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CHAPTER 11

Global Supply Chain Procurement and Distribution



REUTERS/Bobby Yip/ReutersPictures

LEARNING OBJECTIVES

After reading this chapter, you will be able to:

- Discuss outsourcing as a strategic decision.
 - Explain the basic elements of procurement, e-procurement, and spend analysis.
 - Describe distribution strategies, systems, and processes.
 - Assess the advantages and disadvantages of different modes of transportation.
 - Discuss issues and trends in the global supply chain.
-

China and Apple's Global Supply Chain

Apple's overall company success is in large part attributable to outsourcing its manufacturing processes to Asia, and particularly China. Over 330 of Apple's almost 750 global suppliers, and 14 out of 18 Apple's final assembly facilities, are in China. These assembly plants include seven Foxconn plants, a Taiwanese electronics manufacturing company with over a million employees that is the principal manufacturer of Apple products and components. A major reason for Apple's reliance on Chinese-based suppliers is low wage rates; the average wage rate for Apple workers in these Chinese plants ranges from \$1.50 to \$2.50 per hour, low by U.S. and European standards but high for Chinese workers. This low wage enables Apple to capture almost 60% of the value of an iPhone, despite the fact that its manufacture is entirely outsourced. The labor costs in China account for the smallest share, around 2%, or, for example, \$12 for an iPhone that sells for \$600. Although both Apple and Foxconn rely on an army of Chinese workers working 60-hour weeks to meet demand, the cost of Chinese labor in manufacturing is relatively insignificant in Apple's overall profitability.

Another critical part of Apple's supply chain is logistics and distribution, moving components to assembly factories in China and then finished iPhones from these factories in China to its customers, all of which must be done quickly, on schedule, and seamlessly while achieving the lowest cost possible. The distribution process of a new iPhone model begins months before it is formally launched; Apple first pre-books and coordinates

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flights and trucks to move components from suppliers to assembly plants in China. Apple company representatives from sales, marketing, operations, and finance collaborate to forecast how many devices the company expects to sell. The accuracy of this forecast is critical to knowing how many component parts to order and ship, and how much transport to book. Once a forecast is made, millions of iPhones are manufactured and remain in China while Apple's software team at its headquarters in Cupertino, California, finishes work on the iOS software that runs on the device, and when the software is finished, it is loaded on the smartphones. Before a new iPhone model is formally introduced, it is shipped to distribution centers and retail stores around the world so the new model is in stores everywhere at exactly the same time.

Apple primarily ships its iPhones to the United States using FedEx Boeing 777s, which can make the non-stop flight from China to the main U.S. hub in Memphis, Tennessee, in about 15 hours. The planes can each carry about 450,000 iPhones and cost about \$250,000 to charter. The iPhone's high price and light weight, and the ability to pack many devices into air shipments, enable Apple to maximize profit margins despite the relative high cost of air freight, instead of using sea cargo as was historically the case with consumer electronics. Once the iPhone goes on sale the procedure changes, and Apple manages online orders from customers for specific colors and memory. Online orders are received directly at the supplier factories in China, where workers customize the smartphones and put them on pallets with others destined for customers in a similar part of the world. Shipping online orders directly from the factory to the customer, and thus avoiding the phones sitting in warehouses, eliminates inventory costs. Apple continuously monitors sales from its retail stores, website, and third-party sellers (like Best Buy), and reallocates phones to where demand is strongest. For example, smartphones coming off the assembly line in China originally destined for retail stores in Europe could be used to fill a jump in online orders in the United States. Once the initial iPhone launch is over, Apple's supply chain team at the Apple headquarters in California analyzes what went wrong and plans how to improve the process for its next launch.

In this chapter we will learn how companies like Apple and many others manage their global supply chains, including procurement, outsourcing, logistics, and distribution, and doing so in a sustainable manner.

In Chapter [10](#) we introduced the topic of supply chain management and focused on the strategy and design of supply chains. We discussed the various aspects, components, and implications of supply chain management in a broad context, giving more of a *macro*-view of supply chains. Early in Chapter [10](#), in Figure 10.3 we identified the primary processes related to supply chain management—the procurement of supply, production, and the distribution of products and services. In this chapter we are going to focus more closely on two of these processes—procurement and distribution, which also includes transportation; this entails a more *micro*-view of supply chains. We will begin with a discussion of procurement, which is the process of obtaining *supply*: the goods and services that are used in the production process (whether it be goods or services).

Supply chains begin with supply at the farthest upstream point in the supply chain, inevitably from raw materials, as was shown in Figure 10.1. Purchased materials have historically accounted for about half of U.S. manufacturing costs, and many manufacturers purchase over half of their parts. Companies want the materials, parts, and services necessary to produce their products to be delivered on time, to be of high quality, and to be low cost, which are the responsibility of their suppliers. If deliveries are late from suppliers, a company will be forced to keep large, costly inventories to keep their own products from being late to their customers.

Thus, purchasing goods and services from suppliers, or **procurement**, plays a crucial role in supply chain management.

Procurement The purchase of goods and services from suppliers.

Procurement

A key element in the development of a successful partnership between a company and a supplier is the establishment of linkages. The most important linkage is information flow; companies and suppliers must communicate—about product demand, about costs, about quality,

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and so on—in order to coordinate their activities. To facilitate communication and the sharing of information, many companies use teams. *Cross-enterprise teams* coordinate processes between a company and its supplier. For example, suppliers may join a company in its product-design process. Instead of a company designing a product and then asking a supplier if it can provide the required part or a company trying to design a product around an existing part, the supplier works with the company in the design process to ensure the most effective design possible. This form of cooperation makes use of the expertise and talents of both parties. It also ensures that quality features will be designed into the product.

In an attempt to minimize inventory levels, companies frequently require that their suppliers provide **on-demand**, also referred to as **(direct-response)**, delivery to support a just-in-time (JIT) or comparable inventory system. In **continuous replenishment**, a company shares real-time demand and inventory data with its suppliers, and goods and services are provided as they are needed. For the supplier, these forms of delivery often mean making more frequent, partial deliveries, instead of the large-batch orders suppliers have traditionally been used to filling. While large-batch orders are easier for the supplier to manage, and less costly, they increase the customer's inventory. They also reduce the customer's flexibility to deal with sudden market changes because of their large investment in inventory. Every part used at Honda's Marysville, Ohio, plant is delivered on a daily basis. Sometimes parts deliveries are required several times a day. This often requires that suppliers move their location to be close to their customer. For example, most of the U.S. suppliers for Honda are within a 150-mile radius of their Marysville, Ohio, assembly plant.

On-demand (direct- response) delivery Requires the supplier to deliver goods when demanded by the customer.

Continuous replenishment Supplying orders in a short period of time according to a predetermined schedule.

In addition to meeting their customers' demands for quality, lower inventory, and prompt delivery, suppliers are also expected to help their customers lower product cost by lowering the price of its goods and services. These customer demands on its suppliers—high quality, prompt delivery, and lower prices—are potentially very costly to suppliers. Prompt delivery of products and services as they are demanded from its customers may require the supplier to maintain excessive inventories itself. These demands require the supplier to improve its own processes and make its own supply chain more efficient. Suppliers require of their own suppliers what has been required of them—high quality, lower prices, process improvement, and better delivery performance.

