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Developing an E-Logistics System: A Case Study

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Abstract

Third-party logistics (3PL), a relatively new industry, has gained momentum since the emergence of global market and the Internet, in particular Electronic Commerce (E-Commerce). Global competitiveness places more pressure on companies to improve their delivery performance of products and services to customers. In an effort to improve the quality of delivery service, companies have outsourced their logistics services including packing, warehousing (inventory management) and shipping of goods to customers. Communication plays an important role in integrating the activities along the logistics value chain. Information technologies such as Electronic Data Interchange (EDI), the Internet, World Wide Web (WWW) and E-Commerce have contributed greatly to improving communication with partners in the logistics chain. In particular, real-time information systems such as web-based logistics information systems help to improve 3PL services. In this paper, a case study of E-Logistics is used to illustrate the implications of Information Technology (IT) in particular the Internet, WWW and EDI on the performance of the logistics value chain is presented. A framework based on the literature survey and case study is proposed to help companies develop an E-Logistics system to improve their competitiveness.

Keywords: E-Logistics, Framework, Case Study.

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1. Introduction

In today's highly competitive environment, many companies are entering the global arena to gain market share and take advantage of higher production and sourcing efficiencies. E-Commerce has brought new challenges, as well as opportunities to logistics management. The cost of logistics and transportation has a large impact on a company's profitability. A global market, outsourcing, and operations place tremendous pressure on the logistics function to deliver the goods as quickly as possible at the lowest cost (Gunasekaran and Ngai, 2004a). Therefore, a key determinant of business performance is the role of the logistics function in ensuring the smooth flow of materials, products and information throughout a company's supply chain (Sum et al., 2001). More recently, logistics has become more prominent and is recognized as a critical factor in competitive advantage due to the nature of a physically distributed operations environment and global markets.

Logistics can be defined as an operational process that includes inputting, storing, transporting and distributing physical goods (Stratton, 2001). E-Logistics is an Internet-enabled logistics value chain designed to offer competitive logistics services including public warehousing, contract warehousing, transportation management, distribution management, freight consolidation (Gunasekaran and Ngai, 2003; Hesse, 2002). Over the years, logistics has developed from single party logistics (self-managed) to Third-party logistics (3PL) using a logistics network. 3PL is contractual logistics focusing on regional operations. The main objectives of outsourcing logistics services are to: (a) reduce operating costs, (b) meet demand fluctuations, and (c) reduce capital investment¹ (Chiu, 1995; Calza and Passaro, 1997; Hess, 2002; Gunasekaran and Ngai, 2004b). The general problems that arise in corporate logistics include delayed and inaccurate information, incomplete services, slow and inefficient operations, and high product damage rates. This indicates the importance of accurate information exchange among different parties along the logistics value chain. Under such circumstances, the role of information technologies including the Internet, World Wide Web (WWW) and Electronic Data Interchange (EDI)

¹ http://www.tntlogistics.com/EN/about_tnt/social_responsibility/

in providing shared-information platforms for improving logistics performance is significant (Ngai and Wat, 2002).

The key component in the setting-up of an E-Logistics system is developing a logistics community network with suitable Internet technologies. Leung et al. (2000) present a framework for such a network, extending the traditional Business-to-Business (B2B) e-commerce to e-commerce at the industry level. The framework provides a virtual market for agents of the air cargo industry, enabling them to develop and engage in integrating their logistics operations. None of the studies, however, seem to have discussed E-Logistics and its development with the help of a case study.

E-logistics (Internet-enabled logistics) and logistics business process outsourcing are the subsets of a larger external logistics market, part of the supply chain. The supply chain is an integrated business model for logistics management. It covers the flow of goods from suppliers through manufacturing and distribution chains to the end consumer. Schary and Coakley (1991) point out that Information Technology (IT) is a two-edged sword. The increasing power of communication systems makes intra-organizational integration possible in order to improve coordination between organizational units. In recent years, information systems (IS) have been regarded as resources to support various business processes (Alshawi, 2001). Alshawi (2001) highlights the role of the Internet, Intranet and Extensible Markup Language (XML) for enhancing money flow visibility and supply chain visibility. In the literature, few studies deal with 3PL using a web-based information system in a logistics value chain. E-Logistics can be defined as an Internet-enabled 3PL value chain which can provide the best logistics services to customers.

In this paper, an attempt has been made to highlight the importance of logistics in global competitiveness along with the implications of IT including the Internet technologies (such as email and www) in 3PLs. A conceptual framework for E-Logistics based on a literature survey is developed. A case study conducted with a logistics company in Hong Kong is presented as a tool for determining the IT framework needed for IT integration and support of the business partners and highlighting the reasons behind the success of E-Logistics, that is, Internet-enabled logistics value chain operations. The organization of

the paper is as follows: Section 2 presents the background of the research. A conceptual model for E-Logistics is presented in Section 3. The purpose of the case study presented in Section 4. A summary of findings and conclusions is presented in Section 5.

2. Background for the Research

Global competition in the twenty-first century is forcing companies around the world to reexamine their logistics operations and systems with the objective of reducing costs and improving customer service. Increasingly, the most popular strategy in logistics is to outsource one or more logistics activities/services to 3PL firms (Gibson and Cook, 2001). 3PL firms may perform any logistics activity at any point in the supply chain. Logistics activities most frequently outsourced by manufacturers and merchandisers include outbound and inbound transportation, freight bill auditing/payment and warehousing (Stratton, 2001). Since different parties are involved in logistics services, communication between them becomes complex. This difficulty can be overcome by the use of various information technologies including the Internet, email, WWW, and EDI.

