Implementation of e-Logistics Systems for Developing EC Capability in Small and Medium-sized Enterprises: A Conceptual Model

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Abstract: In the 21st century, contemporary small and medium-sized enterprises (SMEs) have come to realize the implementation of e-business systems for developing sound e-commerce (EC) capability is critical to maintain this competitiveness. Given that EC capability can proffer a variety of benefits to modern firms, the majority of SMEs are still slow to adopt e-commerce technologies in Asia-Pacific countries. In Taiwan, SMEs play an important role in the economy than they do in other developed nations. The development of EC capability is not only a novel way of doing business, but also an important solution confronting for the sustainable competitiveness of SMEs. In this paper, we propose a conceptual model to explain the processes of implementing e-logistics systems to develop an integrated B2B2C EC capability for SMEs. This conceptual model can provide instrumental guidelines to help SMEs build their e-business models and EC capabilities by identifying the potential of adopting e-logistics systems to greatly improve their competitiveness in today's business environment.

Key words: E-Commerce, e-business, e-logistics, small and medium-sized enterprise.

1. Introduction

Today, the booming of e-commerce and network economy has driven rapid development in emerging business applications and created noteworthy market opportunities. Various new e-commerce models have significantly changed the landscape of business and the ways in which firms compete [1]. Many modern firms have transformed their business operation paradigm from brick-and-mortar to click-and-mortar because of the opportunities created by online business [2]. The rapid advancement of the Internet and communication technology has accelerated the introduction of e-commerce (EC) technologies in modern small and medium-sized enterprises (SMEs) around the world. EC has already become a widespread way of doing business throughout the world. It is gaining impetus worldwide and the impact is being felt in all sectors, especially in the manufacturing and service SMEs of the economy. Nevertheless, the majority of the local SMEs in Taiwan still lags behind global information technology (IT) revolution and lacks the critical core capability to take advantages of EC as a channel to conduct businesses.

Considering the SMEs' role as a backbone for Taiwan's economic development, the fact is posing unavoidable challenge to their economic development. In addition, today's business environment provides

a rationale for the need to enable firms to enhance their core capabilities in using e-commerce through economic and technical cooperation and to reap the benefits of e-commerce. In order for e-commerce to flourish, SMEs, in Taiwan, are playing a pivotal role in adopting and implementing EC innovative technologies, enterprise applications, best practices and services [3]. However, most of such enterprises are behind in e-commerce sector and this issue must be a complicated issue for their competitiveness.

An e-logistics system can help SMEs in all areas of business, from customer service to new product design. It facilitates new types of web-based business processes for reaching and interacting with customer-online advertising and marketing, online, order taking and online customer service, etc. It can also reduce costs in managing orders and interacting with a wide range of suppliers and trading partners, as well as areas that typically add significant overheads to the cost of products and services [4]. When implementing an e-logistics system, it is critical to ensure two-way communication between the suppliers and customers on all aspects [5]. Drawing upon the aforementioned perspectives, a cyclic-process model for implementation of e-logistics systems for SMEs to help them build the EC capability is proposed in this study. By implementing e-logistics systems with EC technologies in the business processes among strategic business partners, SMEs can effectively integrate the cash, business, material, and information flows throughout the upstream and downstream of their supply chains [6]; thereby, it is essential to bring them from an isolated island into an integrated cooperative-competitive value networks. Through the implementation of such an e-logistics as for firms' EC capability in their own supply chain, SMEs can thus seamlessly communicate and cooperate with their alliance partners just like virtual organizations in the supply chains [7], [8].

2. The Implementation of e-Logistics Systems in SMEs

Today, most of the modern firms need to develop sound EC capabilities to reinforce the dynamic innovation competencies, achieve their business goals, and enhance their competitiveness [9]-[11]. However, how to implement and measure the performance of such capabilities is still a difficult problem in the way of achieving the goal of efficient customer response. Why use EC technologies to construct an e-logistics system for SMEs? We can firstly think about the processes of a supply chain in SMEs. A SME supply chain is a complicated network of firms and serial business processes for procuring raw materials, transforming these materials into intermediate and finished products, and distributing the finished products to customers. It may connect a number of suppliers, manufacturers, distributors, retailers and customers to delivery products and services from source through consumptions [12], [13]. Goods start out as raw materials and transformed into intermediate products and finally into finished products in the supply chain. The final products are shipped to distributors and from there to retailers and customers. Returned items are flown in the reverse direction from the buyers back to the sellers.

