

E-Commerce and Supply Chain Management

Before studying this chapter you should know or, if necessary, review

1. The implications of competitive priorities, Chapter 2, pages 00–00.
2. Product design considerations, Chapter 3, pages 00–00.
3. Process selection considerations, Chapter 3, pages 00–00.

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

- | | |
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| <ol style="list-style-type: none"> 1 Describe the different kinds of electronic commerce. 2 Describe the structure of supply chains. 3 Describe the bullwhip effect. 4 Describe factors affecting supply chain management. 5 Describe factors affecting global supply chains. 6 Describe the role of vertical integration. 7 Solve insourcing or outsourcing problems. | <ol style="list-style-type: none"> 8 Describe the role of the purchasing function in supply chain management. 9 Describe ethics in supplier management. 10 Describe the role of information sharing in supply chain management. 11 Describe the role of warehouses in supply chains. 12 Describe the concept of crossdocking. 13 Describe supply chain performance measures. 14 Describe trends in supply chain management. |
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CHAPTER OUTLINE

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Buying a product used to mean browsing through mail order catalogs or getting dressed, leaving home, and shopping at stores or malls until you found what you wanted. Today, most of us can go on-line anytime during the day, seven days a week, and buy just about anything over the Internet. You can shop while sitting at your computer and never need to leave home. You can order food from a supermarket or a restaurant on-line, or buy clothing and household goods. You can buy books, videos, CDs, or more expensive products like diamonds and cars, or even book your vacation—the Internet has revolutionized the way we do business by allowing us access to numerous suppliers around the world.

The Internet also has allowed companies to change the way they find the materials and supplies that are needed for their operations. Business-to-business (B2B) transactions are conducted between companies and their suppliers, distributors, and customers. Even though direct sales to the general public are more familiar, B2B transactions make up the majority of Internet transactions.

One of the most publicized examples is Covisint, a global business-to-business automotive supplier exchange site, began in 2000 as an initiative by the U.S. automakers Ford Motor Company, General Motors, DaimlerChrysler, and Nissan/Renault and PSA Peugeot Citroën. Covisint became the largest industry-sponsored net marketplace. Based on expected procurement efficiencies, Covisint estimates it will be able to lower procurement and product development costs by 16 percent over a three-year period. Such a reduction could result in saving about \$1000 per car. By January 2003, Covisint claimed more than 76,000 suppliers as members. Covisint is the electronic marketplace for the auto industry, providing on-line purchasing services and promoting supply chain collaboration between major direct suppliers and automakers.

In this chapter, we look at different kinds of e-commerce, including business-to-business, on-line retailing, and service operations. We examine supply chain structures: the connected links of external suppliers, internal processes, and external distributors. We evaluate factors important for successful supply chain management as well as additional factors to consider in global supply chains. The effects of vertical integration, insourcing, and outsourcing decisions are considered. We discuss the purchasing function, ethics in supplier management, and e-procurement as they relate to the supply chain. We also discuss warehousing, crossdocking, and e-distribution. And finally we discuss some supply chain performance measures and speculate on what the future will bring.

E-COMMERCE

E-commerce is defined as the use of the Internet and the Web to transact business. E-commerce is different from e-business in that e-business refers to transactions and processes within an organization. For example, a company's on-line inventory control system is an e-business component and not part of e-commerce. The inventory control system does not directly generate revenue for the company. There are five major types of e-commerce: business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer (C2C), peer-to-peer (P2P), and mobile commerce (m-commerce).

► **E-commerce**
Using the Internet and Web to transact business.

TYPES OF E-COMMERCE

Business-to-Business (B2B) E-Commerce

In **business-to-business e-commerce**, companies sell to other businesses. B2B is the largest segment of e-commerce. By 2006, much of the \$16 trillion B2B trade in the United States will be done on the Internet. Before the Internet, B2B was relatively inefficient. It took time and resources to search for products, to arrange for purchasing and payment, to arrange for shipping, and then to receive the items. By automating at least part of the procurement process, significant dollars are saved by organizations. As an example, General Electric hopes to save \$10 billion in 2003 by using such B2B methods. Let's look at how B2B commerce has developed.

► **Business-to-business e-commerce (B2B)**
Businesses selling to other businesses.

The Evolution of B2B Commerce

B2B commerce began in the 1970s with **automated order entry systems** that used telephone models to send digital orders to suppliers. One company, Baxter Healthcare Corporation, placed telephone modems in a customer's purchasing department to automate reordering supplies from Baxter's computerized inventory database. This technology changed in the 1980s to personal computers and in the 1990s to Internet workstations that access on-line catalogs. Automated order entry systems are seller-side solutions. They are owned by the supplier and only offer the supplier's product line. The primary benefits to the customers are reduced inventory replenishment costs and supplier-paid system costs.

► **Automated order entry system**
A method using telephone models to send digital orders to suppliers.

In the late 1970s, **electronic data interchange (EDI)** emerged. EDI is a form of computer-to-computer communication standardized for sharing business documents such as invoices, purchase orders, shipping bills, product stocking numbers, etc. Most large firms have EDI systems and most inventory groups have industry standards for defining the documents to be communicated. EDI systems are buyer-side solutions: they are designed to reduce the procurement costs for the buyer. EDI systems generally serve a specific industry.

► **Electronic data interchange (EDI)**
A form of computer-to-computer communications that enables sharing business documents.

In the mid-1990s, **electronic storefronts** emerged. Electronic showplaces are on-line catalogs of products made available to the general public by a single supplier. These storefronts evolved from the automated order entry systems. They are far less expensive than their predecessors because: (1) they use the Internet as the communication media, and (2) the storefronts tend to carry products that serve a number of different industries.

► **Electronic storefronts**
On-line catalogs of products made available to the general public by a single supplier.

Net marketplaces emerged in the late 1990s. Net marketplaces bring hundreds or thousands of suppliers (each with electronic catalogs) and significant numbers of

► **Net marketplaces**
Suppliers and buyers conduct trade in a single Internet-based environment.

purchasing firms into a single Internet-based environment to conduct trade. Covisint is an example of a successful net marketplace. Net marketplaces price goods with fixed catalog prices or dynamic pricing (negotiation, auction, and bid-ask exchange models). Net marketplaces generate revenue through transaction fees, subscription fees, service fees, software licensing fees, advertising and marketing, and sales of data and information.

Private industrial networks are Internet-based communication environments that extend beyond procurement. For example, private industrial networks allow buyers and suppliers to share product design and development, inventory, production scheduling, and work as partners.

The Benefits of B2B E-Commerce

The potential benefits from Internet-based B2B commerce include:

- lower procurement administrative costs,
- low-cost access to global suppliers,
- lower inventory investment due to price transparency and reduced response times,
- better product quality because of increased cooperation between buyers and sellers, especially during the product design and development.

Business-to-Consumer (B2C) E-Commerce

In **business-to-consumer e-commerce**, on-line businesses try to reach individual consumers. Let's examine the different models that on-line businesses use to generate revenue. In the **advertising revenue model**, a Web site offers its users information on services and products, and provides an opportunity for providers to advertise. The company receives fees for the advertising. Yahoo.com derives its primary revenue from selling advertising such as banner ads.

In the **subscription revenue model**, a Web site that offers content and services charges a subscription fee for access to the site. One example is Consumer Reports Online (www.consumerreports.org) which provides access to its content only to subscribers at a rate of \$3.95 per month. Companies using this model must offer content perceived to be of high value that is not readily available elsewhere on the Internet for free.

In the **transaction fee model**, a company receives a fee for executing a transaction. For example, Orbitz (www.orbitz.com) charges a small fee to the consumer when an airline reservation is made. Another example, E*Trade Financial Corporation, an on-line stockbroker (www.etrade.com), receives a transaction fee each time it executes a stock transaction.

In the **sales revenue model**, companies sell goods, information, or services directly to customers. Amazon.com, primarily a book and music seller, Travelocity.com, an airline and hotel reservations provider, and DoubleClick Inc. (www.doubleclick.net), a company that gathers information about on-line users and sells it to other companies, all use the sales revenue model.

In the **affiliate revenue model**, companies receive a referral fee for directing business to an "affiliate" or receive some percentage of the revenue resulting from a referred sale. For example, MyPoints.com receives money for connecting companies with potential customers by offering special deals. When members take advantage of the deal, they earn points that can later be redeemed for goods.

▶ **Business-to-consumer e-commerce (B2C)**

On-line businesses sell to individual consumers.

▶ **Advertising revenue model**

Provides users with information on services and products and provides an opportunity for suppliers to advertise.

▶ **Subscription revenue model**

A Web site that charges a subscription fee for access to its contents and services.

▶ **Transaction fee model**

A company receives a fee for executing a transaction.

▶ **Sales revenue model**

A means of selling goods, information, or services directly to customers.

▶ **Affiliate revenue model**

Companies receive a referral fee for directing business to an affiliate.

Consumer-to-Consumer (C2C) E-Commerce

Consumer-to-consumer e-commerce allows consumers to sell to each other with the help of an on-line market maker such as the auction site eBay Inc. (www.ebay.com). In C2C e-commerce, the consumer prepares the product for market, places the product on sale or available at auction, and relies on the market maker to provide the search engine and transaction capabilities so that the product is easily displayed, found, and paid for. In return for providing the market, eBay receives a small commission on each sale.

Consumers uncomfortable with the auction format but wishing to find used merchandise can visit a site like Half.com by eBay that allows consumers to sell unwanted books, movies, music and games to other consumers. However, Half.com allows users to set a fixed price for each item. It charges a 15 percent commission on the sale and a portion of the shipping charges.

Peer-to-Peer (P2P) E-Commerce

Peer-to-peer e-commerce links users, allowing them to share files and computer resources without a common server. The focus is on helping individuals make information available for anyone's use by connecting users on the Web. Examples of P2P sites are Napster.com and My.MP3.com. Both used technology that allowed consumers to share files and services. Such sites can generate revenue by using a subscription revenue model.

M-Commerce

M-commerce provides access to anyone, anytime, and anywhere using wireless devices. Wireless networks connect mobile users to the Internet. For example, Amazon.com has made its site accessible by wireless mobile devices. As the number of cell phones increase, the demand for wireless access is expected to increase significantly.

Now that we have a basic understanding of e-commerce, let's look at the structure of supply chains.

▶ **Consumer-to-consumer e-commerce (C2C)**
Consumers sell to each other with the help of an on-line market maker.

▶ **Peer-to-peer e-commerce (P2P)**
Users are linked and so are able to share files and computer resources without a common server.

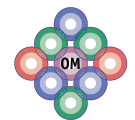
▶ **M-commerce**
Access is provided to anyone, anytime, anywhere, using wireless devices.

WHAT IS A SUPPLY CHAIN?

A **supply chain** is the network of activities that deliver a finished product or service to the customer. These include sourcing raw materials and parts, manufacturing and assembling the products, warehousing, order entry and tracking, distribution through the channels, and delivery to the customer. An organization's supply chain is facilitated by an information system that allows relevant information such as sales data, sales forecasts, and promotions to be shared among members of the supply chain. Figure 4-1 shows a basic supply chain structure.

At the beginning of the chain are the external suppliers who supply and transport raw materials and components to the manufacturers. Manufacturers transform these materials into finished products that are shipped either to the manufacturer's own distribution centers or to wholesalers. Next, the product is shipped to retailers who sell the product to the customer. Goods flow from the beginning of the chain through the manufacturing process to the customer. Relevant information flows back and forth among members of the supply chain.

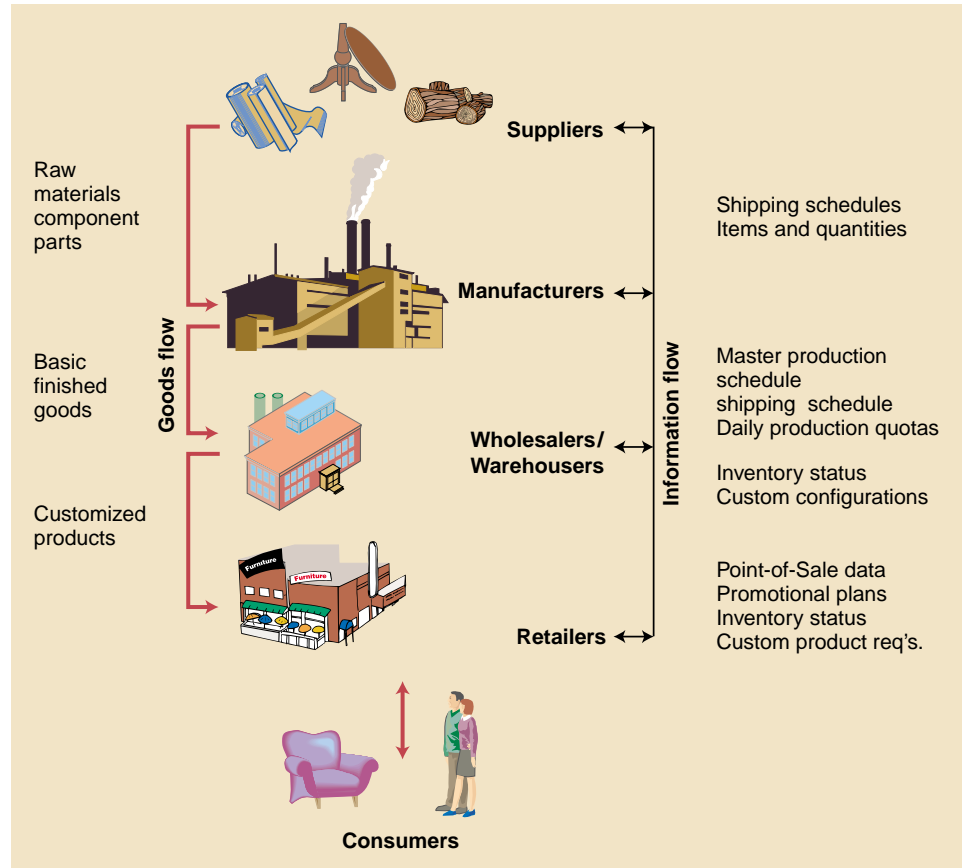
▶ **Supply chain**
A network of all the activities involved in delivering a finished product to the customer.



