

INTEGRATION OF E-COMMERCE AND SUPPLY CHAIN: A NEW BUSINESS MODEL

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ABSTRACT

Supply chain management is an essential strategic approach for companies that pursuing global e-commerce. This paper first discusses various activities that involved in global supply chain management process. It then illustrates the ways that e-commerce to be integrated into supply chain management to gain competitive advantages in dynamic business environment.

Keywords: E-commerce, supply chain management, functional integration

Introduction

A supply chain is “a set of three or more companies directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer” (Mentzer et al., 2001). Since there are more than three parties involved in the process, supply chain management is essentially the management of the relationships and activities among organizational level members. Therefore, supply chains need to be managed as a whole in order to achieve better customer services and more revenue at lower costs, while satisfying various constraints set by companies (Vorst et al, 2000).

Structuring the supply chain requires an understanding of the demand patterns, service level requirements, distance considerations, cost elements and other related factors. Since these factors are highly unpredictable, they need to be carefully monitored during the supply chain analysis process. In essence, there are six key elements within the supply chain process: production, supply, inventory, location, transportation and information. These key elements are further elucidated next.

The production element of the supply chain process focuses on customers and market demands at strategic level, and also on workload scheduling to meet immediate demand of customers in the market. The supply element of the supply chain process centers on maintaining facilities to produce economically and efficiently to meet customer’s demand. Companies have to carefully select their suppliers in order to maintain low cost and high flexibility. The inventory element of the supply chain process concerns the level of product inventory in house. Too much inventory

could impose high inventory cost. On the other hand, insufficient inventory to meet market demand could cause the loss of potential revenue and customers. This is one of critical issues in supply chain management. The location element in supply chain process focuses on the placement of production plants, distribution, and stocking facilities in the served market. The transportation element deals with the decisions of delivering products or services to the customer quickly and economically. The information element refers to the linking of information resources throughout the supply chain process.

Managing supply chain process encompasses major challenges due to the complexity of the interaction among organizational members and the information incompleteness for decision making. One of well recognized issues about information distortion on market demand is referred to as “bullwhip effect”. Information distortion often arises when partners apply local information to forecast market demand and then pass such information to upstream partners. In the mean time, the partners may perceive the uncertainty of supply condition that leads them to exaggerate the orders. Figure 1 shows that the distortions are amplified from one level to another in a supply chain (Lee and Whang, 2001).

Bullwhip effect is one of the major causes of supply chain inefficiency. Lee et al. (1997) indicated that information and management can provide the ways of remedy for these effects. In the sphere of information and technology, the visibility of demand among partners throughout the supply chain and the electronic linkages could create order and transparency.

Increasing Order Variability Up the Supply Chain



Figure1. Information distortion and Bullwhip effect (Lee and Whang, 2001)

In the last decade, several forces that compelled companies to determine their supply chain strategies, including globalization of business, proliferation of product variety, short product life cycle, and complex supply networks. To stay competitive, companies have to achieve greater coordination and collaboration among their supply chain partners. Information technologies, particularly the Internet, play an important role in attaining the goal of supply chain integration. Many retailers have integrated Internet technology into their business model. The emergence of the e-commerce channel of retailers will have profound impacts on supply chain. By integrating

e-commerce technology into supply chain management may lead to better asset utilization, faster time to market, more satisfied customers, and higher return on asset.

The main purpose of this paper is to investigate the impacts of e-commerce technology to supply chain management. It then further identifies the competitive advantages of integrating e-commerce into supply chain process.

The Evolution of Supply Chain Process

At the beginning of the last century, supply chain operations were similar to that of paper chains since it linearly connected manufacturers, warehouses, wholesalers, retailers and consumers. Supply chain ranged from one or two to dozens of tiers that made logistics a nightmare. People and paper were physically connected at all tiers together within the supply chain. Furthermore, the linear nature of the supply chain made communication between its front-end and back-end more difficult and time consuming.

Until mid-1950's, the field of supply chain management was in a state of dormancy. The fields of production and manufacturing were given uppermost attention. The inventory was the responsibility of marketing, accounting and production areas. The order processing was an accounting's or sales' responsibility. This fragmented process resulted in a great deal of confusion among functions of production, marketing, accounting and finance.