Along the Supply Chain

Boeing's Supplier Rating System

Boeing is one of the world's largest aerospace companies, manufacturing commercial jetliners and defense systems, with over 13,000 suppliers in 47 countries with procurement expenditures over \$62 billion. Supplier-provided components and assemblies make up more than 60% of the cost of Boeing products. Monitoring and measuring supplier quality are critical to Boeing's competitive success and to meeting customer expectations. To achieve supply chain quality, Boeing uses a supplier evaluation and rating system that tracks performance for products and services monthly with a final rating based on a 12-month rolling average. Their rating system includes five color-coded threshold standards—gold (the best), silver, bronze, yellow, and red (the worst). Within each color-coded standard a supplier is graded in three areas—on-time delivery; a general performance assessment (GPA), which provides a comprehensive assessment of a supplier's management performance; and quality and value. Each of these areas is graded: 5 (gold), 4 (silver), 3 (bronze), 1 (yellow), and 0 (red). For example, if a supplier's quality is bronze, they receive a 3, if their delivery also rates a bronze they receive a 3, and if their GPA is yellow, they receive a 1. The average of these scores is a GPA summary rating of 2.33, and within the rating system, GPA summary scores above 1 and less than 2.8 fall in the yellow category. An overall yellow rating indicates that improvement in supplier performance is needed to meet Boeing's expectations. Alternatively, a gold rating denotes exceptional supplier performance that clearly exceeds expectations, which includes 100% on-time delivery and 100% quality, while a red rating denotes unsatisfactory supplier performance that clearly fails to meet expectations with deliveries less than 90% and quality below 98%. Boeing's rating system helps it make sourcing decisions, monitor supplier performance, and recognize supplier excellence, and it also provides suppliers with valuable feedback that enables them to improve performance. The Aerospace Industries Association has recognized Boeing's rating system as the industry's best supplier rating system.

Discuss how Boeing's supplier rating system might be applied to a service organization, like a hospital or restaurant.

Source: Based on Kirsten Parks and Timothy Connor, "The Way to Engage, An Inside Look at How Boeing's Supplier Rating System Keeps the Aviation Giant Focused on Continuous Improvement," *Quality Progress* 44 (4) (April 2011), pp. 21–27.

Outsourcing

The selection of suppliers is called **Sourcing**: suppliers are literally the "source" of supply. **Outsourcing** is the act of purchasing goods and services that were originally produced in-house from an outside supplier. Outsourcing is nothing new; for decades companies have outsourced as a short-term solution to problems such as an unexpected increase in demand, breakdowns in plants and equipment, testing products, or a temporary lack of plant capacity. However, outsourcing has become a long-term strategic decision instead of simply a short-term tactical one. Companies, especially large multinational companies, are moving more production, service, and inventory functions into the hands of suppliers. [Figure 11.1](#) shows the three major categories of goods and services that companies tend to outsource.

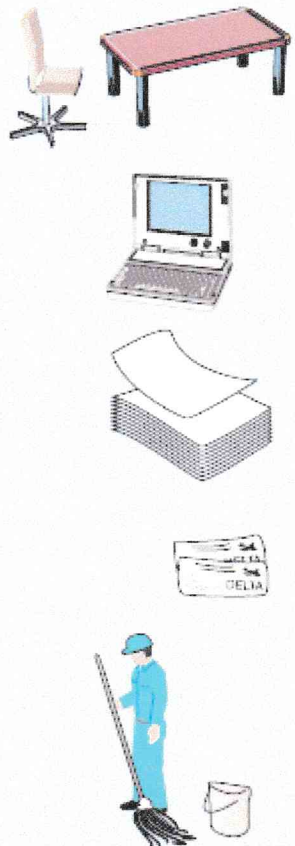
Sourcing The selection of suppliers.

Outsourcing The purchase of goods and services from an outside supplier.

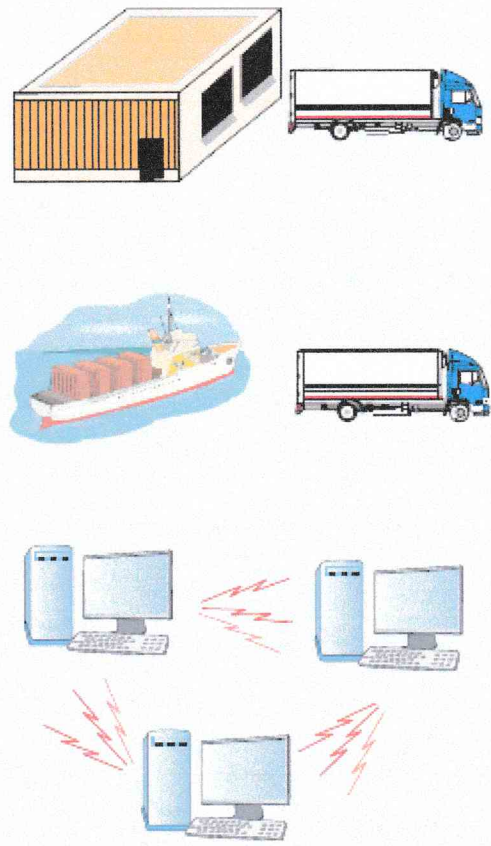
Original Equipment Manufacturer (OEM)
Goods and services that go directly into the production of a product—parts, fabrications, components



Maintenance, Repair and Operation (MRO)
Indirect goods and services that do not directly go into a product—office supplies, furniture, airline tickets, janitorial services



Corporate Services
Services that support the supply chain—distribution, warehousing, information systems



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FIGURE 11.1 Categories of Goods and Services that Companies Outsource

Many companies are outsourcing as a strategic move so that they can focus more on their **core competencies**, that is, what they do best. They let a supplier do what the company is not very good at or doesn't have much experience with, what the supplier is most competent to do. Traditionally, many companies, especially large ones, attempted to own and operate all of their sources of supply and distribution along the supply chain so that they would have direct managerial control and reduce their dependence on potentially unreliable suppliers. They also thought it was more cost effective. However, this stretched these companies' resources thin, and they discovered they did not have the expertise to do everything well. In addition, management of unwieldy, complex supply chains was often difficult. Large inventories were kept throughout the supply chain to buffer against uncertainties and poor management practices.

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The recent trend toward outsourcing provides companies with greater flexibility and resources to focus on their own core competencies, and partnering relationships with suppliers provides them with control. In addition, many companies are outsourcing in countries where prices for supply are lower, such as China.

Core competencies What a company does best.

By limiting the numbers of its suppliers, a company has more direct influence and control over the quality, cost, and delivery performance of a supplier if the company has a major portion of that supplier's volume of business. The company and supplier enter into a partnership in which the supplier agrees to meet the customer's quality standards for products and services and helps lower the customer's costs. The company can also stipulate delivery schedules from the supplier that enable it to reduce inventory. In return, the company enters into a long-term relationship with the supplier, providing the supplier with security and stability. It may seem that all the benefits of such an arrangement are with the customer, and that is basically true. The customer dictates cost, quality, and performance to the supplier. However, the supplier passes similar demands on to its own suppliers, and in this manner the entire supply chain can become more efficient and cost-effective.