The upstream portion of the supply chain is a supply side for a manufacturing-oriented SME that needs to procure some raw materials, parts, intermediate products from suppliers, thus the enterprise can use these parts or raw materials to produce products or provide services. Materials, information, and cash flow through the supply chain in both directions. Ineffectiveness in the supply chain, such as parts shortages, underutilized production capacity, excessive inventory, or high transportation costs may be caused by inaccurate or untimely information [14]. On the other hand, the downstream portion of the supply chain is a demand side for a company, which needs to capture information of requirements from customers or retailers, and then they uses these information to make a production planning for scheduling, inventories, resources, human resources, researches and developments, finance, and sales [15]. Therefore, downstream of a supply chain exists the problems for outbound logistics and information management. Furthermore, it is critical for firms to systematically manage the inbound logistics and information management in an upstream of the supply chain; thereby, e-commerce technologies or enterprise systems may play a vital role

in the supply chains of SMEs. In order to effectively facilitate a SME's e-commerce, the implementation of e-logistics systems to improve the effectiveness of business processes is becoming a critical issue for SMEs [16].

In this paper, we propose a conceptual model to implement e-logistics systems for develop SMEs' EC capability as shown in Fig. 1. This model includes four methodical steps: defining and clarifying business problems of SCM, configuring IT architecture of e-commerce, deploying IT components and e-business model, and measuring and assessing the performance of e-logistics systems and EC capabilities. In this four-step cyclic approach, the first step is defining and clarifying business problems of SCM in SMEs to clearly describe the business problems such as the problems occurring in the supply, operation, and distribution of SCM in implementing e-logistics systems. Followed by configuring IT architecture of e-commerce as the second step, it considers the impact of using e-commerce technologies to solve the problems of e-commerce. Using different e-commerce technologies are able to deal with different problems and lead to different results. The third step of the conceptual model is proposed to integrated IT components to implement e-logistics systems in SMEs. This step can be used to explain various situations taking place at different integrated phases. Additionally, it is necessary to find out what kind of EC technologies can be adopted and when SMEs need to implement e-logistics systems. Finally, the last step is to measure and assess the performance of the. It can help SMEs validate the collaborative efforts of the implementation of e-logistics system for their sustainable competitive advantages [17]. This conceptual model can provide instrumental guidelines to assist SMEs in developing their own core EC capability through the implementation of e-logistics systems (Fig. 1).

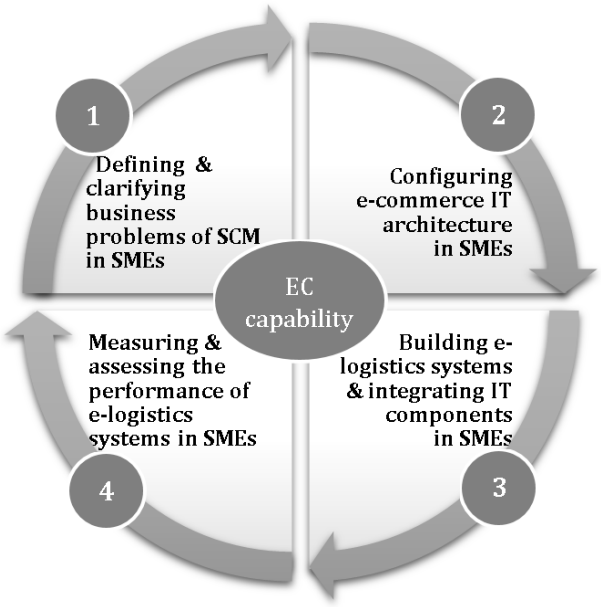

Fig. 1. A conceptual model for developing EC capability through e-logistics systems.

3. Defining and Clarifying Business Problems of SCM in SMEs

It is getting more complicated and difficult for the business processes in contemporary enterprises to be standardized than ever before. The major reason is that the processes in a business enterprise, even for a SME, may have multiple functions and objectives. For example, the procurement process for business production needs may involve some decisional issues regarding which supplier, which price or what quality is the best fit for business enterprises to adopt [18]. Prior research in e-business implementation signified that a few businesses have failed in gaining the benefits from e-business transformation [19]. In reality, the

vendors of software implementation did not promise that they can build business successfully. Failed to use e-commerce not only wastes a lot of time and money and may even damage the trustworthiness of business partners [12]. Finally, it will affect the model of B2B or B2C operation and communication. As a result, the managers of SMEs need to clearly describe the business processes and carefully clarify the problems in implementing e-logistics systems in the supply chains. Accordingly, there are many decisional issues and problems that may occur in the daily operations of the upstream portion (i.e., inbound logistics) and the downstream portion (i.e., outbound logistics) in a supply chain. Defining these problems could be useful for all segments throughout the business processes among strategic partners of the supply chain to construct the electronic business processes [9].

