

Supply Chain Management

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- Learn about the supply chain network and management drivers.
- Understand the complexity and importance of the integration of supply chain.
- Learn about supply chain components, processes, and flows.
- Know the different levels of supply chain integration.
- Examine the impact of the ERP on supply chain management.

CASE 11-1**Opening Case***Managing the e-Supply Chain at Cisco Systems*

Source: Adapted from Managing the e-Supply Chain. Business Intelligence, 2001 and Shister, N. (March 2007). Cisco Builds a Supply Chain, *World Trade*, 20 (3), 34.

Headquartered in San Jose, California, Cisco Systems designs and sells the equipment needed to build Internet technology-based networks: remote dial-up access servers, routers, switches, and network management software. Cisco has the top market share in 16 of the 20 markets in which it competes and is number two in the remaining four. By the mid-1990s, Cisco's managers found that they simply could not increase production capacity fast enough to meet demand.

James Crowther, customer business solutions manager, enterprise, explained: "We realized that growth depended on our ability to scale manufacturing distribution and other supply chain processes quickly. Cisco also realized that we would require the services of far more people than we could reasonably expect to recruit in time. It was at that point that the idea of a new business model emerged. Cisco decided to turn itself into a Web-enabled company by outsourcing most of the manufacturing and logistics activities. In addition, it used networking technology to link supplier and distributors tightly to their in-house business processes. This left us free to concentrate on our real strengths: new product development, looking after customer needs, and brand management."

In Cisco's case, using the Internet to reengineer the organization did not mean pasting a thin dotcom veneer on to a bricks-and-mortar company; however, it was about fundamentally transforming the company from the inside out. Cisco used Internet-based technology to transform its entire supply chain into an extended enterprises system or what Cisco calls "an ecosystem."

Cisco's Internet ecosystem seamlessly links customers, prospects, partners, suppliers, and employees in a multiparty, multilocation electronic network. This e-network both acts as the glue that holds together all the internal operations of the supply chain and enables all the parties involved to present a unified face to the outside world, with the result that all the working parts look and act as if they are one company. At the heart of Cisco's ecosystem are two portals: Cisco Connection Online (CCO), which provides access to Cisco's customers or clients, and Manufacturing Connection Online (MCO), which provides access to Cisco's contract manufacturers, assemblers, distributors, and logistics partners.

CCO COMPONENTS

1. *Marketplace:* a dynamic online catalogue used by more than 10,000 authorized representatives of direct customers and partners to configure Cisco products online. It contains a suite of applications for order processing that enables customers to configure, price, route, and submit orders.
2. *Status agent:* gives Cisco's sales force, direct customers, and partners immediate access to critical information on the status of orders.

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3. *Customer service*: for after-sales nontechnical support and information.
4. *Technical assistance and software library*: to help IT staff and network administrators in installation and maintenance.

MCO COMPONENTS

1. *Access agent*: real-time manufacturing information, including data on demand forecasts, inventory, and purchase orders.
2. *Monitoring agent*: customer orders and ship product, without them actually touching an order.
3. *Payment agent*: collects payments for the parts used by Cisco.

When taken together, these initiatives have had an immense impact on value creation. Cisco estimates that its extended supply chain generated a total of \$695 million in cost savings. Cisco's supply chain model has also provided scalability and agility that allow the company to grow with incredible speed. In the intensely competitive market spaces occupied by Cisco (i.e., where the timelines for new product introduction are counted in weeks rather than months or years) the company's ecosystem has become as great a core strategic capability as its strengths in product design and marketing. In 2005, Cisco announced the demand-driven supply chain (DDSC) solution, which links business applications throughout the supply chain over Internet protocol (IP). The second solution of the Cisco intelligent networked manufacturing strategy, the DDSC solution, enables customers better to integrate information and processes spanning the entire manufacturing workflow. By providing a highly secure visibility into the supply chain, customers can build in the flexibility needed in today's manufacturing world, meet expectations more efficiently, operate more profitably, and respond to market dynamics and mandates. Cisco is currently launching, in a staged approach, a manufacturing-focused product compliance review to be implemented throughout its supply chain. According to V. P. Darendinger, Cisco vice president, "SCM includes strategy development, business reviews, and scorecards, continuous improvement programs and ongoing supply base classification processes."

What do you think of Cisco's e-Business and supply chain management (e-SCM) strategy, and why has Cisco remained successful in its e-SCM strategy?

PREVIEW

As brick-and-mortar enterprises increase their Web-enabling processes, there is one area where more attention is necessary: the firm's supply chain. A good supply chain management (SCM) system can act as a digital nerve center for the entire business and save the company millions of dollars in costs in order fulfillment and other back-end support processes.

Cisco's implementation of their SCM was an optimal combination of technology and business processes that optimized the delivery of goods, services, and information from the supplier to the consumer in an organized and efficient way. SCM gives companies involved in developing, manufacturing, distributing, and retailing of products access to all of the critical information they need to plan their operations in an efficient way—whatever and wherever they need it. A complete supply chain management solution also includes customers, service providers, and partners. SCM is a large, dynamic network of complex but well-defined relationships with

multiple channels in the business, which provides accurate information to everyone in the network. SCM provides companies like Cisco the flexibility and the agility to be in constant control of their businesses. It improves efficiencies and reduces costs substantially while also giving companies the adaptability to modify their business processes.

As the opening Cisco case showed, there are myriad parties and processes involved in the SCM. Availability of proper communication channels, good collaboration policies, continuous innovation, and seamless integration across the systems involved are necessary components for reaping benefits. Cisco's e-SCM strategy benefits include supplier base reduction, greater involvement of supplier management in new product introduction, and increased risk management strategies. In addition, it has also led to refinement of Cisco's outsourcing strategy so it could better leverage its business with electronics manufacturing services (EMS) providers and better use their capabilities.

SUPPLY CHAIN MANAGEMENT

Supply chain is the network of services, material, and information flow that link a firm's customer relations, order fulfillment, and supplier relations processes to those of its suppliers and customers. In practice, people tend to use the terms *value chain* and *supply chain* interchangeably. Supply chain management is the science of developing a strategy to organize, control, and motivate the resources involved in the flow of services and materials within the supply chain.¹ According to the *Council of Supply Chain Management Professionals (CSCMP)*, a professional association that developed a definition in 2004, supply chain management "encompasses 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. In essence, supply chain management integrates supply and demand management within and across companies."

SCM is an outgrowth of the value chain concept developed by Michael Porter.² A business value chain, according to Porter, consists of a series of processes or activities conducted by the company to add value to the existing product or service and to provide a competitive advantage in the market. These business processes can be grouped into primary or secondary activities depending on the company's business strategy, product, or service and relationships with its business partners. Supply chain focus is on improving the efficiencies of the primary activities with a better flow of information across the activities and linking the with the company's external partners and customers.

Supply chain, therefore, improves the value chain of the firm. It has a direct impact on the company's bottom line. To achieve competitive advantage, companies today first need to understand their supply chain and build the strategy in such a fashion that its competitive strategy and supply chain strategy are properly aligned. The company can otherwise fail miserably in the market, even when its product or service is of good value. For example, Toys "R" Us, Inc., failed miserably when it first entered the e-commerce market in 1998. Their Web site got enormous attention from the end users during the Christmas season in 1998, and thousands of users placed online orders for toys to be delivered as gifts before December 25. At the time Toys "R" Us did not have a proper supply chain system in place to fulfill the number of orders it received; hence, it was not able to deliver the toys on time before Christmas Day. This became a major embarrassment

¹ Krajewski, L., Ritzman, L., and Malhotra, M. (2006). *Operation Management Processes and Value Chains*, 8th ed. Publisher: Prentice Hall, p. 371.

