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Suhong Li
The University of Toledo

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Suhong Li
The University of Toledo
sli@pop3.utoledo.edu

Abstract

Electronic commerce (EC) acts as a greater enabler for supply chain management (SCM) and will totally change the way that companies manage their supply chain. It is of great interest to investigate how companies can apply EC to facilitate their SCM and further reap benefits from that. This paper aims to explore this issue. Through extensive literature review, the paper systematically discusses possible applications of EC in traditional (internal) and extended SCM. Some areas of applications of EC in internal SCM are identified as: Internet-based marketing, web storefront and purchasing, virtual warehouses, and online customer services. Some applications of EC in extended SCM include small and medium enterprise (SME) collaboration, supplier-assisted inventory management, supplier collaboration and management, customer interaction, Internet-based manufacturing system, enterprise channel integration and inter-supply chain collaboration.

Keywords: Electronic commerce, supply chain management

Introduction to EC and SCM

EC is the transacting of business information and data, between business and between customers, in order to more effectively and efficiently complete processes across the spectrum of a business (Davies and Garcia-Sierra, 1999). Generally speaking, EC includes business-to-business (B2B) and business-to-consumer (B2C). EC can take a variety of forms such as EDI, direct link-ups with suppliers, Internet, Intranet, Extranet, electronic catalog ordering, and e-mail.

EC has been used in the business-to-business sector for more than a decade. Large companies, which act as hubs for the data transmission, depend on EDI to streamline their processes in manufacturing, SCM, and logistics. EDI enables them to adopt sophisticated technologies such as just-in-time, quick response, and vendor managed inventory (DeCovny, 1998). Over the past couple of years, companies have been exploring opportunities to use the Internet, intranet, and extranets to exchange information, especially with small and mid-sized trading partners that find EDI too complex or expensive to implement (DeCovny, 1998).

The Internet has opened up new ways of doing business for companies of all kinds. The ability to place orders directly and perform B2B transactions at a low cost provided by the Internet is revolutionizing B2B and B2C transactions. It will no longer be possible operationally or strategically to ignore the information-based virtual value chains for any business (Shaw, 1999). One of the hottest business trends over the past five years has been for start-up companies to open as Internet only business (Amazon.com, Etoys) and for existing companies to rush to add web-based arms of their "traditional" business (Barnes and Noble, United Airline).

According to Forrester Research, Internet B2B sales will reach $1.3 trillion by 2003 and, by 2004, B2C sales will reach $1000 billion (Lord, 2000; White, 2000). With B2B e-business outpaces B2C by a factor of 10, to represent 9 percent of all U.S. business trade (White, 2000). No one in business today can afford to ignore the explosive growth of e-business. E-business is opening the door to unprecedented opportunities for building sales and increasing revenue streams by expanding geographic scope, reducing operating costs, improving procurement, productivity and supply chain efficiency (White, 2000).

But Gartner Group estimates that 75% of all e-business ventures will fail, due to lack of technological understanding and poor business planning. DeCovny (1998) reported true cyber-businesses are not making money yet. There are a number of issues that are limiting the business value of the Internet in the short time. Some commonly expressed concerns include reliability, security,

scalability, ease of use, and payment (Kilpatrick, 1995). Bandwidth is also an issue as the number of users rises and applications become increasingly bandwidth hungry (Roberts and Mackay, 1998; Deconvy, 1988). Many companies lack the resource to integrate the EC system with their internal infrastructure. Databases often are not integrated, and data warehousing systems and relational database systems can be extremely expensive. On the demand side, consumer behaviors prevent many people from supplying credit card details over public networks (DeCovny, 1998). However, despite the risks and high costs, today's companies have little choice but to address the Internet challenge (Lord, 2000). Today's EC investments basically are made to acquire new customers, build awareness, and specifically to build Internet brands.

In another hand, SCM has been rated high in manager' agenda. Advanced Manufacturing Research (AMR) in Boston, for instance, expects sales of SCM programs topping $14 billion in four years (Gibson, 1998). According to a recent Deloitte Consulting survey, ninety-one percent of North American manufacturers ranks SCM as very important or critical to their company's success, yet only 2 percent of the manufacturers in the same survey rank their supply chains as world class (Thomas, 1999). Xerox, Hewlett Packard, Allied Signal, and Siemens are examples of firms that have attempted to operationalize supply chain integration with varying degrees of success in their respective industries (Narasimhan and Jayaram, 1998). In today' competing business environment, it is no longer an option to better manage and integrate supply chain-it is a must. If a company is to be competitive in today's marketplace, supply chain excellence is required (O'Connell, 1999).