Marketing

FIGURE 4-1

Basic supply chain



► **Supply chain management**

Coordinates and manages all the activities of the supply chain.

Supply chain management is the vital business function that coordinates and manages all the activities of the supply chain linking suppliers, transporters, internal departments, third-party companies, and information systems. Supply chain management entails

- Coordinating the movement of goods through the supply chain from suppliers to manufacturers to distributors
- Sharing relevant information such as sales forecasts, sales data, and promotional campaigns among members of the chain

A prime example of operations management (OM), supply chain management provides the company with a sustainable, competitive advantage, such as quick response time, low cost, state-of-the-art quality design, or operational flexibility.

Dell Computer Corporation is a good example of a company using its supply chain to achieve a sustainable competitive advantage. Quick delivery of customized computers at prices 10–15 percent lower than the industry standard is Dell's competitive advantage. A customized Dell computer can be en route to the customer within 36 hours. This quick response allows Dell to reduce its inventory level to approximately 13 days of supply compared to Compaq's 25 days of supply. Dell achieves this in part through its warehousing plan. Most of the components Dell uses are warehoused within 15 minutes travel time to an assembly plant. Dell does not order components at its Austin, Texas, facility; instead, suppliers restock warehouses as needed, and Dell is billed for items only after they are shipped. The result is better value for the customer.

COMPONENTS OF A SUPPLY CHAIN

A company’s supply chain structure has three components: external suppliers, internal functions of the company, and external distributors. Figure 4-2 shows a simplified supply chain for packaged dairy products.

External suppliers include the dairy farmer, cardboard container manufacturer, label company, plastic container manufacturer, paper mill, chemical processing plant, lumber company, and chemical extraction plant. Internal functions include the processing of the raw milk into consumer dairy products and packaging and labeling dairy products for distribution to retail grocery outlets. The external distributors transport finished products from the manufacturer to retail grocers, where the products are sold

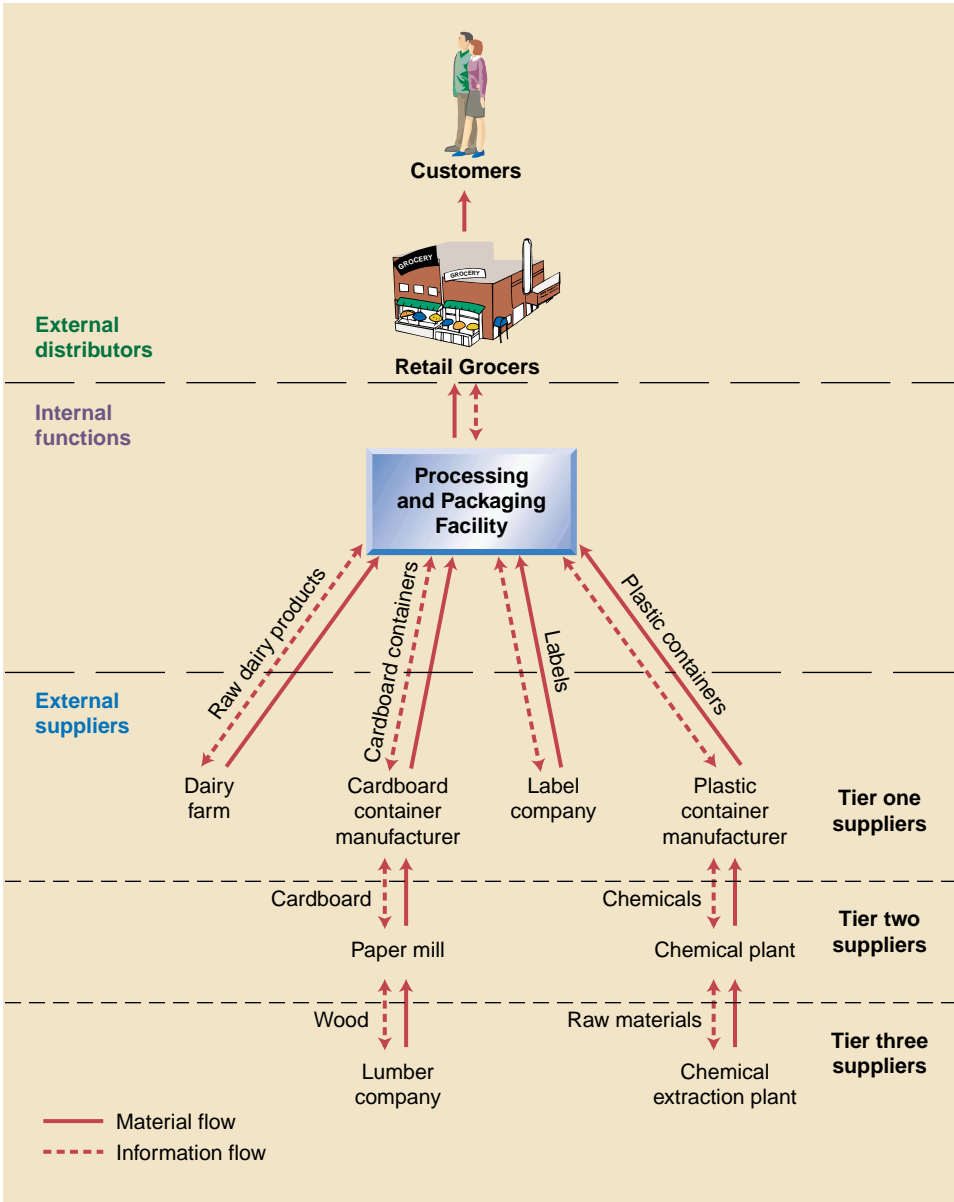


FIGURE 4-2

Dairy products supply chain

to the customer. The supply chain includes every activity from collecting the raw milk, producing the consumer dairy products, packaging the dairy products, distributing the packaged dairy products to retail grocers, to selling the finished dairy products to the customer.

Let's look at each component of the supply chain in detail.

External Suppliers

► **Tier one supplier**
Supplies materials or services directly to the processing facility.

► **Tier two supplier**
Directly supplies materials or services to a tier one supplier in the supply chain.

► **Tier three supplier**
Directly supplies materials or services to a tier two supplier in the supply chain.

Dairy products manufacturing involves several companies as shown in Figure 4-2. The dairy products are packaged either in cardboard or plastic containers made by **tier one suppliers**. Note that any supplier that provides materials directly to the processing facility is designated as a tier one supplier (in this case, the dairy farm, the cardboard container manufacturer, the label company, and the plastic container manufacturer).

The paper mill and the chemical processing plant are **tier two suppliers** because they directly supply tier one suppliers but do not directly supply the packaging operation. The lumber company that provides wood to the paper mill is a **tier three supplier**, as is the chemical extraction plant that supplies raw materials to the chemical processing plant.

Companies put substantial effort into developing the external supplier portion of the supply chain because the cost of materials might represent 50–60 percent or even more of the cost of goods sold. A company is typically involved in a number of supply chains and often in different roles. In the supply chain for the plastics container manufacturer shown in Figure 4-2, for example, the chemical plant is now a tier one supplier and the chemical extraction facility is a tier two supplier. Even though the plastics container manufacturer was a tier one supplier to the milk processing facility, the plastic container manufacturer still has its own unique supply chain. Now consider the supply chain for a retail grocer: the tier one suppliers are providers of packaged consumer products, and the grocer has no external distributors because the customers buy directly from the store. As you can see, supply chains come in all shapes and sizes.

Remember that tier one suppliers (the cardboard container manufacturer, dairy farm, label company, and plastics container manufacturer in Figure 4-2) directly supply the consumer product manufacturer (packaged dairy products), whereas tier two suppliers (paper mill and chemical processing plant) directly supply tier one suppliers. To summarize: supply chains are a series of linked suppliers and customers in which each customer is a supplier to another part of the chain until the product is delivered to the customer.

Internal Functions

Internal functions in a dairy products supply chain, for example, are as follows:

- Processing, which converts raw milk into dairy products and packages these products for distribution to retail grocery outlets;
- Purchasing, which selects appropriate suppliers, ensures that suppliers perform up to expectations, administers contracts, and develops and maintains good supplier relationships;
- Production planning and control, which schedules the processing of raw milk into dairy products;
- Quality assurance, which oversees the quality of the dairy products;
- Shipping, which selects external carriers and/or a private fleet to transport the product from the manufacturing facility to its destination.



Purchasing, Marketing

External Distributors

External distributors transport finished products to the appropriate locations for eventual sale to customers. Logistics managers are responsible for managing the movement of products between locations. **Logistics** includes *traffic management* and *distribution management*. **Traffic management** is the selection and monitoring of external carriers (trucking companies, airlines, railroads, shipping companies, and couriers) or internal fleets of carriers. **Distribution management** is the packaging, storing, and handling of products at receiving docks, warehouses, and retail outlets.

Next, we will look at a common challenge to supply chain managers called the bullwhip effect.

► Logistics

Activities involved in obtaining, producing, and distributing materials and products in the proper place and in proper quantities.

► Traffic management

Responsible for arranging the method of shipment for both incoming and outgoing products or materials.

► Distribution management

Responsible for movement of material from the manufacturer to the customer.

THE BULLWHIP EFFECT

Sharing product demand information between members of a supply chain is critical. However, inaccurate or distorted information can travel through the chain like a bullwhip uncoiling. The **bullwhip effect**, as this is called, causes erratic replenishment orders placed on different levels in the supply chain that have no apparent link to final product demand. The results are excessive inventory investment, poor customer service levels, ineffective transportation use, misused manufacturing capacity, and lost revenues. We will discuss the causes of the bullwhip effect, and how they send inaccurate or distorted information down the supply chain. First, however, let's look at the traditional supply chain shown in Figure 4-3 and follow the product demand information flow from the final seller back to the manufacturer of the product:

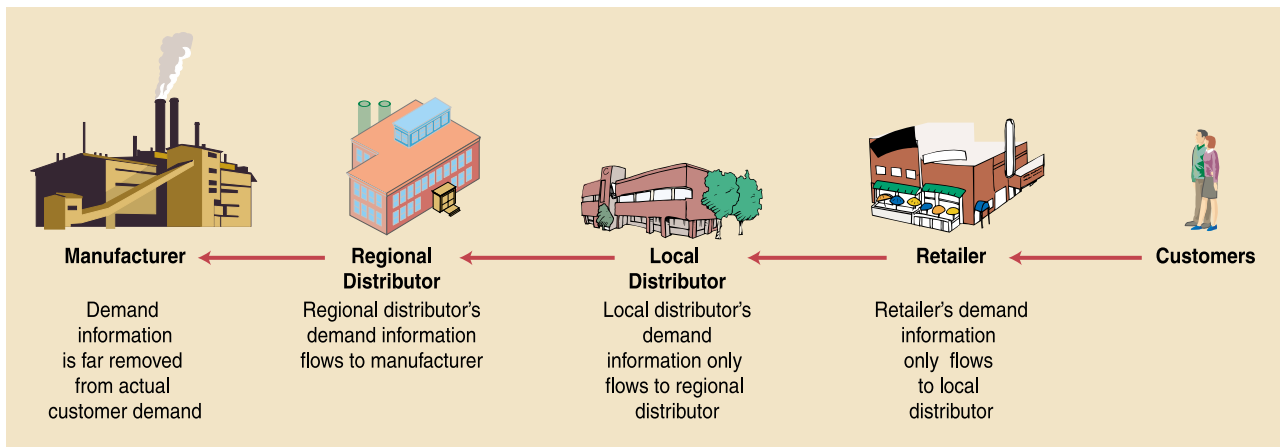
► Bullwhip effect

Inaccurate or distorted demand information created in the supply chain.

1. The final seller periodically places replenishment orders with the next level of the supply chain, which could be a local distributor. The timing and order quantity—for example, monthly orders in varying amounts—are determined by the final seller. The timing and quantity can be fixed or variable.