² Porter, M., and Millar, V. (1985). How Information Gives You Competitive Advantage. *Harvard Business Review*, 63 (4), 149 (12 pages).

for Toys “R” Us, because they made a lot of their customers angry and dissatisfied. Toys “R” Us eventually had to discontinue its business strategy of selling toys online on its own and created a partnership with Amazon.com, which never worked smoothly.³ For any company to be successful, its supply chain strategy and competitive strategy must be aligned or work together toward a common goal. Strategic alignment means that both the competitive and supply chain strategies have the same objective. It refers to consistency between the customer priorities that the competitive strategy hopes to satisfy and the supply chain capabilities that the supply chain strategy aims to build.

A good SCM can assure the company agility and flexibility needed in today’s Web-enabled competitive landscape. As corporations strive to focus on core competencies and become more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other corporations that can perform the activities better or more cost effectively. The consequence is that there is an increase in the number of companies involved in satisfying consumer demand, while there is a reduction in management control of daily logistical operations. Less control and more supply chain partners create the challenge for the SCM. The purpose of SCM is to improve trust and collaboration among supply chain partners and to integrate the processes to a wholesome system, thus improving supply chain responsiveness and efficiency, as shown in Figure 11-1.

Marketing, distribution, planning, manufacturing, and the purchasing departments traditionally operate independently in organizations. These departments have their own objectives,

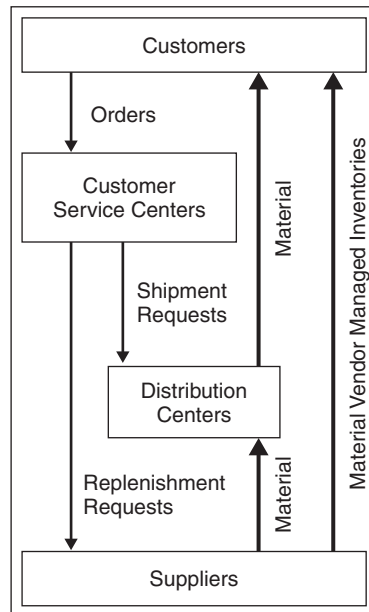


FIGURE 11-1 Collaboration in Supply Chain Information. Source: Sanjay Jain, Supply Chain Management Tradeoffs Analysis, in *Proceedings of the 2004 Winter Simulation Conference*, R. G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds. Reprinted by permission of Dr. Sanjay Jain. The George Washington University.

³ Ouchi, M. S. (March 3, 2006). Toy Story Winds Up Leaving Amazon Grim. *Knight Ridder Tribune Business News*. Washington, 1.

and these are often conflicting to a certain degree. Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these factors is that there is not a single, integrated plan for the organization (i.e., there are as many plans as the number of departments). There is clearly a need for a mechanism through which these different back-office and front-office plans can be integrated together. Supply chain management is a strategy through which such integration can be achieved.

All functions that are part of a company's supply chain contribute to its success or failure. These functions do not operate in isolation: No one function can ensure the supply chain's success. Failure at any one function, however, may lead to failure of the overall chain. Thus, a company's success or failure is closely linked to the following key perspectives. The competitive strategy and all functional strategies must fit together to form a coordinated overall strategy. Each functional strategy must support other functional strategies and help a firm reach its competitive strategy goal. The different functions in a company must appropriately structure their processes and resources to be able to execute these strategies successfully.

To achieve strategic fit, a company must ensure that its supply chain capabilities support its ability to satisfy the targeted customer segments. They must understand the customer and supply chain uncertainty. A company must understand the customer needs for each targeted segment and the uncertainty the supply chain faces in satisfying these needs. This gap analysis will help the company define its desired cost and service requirements, and identify the impact of a disruption or delay, or both, in the supply chain. A company should also understand its supply chain system capabilities. There are many types of supply chains, each of which is designed to perform different tasks well. A company must understand what its supply chain is designed to do well. If there is a mismatch between the supply chain outcomes and the desired customer needs, the company will either need to restructure the firm's competitive strategy or alter its supply chain strategy as seen in the case of Wal-Mart (see Vignette) as it promotes the use of radio frequency identification (RFID) technology to its suppliers and partners.???

Wal-Mart's RFID Strategy

A typical U.S. Wal-Mart has 142,000 items, so multiplying those savings makes sense that Wal-Mart's efforts on enforcing new SCM technology on their suppliers make a big impact on the bottom line.⁴ Wal-Mart has definitely started a ripple effect within its own supply chain.

Ever since 2002, when radio frequency identification technology proponents began insisting that it would dramatically change the way companies track goods in the supply chain, it has remained a niche technology because of the cost of RFID tags. The most generic RFID tags cost around 10 cents apiece, whereas latest generations of chips are getting better with standardization and improved functionality. Consumer goods companies always talk about 5-cent tags as a price that would open RFID up to broader uses and remove the difficulties pioneers like Wal-Mart have had in pulling in a critical mass of partners.

Just 600, or about 3 percent, of its suppliers have started using RFID since the retailer announced its famous supply chain "mandate" in 2003. The slow uptake is prompting Wal-Mart to change its strategy for the RFID technology drastically. It is moving away

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⁴ Weier, M. H. (April 2, 2007). RFID: Hold the Revolution. *InformationWeek*, Manhasset, Issue 1132, 30–31.

from distribution centers, because so many cases and pallets still arrive stamped with bar codes, to stores. There, it can work with goods from the suppliers that place RFID tags to find ways to reduce out-of-stock situations and, more recently, to drive sales promotions.

On the store front, Wal-Mart has expanded its RFID use from 100 to 1,000 stores. Readers are typically located at loading dock entrances, at entrances leading from backrooms to sales floors, and at trash compactors where boxes are destroyed. Data are collected when product moves, including at the cash register, allowing Wal-Mart to generate printouts for employees to prioritize restocking duties. Suppliers can link into Wal-Mart's e-SCM system over the Web to check exactly where their products are. In addition, Wal-Mart is also starting to give employees handheld RFID readers that beep based on proximity to specified products, making them easier to find.⁵

One Wal-Mart supplier, consumer goods company Kimberly-Clark, is focusing on sales promotion through a pilot program that uses RFID to monitor promotions of its Depend adult diapers. The company created fully stocked promotional displays of Depend and put RFID tags on the displays before shipping them to Wal-Mart and Target, another RFID pioneer. Using software from OAT Systems, Kimberly-Clark could see on a color-coded dashboard how many stores received the product in the stockroom and how many put it on the store floor.

SCM Drivers

For companies, achieving strategic fit simply means achieving the balance between supply chain responsiveness and efficiency in its supply chain that best meets the needs of the company's competitive strategy. To understand how a company can improve supply chain performance in terms of responsiveness and efficiency, we must examine the four key drivers of supply chain: facilities, inventory, transportation, and information. These drivers determine the supply chain's performance in terms of responsiveness and efficiency, as well as whether strategic fit has been achieved across the supply chain.

FACILITIES Facilities are the places in the supply chain network where product is manufactured, stored, or transshipped. The two major types of facilities are production sites (plants) and storage sites (warehouses). Whatever the function of the facility, decisions regarding location, capacity, and flexibility of facilities have a significant impact on the supply chain's performance. For a certain company, it needs to decide how many suppliers, manufacturing facilities, distribution centers, and warehouses to have, and where these facilities should be located, along with where the market is for its products (i.e., where are its customers). The decision on facility directly affects the company's inbound and outbound transportation costs, responsiveness to the market, and inventory level. For example, increasing the number of warehouse locations decreases the average outbound distance to a customer and makes outbound transportation distance a smaller fraction of total distance traveled by the product. Thus, as long as inbound transportation economies of scale are maintained, increasing the number of facilities will decrease the overall transportation cost. The inbound lot sizes can become very small if the number of facilities is increased, which results in a significant loss of economies of scale for inbound transportation. In general, increasing the number of facilities increases total transportation cost.

