

## Chapter 11 TOPICS IN LEAN SUPPLY CHAIN E-COMMERCE

### Learning Objectives

- Explain what is involved with e-commerce
  - Describe e-business models
  - Describe the categories of e-business most related to supply chain management
  - Explain the steps in a multi-stage, e-commerce model and its relationship to supply chain management
  - Describe the critical success factors in implementing an e-commerce model
  - Describe the benefits of using an e-commerce model of business as it relates to supply chain management
  - Explain how the bullwhip effect can be reduced using e-commerce technology
  - Explain how Internet-based electronic data interchange technology supports supply chain management processes
  - Explain why trust is so important in e-commerce operations
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### Introduction

A number of the topics presented in this chapter relate to one or more of the lean supply chain management principles discussed in Chapter 3. The content of this chapter will aid in the understanding and the implementation of several of these lean supply chain management principles. The principles in the darkened boxes in Figure 1 are closely related to this chapter's topics.

### E-Commerce

To understand e-commerce, we must first understand the technology and software systems that drive it (Schniederjans and Cao, pp. 3–11). The *Internet* is an international collection of hardware and software from private and public computer networks. It represents a global platform that permits digital information to be shared and distributed, including: communication (e.g., sending e-mails, transmitting data, etc.), accessing information (e.g., searching databases, reading electronic books, etc.), and supplying information (e.g., transferring files, graphics, etc.).

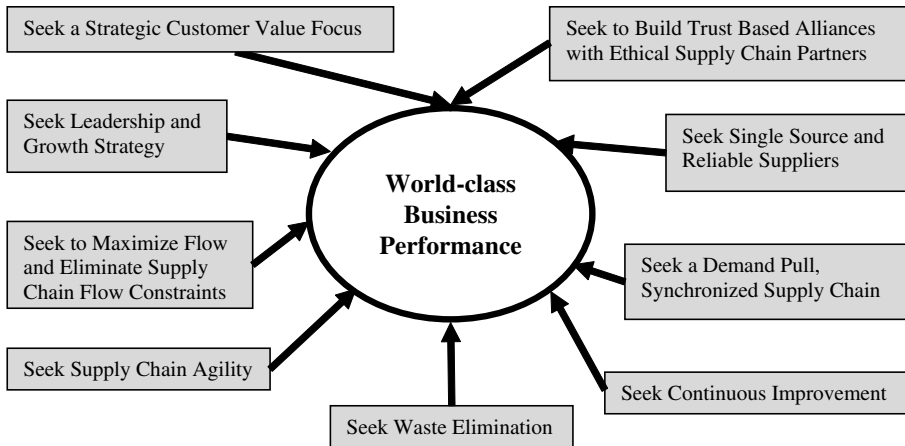


Figure 1. Chapter related topics to lean supply chain management principles

The universality the Internet offers is capacitated by businesses into universally accepted standards for storing, retrieving, formatting, and displaying information in a networked environment. This capacitated environment of the Internet is called the *World Wide Web* (WWW), hereafter referred to as the *Web*, and permits businesses to go online and conduct a variety of business activities. As the use of the web matured during the 1990s, new terms emerged to more accurately differentiate business transactions taking place over the Internet. One of these new terms was called *electronic commerce*, hereafter referred to as e-commerce. *E-commerce* is the exchange transactions which take place over the Internet primarily using digital technology. These exchange transactions include buying, selling, or trading of goods, services, and information. This encompasses all activities supporting market transactions, including marketing, customer support, delivery, and payment. This would include all transactions internal to the business organization and those external with supply chain partners and government agencies. Also, it incorporates the term, *electronic business*, or hereafter referred to as e-business. *E-business* describes the uses of the Internet and digital technology for the management of business processes internal to the organization and with other businesses. There are many different types of e-business models, each requiring unique supply chain service and support (see Table 1).

In a general categorization of business operations, three types are related to e-commerce businesses. A *brick-and-mortar business* (i.e., used to describe traditional or regular business commerce without e-commerce abilities), a *virtual* or *e-commerce business* (i.e., a complete business unit possessing little or no physical

Table 1. Types of e-business models (adapted from Schniederjans and Cao, 2002, p. 9)

E-business model	Explanation
Advertiser	The firm makes money by selling advertising space on their Web site. The advertiser then lures the target audience by giving them free service or information.
Service	The firm creates a Web site that offers customers a service or range of services. Online brokerage houses, travel agencies, etc. are typical examples.
Virtual Mall	The firm offers a wide range of differing manufactured products on a Web site (e.g., AMAZON.COM).
E-tailing	The firm can offer a single customized product or non-customized products, like brand-name appliances.
Information Disseminator	The firm offers up-to-date sources of information of a specific nature. An example would be an online newspaper from a specific city covering a specific type of news.
Sales Facilitator	The firm connects buyers with sellers on a Web site that attracts customers with the promise of finding an inexpensive source for the product or service, while selling access linkage to the seller's site.
E-procurement	The firm provides efficient and cost reducing linkages between buyers and sellers of industrial organizations.

facilities that may be geographically dispersed, but linked by the Internet), and a *click-and-mortar business* (i.e., a combination of a brick-and-mortar and an e-commerce business). Many firms today, like Sears, Wal-Mart, and Target, are click-and-mortar businesses. Even the source of e-commerce customer transactions has changed due to technology advancements. *M-commerce* relies on the use of mobile, wireless technologies, including personal digital assistants, cell phones, and smartphones to place orders and conduct business (Stair and Reynolds, 2010, p. 320).