E-Procurement

E-procurement is part of the business-to-business (B2B) commerce being conducted on the Internet, in which buyers make purchases directly from suppliers through their websites, by using software packages, or through e-marketplaces, e-hubs, and trading exchanges. The Internet can streamline and speed up the purchase order and transaction process from companies. Benefits include lower transaction costs associated with purchasing, lower prices for goods and services, reduced labor (clerical) costs, and faster ordering and delivery times.

E-procurement Direct purchase from suppliers over the Internet.

What do companies buy over the Internet? Purchases can be classified according to two broad categories: manufacturing inputs (direct products) and operating inputs (indirect products). Direct products are the raw materials and components that go directly into the production process of a product. Because they tend to be unique to a particular industry, they are usually purchased from industry-specific suppliers and distributors. They also tend to require specialized delivery; UPS does not typically deliver engine blocks. Indirect products do not go directly into the production of finished goods. They are the maintenance, repair, and operation (MRO) goods and services we mentioned previously (Figure 11.1). They tend not to be industry specific; they include things like office supplies, computers, furniture, janitorial services, and airline tickets. As a result, they can often be purchased from vendors like Staples, and they can be delivered by services like UPS.

More companies tend to purchase indirect goods and services over the Internet than direct goods. One reason is that a company does not have to be as careful about indirect goods since they typically cost less than direct products and they do not directly affect the quality of the company's own final product. Companies that purchase direct goods over the Internet tend to do so through suppliers with whom they already have an established relationship.

Spend Analysis

Spend analysis is a relatively recent addition to the supply chain management supply chain management (SCM) managing the flow of information through the supply chain in order to attain the level of synchronization that will make it more responsive to customer needs while lowering costs. It is a formal process of collecting, cleansing, classifying, and analyzing spending data in order to reduce procurement costs and improve the efficiency of the procurement process. Spend analysis attempts to assess the who, what, when, where, why, and how of a company's expenditure process and thereby answer the questions: How much is being spent? With which suppliers? Is the promised value being realized?

Spend analysis A formal process usually incorporating software for analyzing spend data to lower procurement costs.

Spend data can come from many different sources including supplier data and contracts, purchasing transactions, financial data, and risk data. [Figure 11.1](#) shows three basic categories of spend data—original equipment manufacturer (OEM); maintenance, repair, and operation (MRO); and corporate services. Within all of these categories, spend data can come from different suppliers, where there are too many suppliers for the same commodity. For example,

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in the OEM category a company could purchase office supplies and furniture from several different office supply companies and could work with a number of printing services, copier companies, and couriers; employees could use different travel agents, etc. Within the OEM and corporate services categories, spend data can come from an ERP system and accounts payable. Many companies attempt to consolidate this data on spreadsheets; however, even if all the data from multiple sources is accurately collected, in order to effectively manage spending and realize maximum cost savings, a formal process must be in place to analyze and manage spending, which is the basic premise of spend analysis. A formal spend analysis system can be automated with spend analysis software products, of which there are many, or by outsourcing spend analysis with an outside vendor.

Whatever automated system is used, companies that have a spend analysis process in place tend to have significantly lower procurement costs, have fewer suppliers, have a more efficient supply chain in terms of speed and quality, and tend to use more advanced e-procurement systems, such as vendor-managed inventory. Spend analysis helps companies find opportunities to save money. This can be as simple as determining who is buying what within a company so that purchases can be consolidated and volume discounts can be achieved. This might also include the use of Pareto analysis to see which few items make up the largest spending categories. It can identify suppliers in different business units or in different geographic locations that are providing better buying terms than suppliers in other parts of the business; or it can indicate if contract prices are not being adhered to. One important potential benefit is the analysis of total supply chain cost for a product that integrates spend data not only for supply purchase cost but also for transportation, tariffs and duties, inventory carrying cost, insurance, and so on.

E-Marketplaces

E-marketplaces or e-hubs consolidate suppliers' goods and services at one Internet site like a catalog. For example, e-hubs for MROs include consolidated catalogs from a wide array of suppliers that enable buyers to purchase low-value goods and services with relatively high transaction costs more cheaply and efficiently over the Internet. E-hubs for direct goods and services are similar in that they bring together groups of suppliers at a few easy-to-use websites.

E-marketplaces Websites where companies and suppliers conduct business-to-business activities.

E-marketplaces like Ariba provide a neutral ground on the Internet where companies can streamline supply chains and find new business partners. An e-marketplace also offers services such as online auctions where suppliers bid on order contracts, online product catalogs with multiple supplier listings that generate online purchase orders, and request-for-quote (RFQ) service, through which buyers can submit an RFQ for their needs and users can respond.

Along the Supply Chain

Spend Analysis at Mount Sinai Medical Center

Mount Sinai Medical Center in Miami, Florida, with over 3000 employees and 700 physicians, is the largest private, not-for-profit, teaching hospital in South Florida. It has been designated as one of “America’s Top Hospitals” by *U.S. News & World Report*. In 2001, Mount Sinai had a projected operating loss of over \$60 million, and as a result it initiated an aggressive spend analysis program to manage expenses. The hospital perceived that because supplier contracts were becoming so complex and there was so many of them, it needed to collect the correct purchasing data and automate its spend management. As a result, the hospital enhanced its in-house purchasing system with spend analysis software, which gave it the ability to look at its overall spend picture and benchmark it against other successful hospitals. For example, if the hospital was evaluating pacemaker purchases, it would use the spend analysis software program to collect data and determine how many devices were being used. Next, using other contract software the hospital would confirm that it was purchasing the pacemakers from the correct supplier at the lowest price. Next, using benchmark software it would compare its purchase process for the devices with other hospitals. This information taken together would then allow the hospital to negotiate a better price from suppliers.

By the end of the decade, using its automated spend analysis program, Mount Sinai was generating a positive annual net income, and had accumulated a positive surplus of over \$14 million.

What kind of goods and services would another service provider, like a restaurant, have in a spend analysis program?

Source: Based on Karen Minich-Pourshadi, “Hospital Business Analytics: Elevating the Spend Analysis,” www.HealthLeadersMedia.com, January 13, 2011.

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E-Auctions

A process used by e-marketplaces for buyers to purchase items is the **e-auction**, also known as a reverse auction. In a reverse auction, a company posts contracts for items it wants to purchase that suppliers can bid on. The auction is usually open for a specified time frame, and vendors can bid as often as they want in order to provide the lowest purchase price. When the auction is closed, the company can compare bids on the basis of purchase price, delivery time, and supplier reputation for quality. Some e-marketplaces restrict participation to vendors who have been previously screened or certified for reliability and product quality. e-auctions are not only used to purchase manufacturing items but are also being used to purchase services. For example, transportation exchanges hold reverse auctions for carriers to bid on shipping contracts and for air travel. Google has over 60,000 suppliers and negotiates about 20% of its total supply spending with e-auctions, saving an estimated 18% on prices and saving time, taking only 50 minutes to complete a live auction.