⁵ Wal-Mart. (July 12, 2010). *CIO Still "Bullish" on RFID*, <http://www.rfidjournal.com/blog/entry/7315/>

INVENTORY Inventory is the raw materials, work in process, and finished goods that belong to the company. Inventory is an important supply chain driver because changing inventory policies can dramatically alter the supply chain's efficiency and responsiveness. For example, to deal with the high demand of the product during the holiday season, manufacturers can make it more responsive by stocking large amount of inventory. With large inventory, the likelihood of stock out for that product is low. It can better service its customer during the holiday season. A large inventory, however, will increase the manufacturer's inventory holding cost, thereby making it less efficient. Reducing inventory will make the company more efficient, but will hurt its responsiveness. To reduce the stockout probability, companies usually keep a certain amount of safety stock that provides the buffer for stock out. A successful inventory management policy is to achieve that right balance of responsiveness and efficiency. It is worth noting that there is no finished goods inventory for the service industry. For example, for an accounting firm their finished product is the accounting service, which is not stockable.

TRANSPORTATION Transportation moves the product between different stages in a supply chain. Like the other supply chain drivers, transportation has a large impact on both responsiveness and efficiency. The type of transportation a company uses also affects the inventory and facility locations in the supply chain. Transportation can take the form of many combinations of modes and routes, each with its own performance characteristics. For example, a company can outsource the production to China and ship its entire finished product across the Pacific Ocean via an international container shipment. Such a practice clearly increases efficiency, but it decreases the responsiveness to the customer because shipment via sea takes long periods of time. On the other hand, Dell flies in several PC components from Asia because doing so allows the company to lower the levels of inventory it holds. This practice increases the responsiveness, but it decreases transportation efficiency because it is more costly than transporting parts by ship.

INFORMATION Information consists of data and analysis concerning facilities, inventory, transportation, and customers throughout the supply chain. Information could be overlooked as a major supply chain driver because it does not have a physical presence; however, information is potentially the biggest driver of performance, or efficiency, in the supply chain because it directly affects each of the other drivers. Information presents management with the opportunity to make supply chains more responsive and efficient. Information serves as the connection between the supply chain's various stages, allowing them to coordinate and bring about many of the benefits of maximizing total supply chain profitability. Information is also crucial to the daily operation of each stage in a supply chain. For instance, a production scheduling system uses information on demand to create a schedule that allows a factory to produce the right products in an efficient manner. A warehouse management system uses information to create visibility of the warehouse's inventory. The company can then use this information to determine whether new orders can be filled. There are a lot of SCM solution vendors (e.g., i2, Inc.) currently on the market that provide sophisticated ways to store, analyze, and report the relevant information to the managers.

SCM Flows

Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm. One view of the supply chain is to see it as a network carrying different flows to satisfy the customer demand. Supply

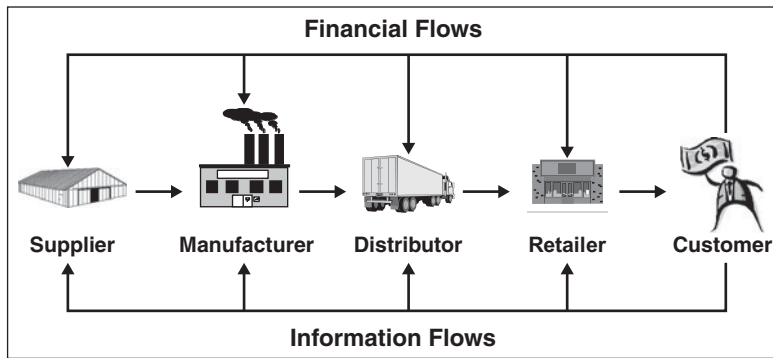


FIGURE 11-2 Flows in Typical Supply Chain.

chain management involves coordinating and integrating these flows both within and among companies. SCM is typically viewed to lie between vertically integrated firms, where the entire material flow is owned by a single firm, and those in which each channel member operates independently. Coordination between the various players in the chain is therefore the key in its effective management. It is said that the ultimate goal of any effective SCM system is to achieve the system's efficiency and respond to customer demand promptly.

SCM flows (Figure 11-2) can be divided into three main categories: product flow, information flow, and finance flow.

- The product flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs.
- The information flow involves transmitting orders and updating the status of delivery.
- The financial flow consists of credit terms, payment schedules, and consignment and title ownership arrangements.

SOFTWARE AND TECHNOLOGY Increasing numbers of companies are using the Internet and Web-based applications as part of their SCM solution. A number of major Web sites offer procurement marketplaces where manufacturers can trade and even make auction bids with suppliers.

There are two main types of SCM software: *planning applications* and *execution applications*. Planning applications use advanced algorithms to determine the best way to fill an order. Execution applications track the physical status of goods, the management of materials, and financial information involving all parties. Some SCM applications are based on open-data models that support the sharing of data both inside and outside the enterprise (this is called the extended enterprise and includes key suppliers, manufacturers, and end customers of a specific company). These shared data may reside in diverse database systems, or data warehouses, at several different sites and companies. By sharing these data “upstream” (i.e., with a company's suppliers) and “downstream” (i.e., with a company's clients), SCM applications have the potential to improve the time-to-market of products, reduce costs, and allow all parties in the supply chain better to manage current resources and plan for future needs. SCM applications are developed using a number of such scalable enterprise-level technologies as electronic data interchange (EDI) and extensible mark-up language (XML).

SCM Processes

Supply chain management involves many processes and procedures for efficient chain management. These will now be examined.

PROCUREMENT Procurement is the business-to-business purchase and sale of supplies and services. Companies usually develop strategic plans with suppliers to support the manufacturing flow management process and development of new products. The desired outcome is a win-win relationship, where both parties benefit, and reduction times in the design cycle and product development are achieved. It is more common to see this process being done over the Internet. An important part of many B2B initiatives, e-procurement Web sites allow qualified and registered users to look for buyers or sellers of goods and services. Depending on the approach, buyers or sellers may specify prices or invite bids. Transactions can be initiated and completed. Ongoing purchases may qualify customers for volume discounts or special offers.

OUTSOURCING AND PARTNERSHIPS Outsourcing is an arrangement in which one company provides services for another company that could also be done or have usually been provided in-house. Outsourcing is common in IT and other industries for services that have usually been regarded as intrinsic to managing a business. This is true both for outsourcing the procurement of materials and components and for the outsourcing of services that traditionally have been provided in-house. The benefit is that the company will increasingly focus on those activities in the value chain where it has a distinctive advantage, and let everything else be outsourced. This is particularly evident in logistics where the provision of transport, warehousing, and inventory control is increasingly subcontracted to specialists or logistics partners (3PL). In addition, managing and controlling this network of partners and suppliers requires a blend of both central and local involvement. Hence, strategic decisions need to be taken centrally with the monitoring and control of supplier performance and day-to-day liaison with logistics partners being best managed at a local level.

MANUFACTURING FLOW MANAGEMENT The manufacturing process is to produce and supply products to the distribution channels based on past forecasts or point of sales (POS) data. Manufacturing processes must be flexible to respond to market changes, and they must accommodate mass customization. Orders are processed on a just-in-time (JIT) basis in minimum lot sizes. Changes in the manufacturing flow process also lead to shorter cycle times, which means improved responsiveness and efficiency of demand to customers and activities related to planning, scheduling, and supporting manufacturing operations, such as work-in-process storage, handling, transportation, and time phasing of components.