E-business software technologies are needed to support business operations, and in particular, supply chain functions. The use of *intranets* (i.e., networks within a single client organization, as shown in the circled area in Figure 2, are also included in broader term of e-commerce. Intranets link internal organization functions for efficiency, timeliness, and issues of privacy for the firm. As intranets are expanded to include external organizations (e.g., suppliers) as authorized users of an organization's intranet, they create *extranets*, which are also included in

the definition of e-commerce. What differentiates extranets from intranets can be factors of openness (i.e., more information about the internal operations of a client firm may be shared with intranet partners) and function (eg., specialized extranet linkages may be designed for NPD uses only). Extranets should be viewed as private intranets accessible to authorized outsiders (Whitten and Bentley, 2008, p. 17).

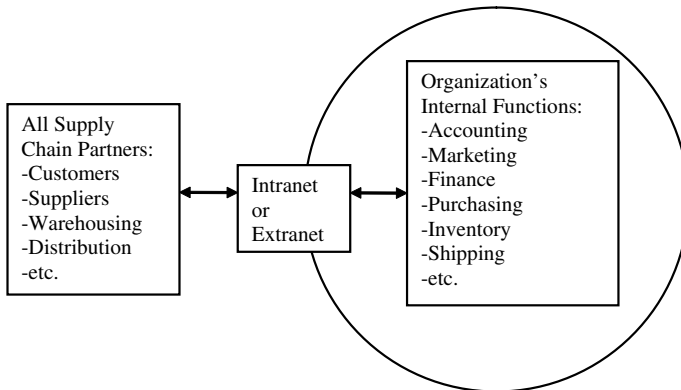


Figure 2. Relationship of internet and extranets with supply chain partners (adapted from Schniederjans and Cao, 2002, p. 5)

## E-Commerce and Supply Chain Management

There are several categories of e-commerce listed in Table 2 (Balasubramanian and Mahajan 2001; Pant and Ravichandran 2001). Many transactions relevant to supply chain management are those from the B2C and B2B categories. The B2C organizations are now able, through online registration, to keep better track of their customers for purposes of product recalls and product updates. The B2B organizations can transact product and material purchases, share design specifications for new products, and perform research and development activities, all online. Yet, in a global context all of the categories of e-commerce have applications to supply chain operations. For example, the G2C, G2B and G2G organizations share information required by law and current legislation on truck transportation requirements that might otherwise take years to convey. These governmental organizations allow for much needed expedience in the dissemination of information concerning the governance of people and assurance that laws will be promptly obeyed.

Focusing on the roles of e-commerce and its technologies in B2B and B2C, Figure 3 presents a multi-stage sequence of activities that either purchasing agents (for a B2B transaction) or customers (for a B2C transaction) experience in

Table 2. Categories of e-commerce (adapted from Schniederjans and Cao, p. 5)

From\ To	transactions	To customer	To business	To government
From Customer		Customer-to-Customer (C2C)	Customer-to-Business (C2B)	Customer-to-Government (C2G)
From Business		Business-to-Customer (B2C)	Business-to-Business (B2B)	Business-to-Government (B2G)
From Government		Government-to-Customer (G2C)	Government-to-Business (G2B)	Government-to-Government (G2G)

e-commerce business activities. Consider each of these stages (Stair and Reynolds, 2010, pp. 314–317):

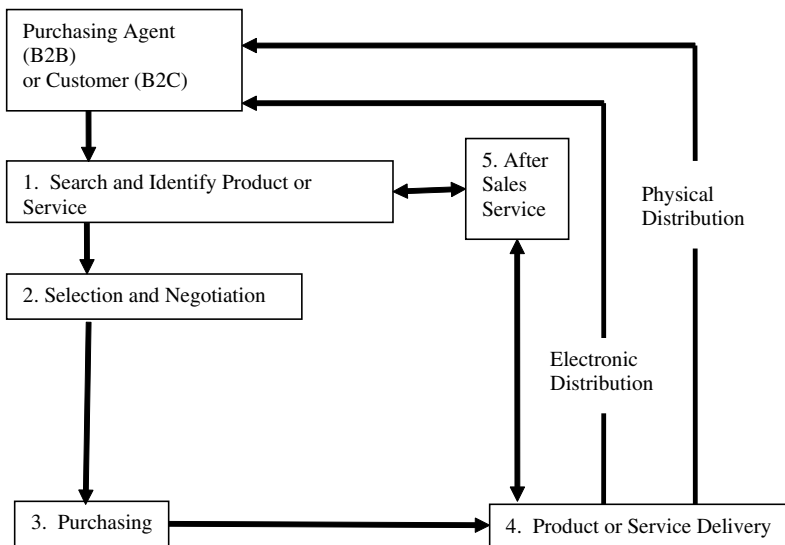


Figure 3. Multi-stage e-commerce B2B and B2C model (adapted from Stair and Reynolds, 2010, p. 315)

1. Search and Identify Product or Service: Using a Web page of a supplier, a purchasing agent or customer can place an order for supplies, spare parts, etc. The Web page provides comparative cost and availability information (the latter if the ERP system is integrated with the warehousing and inventory functions). In this role, the Web technology has helped bring the

customer and purchasing agent into the business's supply chain by having them perform the selling function through Internet improved access to purchasing options. It also helps achieve the lean demand pull principle. Since the customer or purchasing agent will make the purchasing decision, it will be known demand once the order is placed in the system.