E-Auction A company posts items it wants to purchase on an Internet e-marketplace for suppliers to bid on.

Sometimes companies use reverse auctions to create price competition among the suppliers it does business with; other times companies simply go through a reverse auction only to determine the lowest price without any intention of awarding a contract. It only wants to determine a baseline price to use in negotiations with its regular supplier. Companies that award contracts to low bidders in auctions can later discover their purchases are delivered late or not at all, and are of poor quality. Suppliers are often able to see online their rank in the bidding process relative to other bidders (who are anonymous), which provides pricing information to them for the future.

Distribution

Distribution encompasses all of the channels, processes, and functions, including warehousing and transportation, that a product passes through on its way to the final customer (end user). It is the actual movement of products and materials between locations. Distribution management involves managing the handling of materials and products at receiving docks, storing products and materials, packaging, and the shipment of orders. The focus of distribution, what it accomplishes, is referred to as **order fulfillment**. It is the process of ensuring on-time delivery of the customer's order.

Order fulfillment The process of ensuring on-time delivery of an order.

Distribution and transportation are also often referred to as **logistics**. Logistics management in its broadest interpretation is similar to supply chain management. However, it is frequently more narrowly defined as being concerned with just transportation and distribution, in which

case logistics is a subset of supply chain management. In this decade total annual U.S. business logistics is over \$1.4 trillion.

Logistics The transportation and distribution of goods and services.

Speed and Quality

Distribution is not simply a matter of moving products from point A to point B. The driving force behind distribution and transportation in today's highly competitive business environment is *speed*. One of the primary quality attributes on which companies compete is speed of service. Customers have gotten used to instant access to information, rapid Internet-based order transactions, and quick delivery of goods and services. As a result, walking next door to check on what's in the warehouse is not nearly fast enough when customers want to buy a product now and a company has to let them know if it's in stock. That demands real-time inventory information. Calling a trucking firm and asking it when it will have a truck in the vicinity to pick up a delivery is not nearly fast enough when a customer has come to expect delivery in a few days or overnight. That also requires real-time information about carrier location, schedules, and capacity. Thus, the key to distribution speed is information, as it has been in our discussion of other parts of the supply chain.

Internet Companies: Amazon.Com

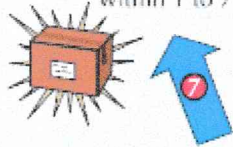
Distribution is a particularly important supply chain component for Internet companies like Amazon.com, whose supply chains consist almost entirely of supply and distribution. These companies have no production process; they simply sell and distribute products that they acquire from suppliers. They are not driven from the front end of the supply chain—the website—but by distribution at the back end. Their success ultimately depends on the capability to ship each order when the customer needs or wants it.

Figure 11.2 illustrates the order fulfillment process at Amazon.com when one of its millions of customers places an order via the Internet (or by phone). The order is transmitted to the closest distribution center (DC) where items are stored in a warehouse in shelved bins. Computers send workers to retrieve items from the shelves, and they place each item in a crate with other orders. When the crate is full it moves by conveyor through the plant to a central point. At this central sorting area bar codes are matched with order numbers to determine which items go with which order, and the items that fulfill an order are sorted into chutes. The items that make up an order are placed in a box as they come off the chute with a new bar code that identifies the order. The boxes are then packed, taped, weighed, and shipped by a carrier, for example, the U.S. Postal Service or UPS.

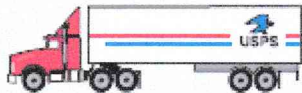
Customer places order—assigned to closest of over 60 Amazon U.S. fulfillment centers



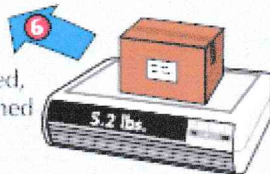
Order arrives within 1 to 7 days



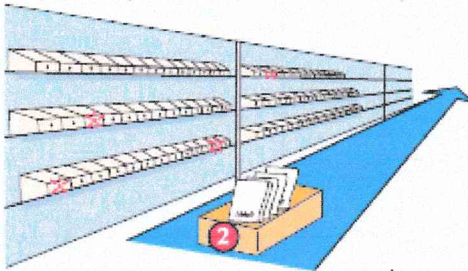
Boxes shipped by U.S. Postal Service and United Parcel Service



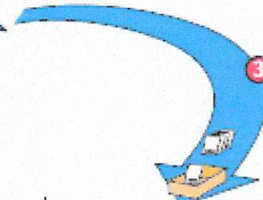
Boxes are packed, taped, and weighed



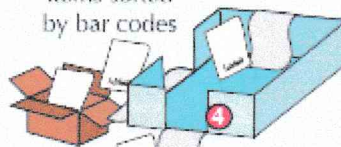
Red lights show worker which products are ordered—bar codes matched with order—product placed in crates on conveyor



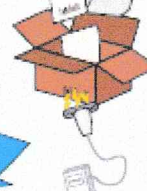
Crates ride conveyors through DC



Items sorted by bar codes



Crates arrive at central point and bar codes of products matched with orders. Items sorted automatically into one of several thousand chutes, into a box



Bar code identifies customer order

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FIGURE 11.2 Order Fulfillment at [Amazon.com](https://www.amazon.com)

Distribution Centers and Warehousing

Distribution centers, which typically incorporate warehousing and storage, are buildings that are used to receive, handle, store, package, and then ship products (see photo). Some of the largest business facilities in the United States are distribution centers. The Target Import DC in Lacey, Washington, has 2 million square feet of floor space—over 37 times bigger than the area of a football field and almost the same floor space as the Empire State Building; one of the largest Amazon fulfillment centers in Phoenix, Arizona, is over 1.6 million square feet. The annual cost of warehousing in the U.S. is over \$470 billion.

As in other areas of supply chain management, information technology has a significant impact on distribution management. The Internet has altered how companies distribute goods by adding more frequent orders in smaller amounts and higher customer service expectations to the already difficult task of rapid response fulfillment. To fill Internet orders successfully, warehouses and distribution centers must be set up as “flow-through” facilities, using automated material-handling equipment to speed up the processing and delivery of orders.

Retailers have shifted from buying goods in bulk and storing them to pushing inventory and storage and final configuration back up the supply chain (upstream). They expect suppliers (and/or distributors) to make frequent deliveries of merchandise that includes a mix of different product items in small quantities (referred to as “mixed-pallet”), properly labeled, packed, and shipped in store-ready configurations. For example, some clothing retailers may want sweaters delivered already folded, ready for the store shelf, while others may want them to be on their own hangers. To handle retailer requirements adequately, distribution centers must be able to handle a variety of automated tasks.



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The logistics distribution center of the Zara Company, known as the Zaragoza Logistics Platform or PLAZA, in the Aragon region of Spain, occupies nearly 13 million square meters and is the largest logistics site on the European continent.