FIGURE 4-3

Traditional supply chain information flow





Marketing

2. The local distributor has many customers (final sellers) placing replenishment orders. Each final seller uses its own product demand estimates and quantity rules. Based on these replenishment orders, the local distributor places replenishment orders with its supplier, which could be a regional distribution center (RDC).
3. As before, the customers (the local distributors) determine the timing and quantity of orders placed with the RDC. Each RDC periodically places orders based on demand at the RDC by ordering from the manufacturer of the finished good.
4. In turn, the manufacturer develops plans and schedules production orders based on orders from the RDCs. The manufacturer does not know what the demand is for the finished good by the final customer but knows only what the RDCs order.

The greater the number of levels in the supply chain, the further away the manufacturer is from final customer demand. Since suppliers in the chain do not know what customer demand is or when a replenishment order might arrive, suppliers stockpile inventory.

Causes of the Bullwhip Effect

The causes of the bullwhip effect are demand forecast updating, order batching, price fluctuation, and rationing and gaming. Let's look at each of these causes.

Each member in the supply chain, beginning with the retailers, does *demand forecast updating* with every inventory review. Based on actual demand, the retailers update their demand forecast. The retailers review their current inventory level and, based on their inventory policies, determine whether a replenishment order is needed. The wholesalers repeat the process. Note that the demand is from the retailers' inventory replenishments and may not reflect actual customer demand at the retail level. The wholesalers update their demand forecast and place appropriate replenishment orders with the distribution centers. The distributors repeat the process, updating their demand forecasts based on demand from the wholesalers. The distributors review their inventory levels and place the appropriate orders with the manufacturer. These orders are determined by the inventory policies at the distributors. Orders placed with the manufacturer end up replenishing each level in the supply chain rather than being directly linked to end-customer demand.

A company does *order batching* when, instead of placing replenishment orders right after each unit is sold, it waits some period of time, sums up the number of units sold, and then places the order. This changes constant product demand—to lumpy demand; a situation where certain levels in the supply chain experience periods of no demand. Order batching policies amplify variability in order timing and size.

Price fluctuations cause companies to buy products before they need them. Price fluctuations follow special promotions like price discounts, quantity discounts, coupons, and rebates. Each of these price fluctuations affects the replenishment orders placed in the supply system. When prices are lower, members of the supply chain tend to buy in larger quantities. When prices increase, order quantities decrease. Price fluctuations create more demand variability within the supply chain.

Rationing and shortage gaming result when demand exceeds supply and products are rationed to members of the supply chain. Knowing that the manufacturer will ration items, customers within the supply chain often exaggerate their needs. For example, if you know the company is only supplying 50 percent of the order quantity, you

double the order size. If you really need 100 pieces, you order 200 so you are sure to get what you need. Such game-playing distorts true demand information in the system.

Counteracting the Bullwhip Effect

Here are four ways of counteracting the bullwhip effect:

1. Change the way suppliers forecast product demand by making this information from the final seller level available to all levels of the supply chain. This allows all levels to use the same product demand information when making replenishment decisions. Companies can do this by collecting point-of-sale (POS) information, a function available on most cash registers.
2. Eliminate order batching. Companies typically use large order batches because of the relatively high cost of placing an order. Supply chain partners can reduce ordering costs by using electronic data interchange (EDI) to transmit information. Lower ordering costs eliminate the need for batch orders.
3. Stabilize prices. Manufacturers can eliminate incentives for retail forward buying by creating a uniform wholesale pricing policy. In the grocery industry, for example, major manufacturers use an everyday low-price policy or a value-pricing strategy to discourage forward buying.
4. Eliminate gaming. Instead of filling an order based on a set percentage, manufacturers can allocate products in proportion to past sales records. Customers then have no incentive to order a larger quantity to get the quantity they need.

FACTORS AFFECTING SUPPLY CHAIN MANAGEMENT

Consumer Expectations and Competition

On-line retailing, or business-to-consumer e-commerce, has shifted the power from the suppliers to the consumers. This shift in power has occurred because the Internet greatly reduced search and transaction costs for the consumer. It was estimated as early as April, 2001 that some 100 million people and over 80 percent of all individuals with Internet access had purchased something (either a product or a service) on-line. In addition, millions more customers researched products on-line and subsequently bought those items off-line. The capability to quickly search, evaluate, compare, and purchase products gives the consumer considerable power. Some examples of successful e-tailers are Amazon.com, eBay, BMG Music Service, Barnes&Noble.com, Columbia House, Half.com, and JCPenney. E-tailers have penetrated significantly the following markets: computer hardware and software, books, travel, music and videos, collectibles and antiques, and event tickets.

Since customers have access to so many suppliers, it is important for suppliers to differentiate themselves by providing customers with excellent value. Dell Computer Corporation, Gateway, Inc., L.L.Bean, Inc., Lands' End, Inc., Amazon.com, UPS, and FedEx are good examples of companies that put a premium on values such as preferred customer service, short lead times, and/or quality guarantees. Dell differentiates itself with short lead times. The company does this by warehousing most of the components used to assemble its computers within 15 minutes of the assembly facility and building customized computers in an assemble-to-order method.

LINKS TO PRACTICE

Lands' End, Inc.
www.landsend.com



Consider how Lands' End uses technology in its business. Lands' End went on-line in 1995. The company sold only \$160 worth of gear the first month. Today, Lands' End sells over \$10 million per month on-line. The company has a live chat room that allows customers to ask questions about merchandise. It also offers a “shopping with a friend” service that allows a customer, his or her friend or friends, and a customer service representative to be linked together. However, Lands' End's “virtual model” highlights how far technology has advanced. A few strokes on the keyboard and the shopper is able to produce an on-screen model with his or her body measurements. Even though this virtual model is not perfect, over 1 million shoppers have built their own models at the Lands' End site.

An additional issue here is how companies handle the return of unwanted merchandise and provide for product exchanges or refunds. The Boston Consulting Group (BCG) reported that the “absence of a good return mechanism” was the second highest reason shoppers cited for not shopping on the Web. There are methods for handling returns. An on-line company often first requires authorization to return an item, then the customer must pack up the item, pay to ship it back to the company, insure the item, and then wait for a credit to be made. Once the item is returned, the original seller must unpack the item, inspect the item, check the paperwork, and try to resell the item. Typically neither the buyer nor seller is happy with the process.

Another approach allows the customer to drop the returned items at collection stations (sometimes the physical stores of the company, i.e. Staples, Inc., Sears, OfficeMax, Inc., etc.). The returned items can then be sold from the receiving store or picked up in bulk and returned to the distribution point. Another approach is to completely outsource returns. FedEx and UPS provide such services.

In addition to buying products on-line, consumers also buy on-line services. Finance, insurance, real estate services, business services, and health services are the largest on-line service industries. Business services include consulting, advertising and marketing, and information processing.

Service organizations are categorized either as those that do transaction brokering or those that provide a “hands-on” service. An example of transaction brokering is a company providing financial services that has stockbrokers acting as intermediaries between buyers and sellers of stock. An example of a “hands-on” service is a legal service that interacts directly with the consumer to create a legal document. In general, most service organizations are knowledge and information intense. To provide value to consumers, these service companies must process considerable information (legal services or medical services) and employ a highly educated and skilled workforce (lawyers and doctors).

Globalization

Experts predict shifts in global demographics and economic power in the not-so-distant future. The world is changing and new markets are emerging—for example, in Latin America, Africa, Asia, and Eastern Europe. The new companies force established

companies to rethink how to provide value to customers worldwide. Consumers in new markets will not accept hand-me-down product designs and services but demand value equal to that received by consumers in established markets.

The ease of developing an electronic storefront has allowed suppliers from around the world to be discovered. A good example is the success of artisans in Kenya, who by marketing over the Internet increased annual export earnings to \$2 million from only \$10,000.

Whereas smaller companies have benefited from electronic storefronts, they often face new problems. For example, how they can deliver products ordered in small quantities to numerous customers around the world. A common solution in B2C is to outsource the delivery to companies such as FedEx and UPS. This works especially well when the customer is paying for delivery.

A good example is Bike World, a company known for its high-quality bicycles, expert advice, and personalized service. After beginning Internet operations in 1996, Bike World found itself overwhelmed processing orders, manually shipping packages, and responding to customer inquiries regarding order status. Because of this, Bike World outsourced its order fulfillment to FedEx. FedEx offered reasonably priced delivery that exceeded customers' expectations.

Information Technology

In addition to the Internet, companies use other technology to help manage supply chains. For example, **intranets** are networks internal to an organization. Intranets allow a company to network groups of internal computers together to form more effective information systems. Typically members of the organization communicate internally on the Intranet. Organizations can link intranet systems of the Internet to form **extranets**. The extranet can be expanded to include both a company's suppliers and customers. Typically, real-time inventory status is available on the extranet as well as are production schedules. Extranets allow suppliers and customers to "see" within the organization. The primary difference between the Internet, intranets, and extranets is who has access to the system. The Internet is wide open, the intranet is open to members of an organization, and the extranet is open to members of the organization as well as to suppliers and customers.

► **Intranets**
Networks that are internal to an organization.

► **Extranets**
Intranets that are linked to the Internet so that suppliers and customers can be included in the system.

Government Regulation

The issue of government regulation of the Internet is still unresolved. Although early Internet users claimed the Internet could not be controlled given its decentralized design and its ability to cross borders, it is clear that the Internet can be controlled. In China, Malaysia, and Singapore, access to the Internet is controlled from government-owned centralized routers. This allows these countries to block access to U.S. or European Web sites. Search engines operating in these countries self-censor their Asian content by using only government-approved news sources. In other countries, freedom of expression has limited restrictions on the Internet.

Another issue of concern is taxation. The question is how, and if, remote sales should be taxed. Think of the advantage gained by e-tailers over local merchants when no taxes are charged to the consumer. In addition to sales taxes, the issue of customs and tariffs must be addressed. Taxation remains a very complicated issue for Internet sales.

Copyright infringement is also an issue. The U.S. copyright law protects original forms of expression such as writing (books, periodicals), art, drawings, photographs, music, motion pictures, performances, and computer programs from being copied by

others for a minimum of 50 years. One exception to the U.S. copyright law is the doctrine of fair use. This doctrine allows teachers and writers to use materials without permission under certain circumstances. In response to copyright issues, the U.S. government enacted the Digital Millennium Copyright Act (DMCA) of 1998. The DMCA declares it illegal to make, distribute, or use devices that circumvent technology-based protections of copyrighted materials, and attaches stiff fines and prison sentences for violations.

Another issue concerns public safety and welfare. In the United States, e-commerce issues of safety and welfare center around the protection of children, strong antipornography sentiments, strong antigambling sentiments, and protecting public health by restricting sales of drugs and cigarettes. It is clear that many issues concerning government regulation of the Internet are yet to be determined.

The Environment

Recycling, sustainable eco-efficiency, and waste minimization affect supply chain management. A company that is a global provider must understand the shipping restrictions (packaging, customs, etc.) in countries around the world. According to the European Union's packaging requirements, for instance, cardboard boxes must be removed from consumption sites and recycled. U.S. automobile parts producers ship parts in reusable containers rather than disposable containers. Supply chains need to focus on the final disposition of products and packaging and develop processes to successfully recycle materials. A company also must have efficient methods for shipping a large number of small, individual orders globally.

ADDITIONAL FACTORS FOR GLOBAL SUPPLY CHAINS

Geographically Dispersed Members

Since a global supply chain has members located around the world, the actual physical distances between the physical locations of the members are typically larger. Larger distances between physical locations can mean longer replenishment transit times. In addition, companies can experience replenishment delays when items are detained clearing customs. Incomplete documentation can further delay shipments.

By definition, longer replenishment lead times mean that the company has a higher investment in pipeline inventory (see Chapter 12). A higher degree of uncertainty with regard to actual delivery times means that manufacturers need to carry additional safety stock (Chapter 12) to assure continuous operations. Scheduling uncertainty and longer delivery times increase the inventory that is necessarily held in the supply chain and contribute to the bullwhip effect. The volatility of demand in the supply chain leads to stockouts, poorer customer service, and higher administrative costs.

Forecasting Accuracy

Greater distances between members and longer delivery times complicate supply chain forecasting (Chapter 8). Global supply chains also have members operating in different cultural environments, using different languages, and observing different operating practices. All of which can cause communication problems and create inaccurate or distorted demand information. Since actual customer-demand forecasting is likely to be poorer, additional safety stock is needed to meet customer service objectives.

Exchange Rates

Members in a global supply chain must be aware of fluctuating currency exchange rates and the impact such changes can have on input costs (materials and labor), sales prices, and sales volume. A firm can develop a global supply chain to take advantage of weaker currencies by establishing links with suppliers in a variety of countries. That way, when the firm needs materials or outsources work, it can take advantage of currency fluctuations to decrease its costs.

Infrastructure Issues

Global supply chains with members in developing countries can face substantial infrastructure issues (such as inadequate transportation networks, limited telecommunication capabilities, uncertain power continuity, low worker skill, poor supply availability and quality, etc.). Each of these issues increases uncertainty in supply and demand for the supply chain, which result in higher costs and poorer service.

Inadequate transportation networks increase distribution lead times. Roads may be inadequate to transport heavy loads (necessitating the creation of smaller loads), rail travel may not be available or very limited in terms of frequency (once or twice a week), air service may be limited in frequency (one or two flights per day or less), and ocean shipping may be limited by the capabilities of the port. It is not unusual for an item to change hands four to eight times before reaching the final customer.