In the new economy, which is characterized by globalization and is information intensive, the focus has been on core competencies, providing real-time information, globalizing service demand, visibility in key performance indicators, collaborating in supply chain operations, and developing E-Logistics. Rao et al. (1993) discuss the role of 3PL in the operations of global firms. They found that international logistics for commodities involving limited complexity in logistics handling were most likely to be outsourced. The complexity in terms of the product and geographical mix approach had little bearing on the use of 3PLs.

Globalization highlights the significance of outsourcing in organizational competitiveness. Given the role of logistics and its global dimension, it is useful to study the implications of the Internet technologies for 3PL. Martinsons (2002) studied the prospects of e-commerce in China and illustrated the nature of e-commerce with Chinese characteristics by profiling an online retailer, a traditional B2B intermediary, and an electronic marketplace or Marketplace. Feraud (1998) points out the similarities between the strategic management of information technology and logistics information management,

and then reports the research conducted in two large-size European companies on the role of logistics in achieving competitive advantage through Information System (IS). Through a survey of a case company and 44 other retailers, Chiu (1995) presents an integrated framework with help of a literature review and case study for distribution firms to improve their distribution systems and highlights the role of IT including point-of-sales (POS) systems, bar-coding, EDI, value-added networks (VANs) and electronic ordering systems (EOSs) in improving the efficiency of the logistics value chain. Dawe (1994) reports the findings of empirical research on the current and planned adoption of IT in logistics activities of global manufacturing firms and key determinants of this adoption which should include the size of the company, the degree of performance evaluation and the department responsible for logistics functions, and the level of integration within the context of the supply chain.

The impact of e-commerce on logistics service providers has been discussed by Delfmann et al. (2002). They argue that the logistical implications of e-commerce can be classified into two main categories: the rise of e-marketplaces, and the elimination of supply chain elements (disintermediation). Virtual logistics resources can be traded in the way most goods are traded by companies and individuals. With the help of information technologies such as the Internet and WWW, resources can be purchased, utilized remotely, and lent or sold when supply outstrips requirements (Clarke, 1998). With virtual logistics operations there is much more flexibility in the allocation of resources, and this means that the resources available can be made equal to the resources actually used.

The integration of IT with logistics management is an important prerequisite for good logistics management (Calza and Passaro, 1997). An electronic commerce portal can be used as a marketing channel in collaboration with existing intermediaries or through bypassing intermediaries—disintermediation will provide high leverage opportunities to the logistics function and increase its flexibility. Hence the development of E-Logistics becomes essential for success in global operations (Hesse, 2002; Aldin and Stahre, 2003). Gudmundsson and Walczuck (1999) discuss the development of electronic markets in

logistics with logistics brokerage systems (LBS). LBS is an open online information and integration system for transportation and logistics services, offering customs and financial links, pricing, space availability, booking capability for freight door-to-door and a single point of payment through clearing houses.

Damsgaard (1999) examined the air cargo industry in Hong Kong, where an electronic trading network was launched in the mid-1990s with considerable success by four international airlines. He identified two critical success factors: (i) the electronic network limited its service to carefully preserve the distribution of power among the stakeholders, and (ii) the system took advantage of the four founding airlines' local strongholds as points of departure.

E-Logistics consists of four important components: (i) one-stop value-added services, (ii) management of electronic information, (iii) a transportation network and (iv) automation in warehousing operations (See Figure 1). In logistics, customer satisfaction can be improved by one-stop value-added services. This requires an integrated value chain to be linked to a customer-care advocate, so that customers can receive all of the required services with just one contact with suppliers. For example, in government services, one-stop services allow you to find out any council service, to make enquiries and applications, to pay your bills etc., - all under one roof. A 3PL also provides multiple value-added services, including product assembly, packaging, re-packing, re-filling, labeling sorting, quality control, etc to comply with local regulations.

Insert Figure 1 about here

E-Logistics can be defined, then, as: a logistics community network consisting of third-party logistics service providers including warehousing and transportation networks with suitable information technologies such as EDI, the Internet, wireless and mobile communication technologies, WWW and Radio Frequency Identification (RFID) with the objective of providing one-stop value-added services to customers.

Van Hoek (2001) presents the experiences of UPS Worldwide Logistics (WWL), a company that had implemented a Fourth Party Logistics (4PL) model which was based on the integration of information in logistics and transport operations. Anderson Consultants define 4PL as “a supply chain integrator that assembles and manages the resources, capabilities and technology of its own organization with those of complementary service providers to deliver a comprehensive supply chain solution”². 4PL is the integration of all companies involved along the supply chain.

Web-based logistics information systems have several advantages, as less human intervention is involved. This minimizes errors in the exchange of information, hence facilitating good decision-making (Delfman et al., 2002; Leung et al., 2000). The advantages include: real-time inventory information, single data entry to minimize human error as the data are input by the customers themselves with no need to reenter the data, real-time online ordering functions, and multi-level password control so that different functions can have different access levels controlled by authorized people. The role of e-commerce models in developing virtual logistics chains has been highlighted in many articles (Graham and Hardaker, 2000). The most important requirements for using new technology are that a firm must understand the value added for its customers and that it restructures many of its business processes in order to receive its full benefits. Ligon et al. (1992) discuss the role of EDI in logistics services. However, only a limited number of articles have dealt with 3PL and the role of IT in improving logistics performance. In the following section, an attempt is made to develop a conceptual model for effective logistics management in a 3PL environment. The appropriateness of the model design is confirmed.