In 1958, Forrester (1958) introduced a theory of management that recognized the integrated nature of organizational relationship in distribution channels. Because organizations are so intertwined, he argued that system dynamics can influence the performance of functions such as research, engineering, sales and promotion. Forrester (1958) proposed that "there will come general recognition of the advantage enjoyed by pioneering management who have been the first to improve their understanding of the interrelationships between separate company functions and between the company and its markets, its industry, and the national economy" (Mentzer, 2000). The issues that Forrester identified that associated with what we call it today - "supply chain management". The term supply chain management (SCM) has risen to prominence in the past ten years. SCM becomes a hot topic across different research areas such as manufacturing, distribution, marketing, customer management, and transportation.

In today's business world, the effectiveness and efficiency of handling a company's supply chain process is essential to corporation's success and survival. With Internet related technologies abound, companies should have the opportunities to integrate e-commerce into their existing supply chain to reduce their operational cost. While most of today's supply chains are still highly fragmented and run either on expensive EDI network or inefficient phone and fax links, Internet related tools provide much more potential for organizations to optimize and streamline their supply chain operations (Kathawala et al., 2002).

The Impact of E-commerce on Supply Chain Process

E-commerce possesses two different formats: B2C (Business to Customer) e-commerce and B2B (Business to Business) e-commerce. B2C e-commerce refers to transactions take place between business and end-user consumers. B2C e-commerce contributed to the rapid growth of the Internet in late 20th century. During that time, a large sum of venture capital flowed into the construction of e-commerce business model. However, while the capital markets turned sour, the B2C e-commerce companies were among the first to fall. Although a lot of dot-com companies were out of business at the beginning of year 2000, there were still some niche businesses that have already enjoyed the fruit of online success. It can be predicted that, in the future, consumer businesses could still thrive through online business model, but not as big and fast as initially predicted.

B2B e-commerce refers to online transactions between business and other businesses. A B2B exchange usually involves information exchanges among companies that buy and sell to another using a common technology platform. A service provider in the marketplace may also provide payment and logistics services to assist their members to complete a transaction. Research suggested that successful e-marketplaces are able to profit from transactions that focusing on transaction fees as a main revenue source (Ordanini, 2006)

E-commerce has changed the nature of conducting business in many ways. “Internet time” is ticking much faster than the time in traditional business cycle. In order to gain their market share, companies have to make their products to reach the market faster than their competitors. The speed of process execution affects company’s outcome to attract more profitable customers. For this reason, companies conduct business faster than before become one of the attractive characteristics of e-commerce.

E-commerce also enhances the network effect among market sellers and buyers. Through the Internet, suppliers and customers are interconnected. Companies can reach to a mass of customers through the Internet in a cost-effective way. Connectivity provides a level of interaction that was not efficiently achieved in traditional business environment. With a characteristic of market access and connectivity, e-commerce allows companies to break their geographic barrier. Companies are no longer to be restricted to their geographic locations while doing business.

E-commerce technology provides information visibility through out the supply chain. The integration of production planning, scheduling, and inventory control with procurement process makes the loop complete. Because of information visibility, suppliers could possess the information of customer demands, in the mean time, customers can receive faster feedback of transaction status from their suppliers. Such strong impact causes companies to incorporate the information visibility into their competitive advantage (Rayport and Svokla, 1995).

The nature of e-commerce accessibility has changed market structure. The emergence of the electronic marketplace provides an opportunity for manufacturers to market their customers directly, that eliminated the need for traditional channel intermediaries. At the same time, new “cybermediaries” stepped in between trading partners. Therefore, the market dynamics changed.

The shifting of environment and dynamism is likely increasing uncertainty for business decision makers.

In order to resolve this problem, Golicic et al. (2002) claimed that business strategy that emphasizes on relationship management enables managers to better manage uncertainty. In order to combat such uncertainty, companies operate in e-commerce environment should stress the relationship and strategic alliance for gaining stability and needed resources.

Integration of E-commerce and Supply Chain Management

The development of Internet technology has brought new business models into the B2B sphere. More and more buyers and suppliers are interested in the electronic market (EM) because the limiting factors of time and space seem to have been overcome by the new media. The evolution of information and communication technology has made the cyberspace a new marketplace.