Ross [20] proposed a strategy through the perspective of supply chain partnerships to help us to define the business problems in e-commerce that requires SMEs' management to think over their functions of supply, operation, and distribution as an integrated pipeline. As for the functional activities for a supply chain are regarded as a water pipeline through supply chain from upstream to downstream. These processes can be modified and redesigned as a serial of electronic processes. For example, the original procuring process may need five steps to be done. The firm can implement an enterprise system such as an ERP system that includes module of procurement, and then the procuring process may be simplified from five steps to three steps or even one step. The e-business process is very critical for modern SMEs, since they can take advantage of these sorts of innovative processes to link each enterprise from demand side of customers to supply side of suppliers [11]. Each transformed process from isolated islands to an electronic group enables the enterprise to achieve successful e-business. However, acquiring understanding of the problems of the supply in business is not enough.

4. Configuring e-Commerce IT Architecture

In order to change, reduce, and add any different process in business, it always will confront with some challenges. Managers in SMEs need to carefully revise and design some key processes. Also, there may be some different opinions from lower level employees. Besides, the implementation of business process reengineering (BPR) will make business spend more money and time to implement, and BPR does not promise whether the implementation can success or not. Therefore identified the problems which exist in a supply chain is the first thing needed to be done. Next, different situations should be considered to build and choose different e-commerce technologies to solve the problems, such as in inbound and outbound logistics have different problems and processes. Thus, business should be decided which e-commerce technology is going to be used to solve their problems and then integrate these processes in a supply chain. To achieve joint optimization of key SCM decisions, it is preferable that a free flow of all relevant information across the entire chain leading to a comprehensive analysis. An overview of information flows through e-business technologies in a supply chain. E-business technologies facilitate information sharing either in supply chains using a number of technologies (e.g. ERP, POS, and/or VMI). Further, the focus of information sharing is helping to integrate and coordinate decision making in supply chains [21].

In addition, enterprise resource planning (ERP) systems were integrated as a business processes for enterprises. These processes include internal and external processes. Internal processes include order process, financial process, research and development process, and human resource management process. External processes such as deliver process, supplier's management process, quality of outsourcing markup language (XML) as a delivery technique, performing electronic document interchange. In addition, point of sales (POS), vendor management inventory (VMI), and collaborative planning, forecasting, and replenishment (CPFR) systems can be used to connect retailers, wholesalers and/or distributors. Retailers use POS systems to capture each transaction record from customers in every day. All of customers' records

are collected and aggregated. Thus, these records could be transformed as some important information for decisions making [14], [15].

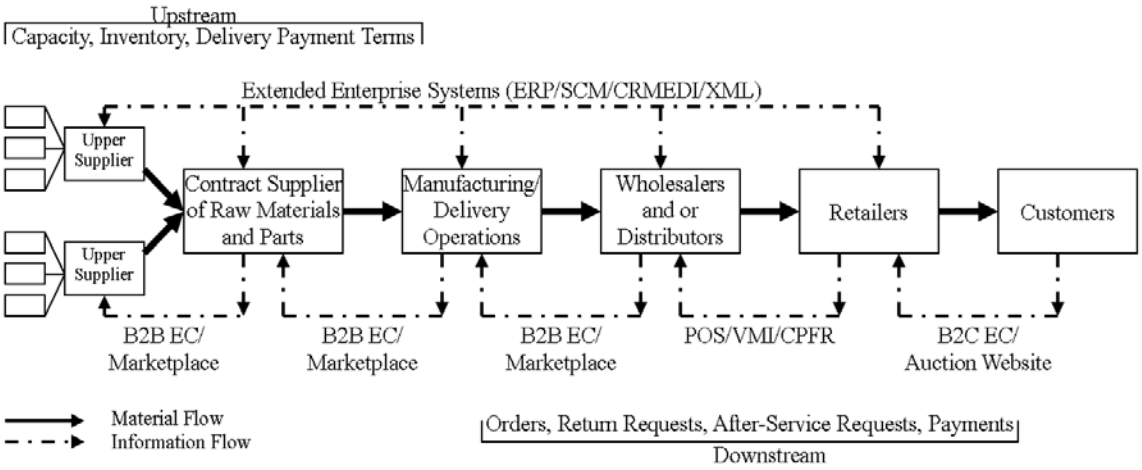

Fig. 2. EC technologies in a supply chain.