2. **Selection and Negotiation:** For many customers the price quoted on the Web is the price required for purchase. In other customer and purchasing agent settings, a price can be negotiated between parties. The Web is ideal for this communication exchange. Suppliers, whose intranet is linked (perhaps with an ERP system) to those of their manufacturers, can be informed on a real time basis as to the actual cost of a part. This gives the manufacturer negotiation room in setting a price that will permit profitable operations, while opening up opportunities for bids from other competitive suppliers. Some purchasing agents utilize *e-commerce auctions* (i.e., match buyers and sellers by using an e-commerce version of a standard auction) to further drive down purchase prices (Kroenke, 2009, p. 292).
3. **Purchasing:** Using the Web, customers or purchasing agents can complete their orders specifying the final agreed-to terms and prices. Complications can arise due to the payment process. Customers and purchasing agents can use credit cards to facilitate payments or electronic checks (Haag *et al.*, 2007) as a form of exchange for hard cash. Another technology for placing and purchasing orders in B2B operations is through *electronic data interchange* (EDI) systems, a technology that enables corporations to exchange data electronically with their suppliers. EDI generally refers to computer-to-computer exchange of high-volume, routine business information between trading partners, using a national or international standard format (Walton and Maruchek, 1997; Attwood, 1998). When combined with the Internet technology for portals in data entry tasks and linked into other ERP systems, it is referred to as *internet/extranet data exchange* (IEDE) or *Internet-based EDI* (IEDI).
4. **Product and Service Delivery:** *Electronic distribution* refers to products that can be downloaded over the Internet (e.g., music, written material, etc.). *Physical distribution* refers to the delivery of tangible items that must be physically moved from one location to another (i.e., via rail, road, by truck or ship). Web technology allows the customer and purchasing agent to track delivery information on orders. Web technology also allows the manufacturer to trace missing orders and provide up-to-date delivery information to customer service agents, who in turn can provide information directly to preferred B2C customers and other B2B purchasing agents.

5. After Sales Service: Given that all of the transactions have been online, the information system (like ERP) will be able to capture information to complete the order (e.g., special follow-up services to ensure customers have received complete orders). In addition, the information can be incorporated into a customer relationship management (CRM) software system (see Chapter 9). Other supply chain information can be placed in the database of a supply chain management (SCM) software system. Such supply chain information, as complaints about the condition, timeliness, or convenience of deliveries are reported by customers, provides useful future planning guidelines to further achieve customer satisfaction. With e-commerce and Web technology, the speed with which this information can reach decision makers is greatly increased over other, less integrated information systems.

The impact e-commerce and its technology enablers, such as the Internet, have on supply chain activities can be dramatic. To illustrate this impact we can theorize and estimate the timing difference between the manufacturing agent's physical method (i.e., more traditional) of purchasing a component for a product and an e-commerce method focused on Internet technology as presented in Table 3. As can be seen in Table 3, there are substantial differences between these methods and the resulting time required to implement the purchase of a component part. The time saved using e-commerce is one example of how it can enforce the lean supply chain management principle of waste removal.

Table 3. Illustration of purchasing process enhanced by e-commerce technology

Order process steps	Physical method (time)	E-commerce method (time)
1. Search for product	Visit with suppliers (15 days)	Use Internet to search supplier Web sites (1 day)
2. Check availability and price	Read hard mail literature sent from suppliers and negotiate by phone and personal interviews regarding availability and price (15 days)	Use Internet email exchanges as contact agent to negotiate availability and price (2 days)
3. Customer places order	Visit with selected supplier and place order (1 day)	Use Internet email or EDI to place order (30 minutes)

Table 3. (Continued)

Order process steps	Physical method (time)	E-commerce method (time)
4. Check order status	Phone supplier (1 hour)	Use Internet tracking (5 minutes)
5. Ship order	Process order in shipping department from manufacturing plant (1 day)	Ship from third party in virtual business (1 day)
6. Invoice to customer	Obtain and fill out hardcopy forms, mail to customers (3 day)	Use Internet or EDI to fill out forms and send to customer (20 minutes)
7. Pay invoice	Issue check or credit card exchange on hardcopy forms (2 hours)	Use Internet or EDI to issue credit or send an electronic check to supplier (1 minute)
Total Time	35 days and 3 hours	4 days and 56 minutes

The illustration in Table 3 also provides some idea as to the profound role changes taking place as e-commerce becomes an important part of supply chain management systems. Note particularly in the the example that most of the activities, which required staff in the physical method, now only require the time of the purchaser in the e-commerce method. Indeed, the use of e-commerce models have done more to integrate the customer into supply chains as an activite participant than any other marketing effort to date.