Poor telephone service can restrict the timely availability of supply and demand information. Because of this a more extensive information system to keep track of items is often required. An unstable power supply can significantly affect the output of a supplier, both in terms of when the product can be produced and the effect on product quality caused by unstable power.

A lack of specific worker skills can limit the technology a firm uses. For example, numerically controlled (NC) machines use more easily trained machine setters and programmers rather than more highly skilled machinists. The increased use of NC machines in South America is a result of an inadequate number of skilled machinists.

A lack of available local materials and competent suppliers can force a firm to redesign its process, or even its product, to minimize or eliminate the use of scarce materials. Imported raw materials may be difficult to obtain due to import restrictions. In some cases, no local suppliers are available. A case in point is McDonald's. When McDonald's started operations in Russia, it had considerable problems developing high-quality Russian suppliers. McDonald's used a vertically integrated strategy, developing its own plant and distribution facility for processing meat patties, producing french fries, preparing dairy products, and baking buns and apple pies. Initially, McDonald's even grew its own potatoes.

Product Proliferation

Global competition forces firms to supply highly customized products and services to multiple national markets. Usually a firm manufactures a basic product that is adaptable to many markets. The basic product contains most of the features and components of the finished product along with some market-specific add-on components. For example, computer products have country-specific power supplies to

accommodate local voltage, frequency, and plug types. In addition, keyboards and manuals must match the local language. Such minor variations create a large number of unique finished-product configurations to be managed. Product proliferation further complicates accurate demand forecasting.

Before You Go On

Make sure you understand the five different types of e-commerce and the role of each. Understand the benefits to companies using B2B e-commerce. Be able to describe the different revenue models. You also need to understand the structure of a supply chain, the bullwhip effect, and some of the challenges to supply chain management in today's marketplace. A supply chain structure has external suppliers, internal functions of the firm, and external distributors. The bullwhip effect causes erratic replenishment orders placed on different levels in the supply chain that have no apparent link to final product demand. Because of the new global marketplace, consumers demand more value from suppliers. Added value can take the form of higher product or service quality, quicker response, lower prices, or better guarantees. Managing global supply chains is further complicated by greater geographical distances between members of the chain, poorer forecasting accuracy, fluctuating exchange rates, inadequate infrastructures, and product proliferation.

VERTICAL INTEGRATION



Marketing, Purchasing

▶ Vertical integration

A measure of how much of the supply chain is actually owned or operated by the manufacturing company.

▶ Insource

Processes or activities that are completed in-house.

▶ Outsource

Processes or activities that are completed by suppliers.

▶ Backward integration

Owning or controlling sources of raw materials and components.

▶ Forward integration

Owning or controlling the channels of distribution.

Which products or services are provided in-house by the manufacturer and which are provided to the manufacturer by other members of the supply chain? **Vertical integration** is a measure of how much of the supply chain is owned or operated by the manufacturer. Products or services provided by the manufacturer are **insourced**. Products or services not provided by the manufacturer are **outsourced**. Outsourcing means that the manufacturer pays suppliers or third-party companies for their products or services, a practice that is on the rise. A recent survey reported that 35 percent of more than 1000 large companies have increased their outsourcing. Another survey of large companies reported that 86 percent outsourced at least some materials or services. The activity most frequently outsourced was manufacturing.

Backward integration is a company's acquisition or control of sources of raw materials and component parts: the company acquires, controls, or owns the sources that were previously external suppliers in the supply chain. **Forward integration** is a company's acquisition or control of its channels of distribution—what used to be the external distributors in the supply chain.

A company bases its level of vertical integration on its objectives. The greater the vertical integration, the lower is the level of outsourcing. Conversely, the higher the level of outsourcing, the lower is the level of vertical integration. Some factors favor vertical integration. For example, companies needing a high volume of a product or service can sometimes achieve economies of scale by providing the product or service in-house. Companies with special skills may find that it is cheaper to provide certain products or services in-house. Other factors encourage outsourcing. For example, companies with low volumes generally find it cheaper to outsource a product or service rather than provide it in-house. Sometimes a company can get a better quality product or service from a supplier than it can provide itself.

Now let's look at the financial calculations behind insourcing and outsourcing decisions.

INSOURCING VERSUS OUTSOURCING DECISIONS

It may be easy to calculate the costs of insourcing versus outsourcing and make the right financial decision. But such decisions involve more than financial calculations. Is a particular product or service critical to your company's success? Is the product or service one of your company's core competencies? Is it something your company must do to survive? If the answer is yes to any of these questions, your company will provide the product or service in-house. If the product or service is not one of its core competencies, the company needs to decide whether it should make or buy the product or service. Other considerations are, for example, whether the products or services provided in-house are identical to those outsourced. Is product quality in-house comparable to product quality in the marketplace? Is product functionality comparable, or does one product have an advantage in terms of quality or functionality? Finally, does the company have the capital needed for any up-front costs to provide the product or service in-house?

Now let's look at how a company might make the financial calculations. To make a financial calculation, we look at the total costs involved in either producing the entire quantity in-house or buying the entire quantity from a supplier. The total cost of buying the item is any fixed annual cost associated with buying the product plus a variable cost for each item bought during the year, or

$$TC_{\text{Buy}} = FC_{\text{Buy}} + (VC_{\text{Buy}} \times Q)$$

where TC_{Buy} = total annual costs of buying the item from a supplier
 FC_{Buy} = fixed annual costs associated with buying the item from the supplier
 VC_{Buy} = variable costs per unit associated with buying the item from the supplier
 Q = quantity of units bought

Similarly, we calculate the total cost of making the item in-house as

$$TC_{\text{Make}} = FC_{\text{Make}} + (VC_{\text{Make}} \times Q)$$

where TC_{Make} = total annual costs of making the item in-house
 FC_{Make} = fixed annual costs associated with making the item in-house
 VC_{Make} = variable costs per unit associated with making the item in-house
 Q = quantity of units made in-house

The first step in solving the make-or-buy decision is to determine at what quantity the total costs of the two alternatives are equal. To do this, we set the total annual cost of buying equal to the total annual cost of making:

$$FC_{\text{Buy}} + (VC_{\text{Buy}} \times Q) = FC_{\text{Make}} + (VC_{\text{Make}} \times Q)$$

Solving this tells us the *indifference point*—that is, how many units we must buy or produce when the total costs are equal. If we need this exact amount, we would be indifferent to whether we bought the item or produced it in-house. If we need less than this quantity, we choose the alternative with the lower fixed cost and the higher variable cost. If we need more than this quantity, we choose the alternative with the lower variable costs.

Let's look at a numerical example. Remember that when the quantity needed exceeds the indifference point, use the alternative with the lower variable cost. If the usage quantity is below the indifference point, then choose the alternative with the lower fixed cost.

EXAMPLE 4.1

MS Bagel Shop:
A Make-or-Buy
Decision

Two recent college graduates, Mary and Sue, have decided to open a bagel shop. Their first decision is whether they should make the bagels on-site or buy the bagels from a local bakery. They do some checking and learn the following:

- If they buy from the local bakery, they will need new airtight containers in which to store the bagels delivered from the bakery. The fixed cost for buying and maintaining these containers is \$1000 annually.
- The bakery has agreed to sell the bagels to Mary and Sue for \$0.40 each.
- If they make the bagels in-house, they will need a small kitchen with a fixed cost of \$15,000 annually and a variable cost per bagel of \$0.15.
- They believe they will sell 60,000 bagels in the first year of operation.

Should Mary and Sue make or buy the bagels?

• **Solution**

First, we set the total annual costs equal to each other using the formula.

$$FC_{\text{Buy}} + (VC_{\text{Buy}} * Q) = FC_{\text{Make}} + (VC_{\text{Make}} \times Q)$$

or

$$\$1000 + (\$0.40 \times Q) = \$15,000 + (\$0.15 \times Q)$$

Solving for Q , we have $(\$0.25Q) = \$14,000$, or $Q = 56,000$ bagels. Since the costs are equal at 56,000 bagels and Mary and Sue expect to use 60,000 bagels, they should make the bagels in-house rather than buy them from the local bakery. By making the bagels, the cost for each additional bagel above 56,000 is \$0.15 instead of the \$0.40 they would pay the local bakery for each bagel.

THE ROLE OF PURCHASING

A company's purchasing department plays an important role in supply chain management decisions. Purchasing is typically responsible for selecting suppliers, negotiating and administering long-term contracts, monitoring supplier performance, placing orders to suppliers, developing a responsive supplier base, and maintaining good supplier relations. Since material costs may represent at least 50–60 percent of the cost of goods sold, purchasing significantly affects profitability. Moreover, changes in product cost structure, with materials comprising the bulk of the cost of goods sold, have elevated the role of purchasing in many organizations.

Outsourcing requires decisions about which supplier to contract with for products or services. These decisions in turn depend on the criticality and frequency of the product or service, and they determine the relationship the company forms with the supplier. For example, if the purchase is one-time only, the company does not need to develop a relationship with the supplier. However, if the company wants a reliable supplier for a critical product or service, it needs to develop a long-term relationship with the supplier.

Ethics in Supply Management

A constant concern within purchasing departments is the issue of ethics in managing suppliers. Sales representatives from suppliers often offer buyers free lunches, free tickets to sporting or entertainment events, free weekend getaways or valuable gifts.

While suppliers may view these merely as promotional activities, at some point buyers need to consider how much is too much. Because buyers are in a position to influence or determine which supplier is awarded business, buyers must make certain that they avoid any appearance of unethical behavior or a conflict of interest.

Many companies have specific policies outlining what constitutes an acceptable gift or promotion. In some companies, buyers are not allowed to accept anything from a supplier, not even a pen. In other companies, there are dollar limits on what may be accepted. To guide purchasing employees the Institute for Supply Management (ISM) has approved a set of principles and standards, which are shown in Table 4-1.

Developing Supplier Relationships

A strong supplier base is essential to the success of many organizations. Choosing a supplier is like choosing where to shop for something you want to buy. The first thing you decide is which merchants have the product or service you want. Adequate quality for the product or service is usually a prerequisite for even considering a merchant. What else is important to you when choosing a merchant? Availability, perhaps size

Loyalty to Your Organization Justice to Those with Whom You Deal Faith in Your Profession

From these principles are derived the ISM (Institute for Supply Management) global standards of supply management conduct.

1. Avoid the intent and appearance of unethical or compromising practice in relationships, actions, and communications.
2. Demonstrate loyalty to the employer by diligently following the lawful instructions of the employer, using reasonable care and granted authority.
3. Avoid any personal business or professional activity that would create a conflict between personal interests and the interests of the employer.
4. Avoid soliciting or accepting money, loans, credits, or preferential discounts, and the acceptance of gifts, entertainment, favors, or services from present or potential suppliers that might influence, or appear to influence, supply management decisions.
5. Handle confidential or proprietary information with due care and proper consideration of ethical and legal ramifications and government regulations.
6. Promote positive supplier relationships through courtesy and impartiality.
7. Avoid improper reciprocal agreements.
8. Know and obey the letter and the spirit of laws applicable to supply management.
9. Encourage support for small, disadvantaged, and minority-owned businesses.
10. Acquire and maintain professional competence.
11. Conduct supply management activities in accordance with national and international laws, customs and practices, your organization's policies, and these ethical principles and standards of conduct.
12. Enhance the stature of the supply management profession.

TABLE 4-1

ISM Principles and Standards of Ethical Supply Management Conduct
Reprinted with permission from the publisher, the Institute for Supply Management™, *Principles and Standards of Ethical Supply Management Conduct*, approved January 2002.

and color for clothing, freshness and appearance for produce, and physical proximity so you can see the product or try it on. Quick response time, such as overnight shipping or rapid alterations; price, of course; ease of doing business; reputation; and warranty or service agreements are all considerations.

What is important to you as an individual when choosing a merchant is also important for your company when choosing a supplier. In general, we want merchants or suppliers who give us good value. Several studies report that the top three criteria for selecting suppliers are price, quality, and on-time delivery. Even more important, however, is that the choice of suppliers be consistent with a company's mission. For example, if your company is competing on the basis of quick response time, your suppliers must offer minimal lead times and be able to respond quickly.

How Many Suppliers?

Once your company has chosen its suppliers, the next question is: Should you give a single supplier all your business for a particular product or service? Or should you use multiple suppliers? Table 4-2 lists arguments in favor of a single supplier and multiple suppliers.