Based on these aggregated transaction information, SMEs in a supply chain (Fig. 2) could analyze rules of transaction and discover customer behavior. Also SME retailers could provide new or suitable merchandises for customers just in time. At first, an auction website let retailers could perform each transaction on a web site such as E-Commerce, in B2C auction; it provides a friendly interface for customers to use easily. Selling products on internet is not only considered to provide a new ways for customers to submit their orders on internet but also considered to provide a new way of customer services. On the other hand, B2C auction also likes B2B auction is used as a bridge between suppliers and manufacturers to be an e-marketplace or an e-procurement. Then, point of sales (POS), vender management inventory (VMI) or collaborative planning, forecasting, and replenishment (CPFR) systems can capture each transaction data and provide real time information for wholesalers or distributors in the upstream of a supply chain. Wholesalers or distributors of upstream can use the information to produce products and also know the requirements of the retailers at the same time. After ordering these products, upstream distributors or wholesalers can automatically deliver products to retailer, and the best part is retailers will never need to worry about running out of products. The major contributions of these systems are to provide an online mechanism of replenishment for wholesalers or distributors of upstream and retailers of downstream [16].

5. Building B2B2C e-Logistics Systems and Integrating IT Components

When business finds out there will be problems on supply chain, and know the impacts of choosing a suitable e-commerce technology, the business will start to consider or plan their process of implementation such as building phases and IT components. The e-logistics system-building phase is shown in Fig. 3. It involves material flow and information flow. The information flow represents customer needs that are requested from customers through distributors, manufacturers and then to suppliers. The materials flow represents the distribution and logistics for products, from suppliers to customers via manufacturers and distributors. Both materials flow and information flow are not directly from customers to supplier, or directly from supplier to customers, it exists in a cycle of a supply chain. Building of an e-logistics system, there are three-phase strategies as follows:

1) Un-integrated e-commerce stage: this stage represents that a supply chain has not been electronically integrated yet. That is a traditional trade environment. The connection between upstream and downstream used traditional ways, such as telephone, fax or post mail. In this stage, the phase for e-Business foundation is very important. It affected whether the implementation of e-Business can

success or not. The electronic infrastructure, for instance network structure, internet, software, hardware and so on, needs to be done. E-Business tools can be used including ERP, BPR, KM and business intelligent systems.

2) Integrating e-commerce stage: Setting an integrating center to integrate upstream and downstream manufacturers. The reasons are suppliers and distributors were easily controlled, the information of the end users were properly noted and logistical arrangement were smoothly made. In this stage, the IT applications of suppliers and distributors include: (1) suppliers: EDI for industrial and commercial aspects; (2) distributors: electronic data synchronization (EDS), vendor managed inventory (VMI), advance ship notice (ASN), electronic invoice, and electronic funds transfer (EFT).
3) Integrating B2B2C e-commerce stage: this stage is also setting manufactures as an integrated center, which combines the final customers with retailers. This is because that the final customers' needs or information is more uncertain than the upstream. In this stage, SMEs should focus on customers or retailers using collaborative planning, forecasting and replenishment as electronic tools.

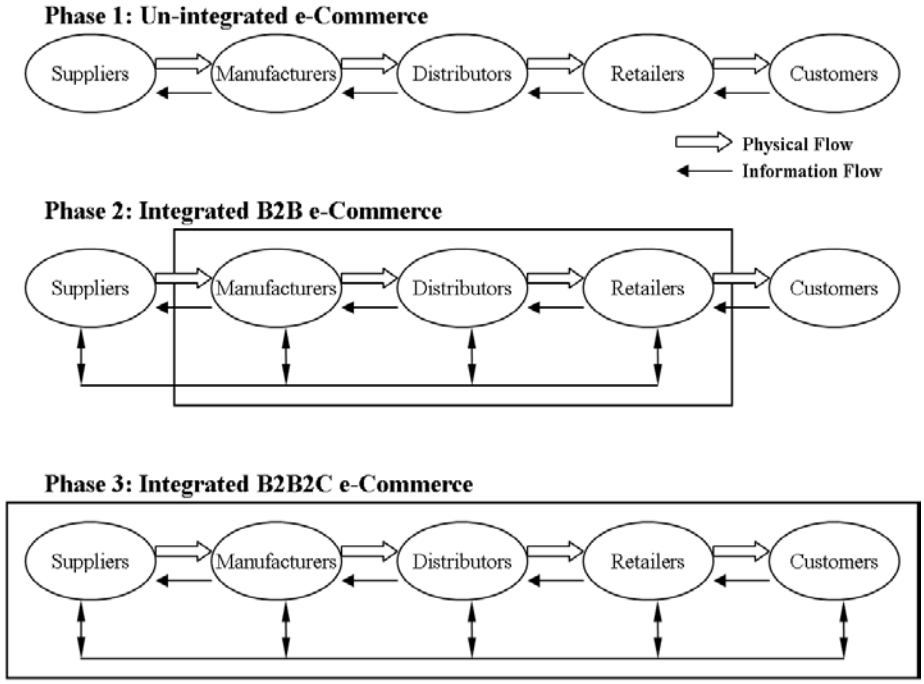

Fig. 3. The building phases of B2B2C e-commerce with e-logistics systems in SMEs.