ORDER FULFILLMENT This is the process that responds to customer demand by merging several important functions: order management, storage, and delivery of finished goods. It also involves the warehouse and inventory management and physical distribution. Warehouse execution may involve final assembly and packaging of products. In addition to better customer response, the benefits of this practice include more efficient inventory management, order entry, warehousing and transportation management, and an optimizing end-to-end order fulfillment process. Physical distribution concerns the movement of finished products, services, or both, to customers. In physical distribution, the customer is the final destination of a marketing channel, and the availability of the product or service is a vital part of each channel participant's marketing

effort. It is also through the physical distribution process that the time and space of customer service become an integral part of marketing; therefore, it links a marketing channel with its customers (e.g., links manufacturers, wholesalers, retailers).

CUSTOMER SERVICE MANAGEMENT PROCESS Customer service provides the source of customer information. It also provides the customer with real-time information on promising dates and product availability through interfaces with the company's production and distribution operations. In retail industry, product return is a big issue, and it contributes to the name "closed loop" supply chain because some of the products will return to the origin of the manufacturing facility due to imperfection or some other issues.

FORECASTING Some literature includes forecasting into the demand management process. It is a crucial part for supply chain management. Forecasting seeks to predict levels of weekly or monthly product activity over a time horizon. The statistical methods proven to make such predictions have been used by manufacturers and distributors since the advent of MRP II systems. In addition to increased availability, the nature of forecasting is also changing. Forecast systems are used to increase agility. Companies are able to consolidate demands from multiple business units, reduce forecasting cycle times from weeks to days, and simultaneously increase forecasting accuracy, thereby eliminating excess inventory and ensuring that material is on hand for scheduled production. A failure to consolidate the forecasting information along the supply chain will result in bullwhip effect. The bullwhip effect is an observed phenomenon in forecast-driven distribution channels. Because forecast errors are a given, companies often carry an inventory buffer called "safety stock." Moving up the supply chain from end consumer to raw materials supplier, each supply chain participant has greater observed variation in demand and thus greater need for safety stock. In periods of rising demand, downstream participants will increase their orders. In periods of falling demand, orders will fall or stop in order to reduce inventory. The effect is that variations are amplified the farther you get from the end consumer.

E-BUSINESS AND SUPPLY CHAIN MANAGEMENT

Supply chain management is poised for a rapid evolution. Brick-and-mortar manufacturers are increasingly adding e-commerce capabilities and, as a result, facing new challenges (e.g., individual delivery of products). The biggest challenge ahead may be to overcome the notion that a single organization can achieve best-in-class SCM. The truth is that organizations must work together to help each other succeed. Everyone in the supply chain is a strategic link. Strong links make strong supply chains; weak links hurt everybody, from the raw material producer to the end customer, who evaluates how well a supply chain is performing every time he or she makes a purchase.

A Web-enabled supply chain management (e-SCM) solution is the digital nerve center of the entire business. An effective e-SCM solution can save companies millions of dollars in costs. e-SCM is the optimal combination of technology and business processes that optimizes delivery of goods, services, and information from the supplier to the consumer in an organized and efficient way. A complete supply chain management solution also includes customers, service providers, and partners. The creation of an integrated e-supply chain solution will be a major key or barrier to entry and would provide a critical edge over competitors as it speeds time to market, improves order fulfillment, improves customer service and satisfaction, improves order management, improves decision making, improves forecasting and demand planning, improves warehouse and

distribution activities, reduces paperwork, reduces inventory buildup, shortens sales cycles, and strengthens partnerships.

The traditional concept of SCM is no longer valid in the digital economy. e-SCM focuses on globalization and information management tools, which integrate procurement, operations, and logistics from raw materials to customer satisfaction. With the widespread implementation and acceptance of e-Business, the traditional methods and rules have changed to improve profitability and fulfillment. e-SCM can use e-Business concepts and Web technologies to manage inventory and information beyond the organization, both upstream and downstream. It is the strategic approach that unites all steps in the business cycle, from initial product design and the procurement of raw materials, through production, shipping, distribution, and warehousing, until a finished product is delivered to a customer. Companies with a network of suppliers, vendors, and distributors need a fast, efficient way to disseminate information and enable two-way communications.

REPLENISHMENT SYSTEMS Supply chain replenishment encompasses the integrated production and distribution process. CVS, a well-known drug store chain, almost completely relies on its e-SCM system to reduce inventory levels as well as to eliminate stocking points. CVS has 9 main warehouse facilities and 15 satellite facilities. These warehouses are placed in central locations around all of the CVS stores. As a purchase is made at CVS, the register captures the inventory replenishment needed via a bar code on the product. At the end of each day, the manager reviews the daily POS report and uses this report as a guide to place the order to replenish the stock that was purchased that day. All of the CVS stores report the amount of new stock needed for the next day to their designated warehouse. A delivery will be made the following morning to replace the exact number of products ordered. If the store needed five bottles of Extra Strength Tylenol Gel tabs, then the store would be delivered five bottles of Extra Strength Tylenol Gel tabs. The entire process will happen again at the end of each day. CVS does have the ability to automate this process.

The POS system can send the needed inventory order directly to the warehouse; hence, eliminating the store manager's involvement. CVS feels that by having a computer take over the responsibility of a human, however, customer service may be sacrificed if an issue arises and a product is not ordered. CVS wants the ownership to rest in the hands of the store manager. If a product is not ordered for a customer, the manager can then apologize and remedy the situation, as opposed to telling the customer that he or she doesn't know why the computer did not order the product. This is just simple depiction of how CVS makes its replenishments. The marketing, finance, and sales departments forecast each month's demands using Manugistics' Demand Planning System and Manugistics' Supply Chain Planning Suite. The system analyzes sales trend climates, market conditions, and seasonal promotions. Once the data are reviewed, the procurement group enters the demands into a Marcam Corp Prism capacity system that schedules the productions of, say, Tylenol needed and generates an electronic purchase order. As Tylenol fills the purchase orders, the boxes are sent to the various warehouses, where they are opened so that individual needs are filled based on each store's request.

E-Procurement

E-procurement⁶ is the use of Web-based technology to support the key procurement processes, including requisitions, sourcing, contracting, ordering, and payment. The use of e-procurement has many benefits. With the use of e-procurement, companies can monitor and regulate buying

⁶ Turban. (2005). *E-Business Book*. New York: John Wiley & Sons.

behavior, consolidate orders to reduce product costs, eliminate maverick purchases, improve payment process, and reduce cycle time and administrative processing fees. Ariba is a company that offers procurement solutions. Dell, a well-known online computer sales company, has written the book on front-end, made-to-order, on-time delivery of computers. According to a study by Ariba, however, Dell's back office was not quite as efficient. Dell has approximately 25,000 employees spread out across the United States. They spent around \$5 billion a year on nonproduction supplies from consulting to office equipment. Dell followed the traditional procurement process that required a three-part form, needed between 8 and 10 signatures, and took weeks to complete. The entire process carried a cost of about \$110 per transaction. Tracking was nonexistent, and maverick spending was out of control.

Dell researched three e-procurement systems with a five-part scorecard: ease of use, optimization on Dell servers and the Microsoft NT platform, e-commerce links to a broad base of suppliers, ease of integration with Dell's back-end systems, and cost-effectiveness. Dell took the big bang approach to implement the new system. Seven months were needed to create approximately 20 interfaces from the Ariba buyer to Dell's legacy systems. With the new systems in place, a Dell employee can make a purchase in less than one minute. Employees are able to search by product, by a service, or by a certain Dell-approved supplier. When a catalog item is selected, the necessary information is populated automatically, including Dell's preferred prices from that supplier and all accounting information. Once the requisition is submitted, an automated workflow approval process is followed. Once approved, the requisition moves out to the Ariba Commerce Services network, a shared infrastructure that enables connectivity between buyers and suppliers on the Ariba B2B commerce platform. Ariba takes responsibility for communicating orders via XML, e-mail, faxes, EDI, or whatever the supplier has required.