3. A Conceptual Framework for Developing an E-Logistics System

In this section, a conceptual framework for developing an E-Logistics system is presented. The objectives of E-Logistics are: (1) reducing operating costs, (2) meeting product delivery deadlines, and (3) improving customer services (Leung et al., 2000;

² <http://www.consafelogistics.com/News/guidetoterminology.aspx>

Gunasekaran and Ngai, 2004b). This framework has four major dimensions: (i) strategic planning, (ii) partnership formation, (iii) inventory management and, (iv) information management. All of the four dimensions are interdependent and have been identified as the major enablers of a successful logistics system to deliver the goods at the right time and at minimum cost. Figure 2 illustrates a conceptual model for the development of an E-Logistics System.

Insert Figure 2 about here

3.1 Strategic Planning

Companies are now focusing on strategic planning for logistics with the objective of developing long-term plans and changes to their organizational logistics operations and in turn to improve their competitiveness through good logistics services. Strategic planning, taking into account both external and internal factors that influence the logistics performance of an organization, requires the involvement of top management (Gunasekaran and Ngai, 2003). Strategic planning for logistics should support the long-term objectives and goals of logistics in terms of flexibility, cost effectiveness and responsiveness to changing market requirements. In logistics, strategic planning involves deciding on outsourcing logistics service requirements, making strategic alliances based on core competencies in logistics, deciding how to handle competitive pressures, planning the locations of distribution centers, and making budgeting and capital investment decisions in logistics, including the number of distribution centers and warehouses, and transportation capacity (Clarke, 1998; Feraud, 1998).

Strategic planning for E-Logistics should be based on developing suppliers related to logistics and core competencies in providing various logistics services. This plan should leverage the application of EDI, the Internet and WWW in integrating the activities of partnering firms along the logistics value chain. Key Performance Indicators (KPI) need

to be established for selecting partners with the objective of providing an E-Logistics service with all the necessary IT infrastructure and skills.

E-Logistics requires strategic alliances between partners who provide different logistics services all over the world. An e-commerce platform should facilitate networking among suppliers/partners by sharing information on opportunities and threats, and on overall business performance. Top management is responsible for strategic planning in E-Logistics. For example, the criteria used to select partners for E-Logistics companies may be different from those of traditional logistics companies. Partners in E-Logistics should include clients, customers, transportation firms and agents. All partnering firms should be brought into a single e-commerce platform with a view to providing competitive logistics services to all the clients, as well as to the customers. Focusing on the customer base will help in locating the distribution centers and in selecting partners with different sub-logistics services accordingly. The aim is to provide competitive services with the required flexibility and responsiveness.

3.2 Partnership Formation

Many companies are decentralizing their operations by outsourcing logistics service requirements. However, the recent trend indicates that companies consolidate their service offerings through merger and acquisitions. The aim is to achieve lean production or operations in both manufacturing and logistics by focusing on core competencies. This will help make a company more flexible and responsive to changing market requirements. The main idea here is to focus on the core competencies of one's organization as well as one's partners to deliver products on time and in the most cost-effective manner. The real challenge is how to select suitable partnering firms (Clarke, 1998; Gunasekaran and Ngai, 2004a, b). There are several (strategic, tactical and operational) criteria that should be used in selecting partners. The partnership is not only with suppliers, but also with customers/clients in order to develop an integrated logistics system. For 3PL companies, the customers are companies wanting to distribute their products to targeted markets or customers, as well as consumers from the downstream link of the logistics chain (Graham and Hardaker, 2000; Leung et al., 2000; Rao et al., 1993). Suppliers of various services

should include companies involved in transportation, order processing, loading and unloading, consolidation and trucking and information service providers.

It is well-known that partnerships can increase the portfolios of E-Logistics service firms. Partners are seen primarily as a means to gain a better reach in the market through technology, financial or manpower resources. The key technology partners are the data-hosting providers. Financial partnerships are mostly with the parent companies, while transportation or delivery manpower is usually outsourced to local transportation agents.

The reasons for outsourcing logistics to a third-party include: limitations in one's logistics technology and information systems; capital constraints such as warehousing investment, computer equipment investment; enhancing customer satisfaction levels via hub, Just-In-Time (JIT), and Customer Relationship Management (CRM); and freeing up resources to focus on one's core business (Sum et al., 2001). Suitable partnerships based on resource requirements can overcome these constraints to offer productive and agile logistics services that will enable companies to compete in the global market.

For E-Logistics, information is needed on product characteristics, customer requirements, and partners' services and performance in terms of cost, quality, flexibility and responsiveness; offering logistics services at competitive prices. Many Small to Medium Sized Enterprises (SMEs) become partners in a logistics chain as they offer a variety of logistics services for order fulfillment. For example, strategic partnerships with big logistics companies such as DHL, FedEx and UPS will help to develop an information technology platforms that would support E-Logistics services. Also, considerable advantages such as a larger customer-base, technology transfer and diffusion can be accrued by becoming a service provider to those global logistics companies. It is important to make sure that both the clients and partners have the right information technologies such as EDI, Intranet, Internet and Extranet, electronic banking, electronic payments, and on-line information services to provide integrated E-Logistics services..