### ***Critical Success Factors in Implementing an E-Commerce System***

Gide and Soliman (1998), who studied success factors for the implementation of e-commerce, identified ten critical success factors for the implementation of e-commerce in manufacturing:

1. Management commitment and support for e-commerce (e.g., financial, time, etc.)
2. Organizational and management objectives for e-commerce (i.e., aligning them and defining them)
3. Communication between users and e-commerce department (i.e., improving interface)
4. E-commerce system security and reliability (i.e., reducing security risks and ensuring useful, timely, and accurate information)

5. E-commerce department's service function (i.e., defining the role of e-commerce in providing services to the firm)
6. Integrating e-commerce into existing business functions (i.e., utilizing existing software platforms and fully integrating e-commerce systems to take advantage of communication capabilities)
7. Change management for e-commerce system implementation (i.e., utilize change management methodologies to ready the organization for the implementation of the e-commerce system)
8. Appropriate e-commerce system applications (i.e., build an e-commerce system around needed organizational goals and objectives)
9. User participation and satisfaction for e-commerce implementation (i.e., Like lean, users will be in a better position to make suggestions on implementation, based upon their potential satisfaction using the system.)
10. Technological competence for e-commerce implementation (i.e., A firm must have technically competent technology staffers to answer implementation questions and avoid constraints in the implementation process.)

These critical success factors are related to the lean supply chain management principles in many ways. Leadership and growth (management commitment), focusing on the customer (organizational and management objectives), waste elimination (reliability), demand synchronization (integrating into existing systems), and seeking customer demand pull systems (service function) are all lean supply chain management principles.

### ***Supply Chain Benefits of Using E-Commerce***

There are benefits for those supply chain partners who embrace e-commerce operations. Some of the more commonly reported supply chain benefits are stated in Table 4 (Schniederjans and Cao, 2002, pp. 9–11; Kamarainen *et al.*, 2001; Deitel *et al.*, 2001).

Table 4. Lean supply chain benefits of e-commerce (adapted from Schniederjans and Cao, 2002, p. 10)

Benefit	Explanation
Better Availability of Service	This conveniently allows customers to shop anywhere online, but also helps a firm achieve customer focus goals by providing computer transaction information to more efficiently identify and segment consumers.

Table 4. (Continued)

Benefit	Explanation
Cost Reduction in Information Processing	This reduces costs of processing and retrieving order and customer information.
Better Timeliness of Service	Online capabilities can offer customers 24-hour product ordering and purchasing services. Combined with automated warehousing systems, this can rapidly process payments and deliver products.
Better Access to Customer Markets	Online services open global markets and new and larger markets than brick-and-mortar facilities.
Less Expensive Initial Cost of Operations	The capital investment in e-commerce facilities is considerably less than for brick-and-mortar operations. A virtual business may not even own or spend money acquiring expensive, physical structures like buildings.
Less Expensive Operating Costs	The expenditures of running a virtual or e-commerce operation is less than brick-and-mortar: less people, less physical equipment, less paper work, etc.
Better Purchasing Prices from Suppliers	The competitive nature of online e-commerce businesses allows for more pricing information to be shared with customers, thus, increasing competition, which can result in lower costs to all supply chain partners.
Improved New Product Development (NPD)	The ability to be online with R&D allows expertise from around the world to participate in NPD, which can help reduce the time-to-market for new products and the costs of their development.
Improved Scheduling	The online ability to keep track of product or service activities (i.e., coordinating purchase orders with production efforts to fill them) allows schedulers to be more accurate and timely in scheduling and rescheduling production activities, which can reduce costs.
Better Supplier Quality	The information available online through e-commerce allows purchasers to more easily learn about material and component quality, permitting a more informed decision on what is possible in terms of quality.

Another benefit of e-commerce concerns the lean notion of avoiding waste. E-commerce operations can permit a reduction of unneeded supply chain partners. E-commerce supply chains have the ability to reduce overall costs by eliminating intermediaries in the distribution and retailing of products or services.

A process Laudon and Laudon (2002, p. 111) refer to as *disintermediation* is achieved when downstream intermediaries (e.g., distributors, warehouses, retailers) are eliminated from the supply chain of an organization. As can be seen in the simple example in Figure 4, the channel of distribution from the manufacturer to the customers can be reduced by offering customers the product directly from the manufacturer, using e-commerce technology to place orders. By cutting out the intermediaries in the distribution system, the costs of the intermediaries (e.g., related to profit, technology, human resource costs, etc.) are saved. Moreover, the delivery time the intermediaries would add is also saved, reducing the total time of delivery and adding value to the customer's experience. Mougayar (1998, p. 12) found that traditional brick-and-mortar distribution channels may add as much as 135 percent to the cost of the item over its original cost of manufacturing. Clearly, a supply chain reduction cost competitive advantage can be achieved using an e-commerce approach toward retailing of products or services.

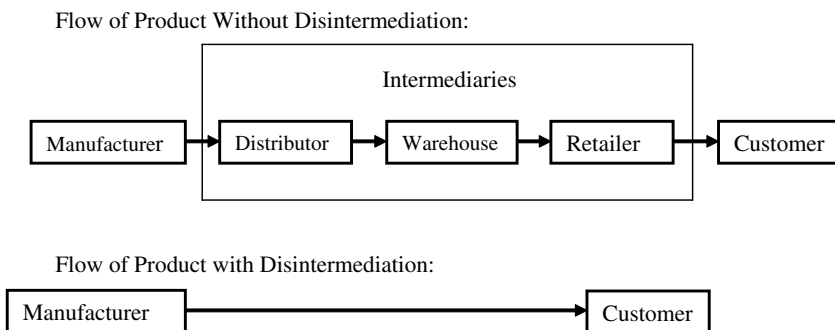


Figure 4. Illustration of disintermediation (adapted from Schniederjans and Cao, 2002, p. 11)

Another benefit of e-commerce and its technology is related to controlling the variability of demand across a supply chain. According to (Metters, 1997), it is generally agreed that a lack of inter-firm communication, combined with large time lags between receipt and transmittal of information, are the root causes of supply chain variability. This variability leads to the bullwhip effect (see Chapter 2), a commonly reported type of supply chain information distortion. Lee *et al.* (1997a, 1997b) investigated four causes of the bullwhip effect: demand signal processing, rationing game, order batching, and price variations.