SCM is a process for designing, developing, optimizing and managing the internal and external components of the supply chain system, including material supply, transforming materials and distributing finished products or services to customers (Spekman et al., 1998). Companies that use effectively SCM have reduced operating expenses, increased revenue growth, and improved customer service level. Analysts' studies have shown that large companies that have completed supply chain improvement projects typically enjoy improvements in individual supply chain functions ranging from 10 to 80%, with the low end of range usually occurring in capacity utilization and the high-end improvements experienced in forecast accuracy and inventory reduction (Cross, 2000).

Today's competition is shifting from individual companies to entire the supply chain (Fingar, 2000). Competition is no longer company to company, but supply chain to supply chain. By its nature, SCM deals with networks of suppliers and channels of distribution. Upstart e-businesses are now redefining or eliminating activities in the physical network through the power of information networks (Cross, 2000). The traditional supply chain models and assumptions are fast becoming obsolete under the intense pressure of new electronically enabled era (Harrington, 2000). An EC platform allows an enterprise to extend supply automation to its suppliers' suppliers and its customers' customers, forming dynamic trading networks (Fingar, 2000). Furthermore, the level of adaptation and cooperation increasingly necessary in the supply chain means that electronic commerce takes on an increasingly critical role. An understanding of how EC can be deployed by firms to exchange information and to maintain and build relationships is important as it may impact on their ability in managing supply chain (Roberts and Mackay, 1998).

As two competitive weapons in today's business battles, the theoretical and practical values of EC and SCM cannot be ignored. It is important for us to understand how to integrate these two together, how organization should respond to take advantage of business opportunities brought out by EC and SCM. Unfortunately, the researches in this area are few and most of them appear in the popular press. This paper aims to address this issue. Through extensive literature review, this paper systematically discusses the application of EC in traditional (internal) and extended SCM and provides some guidance for organizations in effectively managing their supply chain using EC.

Applications of EC in Traditional (Internal) SCM

Traditionally, supply chain has been defined as the collection of activities from procurement of raw materials to production to delivery to the end customers. SCM is the coordination or integration of a series of activities/processes which procure, produce and deliver products and/or services to customers. Traditional supply chain focuses mainly on activities within a company, which has been named as internal supply chain. EC is changing the way that firms are managing their internal supply chain. This paper identifies four areas of applications of EC in internal SCM, which are internet-based marketing, web storefront and purchasing, virtual warehouses, and online customer services.

Internet-based Marketing

The Internet provides a dramatically different method of marketing products and services to customers. Businesses can now reach large audiences relatively cheaply simply by developing web pages showcasing their products and services. Furthermore, this marketing can be customized to the target audiences (Hoffman et al.,1997). As marketing and adverting medium, the web has the potential to radically change the way the firms do business with their customers by blending together publishing, real-time communication broadcast, and narrowcast (Hoffman et al., 1997).

Web-Storefront and Purchasing

 One of the first applications of EC involves the development of electronic storefronts. Companies such as Cisco or Dell computer have developed their web storefronts into major sales channels. Companies can reduce costs by launching an online catalog, which eliminate two major expenses: printing and distribution, and people to capture orders. That can enable company to offer better prices or get better margins (DeCovny, 1998; Shaw, 1999). Web purchasing software simplifies routine transactions, reduce paper handling, and provide an electronic communication framework for daily procurement activities. Web procurements cut out much of the red tape that slows down the replenishment process (Rumer, 1999).

As we know, most organizations' purchasing activities follow 80/20 rules. Essentially, 20% of the products represents 80% of the spend. But this does not correlate with activity levels- the majority of time is consumed on the smaller value items. Streamlining the procurement of these smaller items via EC dramatically reduces acquisition costs while freeing time and money for strategic purchases.

Virtual Warehouse

As the distribution center or warehouse lies at the very heart of most supply chains, the warehouse management systems (WMS) running these facilities is a critical piece of a company's overall success (Harrington, 2000). Richardson (2000) introduced the concept of virtual warehouse. Virtual warehouse focuses on the connectedness that allows a company to be confident in its delivery system. The result is a streamlined supply chain. In virtual warehouse, an EC web site's order management system is communicating with the firm's warehouse management system to coordinate inventories and shipping. Real time information flow is essential to a virtual warehouse (Richardson, 2000).