Xurxo Lobato/Cover/Getty Images

Along the Supply Chain

Adding a New Distribution Center to the Sephora Supply Chain

Sephora, the beauty products brand and chain of cosmetics stores (shown in photo), was founded in Paris and is owned by French conglomerate LVMH (Louis Vuitton Moët Hennessy). The Sephora supply chain includes more than 900 stores in 29 countries, carrying over 250 brands, along with its own private label. Sephora has over 360 stores in the United States and Canada, which until 2008 were served by a single 316,000 square-foot distribution center in Belcamp, Maryland. Precipitated by its rapid growth and becoming the exclusive provider of beauty products for over 300 J.C. Penney stores across the United States in 2006, Sephora began investigating alternatives for its distribution network, including replacing the Belcamp facility with a larger, more optimally located distribution center, opening a second distribution center, or simply keeping the Belcamp facility. The company engaged an outside supply chain consulting firm to undertake a project to investigate these alternatives.

The project team, consisting primarily of Sephora's internal logistics team and members from the consulting firm, first developed a model of the existing Sephora distribution network to better understand how store replenishment worked and what level of service they needed. The network model included transactional data for its stores and Internet site, plus logistics data for freight costs, warehouse operating costs, shipment volumes, and store locations. Next, the objectives for the future distribution network were established, which required an understanding of future store growth patterns including possible locations.

After growth projections were included in the model, the team addressed two possible scenarios—what was the best East Coast site if Belcamp was closed, and if Belcamp stayed open, what was the best site for a second facility. For each scenario the model was evaluated with data for different possible locations, including the average cost per square foot and freight rates, and based on these model results the sites were rated and then ranked according to service cost. The model results showed first that the absolute optimal site was near Philadelphia, only 80 miles from Belcamp, such that the minimal savings in transportation costs would not offset the relocation costs, and thus Belcamp was fixed as one site. Next, the model was reevaluated for second-site candidates that would optimize transportation costs, lead times and expenses. Salt Lake City was selected as the site for the second distribution center not only because of optimal transportation costs, but also because of the support of local and state governments. The Salt Lake City distribution center opened in 2008 and relieved the capacity at Belcamp, increased Sephora's customer service capabilities, and reduced its shipping costs. In 2013, Sephora began considering a

third North American distribution center as it expanded into Brazil and Mexico. In 2014 Sephora replaced the Belcamp facility with a new distribution center a few miles away in Perryman, Maryland, that's almost double the size of the Belcamp warehouse.



Cheng Xuliang/ZUMA Press/Newcom

Do you think the process Sephora used to determine the site of its new distribution center could be universally applied to other retail companies?

Source: Based on Maida Napolitano, "Sephora's Gorgeous Network Reorganization," *Supply Chain Management Review* 15 (11); (November 2011), pp. S40–S50.

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Postponement

Postponement moves some final manufacturing steps like assembly or individual product customization into the warehouse or distribution center. Generic products or component parts (like computer components) are stored at the warehouse, and then final products are built-to-order (BTO), or personalized, to meet individual customer demand. It is a response to the adage that whoever can get the desired product to the customer first gets the sale. Postponement actually pulls distribution into the manufacturing process, allowing lead times to be reduced so that demand can be met more quickly. However, postponement also usually means that a distributor must stock a large number of inventory items at the warehouse to meet the final assembly or customization requirements; this can create higher inventory-carrying costs. The manufacturing and distribution supply chain members must therefore work together to synchronize their demand forecasts and carefully manage inventory.

Postponement Moves some manufacturing steps into the distribution center.

Warehouse Management Systems

In order to handle the new trends and demands of distribution management, companies employ sophisticated, highly automated **warehouse management systems (WMS)** to run day-to-day operations of a distribution center and keep track of inventories. The WMS places an item in storage at a specific location (a *putaway*), locates and takes an item out of storage (a *pick*), packs the item, and ships it via a carrier. The WMS acknowledges that a product is available to ship, and, if it is not available, the system will determine from suppliers in real time when it will be available.

Warehouse management system (WMS) An automated system that runs the day-to-day operations of a distribution center.

Figure 11.3 illustrates the features of a WMS. Orders flow into a WMS through an *order management system (OMS)*. The OMS enables the distribution center to add, modify, or cancel orders in real time. When the OMS receives customer order information online, it provides a snapshot of product availability from the WMS and from suppliers via EDI. If an item is not

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in stock, the OMS looks into the supplier's production schedule to see when it will be available. The OMS then allocates inventory from the warehouse site to fill an order, establishes a delivery date, and passes these orders onto the transportation management system for delivery.

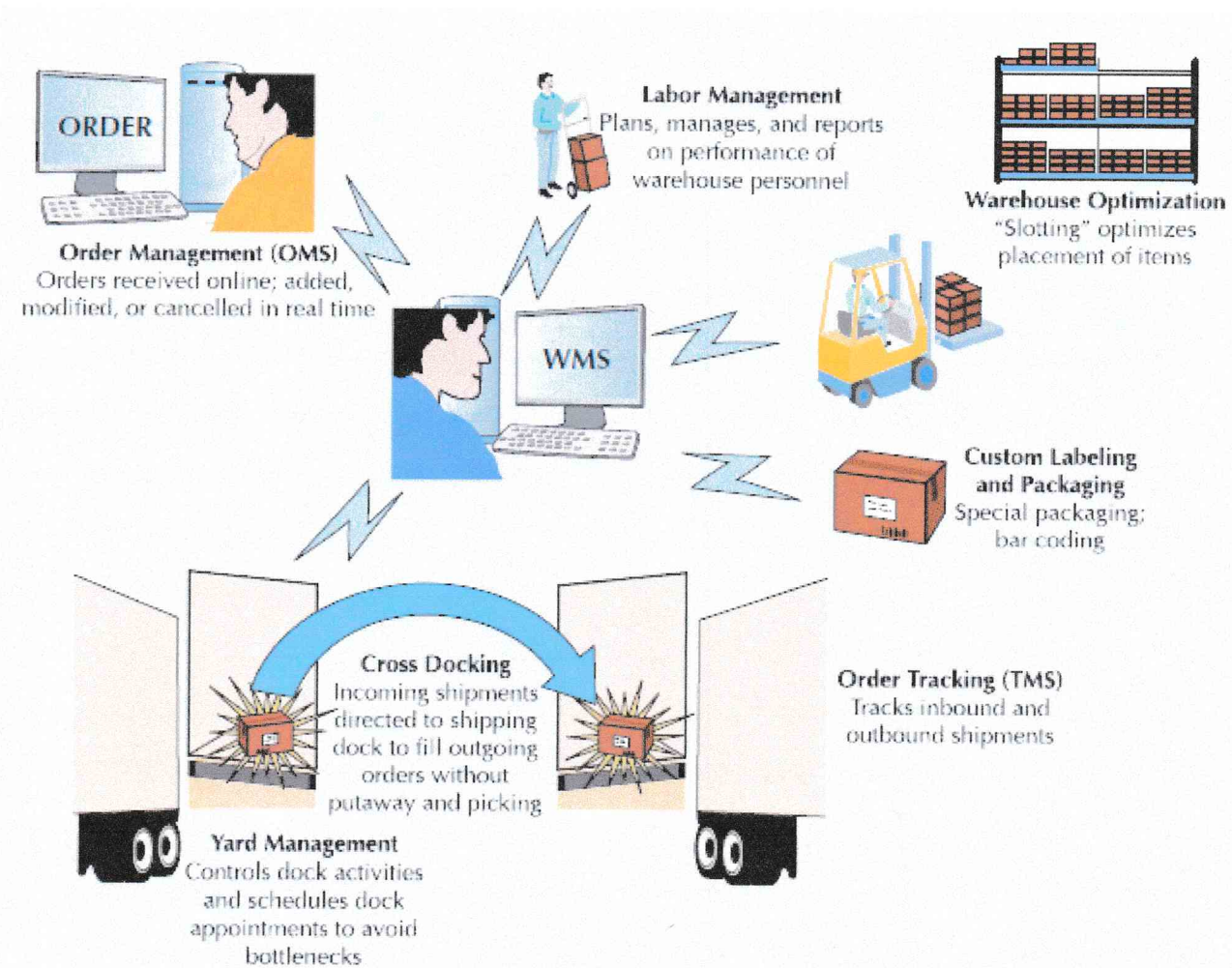


FIGURE 11.3 A Warehouse Management System (WMS)