3.3 Inventory Management

Inventory management is still considered the most important managerial task in logistics operations. At the end of business processes in goods-producing companies, materials are exchanged. Therefore, inventory management plays a significant role in making products available at the right time, at the right place and, of course, at minimum cost. Inventory management involves the planning, co-ordination and control of material flow along the logistics value chain. Basically, this involves determining what to store, where and how much (Gunasekaran and Ngai, 2004a, b). Good inventory management requires effective ordering and physical count systems. This, in turn, requires systems, such as Manufacturing Resource Planning (MRP II), Distribution Requirements Planning (DRP) and Enterprise Resource Planning (ERP). The management of inventories should also include the equipment for the handling of goods and materials (Tarantilis and Kiranoudis, 2002; Sum et al, 2001). There is no doubt that IT/IS such as MRP II, RFID, and ERP have helped to manage inventory along the supply chain in a more cost effective manner and made possible the provision of improved logistics services to customers.

Inventory management in E-Logistics requires real-time information so that the volumes and locations of different materials can be tracked and updated. A web-assisted inventory control system will help all the parties involved in logistics services and in the control of material flow by determining the volume, timing and locations of the goods that should be made available. Classifying goods into ABC items can help control inventories with a much better focus on important products. Enterprise resource planning systems such as SAP, BAAN, Oracle, JD Edwards and PeopleSoft will play a major role in planning for materials flow along the logistics value chain. Inventory control methods such as JIT and Kanban help minimize inventory costs and, at the same time, provide a high level of customer service by delivering goods in the right quantity, at the right time and at the right place. Packing and consolidation can be done such that the levels of inventory can be managed and transportation costs reduced. This will result in more resources being made available at competitive prices and in increasing demand for logistics services. This will also help a company to understand and meet customers' expectations.

3.4 Information Management

Good logistics management is heavily reliant on the availability of accurate information. IT plays a major role in bringing all parties, including customers and suppliers, to a single platform in an integrated logistics system to provide cost-effective and quality logistics services. The importance of IT in logistics management is highlighted by the fact that customers can track, trace and generate advanced logistics reports so that timely decisions can be made and corresponding actions taken. Many companies are trying to develop a seamless information system so that more accurate and timely information can be exchanged to help decision-making and provide competitive logistics services (McFarlan, 1984; Alshawi, 2001; Dawe, 1994; Gunasekaran and Ngai, 2004a; Leung et al., 2000; Ligon et al., 1992). Several commercial information systems are available for use in planning distribution requirements. With the help of the Internet, logistics has become global and that too with shorter delivery cycles (Liao and Cheung, 2001). Nowadays, web-based information systems are widely used to track orders and communicate with both customers and suppliers to help companies to stay competitive internationally (Strader et al., 1998; van Hoek, 2001; Gunasekaran and Ngai, 2004b).

The Internet, Intranet, Extranet and WWW are enabling tools in the emerging digital economy. For E-Logistics, a suitable information system, in particular, a web-based system, is essential for providing competitive logistics services. Effective E-Logistics requires identifying potential markets and partners, shared IS for gathering data about markets, advertising, conducting transactions between suppliers and customers and integrating the activities of extended enterprises (Strader et al., 1998). A global positioning system (GPS) can be used to pinpoint shipments in transit, whether they be by rail, truck or sea. It can track and monitor the transportation assets and cargo from origin to destination throughout the journey.

An E-Logistics management system consists of (i) warehouse management systems which perform inventory control, replenishment, reverse logistics and invoicing; and (ii) a fleet management system that performs task assignments, route planning, scheduling, load planning, order-tracking, etc. Depending upon the scope of the logistics companies involved an appropriate information network that supports electronic brokerage and

contracting, electronic meetings and collaboration including electronic payments and banking, business transactions and on-line information services, is essential. B2B2C e-commerce can be used for integrating the activities of suppliers and customers along the logistics value chain. This demonstrates the importance of Internet, Intranet and Extranet technologies.

4. The Case Study

The conceptual framework developed in the previous section for effectively managing an Internet-enabled 3PL has been studied with the help of a case study conducted at a logistics company called E-Commerce Logistics (ecL), located in Hong Kong. ecL is a privately owned company established only five years ago. The details of the case study are presented in the following sections:

4.1 Company Background

ecL, headquartered in Hong Kong, has service centers in North America and Europe. The company is Greater China's leading provider of technology-enabled logistics and order fulfillment solutions. ecL aims to provide a 24-hour service in customer care, warehousing, order processing, transportation and logistics, seamless real-time data management and provision of technology expertise to meet the varied needs of each link in the supply chain - from suppliers through to manufacturers, distributors, direct marketers and end-consumers. This company has been successful in a short-span of time and has become an active service provider for many well known companies. The company currently operates and manages four logistics and fulfillment centers; two in Hong Kong, a 200,000 sq. ft. facility in Taiwan, serving over 30 active clients from global electronic manufacturers to international cosmetic brands to retail chain stores, and a facility in Shanghai, which has been fully operational since March 2002. The company employs about 80 people. It also has three distribution centers, two of which are in Hong Kong and one in Taipei.

In the coming months, ecL plans to open more facilities in Guangzhou, Beijing, Wuhan, Shenyang and Chengdu. They recognize that mainland China is a key area for both

consumption and manufacturing, and that Hong Kong companies have high demand for mainland – bound distribution services.

4.2 Data Collection

Mr. Edmon Fung Cho Kie is the Chief Operating Officer (COO) of ecL. He has over 23 years of operating experience in customer service, order fulfillment and warehouse operations throughout Greater China. To collect data, we interviewed him, Mr Johnny Leung of ecL (Managing Director), and several senior managers (who are responsible for strategic planning, supplier development, inventory management, information management and customer service), at the company's premises in Hong Kong with a set of questions based on the model discussed in the previous section. The data collection was centered on how the company has been successful in leveraging the applications of IT, especially the Internet and Web-based information systems in their logistics operations. In addition, several secondary sources, such as the company's website and annual reports were referred to. The data collected did not just focus on IT, but also on how the company has evolved right from the beginning, and their strategies and development. We believe this information will be useful for other companies to make use of when pinpointing the critical success factors in developing Internet-enabled logistics systems or E-Logistics.