Online Customer Services

Companies can enhance the attractiveness of their traditional products and services by allowing their customers to access online customer support and consulting services, products or service-related information, training and updates (Angehrn, 1997). Networking giant Cisco Systems began its B2B web initiative in 1994 by introducing customers to the idea of online technical support. As inquires mounted, the company introduced the FAQ site to address common problems and questions. Now 79 percent of Cisco' tech support is handled via the Internet and customers can also configure their networking products and make purchases online (White, 2000). By putting as much of its customer support online as possible so that customers could resolve the vast of majority of their problems quickly online, while leaving Cisco's engineers free to provide support for more complex issues. Moreover, customer service is less expensive on the Internet, because customers can look up the solutions by themselves. That means few calls to the call center, fewer overtime hours and customer service representatives, lower costs, and better customer service (DeCovny, 1998).

Applications of EC in an Extended SCM

Extended SCM applications expand the scope of traditional SCM systems by coordinating multiple suppliers, internal/external SCM systems, and SMEs. An extended SCM system differs with traditional SCM in the extent to which a company can integrate with its suppliers and customers. By sharing information all the way from the point of sale to inventory levels of suppliers' suppliers, all participants in an extended supply chains system can gain competitive advantage and optimize performance and profits (Fingar, 2000).

EC has potential impact throughout the whole supply chain with a host of trading partners (Kalakota and Whinston, 1997) and has a pivotal role to play in the schema of supply chain integration (Davies and Garcia-Sierra, 1999). Fingar (2000) consider inter-supply chain collaboration, SME collaboration, and customer interaction and supplier collaboration as the shared business processes of extended SCM system enabled by EC. Cross (2000) points out some examples of how EC is shaping the physical network: such as supply and demand actuations, collaborative product design, cross-enterprise workflow processes, and demand management collaboration.

Synthesizing the findings of related literature review, the paper summarizes the possible applications of EC in extended SCM as follows: SME collaboration, supplier-assisted inventory management, supplier collaboration and management, customer interaction, Internet-based manufacturing system, enterprise channel integration and inter-supply chain collaboration.

SME Collaboration

E-commerce opens up new possibilities to involve SMEs in real-time supply grids (Fingar, 2000). SMEs represent a whole new world of potential suppliers that can be tapped as a result of Internet smashing the barriers of cost and complexity of traditional EDI-based systems. Even the smallest SME will likely have access to a fax machine and a web browser, because these simple touch points can be reached by the web, SCM business processes can be extended to virtually any SME, anywhere, anytime.

Supplier-Assisted Inventory Management

EC drives down costs in supply chain by enabling business to integrate their activities. Higher and higher degree of integration using EC can lead to a point where the supplier is given enough information by the distributor or consumers that it can make deliveries of "run-of-the-mill" replenishment items with almost no human involvement (Bushnell, 1998). This business concept is called supplier assisted inventory management (SAIM). Companies need go through four steps for implementing SAIM. The first step is product synchronization. This step converts product data into up-to-data, correct and complete electronic information, assessable without confusion by all parties systems. The second step is document transfer. From purchase orders to payments, commerce requires a wide of range of documents. To successfully adapt to an electronic world, industries must adopt standard electronic documents, so all the parties are operating on the same page. The third step is electronic inventory replenishment. With synchronized database and standard electronic documents in place, supplier and distributor can initiate electronic commerce by implementing systems for applications such as electronic inventory replenishment and forecasting. The last step is easy, seamless information exchange. Suppliers and distributors implement compatible systems that allow for the rapid exchange of accurate stock-level and consumption reports.

Supplier Collaboration and Management

The rich and low-cost of the Internet makes it possible to add new collaboration links with existing suppliers and their suppliers for forecasting, logistics, replenishment, bidding and ordering (Fingar, 2000). A given supplier may participate in multiple supply chains, and integrating information from them can give the supplier consolidated information used for planning and operations. Integrating business systems with those of suppliers helps to reduce transaction costs even further. Employees on longer have to mediate the transaction. Once approved, purchase orders can be routed directly into suppliers (Rumer, 1999). EC can help manufactures get better quality components. Every supplier transaction is recorded and, over the long term, this data can be analyzed to evaluate the quality of goods and the supplier chain relationship itself (Rumer, 1999).