The research interests of EM have grown in the last few years. Researchers' viewpoints of electronic market are somewhat varying. Some selected EM definitions are listed below:

“... is an inter-organizational information system that allows the participating buyers and sellers to exchange information about price and product offering.” (Bakos, 1991)

“... facilitating the exchange of information, goods, services and payments. In the process, they create economic value for buyers, sellers, market intermediaries, and for society at large.” (Bakos, 1998)

“EM represents a relatively neutral position between buyer and seller, providing services to both side of a transaction. An EM represents a virtual place where buyers and sellers meet to exchange goods and services.” (Segev et al., 1999)

“Bringing together huge number of buyers and sellers and by automating transactions, web markets expand the choices available to buyers, give sellers access to new customers, and reduce transaction cost for all players.” (Kaplan and Sawhney, 2000)

Grieger (2003) claimed that the unique feature of an EM is that it brings multiple buyers and suppliers together in one central marketplace. He further defined EM in two dimensions: institutional and social. In the *institutional dimension*, EM is a medium that (1) assigns different roles of buyers and suppliers, but also other roles like logistics service providers, banks and other intermediaries; (2) facilitates the exchange information, goods, services and payments; (3) provides an infrastructure – define protocols and processes that rule the interaction within the community, and provide a common language (Grieger, 2003). In *social dimension*, EM is a community that (1) consists of buyers and sellers; (2) can be described by certain conditions, including participants' knowledge, intention, contracts, and goods at certain time; (3) involves rights and duties; (4) intends to use market transaction exchange in order to change their condition according to their intention (Grieger, 2003).

The goal of supply chain management is to improve the performance in a variety of areas, for example, reduce supply costs, improve product margins, increase manufacturing throughput and

raise return on asset. By bringing buyers and sellers under one electronic marketplace, e-commerce will help improve the performance of supply chain management by procurement process automation, information sharing and collaboration among trading partners.

In the procurement process, a buyer-seller relationship involves the activities carried out to execute the buyers' purchase of a commodity. E-procurement is the automation of the purchase process (using specialized tools for the effect), in the access to suppliers catalogues in real time and having the Internet as the main communication channel.

A new B2B marketplace called "E-hub" that enables companies to reduce costs by automating transactions and expanding choices of suppliers. E-hubs use the aggregation mechanism to bring together large number of buyers and sellers under one virtual roof. They reduce transaction costs by providing one-stop shopping. For example, PlasticsNet.com allows plastic processors to issue a single purchase order for hundreds of plastics products sourced from a diverse set of suppliers (Kaplan and Sawhney, 2000).

Trading partners' relationship also involves a variety of information sharing mechanisms, including (1) the partners are given access to a system that has the shared information in it, and (2) one partner transmits shared information to the other partner (Grieger, 2003). Information sharing through Web server can be one-directional or bi-directional. For example, buyers can view the product information through Web-based catalog, or buyers can negotiate price with sellers through the Web. The goal of these types of information sharing is to find the lowest price of the needed goods from the available suppliers.

Lee and Whang (1999) proposed an information hub model (see Figure 2) to enhance the information flow among trading partners in supply chains. An analogy to the information hub in the physical logistics world is "cross-docking," a process in which products from multiple supply sources arriving at a logistics hub to be sorted in accordance to the needs of destination points. In a similar fashion, the information hub allows critical supply and demand data to be "cross-docked" and seamlessly forwarded to the right partners at the right time. The information hub is a node in the data network where multiple organizations interact in pursuit of supply chain integration. It has the capabilities of data storage, data processing, and push/pull publishing.