The questions (see Appendix I) developed for the interviews were based on the aim of the paper, viz., to study the implications of IT, especially Internet-enabled logistics (E-Logistics), on 3PL operations. These questions semi-structured and were defined based on the framework for E-Logistics. Several companies were considered, but finally ecL was chosen because it seemed to have excellent experience in utilizing a Web-based logistics information system and had demonstrated results. The questions were designed to elucidate the key strategies, tactics and technologies for developing and managing an Internet-enabled 3PL.

4.3 The Case Analysis

The case study method has been popular in IS research as it provides a detailed account of the experience and activities of a company involved in a process of change. The objective of this case study is to discuss the conceptual model developed in the previous section and to investigate how a company has been successful in E-Logistics with the help of an e-commerce or web-based information system. ecL has used a four-flow concept: (i) information flow, (ii) materials flow, (iii) property flow, and (iv) cash flow. While information, materials and cash flows are well known, the term property flow indicates the flow of various movable assets, including equipment and vehicles used in different transportation channels. The utilization of available transport capacity in distribution of goods plays an important role in inventory control and transportation costs.

4.3.1 Strategic Planning for Logistics

ecL began providing logistics services in 2000 and covers five components of E-Logistics, including (a) order management, (b) return management (reverse logistics), (c) deliveries, (d) warehousing and distribution, and (e) other services, such as business consulting. The company has a reputation among local multinationals for being dedicated to providing a total supply chain service linking both local and global marketers. ecL's major critical success factors include: agility to open new markets (for example, Greater China), owning many warehouses in Greater China that are connected to an on-line real-time inventory system, and implementation of a Customer Relationship Management (CRM) applications system. It also plans to upgrade its service provisions to encompass more e-supply chain processes, which implies an integrated supply chain system offering one-stop services.

ecL aims to deliver goods on time and so focuses on logistics information management to reduce delays anywhere along the logistics value chain. Management of costs plays a predominant role in logistics management. ecL uses real-time logistics information systems to control their logistics operations and their costs. They also have a large warehouse in Shanghai to take advantage of being closer to the market/customers and reduce the overall cost of distributing the products. They have developed a tailored Business-to-Business (B2B) e-commerce system (e24hours.com); their main strategy is

to avoid conflicting information about available stock and physical inventory. They were able to improve their customer service level by measuring the percentage of defective products, physical inventory and net available products for immediate delivery to customers. They do have a problem with the lack of specifications from customers and suppliers of goods. With the support of Artificial Intelligence (AI) and Expert Systems (ES), and a database for standards and specifications, this problem can be overcome.

4.3.2 Partnership Development

ecL targets local multinational companies with B2B businesses, and helps SMEs to develop their businesses so that ecL can create a market for its logistics operations. They support collaborations with SMEs. The bulk of ecL's customers (85%) are B2B customers. ecL has a dedicated accounting manager for long-term customers while the other customers are handled on a project basis. ecL's customers include a host of wine distributors and manufacturers of electronic goods and cosmetics products.

ecL selects its partners based on their ability to understand the logistics requirements of ecL's customers (opportunity alignment) and integrate them into E-Logistics services (ability to gain share). Attributes under "opportunity alignment" should include: current market share, potential for market dominance, a product and services portfolio, and compliance with industry standards. The attributes under "ability to gain share" should include: customer perception, financial strength, globalization, market trend, partnership strength, service capabilities, value adding, and sales and marketing strategies. Nevertheless, the application of IT/IS should be considered while developing partnerships, not only simply looking at the final services to be offered to customers or clients (such as timely delivery of goods), but also examining their organizational infrastructure, including IT/IS and skills available such as the Internet, E-Commerce, WWW and EDI, and availability/presence of knowledge workers. Without considering these factors, there will be a lack of integration between suppliers along the logistics value chain. From these perspectives, the companies that ecL selected as partners must be on the Web and have the necessary expertise in E-Logistics services.

4.3.3 Information Systems

ecL uses an inventory cycle count system. Their transportation operations are well integrated with their web-based information system. They have not received any government support, which seems to call into question the traditional view. However, they have received support from their clients who are seeking entry into the Greater China market. The cost of warehousing and labor is very high in Hong Kong, which is why ecL chose to have its warehousing operations in China and Taiwan.

ecL barcodes all items. They have a main bulk storage area for heavy items and a detailed picking area for loose items. There is also an area to store fast-moving items. In the warehouses, ecL has web-based cameras that allow its customers to physically view their stock online. ecL uses the IBM AS/400 hardware technology, iadvantage, for its data centers. It has one of the largest data centre networks in the region and has its own vehicle fleet for Hong Kong deliveries, but uses FedEx for overseas deliveries. This demonstrates the role of IT/IS in making a small company like ecL a big player in logistics operations along the line of virtual logistics.

Formerly, ecL used to have two to three weeks' worth of safety stock. Since the implementation of a B2B logistics information system, they have reduced the safety stock level to just two days. This represents a dramatic improvement in performance. Financial transactions have also become much easier and more secure. ecL has very good cash flow at this stage. Also, their partners are on the Web, helping to improve integration with their partnering firms. Since the consolidation of goods is done in real-time, this helps to reduce duplication of effort.