For some operations, like make-to-order products, it is easier to deal with a single supplier. This is especially true for scheduling deliveries, resolving problems, minimizing

TABLE 4-2

Arguments in Favor of One Supplier and Multiple Suppliers

Pros of One Supplier	Pros of Multiple Suppliers
<ul style="list-style-type: none"> • The supplier may be the exclusive owner of essential patents and/or processes and thus be the only possible source. • By using one supplier, quantity discounts may be achieved. • The supplier will be more responsive if it has all of your business for the item. • Contractual agreements may prohibit the splitting of an order. • The supplier is so outstanding that no other supplier is a serious contender. • Single sourcing is a prerequisite for partnering. • The order is too small to split between suppliers. • When the purchase involves a die, tool, mold, or expensive setup, the cost of duplicating may be prohibitive. • Deliveries can be scheduled more easily. • Supports just-in-time manufacturing and EDI. • Allows for better supplier relations. • The just-in-time philosophy can be better utilized. 	<ul style="list-style-type: none"> • Competition among suppliers may provide better service and price. • Probability of assured supply is better. Multiple suppliers spreads the risks. • Eliminates a supplier's dependence on the purchaser. • Provides a greater flexibility of volume. • No single supplier may have sufficient capacity. • Allows for testing of new suppliers without jeopardizing the flow of materials. • Government regulations may require multiple sources.

the cost of dies or tools, developing computer links, and so forth. In addition, using a single supplier can improve the quality of your finished product by ensuring the consistency of the input materials.

On the other hand, multiple suppliers reduce the risk of a disrupted supply—that is, if one supplier suffers a disaster, other suppliers can pick up the slack. Further, multiple suppliers can more easily support changing quantity requirements. For example, if you need a larger quantity than a single supplier can supply, the order can be split between multiple suppliers. This is referred to as flexibility of volume. Finally, government regulations may require the use of multiple suppliers for some operations.

The answer of how many suppliers depends on your supply chain structure. If your company wants to integrate its supply chain, then partnering or using a single supplier makes sense. For example, the trend in industry is toward a smaller supply base. A benchmarking study of 24 industries done by the Center for Advanced Purchasing Studies in 1994 reported a 6.5 percent average decrease in the number of active suppliers.

Developing Partnerships

One compelling argument in support of using single suppliers is that it is a prerequisite for developing a partnering relationship. **Partnering** with a supplier requires a commitment from both the company and the supplier. The goal is to establish an ongoing relationship in which both parties benefit from the arrangement—what is called a “win–win situation.”

The two kinds of partnerships are *basic* and *expanded*. A basic partnership is built on mutual respect, honesty, trust, open and frequent communications, and a shared understanding of each partner’s role in helping the supply chain achieve its objectives. Expanded partnerships are reserved for a few key suppliers. These are long-term relationships built on mutual strategic goals. Expanded partners must be committed to helping each other succeed. They must place a high priority on maintaining the relationship and on sharing information, risks, opportunities, and technologies.

The Timken Company produces high-quality, antifriction, tapered roller bearings and specialty alloy steels for global consumption. In 1987, Timken started a coordinated sourcing strategy aimed at improving the value of purchased products and reducing the supplier base. A cross-functional team at Timken initiated the process.

At a supplier conference, Timken executives explained to prospective suppliers the company’s concept of total value. Timken defines total value as quality, delivery, price, and responsiveness. Timken chose Wayne Steel Company, a steel service center, as its provider of strip steel. Wayne Steel has leading-edge equipment and is known for its response to customers’ quality and service requirements. In addition, Wayne is a leader in close-tolerance, just-in-time programs. Because of this, Wayne can ship small quantities quickly to its customers—a major competitive advantage. Timken and Wayne struggled for three years to establish the partnership. This partnership enabled Timken to save \$1 million because of a fixed-price clause during the first year of the

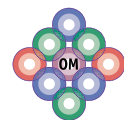


► Partnering

A process of developing a long-term relationship with a supplier based on mutual trust, shared vision, shared information, and shared risks.

LINKS TO PRACTICE

The Timken Company
www.timken.com



contract and another \$350,000 annually through reduction in freight and slitting costs. Wayne was able to reduce Timken's lead time from 3 months to 5 days for cut-to-length flats and 48 hours for coils. Wayne delivered exact requirements (no minimum quantity requirements) to Timken. This eliminated the need for 7500 square feet of warehouse space. Inventory turns went from 4 to 40 and inventory investment was reduced by \$1.5 million. Wayne's use of better material improved the yield rate at Timken by 4 percent.

For Wayne Steel, the benefits of the partnership were also obvious. With long-term commitments, Wayne was able to invest in the equipment and systems needed to differentiate itself from other steel service centers. Long-term relationships also support Wayne Steel's business philosophy. Wayne has a no-layoff policy because achieving its corporate objectives requires loyal and committed personnel. Long-term relationships also ensure a continuous level of business. This stability allows Wayne to invest in its workforce.

The Timken–Wayne partnership illustrates the need for both partners to benefit if the partnership is to survive.

Critical Factors in Successful Partnering

Impact, intimacy, and vision are critical factors in successful partnering. Impact means attaining levels of productivity and competitiveness that are not possible through normal supplier relationships. Intimacy means the working relationship between partners. Vision means the mission or objectives of the partnership. Let's look at each of these factors.

Impact comes through mutual change. The supplier and the customer must be willing to make changes. Studies suggest that the three sources of impact are reduction of duplication and waste, leveraging core competence, and creating new opportunities.

Duplication can involve any activity done by both the supplier and the customer. For example, suppliers count items before shipping, and customers count the same items after receipt. What value is added by having both parties count the same items?

Waste reduction means eliminating any activity that does not add value. For example, moving items into and out of storage adds no value. It makes sense to have items delivered to and stored where they are used.

LINKS TO PRACTICE

Sweetheart Cup
Company
www.sweetheart.com
Georgia-Pacific
Corporation
www.gp.com



Duplication can also be eliminated in paperwork and administration. Sweetheart, a manufacturer of paper drinking cups, faced price-cutting demands from a major customer. Sweetheart was told prices needed to be reduced 10 percent or the customer would use a different supplier. To meet this challenge, Sweetheart partnered with paperboard producer Georgia-Pacific. A shared electronic data interface reduced paperwork and administration, and cut expensive inventory. Joint planning optimized production plans, giving Sweetheart a more consistent product from Georgia-Pacific at a better price. Sweetheart can satisfy its high-volume customers, and Georgia-Pacific benefits through more business.

Leveraging core competence is about sharing knowledge. Different companies have different strengths or competencies. Instead of making the supplier or the customer reinvent the wheel, all partners can benefit from shared expertise. Following is an example.

Hillenbrand Industries, a manufacturer of hospital room equipment products, has six geographically dispersed manufacturing facilities. The company uses its own 400-truck fleet, and both domestic and international carriers. Hillenbrand decided to partner with UPS to improve the cost, quality, and responsiveness of Hillenbrand's overall logistics. For UPS, fleet management is a core competence; for Hillenbrand, fleet management is an expensive, noncore requirement. Hillenbrand does not want to incur the expense of building a world-class core competence in fleet management. By partnering with UPS, Hillenbrand can leverage and benefit from its partner's expertise. Hillenbrand was able to create \$1.5 million in cost improvements during the first year of the partnership. UPS revenues with Hillenbrand have grown by almost \$2 million. Both the supplier and the customer have benefited.

Creating new opportunities means partners working together to produce something that neither could have achieved alone. Let's look at an example involving a tier one supplier to an automobile manufacturer.

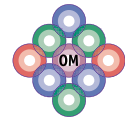
This supplier used to make daily truckload deliveries of a major subassembly to the auto assembly plant approximately 1200 miles away. Every day, four trucks left the supplier filled with subassemblies, and every day four of the supplier's empty trucks left the auto assembly plant. The supplier was wasting significant transport capacity, with empty trucks returning to its facility. To remedy the problem, the supplier worked with the automobile manufacturer to develop a new truck trailer that carried subassemblies to the automaker and also hauled new autos back to a major metropolitan area. Thus, the auto manufacturer could send new cars to market and eliminate wasted transport capacity. Because the supplier transported the cars to market in an enclosed truck, protected from weather and road hazards, the cars arrived customer-ready. By using the empty trucks to haul the new autos to this market, the supplier eliminated the wasted transport capacity, provided a valuable service to the auto manufacturer, and generated cost savings for both partners. The partnership created a win-win situation that neither could have created alone.

Intimacy comes from the working relationship between partners. Because partners share confidential information, trust between them is critical. Intimacy means eliminating surprises: sharing daily information with partners prevents surprises. For example, a tier one supplier to the automotive industry needs to know how many autos are produced daily, any planned changes in production rates, and the current number of days of finished goods inventory. This information shows the supplier near-term demand and facilitates better customer service to the auto producer.

Vision is the mission or objective of the partnership. The partners must articulate and share their vision. This shared vision provides the structure for the partnership and the role each partner plays in achieving success for the supply chain.

Successful partnering needs a substantial commitment by both partners. Many companies try to reduce the number of their suppliers and develop a smaller, highly focused supplier base. The emphasis is on finding viable suppliers and developing long-term partner relationships.

Table 4-3 summarizes the different aspects of partner relationships.



Logistics, Marketing

TABLE 4-3

Characteristics of Partnership Relations

- Have a long-term orientation
- Are strategic in nature
- Share information
- Share risks and opportunities
- Share a common vision
- Share short- and long-term plans
- Are driven by end-customer expectations

► **Early supplier involvement (ESI)**
Involvement of critical suppliers in new product design.

Benefits of Partnering

Early supplier involvement (ESI) is a natural result of partnering relationships and is one way to create impact. Critical suppliers become part of a cross-functional, new-product design team. These suppliers provide technical expertise in the initial phases of product design. Early involvement by suppliers often shortens new product development time, improves competitiveness, and reduces costs. One example of early supplier involvement is Whirlpool Corporation's partnership with Eaton, a supplier of gas valves and regulators. Whirlpool used Eaton's design expertise to bring a new gas range to market several months sooner than it could have using Whirlpool's in-house design skills.

Third-Party Service Providers

A 1996 study by the Council of Logistics Management (CLM) of the third-party logistics industry reported that third-party partnerships add value to the supply chain. In this study, 72 percent of the respondents used third-party logistic services, with outbound transportation and warehousing leading the list. Freight consolidation and distribution were reported most likely to be outsourced in the future. Also companies engaged in international business used third-party logistic services to handle most of their logistics needs.

Partnerships provide the benefits of vertical integration through the sharing of information without the disadvantage of ownership. Next, we will look at what information sharing means for partner relationships.

INFORMATION SHARING

To operate efficiently, supply chain members need to share information. This information includes sales data collected at the point of sale; order change notices such as additional orders or cancellations; global inventory management, both quantity and location; and global sourcing opportunities so that supply chain members can improve purchase leveraging and component standardization.

The benefits of information sharing can be significant. When Osram GmbH bought GTE's Sylvania lighting division, it initiated a supply chain integration program. Within six months, fill rates were at 95 percent and climbing; individual stock keeping unit (SKU) forecast accuracy had improved by 16 percent; obsolete inventory was down 10 percent; and the company had saved more than \$300,000 on transportation costs.



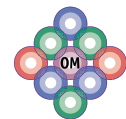
Supermarkets use barcode scanners for obtaining point-of-sale information.

Let's look at the risk and power of information sharing within a supply chain. The risk for a member of a supply chain is the member's partial dependence on the whole supply chain for its success or failure rather than on that member's individual performance.

The greater the amount of business generated by the supply chain for an individual company, the greater that company's risk and the higher its dependency on the success of the supply chain. So if most of the member's business supports the supply chain and the supply chain fails, then the member's business is in trouble.

Through information sharing, the power has shifted from the manufacturers to the customers. This is due in part to the impact of a few giant retail conglomerates controlling the majority of dollars in this industry. Major retailers have achieved this power through the use of technologies such as point-of-sale scanners and bar codes, large sales volume, and their location next to the customer in the supply chain.

Wal-Mart is a good example of successful information sharing. Wal-Mart shares point-of-sale information from its retail outlets directly with its major suppliers. These major suppliers are then responsible for replenishing their products. This practice eliminates the need for Wal-Mart to manage its suppliers and gives suppliers responsibility for the sales and marketing of their products in Wal-Mart stores. As a result, suppliers get information more quickly and can resupply the stores more quickly. Also real-time data on what is being sold around the country gives Wal-Mart and its suppliers a competitive advantage.



Information Systems

INTEGRATED SUPPLY CHAIN MANAGEMENT

Implementing integrated supply chain management needs considerable effort on the part of the initiating company. This strategic change often is a result of external pressures on the company, such as global competitors, industry consolidation, the switch to e-commerce, or major technological changes within the industry.

A company's first step in improving performance is to analyze the supply chain. Typically, a small cross-functional team leads the effort and may reveal that some functional areas are performing at suboptimal levels.

Most companies start by integrating internal functions because they are under the company's direct control. These functions include production planning and control,

TABLE 4-4

Possible Supply Chain Objectives

Manufacturer's Goals	Supplier's Goals
<ul style="list-style-type: none"> • Reduce costs • Reduce duplication of effort • Improve quality • Reduce lead time • Implement cost reduction program • Involve suppliers earlier • Reduce time to market • Reduce inventory 	<ul style="list-style-type: none"> • Increase sales volume • Increase customer loyalty • Reduce costs • Improve demand data • Improve profitability • Reduce inventory

and purchasing and distribution. The focus is on improving system performance through shared information by using a common database and compatible computer software.

The next step is to integrate external suppliers through partner relationships, first by establishing the characteristics of a desired partner and then by evaluating potential partners. Table 4-4 shows possible objectives for the manufacturer and the supplier.

