

THE IMPACT OF E-COMMERCE IN SUPPLY CHAIN MANAGEMENT AT DELL INC.

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Abstract—The impact of e-commerce in supply chain management (SCM) has gained significant interest in researchers and academics in recent years since e-commerce and SCM are critical success factors. A case study on Dell Inc. was chosen because Dell Inc. has survived the recent economic slowdown since March 2000. This phenomenon was the result of Dell's success story demonstrated a real case of effective integration and implementation of SCM and e-commerce. Data was obtained via Web browsing and e-mail. This paper first discussed various activities that involved in supply chain management process; information, products, and financial flows. It then illustrated the ways that e-commerce to be integrated into supply chain management to gain competitive advantages in dynamic business environment. Findings showed e-commerce has the capacity to have an impact on the physical, information and financial flows of supply chains. This paper is origin and empirical study that would be a contribution to business practitioners and academia.

Keywords— *e-commerce; supply chain; SCM*

I. INTRODUCTION

Michael Dell is widely viewed as a pioneer in the personal computer (PC) business. He transformed Dell from struggling PC maker to market leader by introducing supply chain innovations such as direct-to-consumer sales and build-to-order manufacturing to the computer industry. In truth, Michael Dell is a visionary in supply chain management. PCs simply were the medium he used to introduce his idea for a competitive supply chain: Sell direct through e-commerce or Web site, build to order, and ship direct.

This is an example of how Dell Inc. can review and revise its business model. Dell gained early-mover advantage in the mid-1990s when it became one of the first companies to offer PCs for sale online. Its sales of PCs and peripherals grew from the mid-1990s with online sales of \$ 1 million per day to 2000 sales of \$ 50 million per day. Based on this success it has looked at new business models it can use in combination with its powerful brand to provide new services to its existing customer base and also to generate revenue through new customers.

In a separate initiative, Dell launched a B2B marketplace (formally www.dellmarketingplace.com) aimed at discounted office goods and services procurements including PCs, peripherals, software, stationary, and travel. This strategic option did not prove sustainable. This research will explore and delve deeply

into e-commerce affects Dell's SCM and where e-commerce has impact on Dell's supply chains.

II. THEORETICAL BACKGROUND

Commerce is a basic economic activity involving trading or the buying and selling of goods. The earliest example of e-commerce is electronic funds transfer where allows financial institutions to transfer funds between one another in a secure and efficient manner. Beginning in 2003, electronic commerce (e-commerce) began to show signs of new life. As the economy grew, e-commerce also grew, but at a more rapid pace. Thus, e-commerce gradually became a larger part of the total economy.

E-commerce is about the sale and purchase of goods or services by electronic means, particularly over the internet [1]. In broad terms one can distinguish two types of commerce: *traditional commerce* and *e-commerce* as illustrated in Table 1. For example, if you want to buy a book, you will go to a physical bookstore and buy the physical book from a salesman. In a pure e-commerce system, transactions take place via electronic means.

TABLE 1. TRADITIONAL COMMERCE VS. E-COMMERCE

Activity	Traditional Commerce	E-commerce
Product information	Magazines, flyers	Web sites, Online catalogs
Business communications	Regular mail and phone	E-mail
Check product availability	Phone, fax, and letter	Email-Web-sites-Extranet
Order generation	Printed forms	E-mail, web sites
Product acknowledgements	Phone, fax	E-mail, web sites & EDI
Invoice generation	Printed forms	Web sites

A. E-commerce

The application of the Internet to business can best be understood by dividing it into two separate, yet connected concepts and set of practices. The first is termed e-business and is defined as a collection of business models and practices enabled by Internet technologies focused on the networking of customers, suppliers, and productive capabilities with the goal of continually improving supply chain performance. The second concept is termed e-commerce and is defined as the ability of businesses to buy and sell goods and services over the Internet. Over the past decade these

terms have been used as if they were interchangeable. In reality, e-business is a more powerful concept that seeks to utilize the Internet to build integrative, collaborative relationships among supply chain members [2], while e-commerce is a subset of e-business concerned with the performance of commerce transactions electronically. So it is clear that e-commerce as a front-office provides real-time transaction information to the supply chains.