Dell benefited because there was no need to maintain a costly EDI infrastructure for purchasing indirect materials. Orders are submitted over the Internet via XML, and the supplier fills the orders. Once the orders have been received from the supplier, the receiving department can match the packing slip with the online order via Ariba and automatically send it to accounting for payment. With Dell implementing Ariba's e-procurement system, they were able to save 62 percent on the time it took to complete an order and ensure a 61 percent reduction in the cost of the order. Dell is also able to use the data collected by the e-procurement system to go back to suppliers and negotiate greater volume discount.

Collaborative Design and Product Development

Collaborative design and product development among parties in the supply chain are crucial when product design and shortening the time it takes to get the product to market are the goals. With online collaboration, all parties, engineering, suppliers, marketing, and even customers can get involved in a product development before the first dollar is spent. In the early 1990s, GM usually spent four years taking a car to market. When a GM vehicle would land on the showroom floor, it was already stale. Around 1990 GM had more than 9,000 outside suppliers and more than 7,000 legacy systems. Within GM, engineering and design departments had 23 computer-aided design (CAD) systems. No system integrated with another, and collaboration was a nightmare. In 1996, GM chose electronic data systems' (EDS) Unigraphics as its standard CAD program. This program allowed the three-dimensional design documents to be viewed, edited, and changed by more than 18,000 engineers and designers located in more than 14 different locations all over the world. GM also chose to give access to the EDS to more than 1,000 critical suppliers.

Today, with the use of Unigraphics, GM's collaborative design and product development, the time to market for a new vehicle is 18 months. With new systems in place, GM will be redesigning and turning out new cars once every three weeks for the next five years. In addition to reducing time to market, GM is enjoying quite a bit of savings. Before the collaborative design and product software was in place, GM would build around 70 cars per model to test crash. Since these models were prototypes, parts were ordered in small batches, thus carrying a heavy price tag. Each prototype car could cost around \$1 million. Currently, GM builds only 10 cars per model for test crashing, and the rest is taken care of virtually. Once a virtual car is crashed, math-based models and real-time online reviews can be sent back to suppliers with new specifications for certain parts based on the virtual crash results.

SUPPLY WEBS As stated before, supply Webs are also known as an exchange. A supply Web is a virtual location where buyers and sellers can meet and negotiate products, prices, and quantity. Back in early 2001, Forester Research recorded more than 2,500 exchanges worldwide. Within a few years more than 50 percent of the exchanges have gone out of business due to lack of customers, lack of cash, or lack of both. A few success stories exist. ChemConnect is an online chemical exchange that has been around since 1999. They are now part of Intercontinental Exchange and provide exchange services to several large companies worldwide.⁷ So how does the exchange work for ChemConnect? One of ChemConnect's 9,000 members may hold a reverse auction. In a reverse auction Company X will post a request that it will purchase 10 tons of a certain acid for \$1 million. Suppliers will bid against each other to sell Company X the acid requested. In the end of the reverse auction, Company X buys 10 tons of acid from Supplier Y for \$900,000, \$100,000 less than the original bid, as a result of the competitive bidding process via the reverse auction. The benefit? The entire reverse auction process only took 30 minutes! In the past Company X would have to call on suppliers around the world to see if they had the amount they needed and priced at what they wanted to pay and could take weeks or months to complete the transaction.

E-LOGISTICS The Council of Logistics Management defines *logistics* as that part of the supply chain process that plans, implements, and controls the efficient and effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements. Thus, e-logistics is applying the concepts of logistics electronically to those aspects of business conducted via the Internet. In today's world most companies outsource the handling of e-logistics. Amazon has partnered with almost all of the big delivery companies (e.g., FedEx and UPS). It is much easier and cost-effective to plug into FedEx's infrastructure than it is to hire a logistics department and purchase the expensive equipment that would be required to maintain e-logistics. The downside for Amazon is loss of control. If a customer of Amazon does not get their package as promised on a certain day, that customer will be calling Amazon, not FedEx. Online buyers today want to purchase a product online and then track that package until it arrives on their doorstep. The driving need for e-logistics is that today's buyer has much higher expectations. Online customers will not tolerate partial orders, back orders, or poor return policies. Traditional delivery of large bulk or stocking items to a single known location has changed; now many small parcels are being delivered to many unknown locations based on demand, price, and convenience.

⁷ ICE Buys ChemConnect's Trading Business for Undisclosed Sum. (June 2007). *Gas Processors Report* [serial online], 25, www.proquest.com/ (accessed January 16, 2008). Available from: ProQuest Information and Learning, Ann Arbor, MI (accessed November 11, 2007), Document ID: 1295470561.

COLLABORATIVE PLANNING Collaborative planning involves a shared forecast between business partners. These partners all have real-time access to POS information. The goal of collaborative planning is to match production plans and product flow, thereby optimizing resource utilization. Because collaborative planning involves input from multiple parties across different companies, unification is difficult. Rules and deadlines need to be put in place, and a manager must supervise the entire process for collaborative planning to be efficient. The Gem Group, Inc. is a manufacturing company based in Lawrence, Massachusetts. They have collaborated with their customer (i.e., Timberland) to produce T-shirts. Timberland has installed an instance of a retail application at Gem Group's site. That retail application is in turn closely integrated into Gem Group's ERP system. This way both companies have real-time information about their order status, advance shipping notices, invoices, UCC 128 carton labels, and so on.

A typical example of the collaborative portal is shown in Figure 11-3. This is an example of a commercial enterprise-level portal.

ERP System and Supply Chain

ERP and SCM today are commonly integrated in most companies. ERP focus is on providing an integrated transaction processing that enhances organizational performance by increasing information consistency and transaction efficiency. SCMs, on the other hand, are aimed at providing a higher level of business planning and decision support functionality for effective coordination and execution of interorganizational business processes. As these two systems have matured,

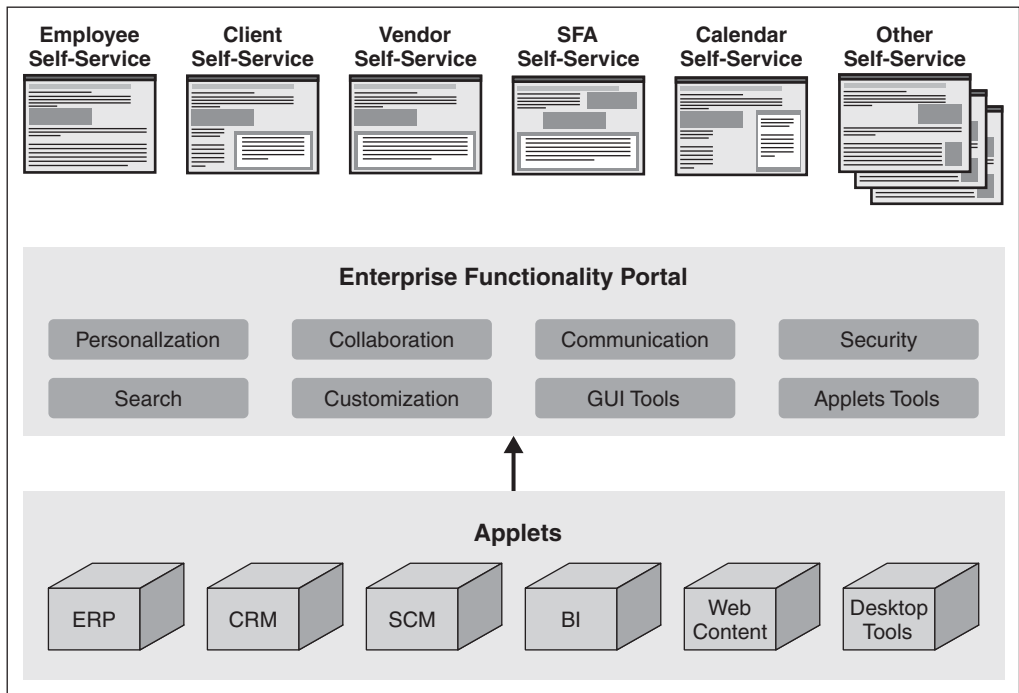


FIGURE 11-3 Example of Enterprise-Level Portal. *Source:* Adapted from Oracle/PeopleSoft Enterprise One Collaboration Portal (www.oracle.com)

their capabilities are beginning to overlap based on normal product enhancements as well as due to business acquisitions and mergers. There is therefore a surge of integrated SCM–ERP solutions available in the market.