The *transportation management system (TMS)* allows the DC to track inbound and outbound shipments, to consolidate and build economical loads, and to select the best carrier based on cost and service. *Yard management* controls activities at the facility's dock and schedules dock appointments to reduce bottlenecks. *Labor management* plans, manages, and reports the performance level of warehouse personnel. *Warehouse optimization* optimizes the warehouse placement of items, called "slotting," based on demand, product groupings, and the physical characteristics of the item. A WMS also creates custom labeling and packaging. A WMS facilitates **cross-docking**, a system that Walmart originated that allows a DC to direct incoming shipments straight to a shipping dock to fill outgoing orders, eliminating costly putaway and picking operations. In a cross-docking system, products are delivered to a warehouse on a continual basis, where they are stored, repackaged, and distributed to stores

without sitting in inventory. Goods “cross” from one loading dock to another, usually in 48 hours or less.

Cross-docking Goods “cross” from one loading dock to another in 48 hours or less.

Vendor-Managed Inventory

With **vendor-managed inventory (VMI)** (also called supplier managed inventory or SMI), manufacturers, instead of distributors or retailers, generate orders. Under VMI, manufacturers receive data electronically via EDI or the Internet about distributors’ sales and stock levels. Manufacturers can see which items distributors carry, as well as several years of point-of-sale data, expected growth, promotions, new and lost business, and inventory goals, and use this information to create and maintain a forecast and an inventory plan. VMI is a form of “role reversal”—usually the buyer completes the administrative tasks of ordering; with VMI the responsibility for planning shifts to the manufacturer.

Vendor-managed inventory (VMI) Manufacturers rather than vendors generate orders.

VMI is usually an integral part of supply chain collaboration. The vendor has more control over the supply chain and the buyer is relieved of administrative tasks, thereby increasing supply chain efficiency. Both manufacturers and distributors benefit from increased processing speed, and fewer data entry errors occur because communications are through computer-to-computer EDI or the Internet. Distributors have fewer stockouts; planning and ordering costs go down because responsibility is shifted to manufacturers; and service is improved because distributors have the right product at the right time. Manufacturers benefit by receiving distributors’ point-of-sale data, which makes forecasting easier. Dell perfected VMI as part of its build-to-order (BTO) production and inventory system; Walmart and Home Depot are examples of companies that also employ VMI on a large scale.

Collaborative Logistics

Rival companies are also finding ways to collaborate in distribution. They have found that by pooling their distribution resources, which can create greater economies of scale, they can reduce their costs.

For example, a company may find it is paying for too many half-empty trucks so they might move to collaborative logistics. Using the Internet as a central coordination tool among producers, carriers, and retailers, companies can share trucks and warehouse space with other companies, even competitors that are shipping to the same retail locations. At third-party logistics (3PL) providers, companies use a website to post the warehouse space they need or have available and share space, trucks, and expenses. The goal is that everyone, from suppliers to truckers to retailers, shares in the savings.

Distribution Outsourcing

Another distribution alternative is outsourcing. Just as companies outsource production to suppliers that they once performed themselves, manufacturers are increasingly outsourcing distribution activities. The reason is basically the same for producers as it is for suppliers: outsourcing allows the company to focus on its core competencies. It also takes advantage of

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the expertise that distribution companies have developed. Outsourcing distribution activities to third-party logistics (3PL) providers tends to lower inventory levels and reduce costs for the outsourcing company, plus it allows companies to focus on its core competencies.

Transportation

In a supply chain, *transportation* is the movement of a product from one location to another as it makes its way to the end-use customer. Although supply chain experts agree that transportation sometimes falls through the supply chain management cracks, receiving less attention than it should, it can be a significant supply chain cost. For some manufacturing companies, transportation costs can be as much as 20% of total production costs and run as high as 6% of revenue. Over \$860 billion is spent on supply chain transportation costs in the United States each year. For some retail companies primarily involved in the distribution of goods, such as L.L. Bean and Amazon.com, transportation is not only a major cost of doing business, it is also a major determinant of quick delivery service. L.L. Bean ships over 15 million packages in a year—over one million in its busiest week—mostly by UPS.

The principal modes of transportation within the United States are railroads, air, truck, intermodal, water, package carriers, and pipeline. In the United States, the greatest amount of freight is shipped by trucking, followed by railroad, pipeline, and inland waterways. The different transport modes and some of their advantages and disadvantages are shown in [Figure 11.4](#).