- **Demand Signal Processing:** This is where amplification of demand is due to increasing safety stock and stock in the pipeline. Forecasts are based upon historical ordering data from the firm's immediate customers and may not have any relationship to actual demand. However, there can be a time lag between production and processing of the orders at the upstream site in the supply chain, which can lead to demand variation.
- **Rationing Game:** When amplification of demand occurs when product demand exceeds supply, organizations often ration sales to retail customers causing fluctuation. This results in end customers placing multiple orders with different retailers, hoping this will result in a greater chance of obtaining the product. Unfortunately, excess demand for products causes the manufacturing organization to increase capacity to satisfy all of the apparent orders, when in fact, the actual demand is not true and inventory continues to build up.
- **Order Batching:** Amplification of demand is caused by customers, who tend to order goods at certain times during the week. Also, some organizations run their production planning and supply chain distribution requirements planning in batches, like at the end of a week or a month. This periodic batching of processes results in a surge of demand at a certain point in time.
- **Price Variations:** Amplification of demand occurs due to the impact of promotion results in forward buying. Manufacturers frequently offer promotions, and retailers quite frequently "forward purchase" seasonal items. This results in customers buying in quantities that do not reflect their immediate needs. Usually, they end up buying in large quantities and stock up for the future. This results in customer buying patterns that do not reflect consumption patterns and needless variation of purchased quantities larger than the variation of the actual consumption rate. Thus, the situation creates the bullwhip effect.

The more information and the more timely the information regarding customer demand, supply chain partner rationing, order batching, and pricing, the more likely it is that the bullwhip effect causes can be recognized, dealt with, and resolved. E-commerce communication capabilities offer better strategies to cope with the bullwhip effect phenomenon. The various and more numerous portals that exist in e-commerce-oriented supply chains create a more comprehensive communication and information network. These e-commerce networks lead to considerably detailed and timely information from all areas across a supply chain, particularly as relates to customer demand information. Chen *et al.* (2000) found that centralizing

demand information results in alleviating the bullwhip effect in supply chains. Cachon and Fisher (2000) found that supply chain costs were more than 22 percent lower on average when full information to supply chain partners was a policy, than for firms using a more traditional and limited information policy.

What are the implications for supply chains based upon the bullwhip effect? First, every supply chain partner is dependent upon others in a supply chain. Effective communication among the partners is one of the key critical success factors of supply chain coordination to promote the alleviation of the bullwhip effect. Secondly, supply chain partners must focus on their capabilities supply chain-wide. To optimize the capabilities of the supply chain, organizations must be willing to cooperate and assist weaker members of the supply chain. These actions will in turn eliminate causes of the demand variation that lead to the bullwhip effect.

### ***E-Commerce Interaction with Supply Chain Management***

E-commerce is sales and marketing driven, and supply chain management is the most important critical success factor helping e-commerce operations to be successful. However, supply chains often are neglected or poorly managed in e-commerce practices. Many dot-com firms, during the early 2000s, lost customers or went out of the business due to the misperformance of their supply chains. Industrial experts attributed the downfalls of many dot-com firms to supply chain failures caused by the lack of a rapid communication structure to identify emerging inventory stock shortfalls, order processing systems to manage needed repeat orders, and supply chain customer relationship management programs to ensure minimal response to customer complaints and returns. In order to be successful an e-commerce firm needs to have an integral business model with an emphasis on supply chain management, rather than a model solely based upon sales and marketing.

According to Nissen (2000), an evolution has been in progress for some years that is leading toward increased integration of supply chain management and e-commerce. E-commerce is an application of interorganizational systems that support the electronic trading of physical goods and of intangible service products. It has a major positive impact on supply chain management in several ways. First, e-commerce represents a means of leveraging the trend toward increased product customization and personalization for the benefit of buyers and sellers in supply chains. Information technology (IT) allows for the large-scale tracking of customer preferences, including those associated with transportation and distribution processes in customer ordering and delivery. Also Lee *et al.* (1997a) pinpoint

the relevance of information exchange in alleviating the supply chain bullwhip effect. They argue IT can help firms create transparency of orders and operations in providing visibility of demand throughout the supply chain.

One development in the evolution of e-commerce and supply chains has been the creation of an e-supply chain. An *e-supply chain* is an organizational regrouping of supply chain efforts to more closely focus on the supply chain as a strategic force useful in achieving organizational goals. There are several major differences between a traditional e-commerce use of supply chains and an e-supply chain. E-supply chains render improvements in supply chain management in an e-commerce setting. First, the many portals (i.e., computer integrated system with laptop computers using a wireless Internet system) required for an e-supply chain implement a supply chain-wide information infrastructure to disseminate relevant market information quickly and directly. Secondly, an e-supply chain uses a strategic approach to information (i.e., rather than using information for ordering and transactional purposes, an e-supply chain uses information for innovation, enhanced consumer relationships, and service activities). E-supply chain is an evolving concept by e-commerce firms. To a greater or lesser degree, most e-commerce firms that view their supply chain as a competitive advantage will continue to evolve into an e-supply chain firm.