ERP was traditionally not considered for SCM; consequently, the information flow between various members of the supply chain was slow. This was because until the late 1990s the focus of organizations was on improving the internal efficiency alone. ERP systems therefore supported only internal organization functions instead of interorganizational supply chain functions.

The organizations soon realized, however, that although internal efficiency is important, its benefit would be limited unless they were complemented by increased efficiency across the supply chain. They also realized that seamless flow of real-time information across the supply chain was the key to success in the emerging market scenario, which was characterized by great advancements of technology, shorter product life cycles, and so forth. Organizations therefore started integrating ERP applications with SCM software. This ensured that the efficiency was achieved across the supply chain and there is a seamless flow of information. Thus, ERP becomes a vital link in the integrated supply chain as it serves as the integrated planning and control system.

In a simple, straightforward way ERP applications help in effective SCM in two ways. Data sharing is the first. They can create opportunities to share data across SCMs, which can help managers to make better decisions. They also provide managers with a wider scope of the supply chain by making much broader information available. Real-time information is the second way. ERP systems can provide real-time information, which can be a great help in supply chain decisions. For example, ordering raw materials can be based on the inventory details provided by the ERP systems.

In short, Web-based technologies have revolutionized the way business is carried on, and SCM and ERP are no exceptions. In order to leverage the benefits offered by this new technology enabler, ERP systems are being “Web-enabled.” The Internet allows linking of the Web sites to such back-end systems as ERP and provides connections to a host of external parties. The benefits of such a system are that customers have direct access to the supplier’s ERP system, and the vendors can in turn provide real-time information about inventory, pricing, orders, and shipping status. As stated in the section on e-supply chain, the Internet thus provides an interface between ERP system and the supply chain members, allowing real-time flow of reliable and consistent information. To illustrate, one of the benefits of Web-enabling ERP is that it would allow customers to go online and configure their own products, get price information, and know immediately whether or not the configured product is in stock. This is possible because the customer’s request is directly accessible by the ERP system of the supplier.

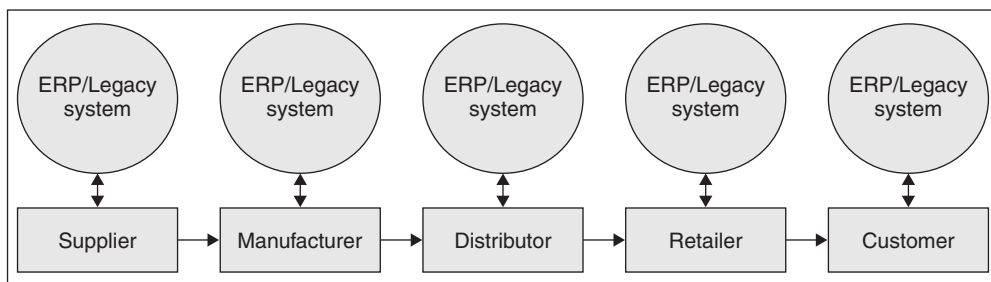


FIGURE 11-4 ERP/Legacy Systems Linkage Across the Supply Chain.

TABLE 11-1 ERP Versus SCM

Point of Comparison	ERP	SCM
Comprehensiveness	Covers a wide range of functionality	Limited to specific supply chain functionality
Complexity	Highly complex	Relatively less complex
Sourcing Tables	Relatively static	Relatively dynamic
Constraints Handling	All the demand, capacity, and material constraints are considered in isolation of each other	Simultaneous handling of the constraints
Functionality	Relatively less dynamic because they are mainly concerned with transaction processing speed and capacity	Relatively more dynamic because it performs simulations of transaction adjustments with regard to the constraints in real time
Processing Speed	Relatively slower	Faster

The differences between ERP systems (e.g., SAP, Infor, Oracle) and SCM systems (e.g., i2, Manugistics) has been subject to intense debate. One of reasons for the heated debate is that the ERP vendors are adding more SCM functionality to their products, whereas SCM vendors are also expanding their functionality, encroaching on the area handled by the ERP vendors. With the vendors of ERP systems and SCM systems adding more and more functionality, the differences between these two have been blurring. For example, major ERP vendors are introducing advanced planning and optimization as an integrated component (also a component in SCM) of their systems. Along with the current trend, it is legitimate to predict that the differences between the two solutions will be diminishing. Table 11-1 highlights the key differences between ERP and SCM systems presently available.

INTEGRATION

Integration is a broad concept that was discussed in Chapter 2. In this section, we will discuss the integration issues involved in supply chain, supply chain and ERP system, and integration of enterprise application. All of these are crucial to the success of the supply chain.

Supply Chain Integration

Over the past decade a combination of economic, technological, and market forces have compelled companies to examine and reinvent their supply chain strategies. Some of these forces include the globalization of businesses, the proliferation of product variety, increasing complexity of supply networks, and the shortening of the product life cycles. To stay competitive, enlightened companies have strived to achieve greater coordination and collaboration among supply chain partners in an approach called “supply chain integration.” There are four key dimensions in which the impact of the integration of supply chain can be found. The major elements and benefits of these dimensions can be found in Table 11-2.

TABLE 11-2 Supply Chain Integration Dimensions

Dimension	Elements	Benefits
Information Integration	<ul style="list-style-type: none"> • Information sharing and transparency • Direct and real-time accessibility 	<ul style="list-style-type: none"> • Reduced bullwhip effect • Early problem detection • Faster response • Trust building
Synchronized Planning	<ul style="list-style-type: none"> • Collaborative planning, forecasting, and replenishment • Joint design 	<ul style="list-style-type: none"> • Reduced bullwhip effect • Lower cost • Optimized capacity utilization • Improved service
Workflow Coordination	<ul style="list-style-type: none"> • Coordinated production planning and operations, procurement, order processing, engineering change, and design • Integrated, automated business processes 	<ul style="list-style-type: none"> • Efficiency and accuracy gains • Fast response • Improved service • Earlier time to market • Expanded network
New Business Models	<ul style="list-style-type: none"> • Virtual resources • Logistics restructuring • Mass customization • New services • Click-and-mortar models 	<ul style="list-style-type: none"> • Better asset utilization • Higher efficiency • Penetrate new markets • Create new products

Information integration refers to the sharing of information among members of the supply chain. This includes any type of data that could influence the actions and performance of other members of the supply chain (e.g., demand data, inventory status, capacity plans, production schedules, promotion plans, and shipment schedules). Such information ideally can be accessible by the appropriate parties on a real-time, online basis without significant effort.

Planning synchronization refers to the joint design and execution of plans for product introduction, forecasting, and replenishment. In essence, planning synchronization defines *what* is to be done with the information that is shared; it is the mutual agreement among members as to specific actions based on that information. Hence, members in a supply chain may have their order fulfillment plans coordinated so that all replenishments are made to meet the same objective—the ultimate customer demands.

Workflow coordination refers to streamlined and automated workflow activities between supply chain partners. Here, *integration* means “what” we would do with shared information, as well as “how.” For example, procurement activities from a manufacturer to a supplier can be tightly coupled so that efficiencies in terms of accuracy, time, and cost can be achieved. Product development activities involving multiple companies can also be integrated to achieve similar efficiencies. In the best-case situation, supply chain partners would rely on technology solutions actually to automate many or all of the internal and cross-company workflow steps.