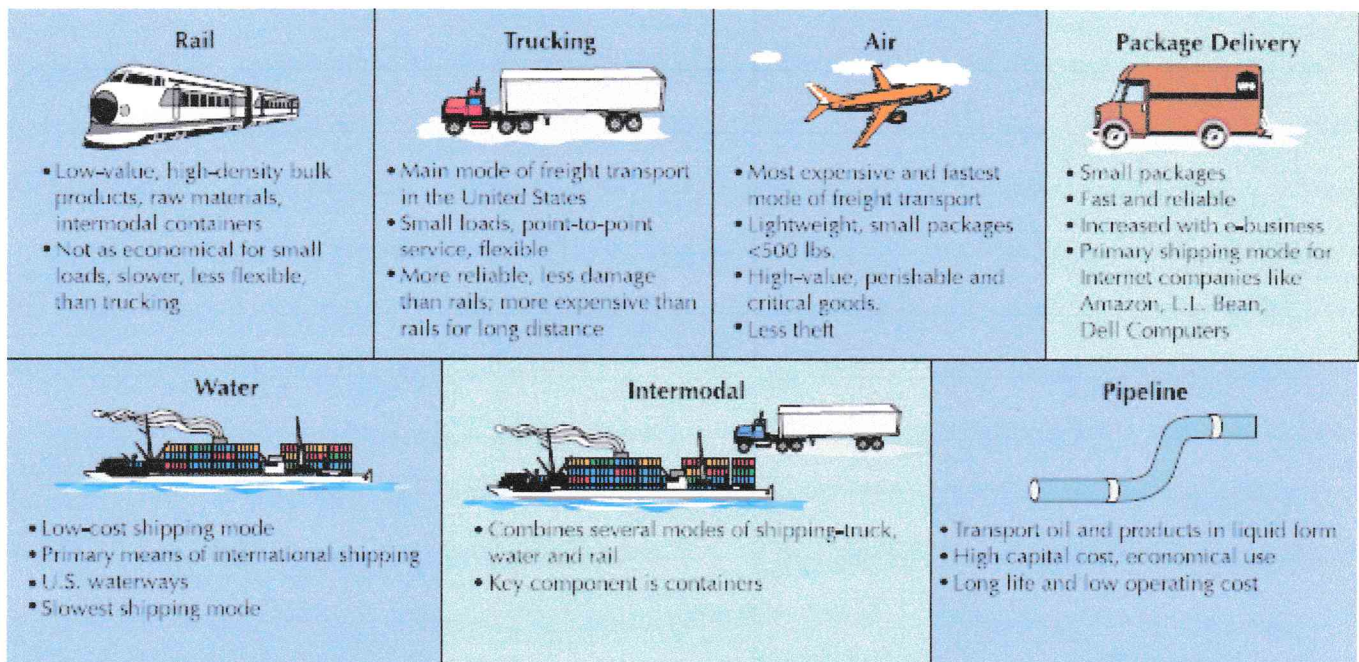


FIGURE 11.4 Transportation Modes

Railroads, with more than 160,000 miles of track in the United States, are cost-effective for transporting products such as raw materials, coal, minerals, ores, and especially containers over long distances. However, railroads operate on less flexible and slower schedules than trucks,

and they usually cannot go directly from one business location to another as trucks can. Railroad freight service also has the worst record of quality performance of all modes of freight transport, with a higher incidence of product damage and almost 10 times more late deliveries than trucking.

Trucking is the main mode of freight transportation in the United States, annually carrying over 60% of U.S. freight tonnage, and generating almost 80% of the nation's total freight cost each year. Trucks provide flexible point-to-point service, delivering small loads over short and long distances over widely dispersed geographic areas.

Air freight is the most expensive and fastest mode of freight transportation. For companies that use air freight, service is more important than price. For some companies, production stoppages because of missing parts or components can be much more expensive than the

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increased cost of air freight. For high-value goods such as pharmaceuticals, high technology, and consumer electronics, speed to market is important. In addition, shorter shipping times reduce the chances for theft and other losses. The general rule for international air freight is that anything that is physically or economically perishable has to move by air instead of by ship. The major product groups that are shipped by international air freight, from largest to smallest, are perishables, construction and engineering equipment, textiles and wearing apparel, documents and small package shipments, and computers, peripherals, and spare parts.



Federal Express superhubs consolidate and distribute shipments from a central location. FedEx is the industry leader in overnight package delivery service.

Bloomberg via Getty Images

Air freight is growing particularly fast in Asia and specifically China. The lack of adequate ground infrastructure makes rail and trucking transport difficult between countries in Asia and regions in China. Companies with manufacturing plants in one place in Asia and suppliers in another often use air freight to connect the two.

Package carriers such as UPS, FedEx, and the U.S. Postal Service transport small packages, up to about 150 pounds. The growth of e-business has significantly increased the use of package carriers. Package carriers combine various modes of transportation, mostly air and truck, to ship small packages rapidly. They are not economical for large-volume shipments; however, they are fast and reliable, and they provide unique services that some companies must have. Package carriers have been innovative in the use of bar codes and the Internet to arrange and track shipments. The FedEx website attracts more than 50 million package tracking requests daily, and it receives 70% of its customer orders electronically. FedEx, as shown in photo, delivers around 9 million packages daily in over 220 countries.

Waterways in the United States include 26,000 navigable miles over inland waterways, canals, the Great Lakes, and along coastlines. Water transport is a slow but very low-cost form of shipping. It is limited to heavy, bulk items such as raw materials, minerals, ores, grains, chemicals, and petroleum products. If delivery speed is not a factor, water transport is cost competitive with railroads for shipping these kinds of bulk products. Water transport is the primary means of international shipping between countries separated by oceans for most products. Over 80% of freight imports into the United States arrive via ocean shipping.

Intermodal transportation combines several modes of transportation to move shipments. The most common intermodal combination in the United States is truck–rail–truck, and the

truck–water–rail/truck combination is the primary means of global transport. Intermodal transportation carries over 35% of all freight shipments over 500 miles in the United States. Intermodal truck–rail shipping can be as much as 40% cheaper than long-haul trucking.

Intermodal transportation Combines several modes of transportation to move shipments.

The key component in intermodal transportation is the *container*. Within the United States, containers are hauled as trailers attached to trucks to rail terminals, where they are double- or triple-stacked on railroad flatcars or specially designed “well cars,” which feature a well-like lower section in which the trailer or container rides (70% of U.S. intermodal shipping over a million containers annually) is double-stacked. The containers are then transported to another rail terminal, where they are reattached to trucks for direct delivery to the customer. For overseas shipments, container ships transport containers to ports where they are off-loaded to trucks or rail for transport, as shown in photo. Container traffic world wide is over 650 million TEUs (i.e., 20-foot equivalent units, a standard size container) annually, with almost 10% in the United States.

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Along the Supply Chain

Supply Chain Operations at Food Distributor Sysco Corporation

Houston-based Sysco Corporation, with annual revenues over \$44 billion, is the global leader in the food services industry. Each year Sysco ships over 21 million tons of produce, meats, prepared meals, and other food-related products to over 425,000 customers, supplying one in three restaurants, cafeterias, and sports stadiums in the United States. Sysco's supply chain, which stretches from the farm to the dinner table, is especially complex because a jar of caviar must be handled differently from a box of frozen onion rings or a tub of flour. As a result of its unique inventory and distribution systems, Sysco is constantly seeking to cut costs and speed delivery times. In one of its sorting and distribution centers, such as its 450,000-square-foot facility in Jersey City, New Jersey, restaurant supplies are sorted and loaded before being sent to their final destination. Forklift drivers, called selectors, wear a wireless scanner plus a printer on their hip that provides exact instructions on what to load; they point their scanners at a bar code above an item, grab it, and put it on a pallet. Software determines how each pallet should be arranged based on the weight of its items, its location, and its destination. The sorting facility is arranged so that work is all done in one direction, drivers never double back, and the aisles are organized according to weight and temperature. Heavier items are put on one side of the warehouse, while lighter items, like potato chips, are put on the other side, in order to maximize efficiency. This sorting facility turns over 11,000 inventory items every 17 days. To achieve this kind of turnover rate each product has an expiration date; if an item passes its expiration, inventory management software alerts workers to pull it, or if supplies are too low the software tells the center to replenish. Sysco uses redistribution centers where truck deliveries from suppliers are consolidated and packed into trucks for delivery to sorting centers. Sysco realizes savings through cross-docking, taking full truckloads from a supplier, bringing them to a cross-dock, mixing the freight and shipping full truckloads to a customer. In some cases pallets are packed and ready for delivery to customers at the redistribution centers so that only a few additional pallets must be assembled at the sorting center before the truck is sent out for delivery, resulting in fewer and fuller trucks. Sysco also uses Roadnet routing software developed by UPS to determine the most efficient routes for its trucks, which in addition to lowering costs, also has the sustainable result of reducing diesel fuel usage.