E-commerce refers to both financial and informational electronically mediated transactions between an organization and any third party it deals with [3]. It follows that non-financial transactions such as inbound customer e-mail enquiries and outbound e-mail broadcasts to prospects and customers are also aspects of e-commerce that need management.

E-commerce is an important concept that describes the process of buying, selling, or exchanging products, services, and information, via computer networks, including the Internet. E-commerce from different perspectives [4]:

- Communication perspective: e-commerce is the delivery of goods, services, information, or payments over computer networks or by any other electronic means
- Business process perspective: e-commerce is the application of digital technology toward the automation of business transactions and workflow
- Service perspective: e-commerce is a tool that addresses the desire of firms, consumers, and management to cut service costs while improving the quality of goods and increasing the speed of service delivery
- Online perspective: e-commerce provides the capability of buying and selling products and information on the Internet and other online services
- Collaborations perspective: e-commerce is the framework for inter- and intra-organizational collaboration
- Community perspective: e-commerce provides a gathering place for community members, to learn, transact, and collaborate

In practice, companies would conduct different types of e-commerce in accordance with their companies' characteristics, activities and products. Among them are Business to Business (B2B) e-commerce, Business to Consumer (B2C) e-commerce, and Business to Government (B2G) e-commerce as applied by Dell Inc.

When evaluating the impact of e-commerce in supply chain management, it is instructive to identify the role of buy-side and sell-side e-commerce transactions as depicted in Fig. 1. *Sell-side e-commerce* refers to transactions involved with selling products to an

organization's customers. *E-marketing* is used directly to support sell-side e-commerce. *Buy-side e-commerce* refers to business-to-business transactions to procure resources needed by an organization from its suppliers. *E-procurement* is used directly to support buy-side e-commerce. This is typically the responsibility of those in the operational and procurement functions of an organization. Remember, though, that each e-commerce transaction can be considered from two perspectives: sell-side from the perspective of the selling organization and buy-side from the perspective of the buying organization. So in organizational supply chains, it needs to understand the drivers and barriers to buy-side e-commerce in order to accommodate the needs of organizational buyers. For example, Dell Inc., promote its sell-side e-commerce service by hosting seminars for buyers within the purchasing department of its customers that explain the cost savings available through e-commerce.

B. Supply Chain and Supply Chain Management

SCM is a tactical and strategic management philosophy that seeks to network the collective productive resources of intersecting supply chain systems through the application of integrative business technologies in the search for innovative solutions and synchronization of channel capabilities dedicated to the creation of unique, individualized source of customer value. SCM has become today's most important management concept because it enables enterprises to exploit the explosion of technology tools that are transforming the realities of the twenty-first century marketplace [5]. The reason why SCM came about is because industrial relationships have become increasingly complex over the last decades [6].

According to Wisner et al. [7], to understand SCM, one must begin with discussion of a supply chain. In a broad sense a supply chain consists of two or more legally separated organizations, being linked by material, information and financial flows [8]. Supply chains connect suppliers to a manufacturing company, departments inside a company to one another, and a company to its customers. SCM is the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers and customers [9] as depicted in Fig. 1. According to The Institute for Supply Management, SCM is the design and management of seamless, value-added processes across organizational boundaries to meet the real needs of the end customer [10].

C. The Impact of E-commerce on SCM

The impact of e-commerce on the supply chain will be felt in how work is done, including how areas of the supply chain interact, and in how supply chains operate between company and geographic boundaries. E-

commerce affects all major areas of supply chain work in companies from design, through buying to fulfilment and service support. The major areas of work inside companies can be illustrated using a simple process map of a supply chain, as shown in Fig. 1. The process map shows the high-level flows and interactions between suppliers' suppliers and customers' customers. It can also be used to show where e-commerce will have its greatest impact:

- Indirect procurement and direct procurement: e-commerce has a direct impact on both indirect and direct procurement of goods and services. E-procurement has its greatest effect on change management and compliance. Direct procurement represents a bigger prize for most companies than indirect spend simply because of the size of direct spends. Here, the combination of e-commerce procurement solutions with existing ERP and MRP systems has the capacity to provide large efficiency savings
- Product and service design: e-commerce has the capacity to improve the quality of product design, reduce design time-scales and fundamentally improve the interaction between designers, engineers, suppliers and manufacturing.
- Manufacturing: e-commerce solutions will also have an impact on manufacturing as companies are required to be more flexible and responsive in what they make and in the levels of mass customization that manufacturing systems can deliver. E-commerce can help manufacturing become more flexible and responsive, and ensure demand and supply planning are more effective
- Demand and supply planning: most people find it difficult to cope with planning when it involves more than a few variables. This is an area where computers, statistics and e-commerce will always be more capable – if they are used in the right way. Demand and supply planning systems are increasingly using e-commerce alongside their traditional software applications to improve the effectiveness of planning solutions. E-commerce is also expected to allow much greater interaction between the planning systems in areas such as collaborative forecasting and replenishment (CPFR) and e-marketplaces
- Fulfilment and e-fulfilment: fulfilment remains an area of great promise for e-commerce solutions, but one that has largely underperformed its potential. E-commerce has the capacity through information, such as tracking and tracing, to revolutionize the way that goods and services are delivered. It has the capacity to virtualize inventory and to change fundamentally the relationship between end customers, retailers, wholesalers and manufacturers

- Service and support: service and support is another area where e-commerce has made some impact but there is still potential for greater change. E-commerce has the capacity to transform the effectiveness of field service forces and to change the way that returns and repairs are managed. Like fulfilment, this is an area where the value proposition will drive radical change, but it will take time
- E-working; e-working is an area that will have a more immediate impact on the supply chain. Most companies have already given thousands of their workers access to intranets and the Internet. They have given them e-working tools such as employee portals, knowledge management systems and computer-based training. Through e-mail they have revolutionized the way in which people work across boundaries of time and space. E-working capabilities have a significant impact on the working of supply chains and on the ability of employees to manage complex events and issues in the supply chain.

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 as illustrated in Fig. 1. 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.

E-commerce is already having a significant impact on SCM. The impact will increase over time as companies adopt e-commerce solutions more broadly and increasingly collaborate between companies and across countries. The broadening of e-commerce will be a gradual process, phased in over time; it will involve a lot of hard work. The benefits of supply chain improvements will be considerable, however, representing 5 to 15 per cent of overall supply chain costs [11]. Leading supply chain operators are likely to achieve collaboration with their key value chain partners far more speedily and effectively than their slower competitors. The benefits of cost savings and performance improvements will accrue to the companies that are the best at harnessing e-commerce solutions.

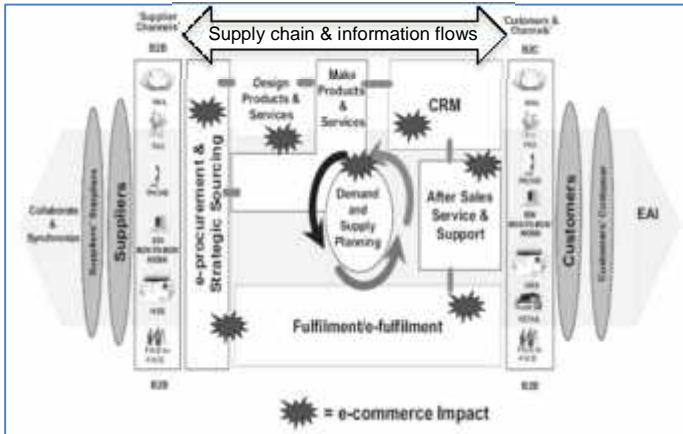


Fig. 1. How and where e-commerce affects supply chain [12]

III. RESEARCH METHODOLOGY

A case study approach was conducted to describe a real practice of how Dell boosts e-commerce to enhance its supply chain management. Data and information pertaining to Dell's e-commerce and SCM on annual reports, whitepapers, journals, and analyst's insights were obtained through Web browsing and e-mail. The current data and information were then studied to get the whole picture of how Dell's e-commerce and SCM take place and what is happening in business today of Dell in order to complete a better understanding of e-commerce and SCM in relation with how e-commerce boosts and enhances supply chain management. A literature review on e-commerce and supply chain management concept, the integration of e-commerce into the supply chain, and the role of e-commerce in the supply chain management were chosen because together they are making a large impact on one another.