Adopting e-Business approaches to supply chain integration promises more than just incremental improvements in efficiency. Many companies are discovering whole new approaches to conducting business, and even new business opportunities not previously possible. E-Business allows partners to redefine logistics flows so that the roles and responsibilities of members may change to improve overall supply chain efficiency. A supply chain network may jointly create new products, pursue mass customization, and penetrate new markets and customer segments. New rules of the supply chain game can emerge as a result of integration fueled by the Internet.

Integrating ERP and SCM Systems

ERP systems offer tremendous benefits by integrating functions across the organization. They help in automating the business processes and enabling reliable information capture and retrieval. SCM systems offer capabilities to integrate various entities that make up the supply chain and facilitate the seamless flow of information between all the supply chain partners. Given the intraorganizational and interorganizational advantages offered by ERP and SCM, respectively, integration of both systems can help in deriving substantial leverage and the potential of such integration is quite huge.

Integration of ERP and SCM is a very tough task because each member in the supply chain may have different hardware and software, and it is very difficult to insist that your company's supply chain partners maintain same systems. It would be ideal, however, if all the parties involved could agree up front to abide by open standards. This would help ease integration. Here are some of the approaches to integration. If the two companies want to integrate on the infrastructure level, and they happen to have the ERP system installed, then the process would be to have the ERP systems of the supply chain partners interlinked to each other directly to enable a seamless flow of real-time information. This might be possible when the ERP systems are sophisticated enough to include the necessary functionality to support SCM (interenterprise integration). If all systems use the same operating platform (or the same vendor's product), then the integration of the systems would be easy. If they are different, however, the necessary middleware software would have to be developed that could enable connectivity and integration of the disparate systems so that there would be a consistent and seamless information flow. If the integration of the supply chain is achieved by linking the ERP and SCM systems, then this integration could be viewed as a way to capitalize on the strengths of the two systems (i.e., ERP and SCM). For this purpose, sophisticated middleware interface software, which enables sharing of data and processes, are used to help in building up the linkage between ERP and SCM systems, specifically at the point where they have overlapping features. For example, i2 technology uses SAP's *ALE*TM (Application Link Enabling) to exchange data between SAP R3 and its SCM product, *Rhythm*TM. There are also some specialized software called specialized integration software, which allow ERP and other systems to share processes and data. This software allows integration by simply choosing the sending application (e.g., SAP, Baan) and a receiving application (like Rhythm, Manugistics) and the process to be linked.

Enterprise Application Integration

Enterprise application integration (EAI) facilitates the flow of information and straps transactions among disparate and complex applications and business processes within and among the organizations. With the move toward market globalization, there have been mergers and acquisitions at a phenomenal pace. EAI has become an essential component for an organization to share data and business logic with its business partners within the supply chain. As IT aims to provide companies with a competitive edge, several factors can slow down its effectiveness. The move from the

traditional brick-and-mortar operations to more sophisticated processes, along with the repercussions of mergers and acquisitions, makes it a necessity to respond to the ever-changing market demands. Application integration has become essential for a company's success in today's economy.

A standard EAI system provides a broad range of services that range from security management to protocol management to data mapping, among other related functions. These services define the functionality and flow of data in the application. EAI solutions can benefit an organization by providing end-to-end visibility and control of business operations. This control improves interactions with partners and customers, increases responsiveness to business changes, enables new market opportunities, and makes captured knowledge more widely available. Companies need integration that can be set up, taken down, and changed quickly, and that can work with a variety of partners, systems, and rapidly changing technologies. In case of application-integration, the focus lies largely on integrating one production application with the other, for EAI middleware is implemented in the form of connectors that handle data transformation and business logic with such outside systems as the ERP (i.e., SAP, PeopleSoft), Database (i.e., DB2, MS SQL Server, Oracle), Message Queuing (i.e., Mqseries, MSMQ), and the like.

As stated, integrating disparate systems is a very complex task. In the past application integration was a rare achievement and was restricted to a simple exchange of data. EAI requires a whole new approach to integration. The old approach involved building custom point-to-point integration one application at a time. This cannot meet the demands of the Internet economy, wherein companies need to integrate their business processes quickly with dozens, even hundreds, of other companies. Today, with the introduction of such component-based models as EJB, DCOM, and CORBA, it has become relatively easier to provide software applications as congregations of stand-alone and independent business components that communicate with the business processes through a standard set of APIs.

Many of the companies today are embracing the component-based applications. This is either by developing a new application or by componentizing their existing applications. The component approach involves splitting up the colossal applications into an assembly of numerous independent business components. DCOM and CORBA/IIOP are the two main protocols for object communication across networks, including the Internet. Both are platform independent programming models that support compatibility between applications in a complex system. DCOM is used for Windows-based applications, and CORBA is found on many platforms. Simple object access protocol (SOAP) is a communication protocol that defines a new way for processes on different systems to communicate, the heart of which is the extensible mark-up language. XML has emerged as the leading business-to-business integration and enterprise application candidate. XML is fast becoming the unifier among integrated systems.

Phases of Enterprise Application Integration Process

There are several phases of an EAI process, including the following:

- Solution outline phase
- Architecture phase
- Design phase
- Implementation phase

The end result of this process is a consolidated, consistent, and coherent view of the vital information that's accessible from multiple points across the enterprise.

Benefits of Enterprise Application Integration

EAI provides advantages through uniting disparate applications, reducing redundant data entry, merging diverse data sets, and reducing transaction costs. EAI proves beneficial to businesses for a number of reasons:

- *Increased efficiency:* The ability to automate business processes across the enterprise and across existing boundaries.
- *Value of information:* Redundant databases are aligned, eliminating duplicate data.
- *Lower costs:* The EAI strategy is to create one interface per application. This lowers the cost of upgrades or modifications/additions to applications.
- *Increased productivity:* Results from business process automation and access to real-time information.
- *Improved customer service:* Customer service employees have improved real-time access to give accurate information to customers.
- *Enhanced access:* EAI increases the ability to extend applications to more users from anywhere and anytime over the virtual private networks.

The integration of applications is compelled by the Internet and the need to connect interorganizational systems with customers, suppliers, collaborators, and partners of all sorts within the supply chain.

RFID

Radio Frequency Identification, or RFID, has been around since the 1950s. RFID is a small microchip (or tag as it is commonly referred to) that sends/receives data via radio waves sent on specific frequencies. Current RFID tags are less than half the size of a tictac. RFID has capabilities to speed updated information from a sales floor inventory to a CEO's reports in a matter of seconds. From detecting product shrinkage in real time to restocking shelves, the possibilities for this technology are almost endless. Many companies have already begun to implement RFID into their corporate structure; however, with the technology still being in its developmental infancy stage, the end result possibilities are yet to be imagined. Even though the technology is 50+ years old, it has never recognized its potential until recent years. We will discuss how RFID relates to ERP implementation, data accuracy, data timeliness, supply chain management, report structuring, and business process reengineering. One of the world's leading users of RFID technology is Wal-Mart. Wal-Mart's CIO Rollin Ford has been quoted as describing their stance on RFID as "bullish" ("Wal-Mart CIO Still 'Bullish' on RFID"). Wal-Mart is a primary reason why this technology is beginning to realize its real value.

RFID is Catching on

RFID is not the magical "do anything" technology many have made it out to be. RFID is an enabling technology that gives and ERP the means to communicate with itself. This allows for real-time automation of many data collection functions originally conducted by paid employees. The labor savings, which we will discuss first, is only a small portion of the savings realized via RFID.

Imagine you are a manager for a popular chain clothing store located in a mall. It is the last day of the month, and it is time to take an inventory. Inventory is taken only twice per month. The store closes and 10 employees begin working, counting every single article of clothing inside the store. It may take these 10 employees 5 hours or more to count every item in the store.