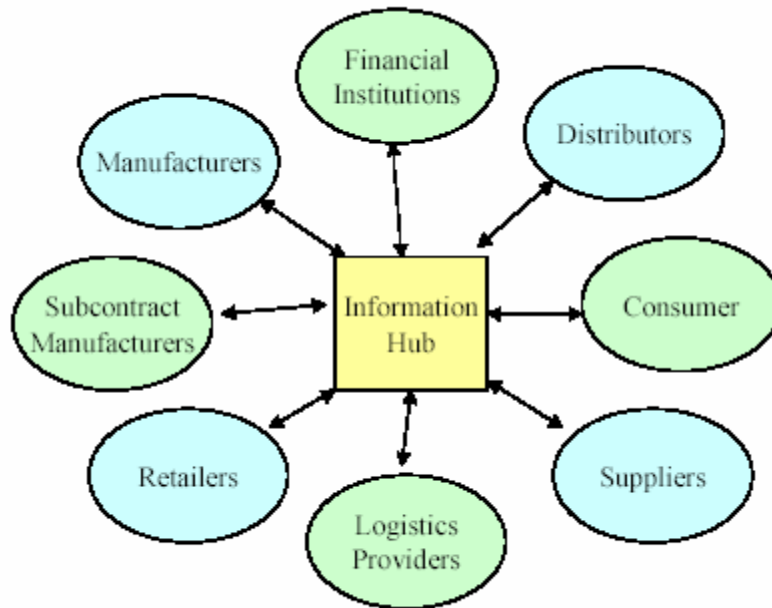


Figure 2: Information Hub Model (Lee and Whang, 1999)

The Scope of E-commerce Application: Business Examples

Companies can apply different scope of e-commerce application into their supply chain process. Hoek (2001) proposed that e-commerce application can be applied to supply chain through the following approaches:

- Partial - applications are limited to segments of supply chain.
- Integral – applications are integral throughout the entire supply chain.
- Operational - applications are limited to business transaction.
- Strategic- applications are essential part of business strategy.

The scope of Amazon's (www.amazon.com) supply chain can be categorized as partial and operational. Its supply chain utilizes information from the sales interface and then integrated partially into the logistics operations of its service providers, yet not through the whole supply chain. As a result, it lacks of reporting structure to identify emerging stock shortfalls. Basically, the information used at Amazon is to organize shipment and to order product, therefore, it is operational in nature.

UPS (www.ups.com) uses third-party logistics service provider, fourth-party logistics (4PL), to provide operational information for the strategic benefits of learning and crating competitive advantages. UPS collects information about the transportation and distribution stages of the supply chain to monitor transportation link and to identify the opportunity for lowering costs. This is an example of strategic approach for e-commerce application.

Nike (www.nike.com) has developed a supply-chain-wide notification system in which retail orders are shared with suppliers. When the Distribution Center receives an advanced notification of shipment leaving suppliers, retailers are notified the scheduled delivery of goods that are in the pipeline. As a result, the trading partners in the supply chain are connected and information are shared through e-commerce applications. Nike's application is integral, since the entire supply chain web is seamlessly integrated. However, the usage of information is operational.

Cisco (www.cisco.com) has been a successful company that integrates e-commerce to its supply chain process. With 74% of its sales conducted over the Internet, the company outsourced most of its sales to contract manufacturers and suppliers. An elaborate Web-based information system links Cisco and its supply chain partners that take care of the necessary information flows. The collaborative relationship also enables Cisco to ship 55% of its sales to customers directly from subcontract manufacturers, without stopping at Cisco's Distribution Centers. As a result, Cisco reduces its operational cost by lowering inventory and speeding up accurate order fulfillment. In addition, the feature of customer self-service enables Cisco's sales force to focus more on managing customer relationships and creating new customers, rather than the administrative aspect of its customer relationships. Hence, the e-commerce application of Cisco's is integral and strategic.

Conclusion

As Web technologies evolve, e-commerce has become a powerful and compelling enabler of supply chain integration that across a wide range of industries. The aspects of speed and connectivity of Internet technology have changed the nature of conducting business. Information visibility is achieved through connectivity among trading partners, therefore, supply chain can be better managed. On the other hand, speed and connectivity make market dynamic and uncertain. Under such circumstance, forming strategic alliance, managing relationship of trading partners and having collaborative relationship through supply chain are particularly imperative.

As the trend of global commerce continues, we will see more and more companies to adopt B2B business model in the near future. Integrating e-commerce into the existing supply chain is not only necessary for attaining companies' competitive advantages, but also for companies' survival in the globally competitive environment. Overall speaking, incorporating e-commerce into supply chain process could achieve the following advantages: reducing purchasing cycle time, cutting transaction cost, decreasing purchasing cost through the more competitive electronic marketplaces, enhancing the collaborations among suppliers and buyers through collaborative software, lowering inventory, fulfilling customers' demand faster, and boosting market access.

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