### ***Internet-based EDI (IEDI) and Supply Chains***

An early integration technology used in supply chains (and a factor in their rise to prominence in strategic planning) is *electronic data processing* (EDI) and its newer version, *Internet-based EDI* (IEDI).

Developed in the late 1960s, EDI enabled buyers to extract purchase orders from a purchasing software application and send it to suppliers where it would automatically feed into a sales order-entry application. The EDI data is then translated by special software from EDI standard data formats and converted into the supplier's database formats for ease of understand and direct action. Its intent is to speed information delivery and processing via a paperless environment, thereby achieving tremendous cost and time saving efficiencies that carry over into improved levels of customer service. *Internet-based EDI* (IEDI) is EDI, but with Internet access portals. The use of IEDI systems further increases the supply chain partner's access to data via entry portals by positioning the portals using the Internet as a connector throughout the entire supply chain system. In terms of lean principles, it should be noted that Steggell (1998) claimed years ago that an IEDI system is much less expensive than EDI. Barber (1997) declared an IEDI system could be as much as eighty percent less expensive.

The benefits that IEDI can bring to supply chain management include:

1. Timely communication via IEDI permits a more demand pulled production cycle time, which in turn can reduce finished goods inventory by not producing products not yet demanded by customers;
2. It can enhance communications between the supplier and the buyer by virtue of easier to use Internet technology (i.e., The Internet is a convenient form of communication in everyday life that users are comfortable using.);
3. IEDI, when linked with other ERP systems, permits easier use of other communication technologies (e.g., A firm might implement a radio frequency identification (RFID) inventory monitoring system to track inventory levels and automatically generate and transmit IEDI purchase orders to suppliers.);
4. At a strategic level, IEDI can serve as a competitive priority or order winner for some firms (i.e., The firm that uses this technology will get contracts with other firms that want supply chain partners to use this technology for purposes of information system integration.).

Another integration issue of e-commerce and supply chains is related to global supply chains. In order to successfully compete in global markets (and e-commerce opens global markets to all firms), organizations must meet or exceed the pace of rapidly changing technology, while also lowering costs, increasing quality, and improving customer service at all stages of the value-chain. A rapidly emerging global market drives businesses to reorganize manufacturing and supply chain partners to be more closely integrated in order to improve operating efficiency. Effective management of these global supply chains presents challenging strategic, tactical, and operational problems. It involves the integration of all value-creating elements in the supply chain processes, from raw material extraction to end-user consumption. Global supply chain management (GSCM) activities are motivated by the ideals of customer service, lead-time compression, and inventory reduction (see Chapter 8). GSCM is facilitated greatly by communication technologies, such as IEDI, and inspired by the lean supply chain management principles of close supplier relationships, reduced supplier bases, and frequent on-time deliveries by suppliers, who are synchronized with a customer's requirements. GSCM fosters involvement of members of the supply chain in new product development (see Chapter 10), production planning, and quality efforts. When e-commerce data on market demand and production scheduling requirements are shared, it enhances global supply chain information system networks and helps to implement global supply chain operations.

### ***E-Trust and Supply Chains***

The Internet and other e-commerce technologies have created opportunities for seamless business collaboration between all partners that comprise a traditional supply chain. The B2B and B2C models break down traditional boundaries between business partners. In essence they make all participants in a business transaction part of an expansive extranet. Theoretically, these business partners will easily and securely communicate, and complete end-to-end transactions from within their respective firms, streamlining communications, increasing the precision of forecasts, and reducing operational costs. What the supply chain management in e-commerce has failed to do is replace or improve the one fundamental attribute required to conduct business: trust.

Trust has long been the cornerstone of any successful business relationship, and as an e-commerce extension of Chapter 7, we will briefly mention this subject here. Before the Internet face-to-face communication typically formed the basis for long-lasting and profitable ventures, instilling confidence in both parties. In fact, countless research studies confirm face-to-face interactions promote the greatest trust, followed by telephone, then text chat, and, lastly, e-mail. But with the explosion of B2B e-commerce, trust can no longer be built upon face-to-face contacts. Firms are now expected to collaborate extensively with supply chain partners. Those that can leverage the power of e-commerce, while addressing issues of identity, trust, and performance management, will maximize business performance.

Ratnasingham (1999) defines trust in e-commerce or *e-trust* as promises, assurances and a demand for high quality products and services. Credibility is a measure of honesty and ethical behavior. Higher levels of credibility create higher levels of trust (Schniederjans and Schniederjans, 2008). Sheppard and Sherman (1998) identify factors likely to influence the development and maintenance of trust in the domain of a B2C supply chain. Understanding the major influences and components of trust in e-commerce transactions, listed in Table 5, can aid in establishing a trusting relationship with supply chain partners.

### **Lean Supply Chain E-Commerce Topics**

What follows in this section is a listing of lean supply chain topics dealing with e-commerce. E-commerce issues are typically covered to focus on aids in supporting the lean supply chain management principles discussed in Chapter 3. The research and articles that are discussed here offer current strategies, concepts, and ideas that can serve to implement lean supply chain management principles, overcome difficulties, and provide practical information on how lean supply chains can be successfully operated.