Assume 10 employees, for 5 hours, at \$15.00/hr (overtime), that is, \$18,000.00 per year in labor just to count inventory. Imagine this same scenario except that the store is using RFID combined with their ERP, that is \$ 0.00 in labor, and the inventory is checked constantly with perfect accuracy. At the end of every night, every person in the chain of command has an exact count of inventories. This information will be automatically sent to marketing so they can consider what items they may want to put on sale. The information will be sent to the supply warehouses and a reorder will automatically be generated for the shelves. This streamlines the supply chain removing lag time and human error, all the while accounting for shrinkage. This information will be automatically generated into reports to be waiting in the inbox of regional managers first thing in the morning. Employees across the entire company, from the top of the pyramid to the bottom, can use this information.

RFID Technology

“RFID is a very complicated and costly technology”⁸ and will thus increase the initial challenge and cost of a successful ERP implementation. If an organization decides RFID is a technology they wish to explore, this will help narrow the field of optional vendors in which they begin their ERP purchase search. Both hardware and software much be considered.

Hardware. Although the technology has been around for over 30 years, there are no “off the shelf” hardware packages. Each hardware implementation will need to be designed specifically to meet the needs of purchaser. Choosing a vendor with extensive RFID experience will be a critical choice to the success of the ERP. Tags range from passive to active, single unique identifier to writable, and come in sizes in shapes ranging from the tiny and round to the big and flat. Tag readers can be mounted just about anywhere: in a doorway, to a pallet jack, on a ceiling, in a shelf, or carried in a hand. Depending on the reader and tag they can read at distances of up to 300 feet.

Software. Unlike the hardware, software will be much easier to design. There are even cases where a near vanilla implementation would be sufficient. This would be great cost savings if possible. RFID, as far as the ERP is concerned, will be just another interface device.

Data Accuracy and Timeliness

As shown in the earlier example of Zara, Inc. a clothing store, data are only as accurate as the device collecting and entering the data. In most historical cases, a human is part of that device to collect and enter data. With a human doing the operational steps of collecting and entering data, you have a minimum of three places an error and/or retardation of the data can occur:

1. Physical counting of the data
2. Writing down of the data collected
3. Typing the data into ERP

Changing any process where these steps occur to automated RFID data collection will eliminate the possibility of human error. Data can be collected instantaneously and with 100 percent accuracy. RFID is so accurate and current; the clothing store would be able to view shrinkage as it is

⁸ Chuang, M. L. and Shaw, W. H. (2008). An Empirical Study of Enterprise Resource Management Systems Implementation. *Business Process Management Journal*, 14 (5), 675, Print.

happening. In sum, RFID is a growing technology that has yet to see its full potential. With industries consistently driving to cut labor costs and increase speed and accuracy of data flow, not implementing an applicable ERP RFID solution is money being lost. The data generated from a RFID system are immense; ERP increases the speed and accuracy with which these data can be useful for business decisions.

IMPLICATIONS FOR MANAGEMENT

Managers should understand that SCM is an important component for the successful implementation of ERP systems. It does not matter whether SCM is an external or internal component of ERP as long as there is seamless integration between the two applications.

Balancing the supply chain efficiency and responsiveness is more an art than science. The competitiveness of products and services in the global economy is increasingly measured both by individual product or service characteristics and by the efficiency and responsiveness of the supply chain of products and services in catering to differentiated customer requirements. In the face of shrinking product life cycles, differentiation and diversification of customer requirements, and cost transparency and accountability, there is constant focus on supply chain efficiency and responsiveness. For supply chain managers, this translates to a need for managing and monitoring the partnerships in the supply chain with a strategic view to sense opportunities for improvement and growth. This also translates operationally to the need for balancing customer service requirements with the costs of operating the supply chain. SCM are complex systems whose success often depends on external environment. These systems need to be integrated or linked with the systems of a company's trading partners, suppliers, clients, and other external sources. The success of the system often depends more on standardization and agreed policy between trading partners rather than on sophisticated information technology. Management emphasis for IT departments should be on collaborative design rather than on a stand-alone design for SCM systems.

E-supply chain provides great competitive advantage in today's Web-enabled economy. High-speed, low-cost, communication and collaboration with customers and suppliers are critical success factors to managing the supply chain more effectively. The very essence of SCM is effective information and material flow throughout a network of customers and suppliers. The potential of e-supply chain for improved productivity, cost reduction, and customer service are enormous. Of course, the benefits are based on effectively employing the right processes and supporting IT. Providing the right amount of relevant information to those who need to know it, and when they need to know it, is in fact effective SCM from information point of view. Fast access to relevant supply chain information can pay off remarkably in lower costs, reduced inventory, higher-quality decision making, shorter cycle times, and better customer service. One of the biggest cost savings is in the overhead activity associated with a lot of paperwork and its inherent redundancies. The non-value-added time of manual transaction processing can instead be focused on higher revenue creation activities without proportional increases in expense. The result in cycle time compression, lower inventories, decision-making quality, and reduced overhead costs, among other benefits, makes e-SCM a highly desirable strategy. Supply chain processes are more streamlined and efficient today. For many companies, more effective e-SCM is where the profit and competitive advantages will emerge and be sustained. For e-commerce to be successful, efficient fulfillment of orders and good customer service are extremely important. E-SCM systems are critical components for serving better back-end business processes in e-Business. Companies similarly will not be

able to develop good B2B operations with their business partners without a good SCM platform. Even companies that do not have online stores need an efficient e-SCM for their B2B operations, as well as for their intranet applications (e.g., warehouse management systems) that work hand-in-hand with the e-SCM system.

Integrating is the key issue to the successfulness of the supply chain. Integration must occur at multiple levels, and not just at the network or hardware platform level. An important aspect of integration is sharing and access. For integration to be successful, organizations must become comfortable with the idea of sharing critical information with their partners, and they must be willing to provide proper access to sensitive information. This can be a double-edged sword because sharing could potentially make the organization less competitive, and more access also means less security for the organization's information. Each organization will have its comfort level, depending on the industry, culture, and other environmental factors. Management will need to find a "sweet-spot" for their company. Finally, instead of just thinking about integrating ERP and SCM, management needs to think of enterprise application integration.

Summary

- Supply chain management (SCM) is a central piece of technology in today's enterprise system. They are interorganizational systems that provide an efficient and flexible operational environment between the company, its external partners, and suppliers, thereby saving millions of dollars in manufacturing and distribution costs.
- SCM provides a link for services, materials, and information across the value chain of the organization. It plays a major role in logistics management, procurement, and collaboration activities among others in the organization. The SCM strategy of the organization must be aligned with the corporate strategy of the organization; otherwise, the consequences will not be good for the company.
- ERP vendors have started including SCM as a component or module of the software. SCM was traditionally not part of ERP because the domain of SCM was to link the company with external partners, whereas the focus of ERP was mainly on the internal functions of the company.
- There are four main drivers for the SCM system performance: *facilities*, from which the product or service is delivered; *inventory* (i.e., the product or service that need to be distributed or procured with the external partners); *transportation*, which moves the product or service between two points of the supply chain; and *information*, which stores data and analysis of the other three drivers. Information is the most powerful driver for SCM performance.
- SCM involves the operation or management of many organizations' processes and procedures. They include procurement, outsourcing, manufacturing flow management, order fulfillment, customer service, and forecasting. The scope depends on the implementation of SCM in the organization.
- SCM plays a major role in the success of e-Business and e-commerce. Without a good SCM, an organization will not be able to build B2B partnerships with its trading partners, work on e-procurement from suppliers, and have proper e-fulfillment of client orders. A strong SCM implementation is necessary for e-Business.
- A good SCM is designed in collaboration with the organizations' partners rather than stand alone. SCM development should focus on standardized technology rather than sophisticated technology. Success is