A company evaluating potential partners looks at the following aspects of the potential partner's business:

- History, sales volume, product lines, market share, number of employees, major customers, and major suppliers;
- Current management team in terms of past performance, stability, and strategic vision;
- Labor force in terms of skill, experience, commitment to quality, and relations with the supplier;
- Internal cost structure, process and technology capabilities, financial stability, information system compatibility, supplier sourcing strategies, and long-term relationship potential.

The company reduces the selection pool to a few potential partners, identifies a single partner, and commits to the partnership. At this point, both parties agree on how to measure the performance of the partnership. The partners set time frames for the frequency and methods of performance assessment, and decide how problems will be resolved. When they reach agreement on these issues, the partners develop supply chain operating procedures and put the partnership into motion.

THE ROLE OF WAREHOUSES

► **General warehouse**
Used for long-term storage.

► **Distribution warehouse**
Used for short-term storage, consolidation, and product mixing.

Warehouses include plant, regional, and local warehouses. They can be owned or operated by the supplier or wholesaler, or they can be public warehouses. A further classification is general warehouse or distribution warehouse.

A **general warehouse** is used for storing goods for long periods with minimal handling. A **distribution warehouse** is used for moving and mixing goods. Within the supply chain, warehouses have three roles: transportation consolidation, product mixing or blending, and service.

The business of a general warehouse is storage. The business of a distribution warehouse is movement and handling; therefore, the size of the facility is less important than its throughput. At a distribution warehouse, goods are received in large-volume lots and broken down into small individual orders.

A good example of the importance of distribution warehousing in support of e-commerce is Fingerhut's warehouse in St. Cloud, Minnesota. Employees rush through the warehouse on forklifts and cargo haulers filling orders for on-line retailers. Every item is encoded to speed packing. Red lasers scan each package as it rushes down the conveyor, verifying the actual package weight against expected package weight. Packages that do not match are pushed aside for further inspection. The crew at this warehouse can process as many as 30,000 items per hour.



LINKS TO PRACTICE

Fingerhut Corporation
www.fingerhut.com

Transportation Consolidation

Warehouses can consolidate less-than-truckload (LTL) quantities into truckload (TL) quantities. This consolidation can be both in supplier shipments to the manufacturer and in finished goods shipped to distant warehouses. The goal is to use TL shipments for as much of the distance as possible because TL shipments are cheaper than LTL shipments.

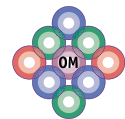
For inbound supplier shipments, a manufacturer can have small LTL deliveries from several suppliers consolidated at a convenient warehouse and then shipped to the manufacturer in TL shipments. For outbound shipments, the manufacturer can send TL deliveries to distant warehouses that break down the shipment for LTL delivery to local markets.

Product Mixing

Transportation consolidation is typically done to reduce transportation costs, whereas product mixing is a value-added service for customers. With product mixing, the customer places an order to the warehouse for a variety of products. The warehouse groups the items together and ships the mixture of items directly to the customer. Without product mixing, the customer would have to place individual orders for each item and pay shipping for each item. Instead, product mixing enables quicker customer service and reduces transportation costs.

Services

Warehouses improve customer service by moving the goods closer to the customer and thus reducing customer response time. The warehouse can also customize basic products before they are shipped to the customer. For example, an electronics appliance manufacturer can send almost finished products to the warehouse. When the warehouse gets an order for the product, the warehouse can insert the product directions



Marketing

in the appropriate language inside the container. The warehouse can also insert the correct power cord for such an appliance. This service allows the company to provide a customized product for the customer without requiring repackaging; this maximizes the flexibility of its inventory.

Crossdocking

► Crossdocking

Eliminates the storage and order-picking functions of a distribution warehouse.

► Manufacturing crossdocking

The receiving and consolidating of inbound suppliers and materials to support just-in-time manufacturing.

► Distributor crossdocking

The receiving and consolidating of inbound products from different vendors into a multi-SKU pallet.

► Transportation crossdocking

Consolidation of LTL shipments to gain economies of scale.

► Retail crossdocking

Sorting product from multiple vendors onto outbound trucks headed for specific stores.

Crossdocking eliminates the storage and order-picking functions of a distribution warehouse while still performing its receiving and shipping functions. Trucks arrive at a crossdock with goods to be sorted, consolidated with other products, and loaded onto outbound trucks. Those trucks may be headed to a manufacturer, a retailer, or another crossdock. Shipments are transferred directly from inbound trailers to outbound trailers without any storage in between. Shipments should spend less than 24 hours in a crossdock.

What is the big difference between crossdocking and traditional distribution warehousing? In a traditional setting, the warehouse holds stock until a customer places an order, then the item is picked, packed, and shipped. The customer typically is not known before the items arrive at the warehouse. With crossdocking, the customer is known before the items arrive at the warehouse and there is no reason to move the items into storage.

Crossdocking has two major advantages. First, the retailer reduces inventory holding costs by replacing inventory with information and coordination. Second, crossdocking can consolidate shipments to achieve truckload quantities and significantly reduce a company's inbound transportation costs.

Types of Crossdocking **Manufacturing crossdocking** is the receiving and consolidating of inbound supplies to support just-in-time manufacturing. In this case, the warehouse might be near the manufacturing facility and used to prep subassemblies or consolidate kits of parts. **Distributor crossdocking** is the receiving and consolidating of inbound products from different vendors into a multistock-keeping unit pallet that is delivered once the last product is received. **Transportation crossdocking** is the consolidating of shipments from LTL and small package industries to gain economies of scale. **Retail crossdocking** is sorting product from multiple vendors onto outbound trucks headed for specific retail stores.

LINKS TO PRACTICE

FedEx Freight
www.fedexfreight.
fedex.com



Home Depot, Inc., Wal-Mart, Costco Wholesale Corporation, and FedEx Freight are examples of companies using crossdocking. At FedEx Freight, pickup and delivery drivers are busy during the day picking up freight that must be delivered that night and making deliveries. Each evening, drivers return to the crossdock. Freight is unloaded, sorted, and placed onto outbound trucks. The trucks

travel through the night to their destinations where the freight is unloaded and sorted onto local delivery trucks. FedEx Freight has achieved economies of scale that allow cost-effective transportation to areas with relatively little freight traffic.

Radio Frequency Identification (RFID)

An example of new technology that will help improve package-tracking efficiency is **radio frequency identification**, which uses unpowered microchips to wirelessly transmit encoded information through antennae. The RFID tags contain encoded information that identifies items at the case, pallet, or container level. The RFID tag is activated only when placed in the transmission field of an RFID reader. The information is transmitted automatically so no one needs to unpack or scan individual bar code labels, resulting in improved inventory accuracy with reduced labor costs.

In order to use RFID, companies must purchase and apply RFID tags to their products at the pallet, case, or unit level. This can be done effectively using remote RFID printing technology, which allows suppliers to generate RFID tags and apply them to goods before they are shipped. The supplier using RFID tags and advance ship notifications (ASNs) allows for scan-free receipt of goods by the customer and provides automatic tracking.

Manhattan Associates, Inc. was the first supply chain execution software company to extend a retail compliance guarantee to its customers, enabling them to meet the shipping and labeling requirements of the top 100 U.S. and global retailers. Manhattan Associates believe that RFID has the potential to transform tracking technology and eventually to become a requirement for doing business.

► **Radio frequency identification (RFID)**
Unpowered microchips are used to wirelessly transmit encoded information through antennae.

SUPPLY CHAIN PERFORMANCE MEASUREMENT

When measuring performance, a company can use traditional financial measures such as return on investment (ROI), profitability, market share, and revenue growth, as well as additional measures such as customer service levels and traditional inventory performance measures such as inventory turns; weeks of supply; and inventory obsolescence (all discussed in Chapter 12). In addition, it is important to measure different supply chain activities so that members understand how their performance directly affects the supply chain. Companies use supply chain management to respond to pressures from customers for better quality products or services, quicker response time, lower costs, and better value. It is important for companies to measure activities that add these values.

Since customers demand better quality products or services, the company needs ways to measure improvements. The company can measure product quality by warranty costs, products returned, and cost reductions allowed because of product defects. In Chapters 5 and 6 you learn about different aspects of quality and methods for measuring product quality. These quality measures could easily track product and service quality improvement in a supply chain.

In Chapter 15, you learn about scheduling performance measures that could be used to evaluate the company's response time as well as to evaluate how well the company is using its capacity. Excess capacity may enable much quicker response times, but the company must assess the cost of low capacity utilization.

Purchasing can also track transaction costs to determine if the supply chain linkage has reduced these costs. The company can also track transportation costs to see if efficiencies have occurred.

The company needs to determine what customer satisfaction means to its customers. Does it mean filling the entire order? Does it mean how quickly you can respond to their requests? Or is it more important to have the product always arrive on time? Answering these questions identifies the activities that support the supply chain's objectives. These are the activities that must be measured.

In a study of U.S. – Mexican maquiladora operations, performance measurements were measured in the order of cycle-time reduction (response time), routing and scheduling (on-time delivery, response time, and capacity utilization), and outbound cross-border transportation. The bottom line is that companies must measure performance of the supply chain and the measurements must support behavior that is consistent with the supply chain objectives.

CURRENT TRENDS IN SUPPLY CHAIN MANAGEMENT

Perhaps the most significant advance in e-commerce with regard to supply chain management is the use of electronic marketplaces that bring thousands of suppliers into contact with thousands of customers. The objectives of net marketplaces are to have suppliers competing on price, to have automated low-cost transactions, and to reduce the price of industrial supplies.

Net marketplaces can be classified on two dimensions: the type of goods supplied (direct or indirect), and the type of purchase (contractual or spot). Indirect goods refer to goods used to support production, while direct goods are goods used in production. Contractual purchasing refers to purchases made according to a contract between companies with an on-going relationship, while spot purchasing refers to occasional purchases from companies without an on-going relationship.

E-distributors are the most common form of net marketplace. E-distributors provide electronic catalogs representing the products of thousands of suppliers. E-distributors are independently owned intermediaries that provide a single source for customers to make spot purchases. About 40 percent of a company's items are purchased on a spot basis. E-distributors typically have fixed prices, but do offer quantity discounts to large customers (see Chapter 12). The primary benefits of e-distribution to the manufacturing company are lower product search costs, lower transaction costs, a wide selection of suppliers, rapid product delivery, and low prices.

E-purchasing companies connect online suppliers offering maintenance, repair parts, and operating supplies (MRO) to businesses who pay fees to join the market. E-procurement companies are typically used for long-term contractual purchasing and offer value chain management services to both buyers and sellers. **Value chain management (VCM)** automates a firm's purchasing or selling processes. VCM automates purchase orders, requisitions, product sourcing, invoicing, and payment. For suppliers, VCM automates order status, order tracking, invoicing, shipping, and order corrections.

On-line **exchanges** connect hundreds of suppliers to unlimited buyers. Exchanges create a marketplace focusing on spot requirements of large firms in a single industry, such as the automotive industry or electronics industry. Examples of exchanges include ProcureSteel.com (a market for steel products), e-Greenbiz.com (spot market for nursery supplies), and Smarterwork.com (professional services from Web design to legal advice).

The last type of net marketplace is an industry consortium. **Industry consortia** are industry-owned markets that enable buyers to purchase direct inputs from a limited set of invited participants. The objective of an industry consortium is the unification of supply chains within entire industries through a common network and computing platform. Examples of industry consortia include Covisint.com (automotive industry), Avendra.com (hospitality industry), and ForestExpress.com (paper and forest products). It is clear that net marketplaces will be a dominant factor in effective supply chain management now and in the future. Technology continues to bring suppliers, buyers, and distributors closer together so that supply chains can be managed effectively.

► E-distributors

Independently owned net marketplaces having catalogs representing thousands of suppliers designed for spot purchases.

► E-purchasing

Companies connect on-line MRO suppliers to businesses who pay fees to join the market, usually for long-term contractual purchasing.

► Value chain management (VCM)

A firm's purchasing or selling processes are automated.

► Exchanges

A marketplace focuses on spot requirements of large firms in a single industry.

► Industry consortia

Industry-owned markets enable buyers to purchase direct inputs from a limited set of invited suppliers.

OM ACROSS THE ORGANIZATION

Supply chain management changes the way companies do business. Consider how supply chain management affects different functional areas in the organization.

Accounting shares some of the benefits and responsibilities of supply chain management. As inventory levels decrease, customer service increases. Manufacturing is using its capacity more effectively. Accounting is exposed to the risks of information sharing and of developing partnerships. With information sharing comes the need for increased confidentiality.

Marketing benefits by improved customer service levels achieved by POS data collection. A shared database provides marketing with current demand trends and eliminates demand filtering between levels of the supply chain. POS data also facilitates quick customer response time.

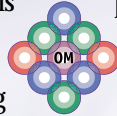
Information systems are critical for supply chain management. Information systems provide the means for collecting relevant demand data, developing a com-

mon database, and providing a means for transmitting order information. Information systems enable information sharing through POS data, EDI, the Internet, intranets, and extranets.

Purchasing has an elevated role in supply chain management within organizations. Purchasing facilitates and manages a strong global supplier base through partnering.

Operations uses timely demand information to effectively plan production schedules and use its capacity. Operations responds to customer demand data, improving customer service.