AN ILLUSTRATIVE CASE STUDY [12]:

Dell Inc. was one of the first to establish a customer-driven PC configuration capability. Dell had a make-to-order assembly model that received orders from its own direct-to-customer retail channels—using call centers, fax, and phone orders—but no retail stores. Dell's Web site leveraged the software applications and experiences of its own customer service representations to create an effective "self-service" Web application that let online customers create their own custom PC orders. Customers can experiment with different computer configurations using a "choice board" capability that shows them price differences for components and calculates the total price before finalizing their order.

Customers submit their PC order via the Web site- e-commerce, and the order data are translated into a design, the components are ordered, and then the right resources are electronically scheduled to fulfill the order "Direct from Dell" as delineated in official Web site of Dell Fig. 2 and 3. For retail sales to business customers (which is a larger customer segment than end-consumer sales), Dell's sales staff works with an organization's procurement managers to select a small number of PC configurations at a pre-negotiated price to fit the

company's infrastructure standards and employee needs. Dell Computers has survived the recent economic slowdown since March 2000. This phenomenon was the result of "Dell's super-efficient supply chain" that is affected by effective e-commerce. Dell's vice president who was overseeing Dell's SCM. Dell's success story demonstrated a real case of effective integration and implementation of SCM and its e-commerce delineated in Fig. 2 and 3.

By year-end 2002, Dell was number one in market share for desktop PCs and was also the number one online computer retailer. However, by mid-2006 Dell had lost its market share position to Hewlett-Packard (which had merged with Compaq Computer a few years earlier). The company's highly efficient supply-chain model and direct sales retail approach were still intact, but by then its competitors were also able to compete online as well as through their traditional distribution channels.

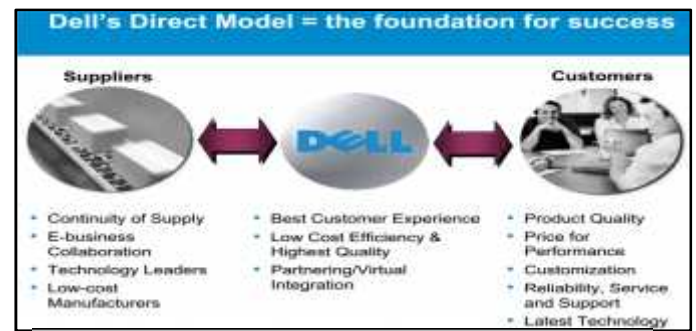


Fig. 2. Dell's supply chain model

How does Dell's official Web site of SCM look like? Dell has successfully created an interesting friendly-users e-commerce marketing in its Web site for its customers to create an order online as can be seen in Fig. 3.



Fig. 3. Dell's Web site e-commerce marketing

Dell achieved a great innovation in SCM by adopting a direct-sales model; that is, a demand-driven supply chain in which the traditional build-to-stock approach is replaced with a build-to-order model delineated in Fig. 2 and 4.



Fig. 4. Dell's Web-based SCM

With the new model, Dell was able to reduce inventories, cut costs, and reduce production cycles. Dell has expanded its JIT practices from the company to the entire supply chain as suppliers have been integrated into Dell's operations. Dell's product lines as depicted in Fig. 5.



Fig. 5. Dell's product lines

Finally, a good research to be answered is that "Why do some companies succeed while others fail? Why has Dell Computer been able to do so well in the fiercely competitive personal computer industry, while its competitors like Acer, Hewlett-Packard, and Lenovo have struggled to make money?"

IV. RESEARCH RESULT AND DISCUSSION

A. The Impact of E-Commerce in SCM

The commercialization of the Internet in the early 1990s and the introduction of the World Wide Web in 1993 provided Dell with an opportunity to expand rapidly. Dell implemented aggressive online order-taking and opened subsidiaries in Europe and Asia. Dell also started to offer additional products on its Web site (e-commerce) which affected its supply chains. This enabled Dell to batter Compaq, and in 2000 Dell became number one in worldwide PC shipments. At that time, Internet sales topped \$50 million per day (about \$18 billion per year). Dell sells about \$62 billion a year in computer-related products online, from network switches to printers, employing over 88,000 people.