The capabilities of ecL for managing customer demand and business development are presented in Tables 1 and 2. Table 1 presents a list of successful strategies/technologies adopted by ecL to effectively meet the demand of customers. For example, ecL has used a web-based monitoring platform for real-time visibility of customer products. In order to improve its flexibility and responsiveness, the company has many stock-keeping units (SKUs), and distributes goods in small quantities with many deliveries using 3PL management. Also, KPIs such as time to deliver the products, number of orders fulfilled

on time, provision of faultless invoices, cost of distribution, etc have been used for transaction-based costing, which have ultimately led ecL to being able to provide high quality logistics services at competitive prices. Table 2 indicates how ecL was able to develop their business more effectively. For example, through the web-based platform/Warehouse Management Systems, ecL was able to understand thoroughly the customer's core business. Also, ecL has developed a call centre with CRM to improve its relationship with customers. ecL has invested in providing comprehensive professional education and training to develop knowledge in e-commerce on the part of its staff.

Insert Tables 1 and 2 about here

The ecL Web platform has resulted in the following advantages: (a) provides real-time inventory information, (b) provides real-time order status checking, (c) single data entry to minimize human error – the data input is handled by the customers themselves with no need for re-entry by ecL, (d) offers multi-level password control (ADMIN-order approval; ORDER – order placement and online enquiry; ENQUIRY- online enquiry only), and (e) provides real-time inventory information. Through a Web browser, users can retrieve historical order data easily and efficiently.

4.3.4 Inventory Management

At their warehouses, ecL classifies the items into ABC items such as high, medium and low turnover products, so that critical items can receive due attention. Also, from the human resources point of view, people have problems with understanding the complex information system. That is why ecL decided to go for a simple and effective web-based real-time information system for their logistics operations. The online real-time inventory control system allows customers to control stock directly via the Internet. Updated stock information and delivery information is easily available in the system.

The company believes in an information system that is easy to use and develop. They are in the process of migrating to mobile commerce using Palm for electronic signatures to reduce delays in delivering goods. There are 20 stages in their logistics operations and all

of these stages are integrated. They are looking into developing 5PL (which is multi-party logistics using logistics networks) in China. They evaluate their operations performance by computing the value and amount of goods in transit and not in the warehouse. ecL has KPIs in place for monitoring the performance of their operations and their overall performance in various areas of their logistic operations. They have been able to improve their overall financial performance by 17% with the help of their real-time information system.

5. Summary of Findings and Conclusions

In this paper, a conceptual framework for E-Logistics was first developed on the basis of a literature survey and some reported case experiences. The case study concluded at “The framework distinguishes the necessary dimensions that a logistics company must have to offer an integrated, online service for its customers”. The main objectives of this research were to: (i) understand the current and emerging issues of logistics operations and their role in organizational competitiveness (ii) develop a conceptual model for E-Logistics, (iii) study the model with reference to an emerging E-Logistics company, i.e., the case company in Hong Kong, and (iv) summarize the overall findings.

Based on the case study and its results, the following were seen as critical success factors for E-Logistics: (1) application of a real-time logistics information system to improve communication along the logistics value chain, (2) a web-based inventory control and ordering system, (3) supporting SMEs to develop their business (strategic alliances), (4) vouching customers, (5) location of the company, (6) development of relationships with large-scale logistics companies, such as DHL, FedEx and UPS, (7) focusing on the customer-base, (8) networking and relationship management, (9) having a B2B2C E-Commerce system for 3PL, (10) receiving good capital support from partners, (11) blending expertise in IT and industry, (12) business partnering, (13) understanding customers, and (14) government initiatives. The theoretical and practical implications of our findings are discussed below.

5.1 Theoretical Implications

The framework presented in this paper opens up many avenues for further research to study the conceptual framework with more empirical evidence such as a questionnaire-based mail survey with logistics companies. Although we proposed a variety of IT/IS for developing E-Logistics, a model needs to be developed based on this logistics paradigm to identify the right technologies given the organizational strategic goals and infrastructure available. There are many issues which should be addressed with appropriate analytical models for optimizing the logistics system configuration given the implications of web-based logistics information systems. Strategic planning has been considered as very important in managing any system including E-Logistics. However, this poses a great challenge for selecting the optimal strategic choices taking into account the corporate objectives/goals. Partnership formation is not a new approach, but E-Logistics requires a different set of criteria in selecting the partners including the geographical location of the company, technological infrastructure and expertise available as well the organizational choice of logistics productivity and competitive performance objectives. The next major theoretical implications come from the application of existing models for managing inventory in E-Logistics environments. Now the important question that needs to be addressed in E-Logistics inventory management is what the decision variables, parameters and optimization criteria are. E-Logistics architecture will vary from company to company based on the nature of their business and strategic goals. This offers opportunities to develop a framework for determining an optimal architecture for E-Logistics system.

5.2 Practical Implications

ecL aims to provide a one-stop service for total E-Logistics services, linking global merchants and direct marketers to their customers. As noted earlier, the main reasons for outsourcing are: (1) to reduce operating costs and (2) to meet fluctuations in demand. Companies in the new economy are focusing on core strengths, providing real-time information, globalizing service demand, visibility in KPIs, collaboration in supply chain operations, and e-commerce development. It is also important to have partners with a

clear understanding of the local market environment. Credibility and reputation are two key criteria that E-Logistics services firms aim for when selecting partners. Adherence to timeliness and thoroughness in performance is just as important.