Who is responsible for supply chain management within an organization? In a manufacturing company this is usually the materials manager, who is familiar with external suppliers, internal functions, and external distributors. The person who does supply chain management must see the “big picture” so that local priorities do not overshadow global priorities. In a service organization it may be the operations or office manager.



INSIDE OM

Supply chain management is directly linked with many OM activities. The degree of supply chain management is a strategic decision for the organization and determines the level of vertical integration in the organization. SCM is concerned with external suppliers, internal operations, and external distributors.

Effective SCM requires supplier partnerships. Purchasing develops partnerships with suppliers to assure a continuous supply of materials at a reasonable cost. Purchasing also works with suppliers to improve communications, to develop flexibility in meeting changes of demand, to improve quality of materials, and to assure on-time delivery. This assured, continuous supply of materials allows the production planners to effectively schedule jobs and use equipment and personnel efficiently.

SCM also provides for streamlined communications between suppliers and the company, thus reducing purchasing lead time. As we learn when studying inventory management, reduced lead time results in lower inventory levels. The improved communications within the supply chain also improve demand-forecasting accuracy. This improvement reduces uncertainty, which leads to lower safety stock levels resulting in lower total inventory levels. Lower inventory levels typically mean lower costs for the organization while maintaining customer service levels. Improved demand forecast accuracy also contributes to the development of better staffing plans, which in turn can lead to lower personnel costs, lower inventory costs, and improved customer service.

SCM affects product and process design by specifying which items are done in-house and which items are outsourced. Good supply chain management provides timely, accurate information that is critical to successful operations management.

Chapter Highlights

- 1 E-commerce is the use of the Internet to transact business. There are five kinds of e-commerce: business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer (C2C), peer-to-peer (P2P), and mobile commerce. B2B is the largest segment of e-commerce.
- 2 Every organization is part of a supply chain, either as a customer or a supplier. Supply chains include all the processes to make a finished product, from the extraction of raw materials through to the sale to the end user. Supply chain management is the integration of all these activities.
- 3 The bullwhip effect distorts product demand information passed between levels of the supply chain. The more levels that exist, the more possible distortion. Variability results from updating demand estimates at each level, order batching, price fluctuations, and rationing.
- 4 Many factors affect supply chain management. Consumer expectations have done so significantly. Customers demand better service, better product quality, quick response at a reasonable price, and an ability to return merchandise. New markets have created a global marketplace. The evolution of on-line marketplaces has significantly changed the way companies do business, both between businesses and with consumers.
- 5 Additional factors affect global supply chains. Greater geographical distances between members of the supply chain lengthen lead-time replenishment causing greater uncertainty in delivery times. This uncertainty results in increased investment in pipeline inventory and exacerbates the bullwhip effect. Forecasting accuracy is often poorer, too. Fluctuating exchange rates further complicate global supply chains. In addition, there are many possible infrastructure issues that a company may face, such as inadequate transportation networks, limited telecommunication capabilities, uncertain power continuity, low skill levels of workers, and poor supply availability.
- 6 Organizations determine the appropriate level of vertical integration based on corporate objectives. Typically, standardized, high-volume products or services have higher levels of integration than customized, low-volume products or services.
- 7 Companies make insourcing and outsourcing decisions. Make-or-buy decisions are based on financial and strategic criteria. Companies outsource activities that are not part of its core competencies.
- 8 Purchasing manages supplier selection and develops the supplier relationship. Developing the supplier base can include forming partnerships, that is, long-term relationships with mutual strategic goals. Partners share information, risks, technologies, and opportunities. Impact, intimacy, and vision are critical to successful partnering. Impact means attaining higher levels of productivity and competitiveness that are not possible through normal supplier relationships. Impact comes from reducing duplication and waste, leveraging core competencies, and creating new opportunities. Vision is a shared objective.
- 9 Ethics in supply management is an ongoing concern. Since buyers are in a position to influence or award business, it is imperative that buyers avoid any appearance of unethical behavior or conflict of interest. The Institute for Supply Management has established a set of principles and standards to guide purchasing employees.
- 10 Technology advancements such as electronic scanners, bar coding, electronic data interchange (EDI), and point-of-sale (POS) terminals have improved demand data collection. Intranets and extranets have improved communication flow within organizations and supply chains. Technology has greatly reduced the cost of developing a common database for supply chain management.
- 11 Within the supply chain, warehouses have three roles: transportation consolidation, product mixing or blending, and service. Warehouses consolidate (LTL) quantities into (TL) quantities. Product mixing adds value for the customers because the warehouse groups the items and ships them directly to the customer. Warehouses improve customer service by placing goods closer to the customer in order to reduce response time or by customizing basic products before they are shipped to the customer.
- 12 Crossdocking eliminates the storage and order-picking functions of a distribution warehouse while still performing its receiving and shipping functions. Shipments are transferred directly from inbound trailers to outbound trailers without any storage in

between. RFID is a new wireless technology designed to make order tracking easier.

- 13 A company needs to evaluate the performance of its supply chain. In addition to regular performance measures (ROI, profitability, market share, etc.), a company must also measure activities that reflect the objectives of the supply chain (on-time delivery, customer service levels, inventory investment, etc.).

- 14 The most significant advance in e-commerce with regard to supply chain management is the use of electronic marketplaces. Net marketplaces are classified by the types of goods supplied (direct or indirect) and the types of purchases made (contractual or spot). E-distributors are the most common form of net marketplace.

Key Terms

e-commerce 99
 business-to-business e-commerce (B2B) 99
 automated order entry systems 99
 electronic data interchange (EDI) 99
 electronic storefronts 99
 net marketplaces 99
 business-to-consumer e-commerce (B2C) 100
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Formula Review

For insourcing or outsourcing:

$$FC_{\text{Buy}} + (VC_{\text{Buy}} \times Q) = FC_{\text{Make}} + (VC_{\text{Make}} \times Q)$$

Solved Problems

• Problem 1

Jack Smith, owner of Jack's Auto Sales, is deciding whether his company should process its own auto loan applications or outsource the process to Loans Etc. If Jack processes the auto loan applications internally, he faces an annual fixed cost of \$2500 for membership fees, allowing him access to the TopNotch credit company, and a variable cost of \$25 each time he processes a loan application. Loans Etc. will process the loans for \$35 per application but Jack must lease equipment from Loans Etc. at a fixed annual cost of \$1000. Jack estimates pro-

cessing 125 loan applications per year. What do you think Jack should do?

• Solution

First, set the total costs of each alternative equal to each other, or $\$1000 + (\$35 * Q) = \$2500 + (\$25 * Q)$. Solving for Q , we have $10Q = \$1500$, or $Q = 150$ loan applications. Since the costs are equal at 150 loan applications and Jack expects to need 125 applications processed, he is better off outsourcing the loan applications to Loans Etc.

• Problem 2

Big State University (BSU) is considering whether or not it should outsource its housekeeping service. Currently BSU employs 400 housekeepers at an average annual wage of \$23,000 plus another 39% for fringe benefits. Annual fixed costs associated with housekeeping are \$1,278,800.

Eric's Efficient Cleaners (EEC) will provide similar housekeeping for a fixed annual cost of \$7,500,000 plus a variable cost of \$20,000 per housekeeper required. Because Eric uses state of the art equipment and well-trained employees, his company would only need 80% of the current BSU housekeeper staff (or 320 housekeepers).

- Calculate the annual cost of BSU using its current housekeeping staff.
- Calculate the annual cost if BSU lets EEC do the housekeeping.
- Find the indifference point for the two alternatives.

• Solution

- If BSU does its housekeeping with its current staff, the cost is \$14,066,800

$$\begin{aligned} \text{Cost per housekeeper } (\$23,000 + 39\% \text{ fringe benefits}) \\ = \$31,970 \end{aligned}$$

$$\begin{aligned} \text{Cost for 400 housekeepers } (400 \times \$31,970) &= \$12,788,800 \\ \text{Annual fixed costs} &= \underline{1,278,000} \\ \text{Total annual costs} &= \underline{\$14,066,800} \end{aligned}$$

- If BSU has EEC do the housekeeping, the cost is \$13,900,000.

$$\begin{aligned} \text{Cost for 320 housekeepers } (320 \times \$20,000) &= \$ 6,400,000 \\ \text{Annual fixed cost} &= \underline{7,500,000} \\ \text{Total annual costs} &= \underline{\$13,900,000} \end{aligned}$$

- The indifference point is found by setting the two cost functions equal to each other. Since EEC only needs 80% as many employees as BSU, we need to adjust the cost functions.

$$\$1,278,800 + \$31,970(Q) = \$7,500,000 + (0.8Q)(\$20,000)$$

$Q = 389.55$ or 390 employees. Therefore if the school needs fewer than 390 in-house housekeepers, it should do the housekeeping rather than outsource it. If BSU needs more than 390 housekeepers, it should outsource with EEC.

Discussion Questions

- Discuss the different types of e-commerce.
- Explain the different revenue models used in e-commerce.
- Give two examples from the Internet for each of the different revenue models used in e-commerce.
- Describe the evolution of business-to-business (B2B) e-commerce.
- For the next item you buy, determine its supply chain.
- How do supply chains for service organizations differ from supply chains for manufacturing organizations?
- How can companies satisfy increasing customer expectations?
- Describe the additional factors that affect global supply chains.
- Think of your last major purchase. What criteria did you use to select the supplier?
- Explain the concept of partnering, including advantages and disadvantages.
- Explain the benefits of using a single supplier as opposed to multiple suppliers.
- Describe the kinds of information that are necessary in a supply chain.
- Describe the role of warehouses in a supply chain.
- Describe radio frequency identification (RFID) and how it could be used by an organization.
- Describe the current trends in e-commerce and how they affect supply chain management.

Problems

- Gabriela Manufacturing must decide whether to insource or outsource a new toxic-free miracle carpet cleaner that works with its Miracle Carpet Cleaning Machine. If it decides to insource the product, the process would incur \$300,000 of annual fixed costs and \$1.50 per unit of variable costs. If it is outsourced, a supplier has offered to make it for an annual fixed cost of \$120,000 and a variable cost of \$2.25 per unit in variable costs.
 - Given these two alternatives, determine the indifference point (where total costs are equal).
 - If the expected demand for the new miracle cleaner is 300,000 units, what would you recommend that Gabriela Manufacturing do?
- Gabriela Manufacturing was able to find a new supplier that would provide the item for \$1.80 per unit with an annual fixed cost of \$200,000. Should Gabriela Manufacturing insource or outsource the item?
- Downhill Boards (DB), a producer of snow boards, is evaluating a new process for applying the finish to its snow boards. Durable Finish Company (DFC) has offered to apply the finish for \$170,000 in fixed costs and a unit variable cost of \$0.65.

Downhill Boards currently incurs a fixed annual cost of \$125,000 and has a variable cost of \$0.90 per unit. Annual demand for the snow boards is 160,000.

- Calculate the annual cost of the current process used at Downhill Boards.
- Calculate the annual cost if Durable Finish Company applies the finish.
- Find the indifference point for these two alternatives.
- How much of a change in demand is needed to justify outsourcing the process?

4. Fast Finish, Inc. (FFI) has made a technological breakthrough in snow board finish application. FFI will apply the finish for \$0.23 per unit in variable costs plus a fixed annual cost of \$230,000. Use the cost and demand information given in Problem 3 for Downhill Boards to evaluate this proposal.

- What will it cost Downhill Boards to outsource the finishing process?
- At what demand level does it make sense economically to outsource the finishing process?
- What additional factors should be considered when making this outsourcing decision?

5. Henri of Henri's French Cuisine (HFC), a chain of 12 restaurants, is trying to decide if it makes sense to outsource the purchasing function. Currently Henri employs two buyers at an annual fixed cost of \$85,000. Henri estimates that the variable cost of each purchase order placed is \$15. Value-Buy (VB), a group of purchasing specialists, will perform the purchasing function for a fixed annual fee of \$100,000 plus \$5 for each purchase order placed. Last year, HFC placed 1450 purchase orders.

- What was the cost last year to HFC when doing the purchasing in-house?

- What would the cost have been last year had HFC used Value-Buy?

- What is the indifference point for the two alternatives?
- If HFC estimates it will place 1600 purchase orders next year, should it use VB?
- What additional factors should be considered by HFC?

6. Cal's Carpentry is considering outsourcing its accounts receivable function. Currently Cal employs two full-time clerks and one part-time clerk to manage accounts receivables. Each full-time clerk has an annual salary of \$36,000 plus fringe benefits costing 30 percent of their salary. The part-time clerk makes \$18,000 per year but has no fringe benefits. Total salary plus fringe cost is \$111,600. Cal estimates that each account receivable incurs a \$10 variable cost. The Small Business Accounts Receivables Group (SBARG) specializes in handling accounts receivable for small- to medium-size companies. Doris Roberts from SBARG has offered to do the account receivables for Cal's Carpentry at a fixed cost of \$75,000 per year plus \$30 per account receivable. Next year, Cal expects to have 2000 accounts receivable.