Table 5. Major components of trust in e-commerce (adapted from Sheppard and Sherman, 1998)

Component	Explanation
Pre-Interactional Filters	This involves knowing that individuals differ in their general propensity to trust. Foreknowledge and expectations with respect to a certain industry or firm is important in case damage control is needed. The reputation (i.e., the strength of a company's brand name), previous interactions on- and/or off-line, or reports from trusted third parties (hence, transference of trust), can all be factors in building e-commerce trust, because they precede the initial meeting of potential supply chain partners.
Interface Properties	The development of trust is strongly affected by first impressions of a business system. Thus, graphic design and layout are important appeal components. The extent to which a firm's Web sites and other Internet commercial offerings and resources are made explicit by organizing content in a manner relevant to the end user can help build trust. Enhancing usability by making the e-commerce system reliable, ease-to-use, and familiar in terms of the business model, classification schemes, and terminology also enhances trust by eliminating confusion of purpose.
Informational Content	Information about products and services should be complete, relevant and structured in a way that reduces user costs. The trust component here reflects the need to communicate the firm's history, values, and commitment. Issues of security (i.e., the completeness and the understandability of information about financial risks and guarantees), and privacy (i.e., the supplier's openness with respect to its privacy policy) are both important trust building factors.
Relationship Management	Supply chain partners have to gain enough trust to engage in a commercial relationship with an e-commerce business. Whether the trust will be honored in the long-term will depend upon follow-up to initial transactions (e.g., post-purchase communication and customer service). Communication trust reflects the facilitating effect of frequent and personalized supplier interactions with customers on trust maintenance.

### *Using E-Commerce as a Means to Enhance Supply Chain Responsiveness*

Gunasekaran *et al.* (2008) examined the comparative differences between three types of supply chains (i.e., lean supply chains, agility supply chains, and responsive supply chains). As shown in Table 6, they found there were differences between each of these types of supply chains as related to the objectives, strategic planning focus, and organizational structure considerations.

Table 6. Comparison of three types of supply chains in e-commerce

Characteristics	Lean supply chain	Agility supply chain	Responsive supply chain
Objectives	Seek reduced costs, moderate speed and flexibility	Cost minimization less important, seek increased speed and flexibility	Seek reduced costs, increased speed and flexibility
Strategic Planning Focus	Operate with fewer suppliers, utilize outsourcing, IT	Focus effort on core competencies, global outsourcing, virtual enterprises	Focus effort on supply management, strategic alliances, virtual enterprises, global outsourcing, and IT
Organizational Structure Considerations	Supplier development network system	Virtual enterprise, alliance partnerships based upon core competencies	Virtual enterprise, supply chain integration, and IT

Their research found an *agile supply chain* can be developed with an investment in advanced IT, and that agile supply chains rely upon the development of global suppliers/partnerships and ERP systems. They went on to develop a framework to achieve what others have also termed as *responsive supply chain*, whose objectives are to achieve supply chain speed, flexibility, and cost reduction (Krajewski *et al.*, 2010, pp. 342–343). They suggested that in order to achieve a truly responsive supply chain, a suitable information system integrating ERP, EDI, and the Internet is important for improving communication and ensuring a smooth flow of materials along the value chain of an organization. They concluded that an effective implementation of IT is highly desirable if a supply chain is to be responsive and flexible. They also suggested that appropriate benchmarking, performance measures, and

metrics are required to encourage agility in the supply chain. A flexible information architecture that supports decentralize, collaborative processes is also essential. Visibility and collaboration are additional keys to advances in the development of a responsive supply chain.

It becomes obvious from this research that the authors believe a lean supply chain can become more agile and more responsive to the needs of its supply chain partners. It will do so by focusing effort and establishing a strategic goal to become a more responsive supplier. That focus and reallocation of resources can permit the development of a specialized supply chain that is less concerned with many of the broader lean and supply chain goals, and more interested in achieving a responsive goal. The authors make the point that if this is the direction that a supply chain wishes to take, e-commerce IT technology and concepts can help make this a reality.

### ***E-Business Software Supports Lean Supply Chain Principles***

Ferguson (2004) reports on the Oracle Corporation's e-business software suite of applications that combines supply chain management with lean principles and globalization support features. The e-business suite enables firms to collaborate more effectively with partners and suppliers along a global network by including *international drop shipping* (i.e., enables users to manage the required paperwork for cross-border shipments), *multi-organization drop shipping* (i.e., enables users to allow shipment transfers from one area in an organization to another and across different geographies), and global forecasting capabilities. The global forecasting capability allows users to look at their international supply network and create a global supply plan. This functionality feature helps coordinate demand planning forecasts across the supply chain using demand feeds from networked ERP systems. Embedding all of these capabilities will enable lean manufacturing to work toward NPD, supplier management, and service management applications. Capabilities include combining inventory allocation planning with customer demand planning to allow users to fulfill orders for maximize profitability. Lean features that help managers reduce waste include, control features enabling smaller lot sizes in production batching to control costs, compliance with government mandates to control costs, RFID systems to control auditing costs in warehousing, and integrating other inventory and customer order tracking measures.

### ***Integrating Supply Chain Management in E-Commerce Environments***

Chuang and Shaw (2005) suggested the integration of software systems supporting e-commerce, supply chain management, and ERP systems in a similar system

architecture presented in Figure 5. This study also identified critical factors for success with e-commerce supply chain operations, including an online product catalog, a secure electronic payment system, customer satisfaction, tight integration between ERP and SCM systems, a reduction in costs, and online customer service. Note the last four factors are recommended lean supply chain management principles. Chuang and Shaw (2005) also found several required activities performed cross-functionally within organizations aid in the successful integration of e-commerce with supply chains. Those activities included concurrent engineering analysis (see Chapter 10), reliable budgeting, planning system implementation time, reliable scheduling, supplier's having extensive business process knowledge, and having an accurate level of expectation regarding supply chain performance. The aforementioned were the most significant factors that contributed to implementation success.