E-Logistics poses numerous managerial challenges in terms of establishing strategic alliances based on core-competencies while developing a logistics value chain. Moreover, how the logistics component of the value chain can be integrated with the rest of the supply chain needs to be addressed so that an integrated business process can be achieved. The behavior and role of logistics managers will be different in E-Logistics from those of traditional logistics systems which are based on centralized resources. E-Logistics is based on an IT/IS integrated 3PL system, so the manager's function in E-Logistics will be more of knowledge management involving close control over the strategic operations of 3PL and leveraging the application of web-based logistics information systems.

Now managers of E-Logistics face the question of what the suitable performance measures and metrics are that need to be used in controlling the operations of their system with the objective of providing reliable and fast services to global customers. Enterprise resource planning systems have their own modules to manage logistics functions and in that case, how the managers will interact to reach more informed decisions which will effectively contribute to providing world-class logistics services should be studied. Furthermore, the type of education and training required to operate in an E-Logistics environment should also be investigated so that the right skills can be made available for managing E-Logistics systems productively. Incentive schemes need to be developed so that appropriate scales can be used to evaluate managers for their contribution in providing quality logistics services in E-Logistics environments. Data mining and warehousing require the certain of data which need to be collected and stored in E-Logistics in specified formats. Some key performance indicators may be helpful.

In summary, successful 3PL management is vital for competing regionally and globally as IT/IS provides the information linking the different logistical functions throughout the logistics value chain. We see IT/IS as an enabler in logistics management to get the right products to the right place in the right quantity at the right time, and to provide quality

services to satisfy the customer's needs. There is no doubt that E-Commerce is the catalyst across the supply chain network. From our literature review and case analysis, it is clear E-Commerce has an enormous impact on the performance of a logistics system. It changes and redefines some traditional roles in a logistics system from cargo ordering, invoicing, to global cargo tracking, monitoring, etc.

E-Logistics will grow exponentially in the future and this development will drastically affect pricing and charging schemes in the industry. The overarching critical success factor of the logistics industry under the new economy is establishing an information-based supply chain that improves continuously and provides flexibility and responsiveness to changing customer requirements. We see IT applications like the Internet, WWW, and E-commerce as a major source of logistics productivity.

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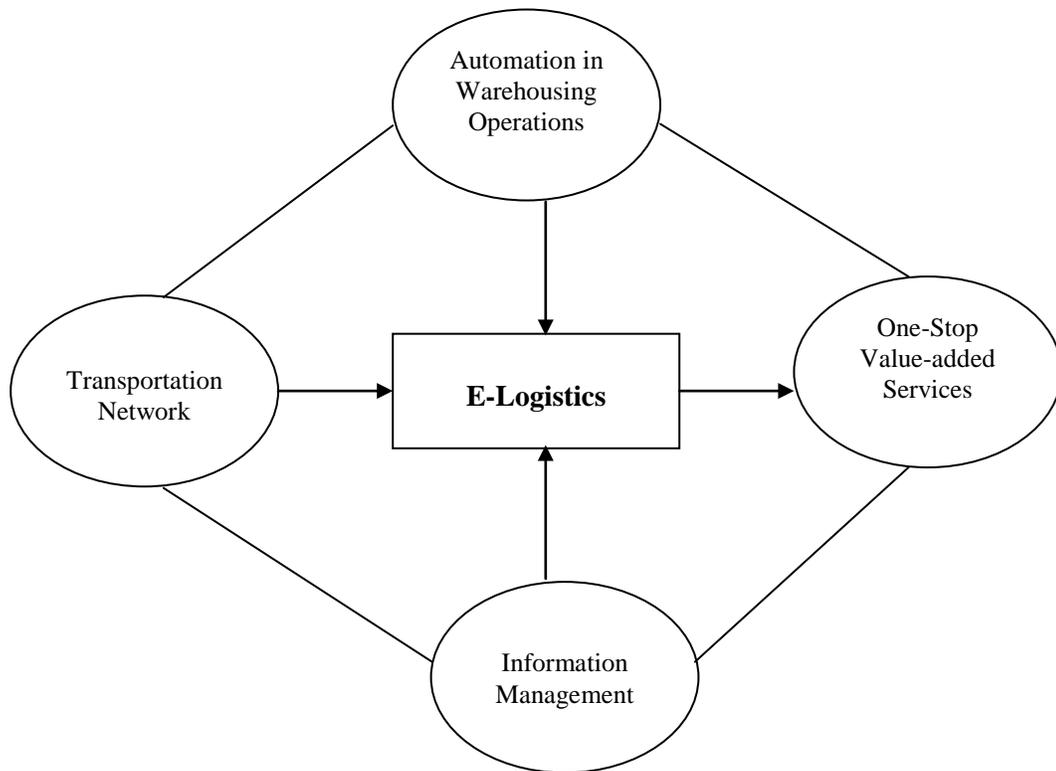