- Calculate the cost for Cal's Carpentry to continue doing accounts receivable in house.
- Calculate the cost for Cal's Carpentry to use SBARG to handle the accounts receivable.
- If the fixed annual cost offered by SBARG is nonnegotiable but they are willing to negotiate the variable cost, what variable cost from SBARG would make Cal indifferent to the two options?
- What other alternatives might Cal consider in terms of his current staffing for accounts receivable?
- What additional criteria should be considered by Cal before outsourcing the accounts receivable.

CASE: Electronic Pocket Calendars Supply Chain Management Game

In this supply chain game, retailers sell electronic pocket calendars to their customers and place replenishment orders to their wholesaler. The wholesaler sells the pocket calendars to the retailers and orders the calendars from a distributor. The distributor sells the pocket calendars to the wholesalers and orders calendars directly from the factory. The distribution system is shown in the figure. For each period the game is played, participants must follow the same sequence:

- Receive any shipments into inventory.
- Ship calendars to satisfy both new customer demand and any backorders, as long as sufficient product is available.
- Determine the ending inventory (a negative value indicates backorders exist).
- Determine the inventory position (ending inventory plus any quantity already ordered).
- Place replenishment orders.

For this game, inventory holding costs will be \$10 per case per week and backorder costs of \$15 per case per week.

Each person must keep track of his or her own costs. The weekly demand at the retailers will be provided by your professor. Once the demand is known by the retailers, the retailers place the appropriate replenishment orders with the wholesalers. The wholesalers update their inventory records and place the necessary orders with the distributor. At this point, the distributor updates its inventory records and places the appropriate replenishment order with the factory. Lead time throughout the supply chain is two weeks. For example, once the factory releases an order to be manufactured it is two weeks before it is available or, when the distributor orders pocket calendars from the factory, it is two weeks before they arrive.

A number of participants are needed in this game (see the figure). One person manages the factory (1). There are three distribution centers, each needing a manager (3). Each distribution center supplies two different wholesalers (6), and each wholesaler supplies two unique retailers (12). In some cases a location may have co-managers to speed up the transactions.

The accompanying table provides information regarding each location in the supply chain.

For each period of the game, retailers follow these procedures.

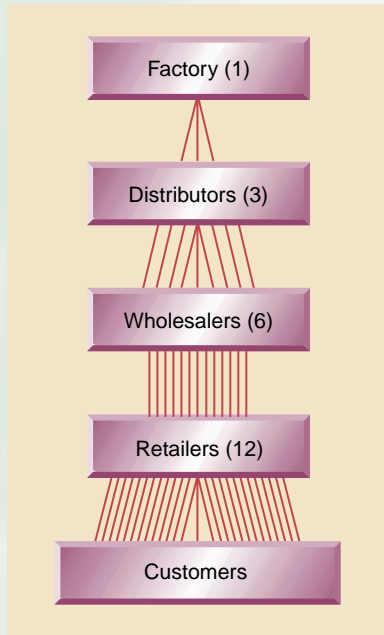
1. The retailer accepts into stock any orders due to arrive during the current period. The beginning inventory plus the arriving order determine how much inventory the location has available to satisfy demand during that period.

2. Next, the professor provides each retailer with actual demand data for that period. The demand is given to the retailer on a paper order form. The data are not shown to other members of the supply chain but are treated as confidential information.

3. Retailers fill orders as long as sufficient inventory (calculated in Step 1) is available.

4. Retailers calculate their ending inventory level. If sufficient inventory is available, ending inventory is beginning inventory minus that period's actual demand. If there is not sufficient inventory, then backorders occur. When a backorder occurs, your ending inventory value is negative. For example, if you only have 30 units available and demand is 32 units, your inventory balance is -2 units.

5. Retailers calculate their inventory position. Inventory position is the ending inventory plus any quantity already ordered that has not yet arrived. For example, if your ending inventory is -2 but you have placed an order for 90 additional cases, your inventory position is 88 cases ($-2 + 90$).



Electronic pocket calendar supply chain

6. If the retailer's inventory position is at or below its reorder point, the retailer places an order with its wholesaler. Retailers

Individual Location Information

	Replenishment Order Quantity (cases)	Reorder Point (cases)	Beginning Inventory (cases)	Average Weekly Demand (cases)
Factory	350	190	277	175
Distributor A	120	125	185	60
Distributor B	180	190	280	90
Distributor C	100	52	77	25
Wholesaler A1	90	95	140	45
Wholesaler A2	60	31	46	15
Wholesaler B1	105	110	163	52.5
Wholesaler B2	75	80	118	37.5
Wholesaler C1	60	31	46	15
Wholesaler C2	40	21	31	10
Retailer A11	60	62	92	30
Retailer A12	30	31	46	15
Retailer A21	45	24	35	11.25
Retailer A22	15	8	13	3.75
Retailer B11	75	78	116	37.5
Retailer B12	60	31	46	15
Retailer B21	40	42	62	20
Retailer B22	35	37	55	17.5
Retailer C11	40	21	31	10
Retailer C12	20	11	16	5
Retailer C21	20	12	18	5.5
Retailer C22	20	10	15	4.5

A11 and A12 order from wholesaler A1, retailers A21 and A22 order from wholesaler A2, and so on. These orders are made in writing and delivered to the appropriate wholesaler. No other communication is permitted.

For the wholesalers, the procedure each period is:

1. The wholesaler accepts into stock any orders due to arrive during the current period. The beginning inventory plus the arriving order determine how much inventory the location has available to satisfy demand during that period.

2. Next, the wholesalers look at the replenishment orders from the retailers for that period. These data are not shown to other members of the supply chain but are treated as confidential information.

3. Wholesalers fill orders as long as sufficient inventory (calculated in Step 1) is available.

4. Wholesalers calculate their ending inventory level. If sufficient inventory is available, ending inventory is beginning inventory minus that period's actual demand. If there is not sufficient inventory then backorders occur. When a backorder occurs, your ending inventory value is negative.

5. Wholesalers calculate their inventory position. Inventory position is the ending inventory plus any quantity already ordered that has not yet arrived.

6. If the wholesaler's inventory position is at or below its reorder point, the wholesaler places an order with its distributor. Wholesalers A1 and A2 order from distributor A, wholesalers B1 and B2 order from distributor B, and so on. These orders are in writing and delivered to the appropriate distributor. No other communication is permitted.

For the distributors, the procedure followed each period is:

1. The distributor accepts into stock any orders due to arrive during the current period. The beginning inventory plus the arriving order determine how much inventory the location has available to satisfy demand during that period.

2. Next, the distributor looks at the replenishment orders from its wholesalers for that period. These data are not shown to other members of the supply chain but are treated as confidential information.

3. Distributors fill orders as long as sufficient inventory (calculated in Step 1) is available.

4. Distributors calculate their ending inventory level. If sufficient inventory is available, ending inventory is beginning inventory minus that period's actual demand. If there is not sufficient inventory then backorders occur.

5. Distributors calculate their inventory position. Inventory position is the ending inventory plus any quantity already ordered that has not yet arrived.

6. If the distributor's inventory position is at or below its reorder point, the distributor places an order with the factory. These orders are in writing and delivered to the appropriate distributor. No other communication is permitted.

The factory follows these procedures each period:

1. The factory accepts into stock any manufacturing orders completed for the current period. The beginning inventory plus the arriving order determine how much inventory the location has available to satisfy demand during that period.

2. Next, the factory looks at the replenishment orders from the distributors for that period.

3. The factory fills orders as long as sufficient inventory (calculated in Step 1) is available.

4. Factory calculates its ending inventory level. If sufficient inventory is available, ending inventory is beginning inventory minus that period's actual demand. If there is not sufficient inventory then backorders occur. When a backorder occurs, your ending inventory value is negative.

5. The factory calculates its inventory position. Inventory position is the ending inventory plus any quantity already ordered that has not yet arrived.

6. If the factory's inventory position is at or below its reorder point, the factory releases an order to manufacturing.

Procedures for all locations include the following:

1. At the end of each period record the amount of actual inventory you have left, the actual number of backorders, the cost of holding the inventory, the cost of the backorders, and the total cost.

2. Update your total statistics, that is, keep a running total of the cases of inventory, the number of backorders, and the cumulative holding costs, cumulative backorder costs, and total costs.

End of Game Discussion Questions

1. How well does the distribution system seem to work? Talk about it in terms of customer service, costs, effective use of inventory, and information flows.

2. Given the amount of inventory in the system, why did backorders occur?

3. In this distribution chain, what happened to customer demand data?

4. How should customer demand data be communicated through the system?

5. What would you recommend be done differently?

CASE: Supply Chain Management at Durham International Manufacturing Company (DIMCO)

Lucille Jenkins, the CEO for the Durham International Manufacturing Company (DIMCO), believes that the company can

significantly increase its operating profit by implementing supply chain management. DIMCO manufactures a variety of con-

sumer electronic products, from hair dryers to humidifiers to massagers for the world market.

Lucille believes that DIMCO has already integrated its internal processes and is ready to proceed with external integration. However she is uncertain as to which direction to head. Should the company work on integrating the suppliers or the distributors first? Currently DIMCO uses approximately 1350 different components and/or raw materials in manufacturing its product line. Those components and raw materials are purchased from approximately 375 different suppliers around the world. In terms of distribution, DIMCO currently sends its finished products to a central warehouse that supplies ten regional distribution centers (RDC); six are domestic and four are located outside of

the United States. Each RDC, supplies an average of twelve local distributors that each supply an average of 35 retailers.

Lucille is looking for some advice.

1. Briefly describe DIMCO's supply chain.
2. What are the advantages that DIMCO can gain by implementing supply chain management?
3. What would you recommend DIMCO attempt next? Should it work on integrating the suppliers or the distributors first? Or should it work on it simultaneously?
4. What are your recommendations with regard to the external suppliers?
5. What are your recommendations with regard to the external distributors?

Interactive Learning

Enhance and test your knowledge of Chapter 4 using the interactive CD. Visit our Web site, www.wiley.com/college/reid, for additional resources and information.

1. Company Tour

*Broad Run Cheese House, Curtains & Lace.
Reynolds Metal Company/Alcoa Inc.*

2. Additional Web Resources

*nummi (New United Motor Manufacturing, Inc.), www.nummi.com
IBM, <http://houns54.clearlake.ibm.com>
Institute for Supply Management, <http://www.ISM.ws>
www.manufacturingiscool.com*

3. Internet Challenge *Global Shopping*

Since the Internet provides access to products around the world, your challenge involves some global shopping. This year you have been given a budget of \$10,000 to furnish and decorate your off-campus apartment. You have chosen a global theme. Your job is to find items from as many different parts of the world as you can to use in your apartment. You can spend up to \$10,000 but you cannot exceed your budget. Do not forget that shipping must be included in your budget. You can choose more than a single item from any country.

- (a) Visit the Internet to find products for your apartment. You need to furnish a one-bedroom apartment. You do

not need to worry about major appliances (computer, television, stereo, oven, refrigerator, dishwasher, etc.) but you do need everything else. Since you plan to host a major party in your new apartment, everything you buy must be delivered within six weeks.

- (b) Provide a list of all of the items you would buy, the cost of each item, and the total money spent. Organize your list by the room the item is intended for. Be sure to identify the country of origin for each item. Have fun shopping!



Virtual Company: Valley Memorial Hospital

Assignment: Supply Chain Management at Valley Memorial Hospital Bob Reilly, head of Kaizen, just called you to say that he was impressed with your progress in familiarizing yourself with the operations at VMH—both the strategic details pertaining to its mission and competitive priorities, and the specific details concerning its products and processes. He tells you that, with all of the buzz about supply chain management (SCM) that you hear these days, VMH is actively interested in exploring how SCM concepts and techniques could be adopted in their operations. Maintaining adequate and timely supply of a variety of laboratory equipment, surgical instruments, and supplies is critical to VMH.

[www.wiley.com/
college/reid](http://www.wiley.com/college/reid)



Meg Willoughby, the head of Materials Management at VMH, has a couple of specific assignments that you will work on later. For now, Meg has suggested that you prepare a concise research report for the top management addressing SCM issues relevant to VMH. She has also put together a few specific questions for you to address. This assignment will enable you to enhance your knowledge of the material in Chapter 4.

To complete this assignment, go to www.wiley.com/college/reid to get more details to answer the following questions:

1. What are the essential concepts of SCM? To what extent is SCM applicable to a service operation such as VMH?
2. What is internet-based electronic data interchange (EDI)? In what ways could VMH benefit from using EDI in managing its inventories?
3. Would it help if VMH entered into partnering arrangements with its suppliers? What are some of the important considerations that should be kept in mind?
4. Consider the variety of activities or services in VMH's supply chain. Which, if any, of these activities do you think might be outsourced advantageously? What are the key issues to consider before outsourcing?
5. Purchasing is a major function in SCM, especially in a critical service industry such as health care. From your fresh-from-school perspective, what do you think are some of the potential conflicts of interest of ethical issues in the purchasing function?

To access the Web site:

- Go to www.wiley.com/college/reid
- Click **Student Companion Site**
- Click **Virtual Company**
- Click **Kaizen Consulting, Inc.**
- Click **Consulting Assignments**
- Click **Supply Chain Management at Valley Memorial Hospital**

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