6. Measuring and Assessing the Performance of e-Logistics Systems

The e-logistics system is an industry-wide initiative, which is commonly believed to have fallen far short of its promised efficiency and values. The level of internal and external changes requires making desired outcomes. A reality has been underestimated and poorly understood by prospective participants. While change slower than desired state, many firms collaborate effectively and achieved significant results through coordinated activities of supply chains [22], [23]. Managers of SMEs should understand the problems that may occur in the supply chains; then realize how to define and clarify these problems from inbound and outbound logistics; and thereby, they configure the appropriate e-commerce technologies to solve the problems in their own supply chains. In building phases, the built IT components were proposed in an e-logistics system; however, building phases and IT components is just only a concept for e-Business in a supply chain. It is essential for implementation of e-logistics system in e-business strategy to measure its performance in the e-logistics system.

Appropriate measurement and assessment of the performance of e-logistics systems enable SMEs to

greatly improve their own sustainable competitive advantages [17]. The measurement and assessment approaches for e-logistics systems across the firms of a supply chain should be viewed as extremely important issues to maintain foci in collaborative efforts. The measures must be well defined, consistently measured and related (either directly or indirectly) to the performance of e-logistics systems and the objectives of the collaboration of a supply chain. A good performance measurement and assessment mechanism for evaluating the implementation of e-logistics systems keep all interested parties focused on the aspects of performance that make an impact upon the success of new or on-going partnerships [20]. It is critical for SMEs to integrate the measures including cross-functional, multi-organizational measurement vision, accurate performance data shared regularly between participating firms. Besides, the multiple, cascading measures that capture cross-functional performance, measures aligned with internal budget allocation as well as internal/external reward structures, and a focus on creating customer benefits.

Moreover, in order to develop a network of improved communication, examining SMEs' ability to generate accurate information, share information internally, and determine the degree of external information sharing. Those requirements for this form of information sharing are a high degree of trust across firms of the collaborating supply chain. When logistics problems occurred, the management team could quickly assess the cause of these problems on the key accounts and could either solve the problems before it affected the customers or developing a contingency plan to share with the customers. This action improved customer service greatly because it reduced the anxiety that negatively affected customers regarding late deliveries, and back orders. This form of collaboration of supply chains will require a new technological infrastructure that offers a variety of attributes such as low cost connectivity, flexibility, systems and channel integration, analytical tools, e-business exchange, and information security.

7. Implications and Conclusion

In this paper, we propose a conceptual model for building an e-logistics system for SMEs' EC capability development. The conceptual model includes four cyclic steps. The first step is to define the business problems for the supply chains in SMEs. Second, SMEs have to configure the IT architecture to determine which business process needs to be transformed and which type of EC technologies and/or enterprise applications needs to be adopted and implemented. Third, we present three developing stages to elucidate the scopes of the supply chains that can be integrated; then different IT components were employed in the integrated stage of the e-logistics systems strategy. Finally, we propose the related perspectives for measuring and assessing the performance of the e-logistics systems. This conceptual model can provide instrumental guidelines to assist SMEs in developing their own core EC capability by identifying the potential of adopting e-commerce to be competitive in the industry. The buildings of e-logistics systems are able to facilitate SMEs in all areas of business functions from customer service to new product design. It facilitates new types of web-based business processes for reaching and interacting with customers-online advertising and marketing, online, order taking and online customer service. Moreover, it can reduce costs in managing orders and interacting with a wide range of suppliers and trading partners, as well as areas that typically add significant overheads to the cost of products and services. Integrated design, production innovation and image building, and integrated marketing of EC capabilities are all areas where Taiwanese SMEs tend to be relatively weak. The Taiwanese government could help by fostering the development of related service industries to support SMEs' efforts to upgrade their EC capabilities by developing e-logistics systems for the supply chains. Supporting powers and activities continue to display many areas of weakness, particularly with regard to the provision of market information, payment and financing services, intellectual property rights management. In these areas, SMEs need assistance from governments to build up an environment conducive to the development of these activities.

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