is a lack of exposure of these companies to the capabilities of SCM technology in increasing business efficiency and ultimately projecting Johor as the logistics hub in Malaysia.

The top five motivating factors for SCM adoption in LSP are increase customer service and satisfaction, increase coordination among various business partners, provides on time delivery, reduce operation costs and improve inventory management so that they can plan their production more efficiently.

B. E-Commerce Technology Adoption

We found that the current status of E-Commerce adoption among LSP to support logistics management involving their suppliers, customers and partners respectively. The results shows that internet technologies (internet billing and EDI) are widely used in logistics because communication technology is one of the main ways in which E-Commerce is used to support logistics operations among all parties in the supply chain.

LSP are begin to realize that with increased adoption of EDI and E-Commerce information received by one party can be directly fed into its in-house application system for planning and execution. That way, LSP would be able to enhance the level of customer service and reduce operating cost on both sides. Therefore, it is recommended that all LSP companies start to develop their strategies of using E-Commerce to change the way business is being conducted.

VI. CONCLUSION AND FUTURE WORK

The main purpose of the study was to investigate the current status of SCM and E-Commerce technology adoption among the LSP with regards to the perceptions and the impact on the use of SCM and E-Commerce technology in Malaysia.

This study has shown that the LSPs used SCM technology most extensively to support all the processes of their logistics activities. In addition, the adoption and utilization of SCM and E-Commerce technologies can act as a strategic tool to help them to compete in a larger market when they perceived that those technologies can bring advantages in a competitive environment as long as technical resources are available.

With regards to the level of E-Commerce technology adoption, the internet technology that supports their daily transaction such as EDI is the most popular means of communication among the LSP since it was found to be more effective ways of communication between two parties. The results of the study indicate that level of SCM and E-Commerce technology adoption between LSP are almost high. However, these findings are only true for the companies in Johor and cannot be generalized to other LSP companies from other states.

In summary, this study sets the stage for future research on SCM and E-Commerce adoption. It would be interesting to reexamine the technologies adoption in the context of other states in Malaysia. It seems clear that more research is required to generate company conclusions as to why so many of LSP companies are slow to adopt the E-Commerce technology. Therefore, there are many reasons why action should be taken to overcome this set of technology adoption barriers.

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REFERENCES

- [1] McLaren, et al., Supply chain management information systems capabilities. An exploratory study of electronics manufacturers. Information Systems and E-Business Management, 2004. Volume 2(Numbers 2-3).
- [2] Chopra, S. and P. Meindl, Supply Chain Management. 2003: Prentice Hall.
- [3] Dagenais T and G. D. Net Markets: Driving Success in the B2B Networked Economy. ON Effect.Management Science. Vol. 43. 2002, Toronto: McGraw-Hill Ryerson Ltd.
- [4] HL, L., Creating Value through Supply Chain Integration. Supply Chain Management Review, 2000.
- [5] Ndubisi, N.O. and M. Jantan, Evaluating IS usage in Malaysian small and medium-sized firms using the technology acceptance model. Logistics Information Management, 2003. 16(6): p. 440 - 450.
- [6] Zailani, S., et al. Supply Chain Technology: An Empirical Study In The Context Of Malaysia. in Proceedings of the 9th Asia Pasific Industrial Engineering & Management Systems Conference. 2008. Nusa Dua, Bali - Indonesia.
- [7] Mukhopadhyay T, Kekre S, and K. S, Business Value of Information Technology: A Study of Electronic Data Interchange. MIS Quarterly, 1995. 19 (2): p. 137-156.
- [8] Piplani, R., S. Pokharel, and A. Tan, Perspectives on the Use of Information Technology at Third Party Logistics Service Providers in Singapore. Asia Pacific Journal of Marketing and Logistics, 2004. Volume 16(Number 1): p. 27-41.
- [9] Gulati, R. and J. Garino, Get the right mix of bricks & clicks. Harvard Business Review, 2000. Vol. 78(No. 3): p. 107-114.
- [10] Delfmann, W., S. Albers, and M. Gehring, The Impact of electronic commerce on logistics service providers. International Journal of

- Physical Distribution & Logistics Management, 2002. Vol 32(No 3): p. 203-222.
- [11] Logisticsworld.com. "What Is Logistics". 2006 [cited October 2009]; Available from: logisticsworld.com/logistics.htm.
 - [12] Turban, E., et al., Information Technology for Management - Transforming Organizations in the Digital Economy. 6th ed. 2008, New Jersey: John Wiley & Sons (Asia) Pte Ltd.
 - [13] Rushton, A., J. Oxley, and P. Croucher, Handbook of Logistics and Distribution Management. 2nd Edition ed. 2001: Kogan Page. 512.
 - [14] Turban, E., et al., Electronic Commerce 2006 A Managerial Perspective. 2006, New Jersey: Pearson Education Inc.
 - [15] Rayport, J.F. and B.J. Jaworski, e-Commerce. E-Commerce Series. 2001, New York: McGraw-Hill/Irwin Marketspace U.
 - [16] Fang, L. and C.-q. Zhang, The E-Logistics Framework in E-commerce, in ICEC'05. 2005: Xi'an China. p. 408-412.
 - [17] Norris G., e.a., E-Business and ERP: Transforming the Enterprise. 2000, New York: McGraw-Hill.
 - [18] Kumar, R., Research Methodology -A Step-by-Step Guide for Beginners 1999, London, Thousand Oaks, New Delhi: Sage Publications.