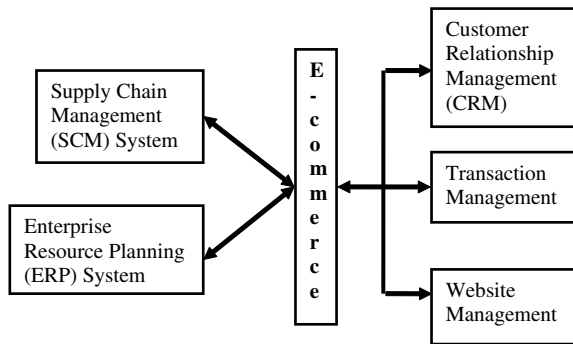


Figure 5. Integration of supply chain and e-commerce functions

### ***Maximizing B2C Supply Chains***

In a literature review by Agatz *et al.* (2008) an examination of supply chain practices and issues were undertaken for two types of B2C e-commerce operations. One type was an e-commerce business (i.e., referred to as an *e-fulfillment model*, because their only means of business and selling was through the Internet), and the other type was a version of a click-and-mortar operation (i.e., referred to as a multi-channel model because they used a variety of channels to reach customers, including the Internet, retail stores, etc.).

From a supply chain management perspective, click-and-mortar operations provide opportunities for serving different customer segments, creating synergies, and exploiting economies of scale. However, in order to successfully exploit these

opportunities, firms need to design a multi-channel distribution system to reach broader groups and segments of customers. This design and development effort requires a constant trade-off between process integration and separation across multiple channels. That is, allocating resources between an e-commerce department and the brick-and-mortar retail outlets requires a continuous effort of gauging each channel's needs. Also, sales and operations decisions are ever more tightly intertwined, since delivery and after-sales service are important, key components of product offerings. The Agatz *et al.* (2008) review of the literature revealed a number of critical success factors in designing and developing either type of business. These supply chain design factors are presented in Table 7. The value of these factors to supply chain managers is that they represent key starting places in which to focus resource allocations in order to maximize the particular type of e-commerce B2C operation.

Table 7. Supply chain critical success factor comparison: e-commerce business and click-and-mortar business

Factor	E-commerce business	Click-and-mortar
Design of Distribution Network	Inventory location, drop shipping	Inventory aggregation, shared facilities, assortment planning
Design of Warehouse	Degree of automation, warehouse layout, return handling	Different transaction sizes
Inventory and Capacity Management	Safety stocks, integration with demand management, inventory rationing, integration of returns, staffing levels	Aggregate stock levels, service differentiation

## Summary

In this chapter the subject of e-commerce and supply chain management has been presented. E-commerce and supply chain management subjects included were e-commerce, e-commerce and supply chain management issues, critical success factors in implementing an e-commerce system, supply chain benefits of using e-commerce, e-commerce interaction with supply chain management, Internet-based EDI (IEDI) and supply chains, and e-trust and supply chains. This chapter also presented a series of lean supply chain e-commerce topics. These

topical subjects included using e-commerce as a means to enhance supply chain responsiveness, e-business software supporting lean supply chain principles, integrating supply chain management in e-commerce environments, and maximizing B2C supply chains.

In an effort to be customer focused and compete in global markets, firms have had to re-evaluate what they do best and focus on those core operations as a strategy for business success. Some firms have supply chain management as a core strategy, and others do not. The non-core activities, as we found in Chapter 5, are candidates to be improved or removed. Yet some non-core production or service operations, like supply chain distribution, have to be done by someone. In the next chapter we will see how outsourcing can be used to improve overall business operations and how it relates to lean supply chains.

### ◆ Review Terms

Advertiser model	Extranets
Agile supply chain	Information disseminator model
Brick-and-mortar business	International drop shipping
Click-and-mortar business	Internet
Disintermediation	Internet/Extranet Data Exchange (IEDE)
E-business	Internet-based EDI (IEDI)
E-commerce	Intranets
E-commerce auctions	M-commerce
E-fulfillment model	Multi-channel model
Electronic business	Multi-organization drop shipping
Electronic commerce	Physical distribution
Electronic Data Interchange (EDI)	Responsive supply chain
Electronic distribution	Sales facilitator model
E-procurement model	Service model
E-supply chain	Virtual mall model
E-tailing model	Virtual or e-commerce business
E-trust	World Wide Web (WWW)

### ◆ Discussion Questions

1. What are e-business models?
  2. What is the difference between a click-and-mortar and a brick-and-mortar e-business?
  3. How are intranets and internets different, and how do they impact supply chains?
  4. What are multi-stage e-commerce models?
  5. What are the ten critical success factors for implementing an e-commerce operation in manufacturing?
  6. What are the benefits of using an e-commerce model in supply chain management?
  7. What is disintermediation? How is it related to supply chain management?
  8. How is the bullwhip effect related to e-commerce technology usage?
  9. How does EDI and IEDI support supply chain activities?
  10. What are the major components of e-commerce trust, and how can they be used to build trust?
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