In the past, the tools of SCM-phone, fax, and mail- shaped practices regarding vendor consolidation, competitive bidding, vendor qualification, and order quantity. Because of the time and energy required, companies had to make compromises in their searches for the optimal source and buying quantity for any given item or transaction. Today, the Internet's broad "bandwidth" and ubiquity of access allows migration where visibility across the network, which increases the chances that each participant will be able to choose the optimal partner for every transaction (Cross, 2000).

EC applications may be mapped to the framework to support different types of supplier relationships. Based on a case study of BT supply management, Roberts and Mackay (1999) developed a supplier relationship framework to categorize suppliers and select appropriate procurement strategies. Supplier management is differentiated by greatly simplified with commodity suppliers while reinforcing deeper relationships with strategic suppliers. Different electronic commerce applications have been used to support different types of supplier relationships.

Customer Interaction

As consumer-facing applications come online they must be integrated with the extended SCM systems. Ultimately, as such applications go live, the results can be customer-centered SCM. Customer information and behavior captured at the point of sale is the lifeblood of customer data warehouses and decision support systems. Through a customer self-service business model, fewer customer service personnel are needed as customer gain automated access to the overall supply chain. They can independently browse and price products, configure and order them, lookup shipment schedules and track delivery. The result is customer-driven supply chains and increased customer satisfaction (Fingar, 2000).

Internet-based Manufacturing System

The strategy requires electronic management of products and orders on the manufacturing floor, direct transfer of customer orders details to manufacturing personnel and equipment, tight electronic connections to suppliers and partners, and electronic product life cycle management (Mullin, 2000). E manufacturing include trading exchanges and design collaboration sites; web-enabled plant management applications that allow partners to monitor their orders; web-enabled controls and manufacturing equipment that support remote monitoring diagnostics and maintenance services; and program management applications to assist in project design and new product launches. Internet-based manufacturing delivers a significant competitive advantage by enabling process companies to link the shop floor, ERP systems, suppliers, and customers (Mullin, 2000).

Enterprise Channel Integration (Virtual Enterprise)

EC has make enterprise channel integration come true. With the web providing the links for sharing information among channel partners and the component technology providing the interoperability to integrate business, company will use more outsourcing in their business model. As a result, companies will concentrate on their specialized products while working closely with their supply chain partners through information technology (Shaw, 1999). Web-based collaboration systems cost-effectively automate many commerce transactions between trading partners, giving them a more flexible, cost effective, and powerful form of EDI. The success of a virtual enterprise requires the development of much higher level of trust between business partners; for example, information once considered confidential must be openly shared (Kernohan, 1999).

Inter-supply Chain Collaboration

Multi-division companies typically operate multiple SCM systems to handle multiple plants and distribution channels. Ralph Szygenda, CEO of General Motors, describes the situation: "A manufacturer, for example, can configure multiple supply chains to deal with the many suppliers, distribution and customer channels needed to reach a variety of customers around the globe. Value chains are being made into multiple-path, multiple node value webs". An EC can allow companies to share information across different supply chains and provide new opportunities for optimization across multiple, external supply chains (Fingar, 2000).

Conclusion

Through extensive literature review on EC, SCM, this paper systematically discusses the applications of EC in traditional (internal), and extended SCM. Applications of EC in traditional supply chain include internet-based marketing, web storefront and purchasing, virtual warehouses, and online customer services. Applications of EC in extended supply chain include SME collaboration, supplier-assisted inventory management, supplier collaboration and relationship management, customer interaction, Internet-based manufacturing system, enterprise channel integration and inter-supply chain collaboration. This study will provide some insights for organizations in effectively managing supply chain using EC technology.

Value networks of the future will use networked technologies and business processes to form and recast themselves in response to dynamic customer demands, optimizing their structure and performance at higher levels of efficiency and responsiveness. That will require the movement and management of vast amounts of knowledge in ways and to places not previously feasible or practical (Cross, 2000). Analysts predict the way companies manage their supply chain will continue to change with each technologies advancement and new Internet business model. What won't change is the fact that SCM is an increasingly critical element of running a successful business online or off-line (Democker, 2000).

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