Dell's goal is to coordinate its e-commerce with its supply chain to such an extent that it drives all inventories out of the supply chain, apart from those

actually in transit between suppliers and Dell, effectively replacing inventory with information. Dell has succeeded in driving down inventory to the lowest level in the industry. In mid-2006, it was turning its inventory over every five days, compared to an average of forty-one days at key competitor Hewlett-Packard. This is a major source of competitive advantage in the computer industry, where component costs account for 75% of revenues and typically fall by 1% per week due to rapid obsolescence as delineated in Fig. 6.

Despite its high profitability, between mid-2005 and mid-2006, Dell's stock lost half its market value, sliding from \$42 a share to \$22. There were several reasons for this. First, after years of trying, three of Dell's competitors, Acer, Hewlett-Packard, and Lenovo, had reduced their cost structure and become more competitive with Dell, enabling them to match Dell on prices and still make profits.

Through its Web site, Dell did its direct selling through mailings and telephone contacts, but since the mid-1990s, much of its sales have been made through its e-commerce or website. Dell's sophisticated website allows customers to mix and match product features such as microprocessors, memory, monitors, internal hard drives, CD and DVD drives, keyboard and mouse format, and so on, to customize their own computer systems. The ability to customize orders kept retail customers coming back to Dell and helped to drive sales to a record \$55.9 billion in 2004. Dell uses the Internet, particularly e-commerce to feed real-time information about order flow to its suppliers in the supply chains, so they have up-to-the-minute information about demand trends for the components they produce, along with volume expectations for the upcoming four to twelve weeks. Dell's suppliers use this information to adjust their own production schedules, manufacturing just enough components for Dell's needs and shipping them by the most appropriate mode so that they arrive just in time for production. This tight coordination is pushed back even further down the supply chain because Dell shares this information with its suppliers' biggest suppliers.

A strong impact of e-commerce in supply chains has made Dell survive from its losses of over US\$ 100 million through a best-practice leader at seamlessly integrating e-marketing and SCM to enhance all processes across and an extended supply chain and e-Commerce. Dell sells its product lines to individual and household such home and offices; Business, Enterprise, Government, Healthcare, Partners of small and medium-sized Enterprises (SMEs) with up to 200 employees; Large Corporations which consist of over 200 employees; Institutions/education, Government, health-care organizations, and partners (see Fig. 6).

For Dell's B2C e-commerce: Sales to the first group are classified as B2C e-commerce. Consumers shop at *dell.com* using an electronic catalog. The sales are completed using mechanisms of e-commerce platform. Business-to-customer (B2C) sales are facilitated by standard shopping aids (e.g., catalogs, shopping carts,

credit card payments. Dell matches supply and demand because its customers order computer configurations over the phone or online (Internet). These computer configurations are built up from components that are available. Dell's strategy is to provide customized, low cost, and quality computers that are delivered on time. Dell successfully implemented this strategy through its efficient manufacturing operations, better supply chain management and direct sales model. Dell's product lines and its markets as shown in fig. 6.

For Dell's B2B e-commerce: Sales to the other four groups are classified as B2B e-commerce. Most of Dell's sales are to businesses that cover SMEs, Large enterprise Institution/educational, Government, and health-care organizations. B2B customers obtain additional help from Dell where Dell provides each of its nearly 100,000 business customers with Premier Dell service as shown in Fig. 3.

British Airways as an example considers Dell to be a strategic supplier. Dell provides notebooks and desktops to 25,000 British Airways users. Dell offers two e-procurement services to British Airways purchasing agents. The more basic service, Premier Dell, allows British Airways and other businesses to browse, buy, and track orders on a Dell Web site customized for the user's requirements. The site enables authorized users to select preconfigured PCs for their business unit or department. A more advanced version, Premier B2B, supports e-procurement systems.



Fig. 6. Customers who use Dell's products and sales revenues

This provides automatic requisition and order fulfillment once an authorized user has chosen to buy a PC from Dell. British Airways has placed the e-procurement tools on its E-Working intranet. This allows authorized staff to purchase PCs through a portal that connects directly into Dell's systems.