Figure 1: A Conceptual Framework for E-Logistics

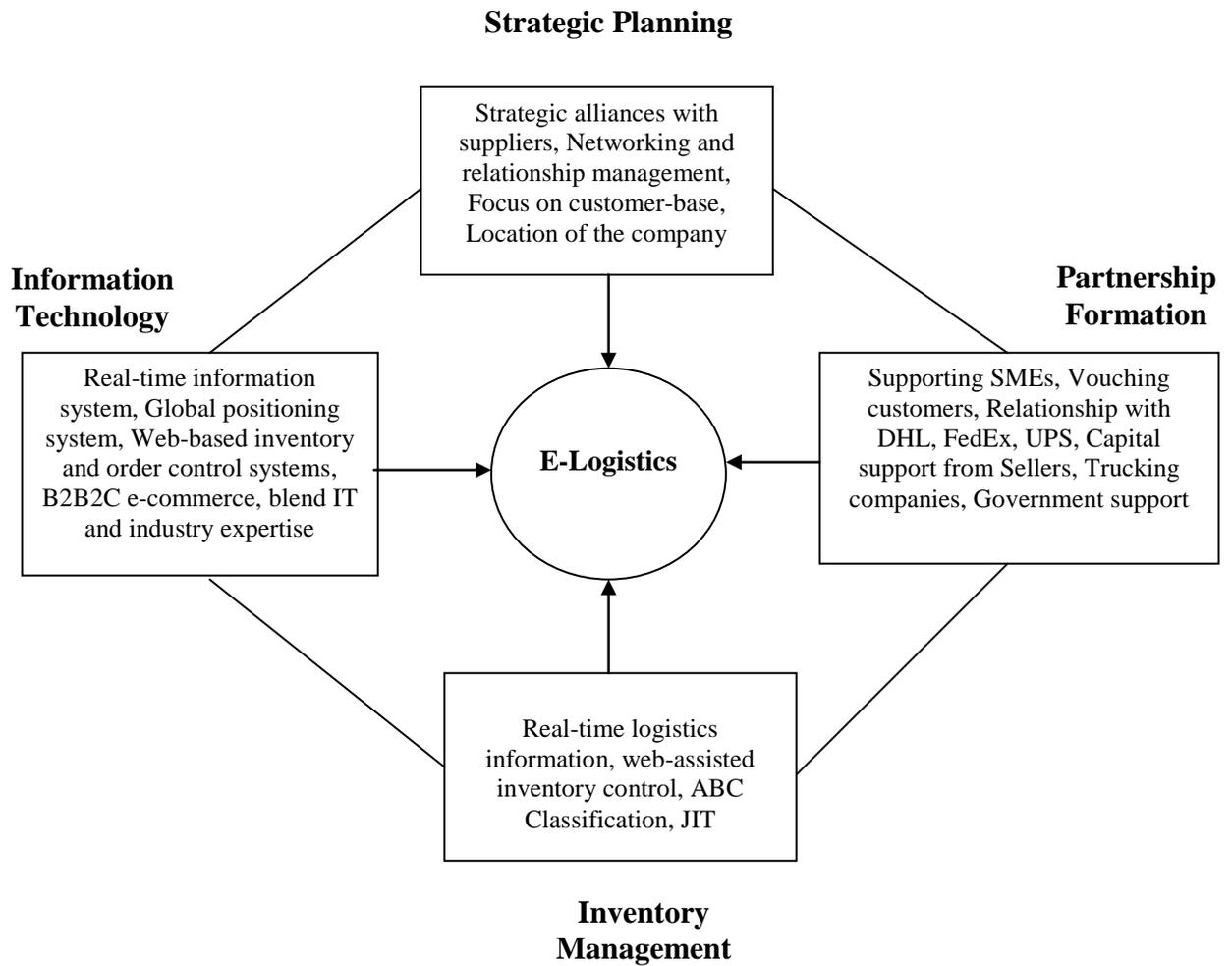


Figure 2: A Framework for the Development of E-Logistics

Table 1: ecL Capabilities to meet Customer Demand in 3PL

Customer Demand	ecL Capabilities
Real-time visibility	Web-based monitoring platform
Many SKUs, Small Quantity Orders with many deliveries	3PL management
Transaction-based costing	KPI handling
Flexible charging scheme	Charge based on online ordering and per item

Table 2: ecL Capabilities for Business Development in 3PL

Business Development	ecL Capabilities
Thorough understanding of customer's core business	Web-based platform/Warehouse Management System
Globalized development	Web-linked regional distribution centers
Customer Relationship Management	Call centre with CRM capabilities
Staff Knowledge of E-Commerce	Providing comprehensive professional training

Appendix I: Semi- Structured Questionnaire for the Case Study

General Information about the Company

Section 1: Strategic Planning

What are your company's objectives and mission?

Who are your customers? (Global Operations!)

What are value-adding activities are performed?

How do you deal with reverse logistics?

What are you future strategies and plans to expand your business?

How do you evaluate your own performance? (Performance measures)

What you think is the most challenging in today's logistics operations?

What is your future strategic planning?

What are the factors that contributed to your success in logistics business?

What is the focus of your logistics services?

Section 2: Partnership Formation

Who are your partners? (What criteria you use to select your partners)

How do you select your partners for your logistics chain?

Do you network with SMEs?

How the relationship with large 3PL such as FedEx, DHL and UPS will affect the performance?

What you think about the role of Government would support small logistics companies?

Are you outsourcing your transportation service requirements?

Section 3: Inventory Management

How do you manage customer demand with your inventory?

What inventory model you use? (For example, JIT)

How do you manage your warehouse storage space?

How do you deal with the delays in delivery or damages, etc?

What type of information system for inventory management you have?

Do you have web-based information system for inventory control?

How do you management your inventory using ABC classification?

Section 4: Information Technology

What types of IT systems you use? (Applications?)

To what extend you use IT in your operations? What are the different of IT systems?

What are the advantages by implementing IT (including Web-based) in your logistics operations?

Do you have global positioning system?

Do you use any standard ERP system in your logistics operations?

What is your future plan about e-logistics?

Any comments on e-Logistics?