In addition to supporting its business customers with e-procurement tools, Dell also is using e-commerce in its own e-procurement. Dell developed an e-procurement model that it shares with its business partners. One aspect of this model is the use of electronic tendering to conduct bids. Dell uses electronic tendering when it buys the components for its products.

B. Where E-commerce affects Dell's SCM

Dell demonstrates effective e-commerce enabled SCM in conducting business. Dell adjusts to its changing environment by deploying a comprehensive integration

of e-commerce and SCM. IT-enabled SCM enables to communicate and collaborate (e-collaborate) with its many business partners with whom it needs. Dell uses shippers, such as UPS and FedEx, to deliver its computers to individuals. It also uses third-party logistics companies to collect, maintain, and deliver components from its suppliers, and it has many other partners. Dell is using Web Services, an e-commerce technology, to facilitate communication and reduce inventories. Web Services facilitate B2B integration. Integration efforts began in 2000 with other technologies when Dell encouraged its customers to buy online. The B2B integration offer combines Dell PowerEdge servers based on Intel architecture and Web Methods B2B integration software to link customers' existing enterprise resource planning (ERP) or procurement systems directly with Dell and other trading partners. In addition, Dell can provide e-procurement applications and consulting services. Dell also educates customers in its technologies and offers suggestions on how to use them. This is particularly true for emerging technologies such as wireless. Dell has a superb communication system with its over 15,000 service providers around the globe.

Dell demonstrates successful Intra-business e-commerce. The well-managed SCM fully supports Dell for *mass-customization*. To support its build-to-order capabilities, significantly improve its demand-planning and factory execution accuracy, reduce order-to-delivery time, and enhance customer service, Dell partnered with Accenture to create a new, high-performance supply chain planning solution. Now in place in Dell's plants around the world, the program, which paid for itself five times over during the first 12 months of operation, enables Dell to adapt more quickly to rapidly changing technologies and the business environment, maintaining its position as a high-performance business. Dell also has automated its factory scheduling, demand-planning capabilities, and inventory management using information technology and e-supply chain models.

V. CONCLUSIONS AND PERSPECTIVE

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. Because e-commerce affects SCM, information visibility is achieved through connectivity among trading partners, therefore, supply chain can be better managed. 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.

Dell was offering Web-based storefronts that combined online catalogs and advertising techniques with new technology tools such as Web site personalization, self-service, interactive shopping carts, bid boards, credit card payment, and online communities

that permitted actual online shopping including bidding and auctioning.

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 buyer through collaborative software, lowering inventory, fulfilling customers' demand faster, and boosting market access.

Dell matches supply and demand because its customers order computer configurations over the phone or online. This allows Dell to know what he must be able to supply in real time and then very quickly and precisely meet that demand while maintaining low inventory. These computer configurations are built up from components that are available. Dell's strategy is to provide customized, low cost, faster, and quality computers that are delivered on time. Dell also saves time on processing orders that other companies normally incur in their sales and distribution system. In addition, by directly dealing with the customer Dell gets a clearer indication of market trends. This helps Dell to plan for future besides better managing its supply chain.

Web technology, especially e-commerce has the capacity to have an impact on the physical, information and financial flows of supply chains. At a simplistic level, supply chains are typically made up of three major flows – physical flows, financial and information flows. Physical flows can be affected by using information to avoid physical movements and to make product information available through virtual ways. In essence, e-commerce can give companies access to more markets and customers without the physical need to move the levels of product and inventory that were required in the past. Information flows can be affected by the capacity of e-commerce solutions to provide 24/7 access to information and to eliminate traditional paper-based approaches to working and company interactions. E-commerce is also particularly well suited to providing information such as product tracking and tracing. And financial flows can be affected by the capacity for e-commerce solutions to offer faster payment and settlement solutions at all stages of the supply chain.

The final and most sophisticated of the e-commerce regions is supply chain collaboration where both customers and partners are able to seek to leverage the full value of real-time transactions and collaboration solutions.

ACKNOWLEDGEMENT

I would like to thank the reviewers and the editor of JMEST for publicizing this journal article

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