In a number of ways the warehouse and distribution system used by Sysco is similar to other large retailers like Walmart, Target, L.L. Bean, and Amazon. Discuss the similarities and differences in supply chain operations between Sysco and these other retailers.

Source: Jia Lynn Yang, 'Veggie Tales', *Fortune*, 159 (12); (June 2009), p. 25.

There are over 2 million miles of *pipelines* in the United States, 75% of which are used primarily for transporting oil and petroleum products. Pipelines called slurry lines carry other products such as coal and kaolin that have been pulverized and transformed into liquid form. Once the product arrives at its destination, the water is removed, leaving the solid material. Although pipelines require a high initial capital investment to construct, they are economical because they

can carry materials over terrain that would be difficult for trucks or trains to travel across, for example, the Trans-Alaska pipeline. Once in place, pipelines have a long life and are low cost in terms of operation, maintenance, and labor.



One of the most popular forms of intermodal transportation uses containers that are transported via rail or truck to ports where they are loaded onto container ships for shipment overseas, and then loaded back onto trucks or rail at destination ports for delivery to end-use customers.

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Internet Transportation Exchanges

Internet transportation exchanges bring together shippers who post loads and carriers who post their available capacity in order to arrange shipments. In some exchanges once the parties have matched up at a website, all the negotiation is done offline. In others the online service manages the load matches automatically; the services match up shipments and carriers based on shipment characteristics, trailer availability, and the like. For example, shippers tender load characteristics, and the online service returns with recommendations on carrier price and service levels. Some services also provide an online international exchange structured as a reverse auction. The shippers will tender their loads, and carriers will bid on the shipment. Shipments remain up for bid until a shipper-specified auction closing time (like auctions on eBay). However, the lowest price, or lowest bid, is not always conducive to quality service. At some sites the low bid does not necessarily win; the service takes into account quality issues such as transit time, the carrier, and availability in addition to price.

One of the more well-known Internet exchange services is www.freightquote.com. At this site (and others like it) shippers and carriers identify their available shipment or capacity needs and their business requirements. The exchanges automatically match compatible shippers with carriers based on price and service. Automated processes make the trade within a few hours with no phone calls, invoices, and so on.

The Global Supply Chain

A number of factors have combined to create a global marketplace. International trade barriers have fallen, and new trade agreements between countries and nations have been established. The dissolution of communism opened up new markets in Russia and Middle and Eastern Europe, and the creation of the European Union resulted in the world's largest economic market—500 million people. Europe, with a total population of 730 million, is the largest, best-educated economic group in the world. Emerging markets in China, growing Asian export-driven economies, burgeoning global trading centers in Hong Kong and Singapore, and an increasingly robust economy in India have linked with the rest of the world to form a vigorous global economic community. Global trade now exceeds \$27 trillion per year.

Along the Supply Chain

Global Supply Chain Management at Li & Fung

Li & Fung Limited, headquartered in Hong Kong, is the world's leading consumer goods sourcing company supplying high volume, time-sensitive apparel products to over 8000 customers worldwide. It is the recognized world leader in supply chain management, providing a spectrum of services that covers the entire supply chain. It has over 300 offices and distribution centers with 26,000 employees in over 40 countries. Garments, including denim jeans, make up about two-thirds of Li & Fung's business; it is involved in the production of between 40% to 50% of the clothes you'll find in any U.S. shopping mall.

Li & Fung's extensive global network of over 15,000 suppliers includes product design and development, raw material and factory sourcing, production planning and management, quality assurance, shipping and distribution, warehousing, customs brokerage, and export documentation. It manages the supply chain of large retailers such as Walmart, Kohl's, Sears, JC Penney, Target, Abercrombie & Fitch, Marks and Spencer, and Talbots, helping them (and all their customers) optimize the flow of inventory and information to reduce cost and improve service level. For apparel products like denim jeans, Li & Fung finds raw materials and factories and takes on manufacturing responsibilities to make sure factories meet labor standards and deliver jeans at set prices and quickly (although Li & Fung generally owns few factories itself).

Several years ago Li & Fung took over Liz Claiborne Inc.'s sourcing operations, which encompasses all aspects of its production, from acquiring materials to manufacturing and delivery. Liz Claiborne, which includes Juicy Couture, Kate Spade, and Lucky Brand, retained its design and marketing functions—for example, it gives jeans designs to Li & Fung, and Li & Fung then bids them out worldwide to the manufacturer with the best combination of quality, speed-to-market, and price. Liz Claiborne recognized that Li & Fung, with its vast sourcing network and supply chain expertise, could manage its supply chain better than it could itself.

Sources: Based on Li & Fung's website at www.lifunggroup.com; Bruce Einhorn, "Li & Fung: A Factory Sourcer Shines," www.businessweek.com/magazine, (May 14, 2009); and Sandeep Agarwal, "Li & Fung – Operations, Emerging Supply Chain Changes & More...," www.denimandjeans.com, (October 8, 2011).

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Globalization is no longer restricted to giant companies. Technology advances have made it possible for middle-tier companies to establish a global presence. Companies previously regional in scope are using the Internet to become global overnight. Information technology is the “enabler” that lets companies gain global visibility and link disparate locations, suppliers, and customers. However, many companies are learning that it takes more than a glitzy website to be a global player. As with the domestic U.S. market, it takes a well-planned and coordinated supply chain to be competitive and successful.

Obstacles to Global Supply Chain Management

Moving products across international borders is like negotiating an intricate maze, riddled with potential pitfalls. For U.S. companies eager to enter new and growing markets, trading in foreign countries is not “business as usual.” Global supply chain management, though global in nature, must still take into account national and regional differences. Customs, business practices, and regulations can vary widely from country to country and even within a country. Foreign markets are not homogeneous and often require customized service in terms of packaging and labeling. Quality can be a major challenge when dealing with emerging markets in countries with different languages and customers.

Some of the other major differences between domestic and global supply chain transactions include:

- Increased documentation for invoices, cargo insurance, letters of credit, ocean bills of lading or air waybills, and inspections
- Ever-changing regulations that vary from country to country and govern the import and export of goods
- Trade groups, tariffs, duties, and landing costs
- Limited shipping modes and infrastructure
- Differences in communication technology and availability
- Different business practices as well as language barriers
- Government codes and reporting requirements that vary from country to country
- Numerous players, including forwarding agents, custom house brokers, financial institutions, insurance providers, multiple transportation carriers, and government agencies
- Numerous security regulations and requirements

Duties, Tariffs, and Global Trading Groups

The proliferation of trade agreements has changed global markets and has accelerated global trade activity. Nations have joined together to form trading groups, also called **nation groups**, and customs unions, and within these groups products move freely with no import tax, called **tariffs** or **(duties)**, charged on member products. The members of a group charge uniform import duties to nations outside their group, thus removing tariff trade barriers within the group and raising barriers for outsiders. The group adopts rules and regulations for freely transporting goods across borders that, combined with reduced tariffs, give member nations a competitive advantage over nonmembers. These trade advantages among member nations lower

supply chain costs and reduce cycle time—that is, the time required for products to move through the supply chain.

Nation groups Nations joined together into trading groups.

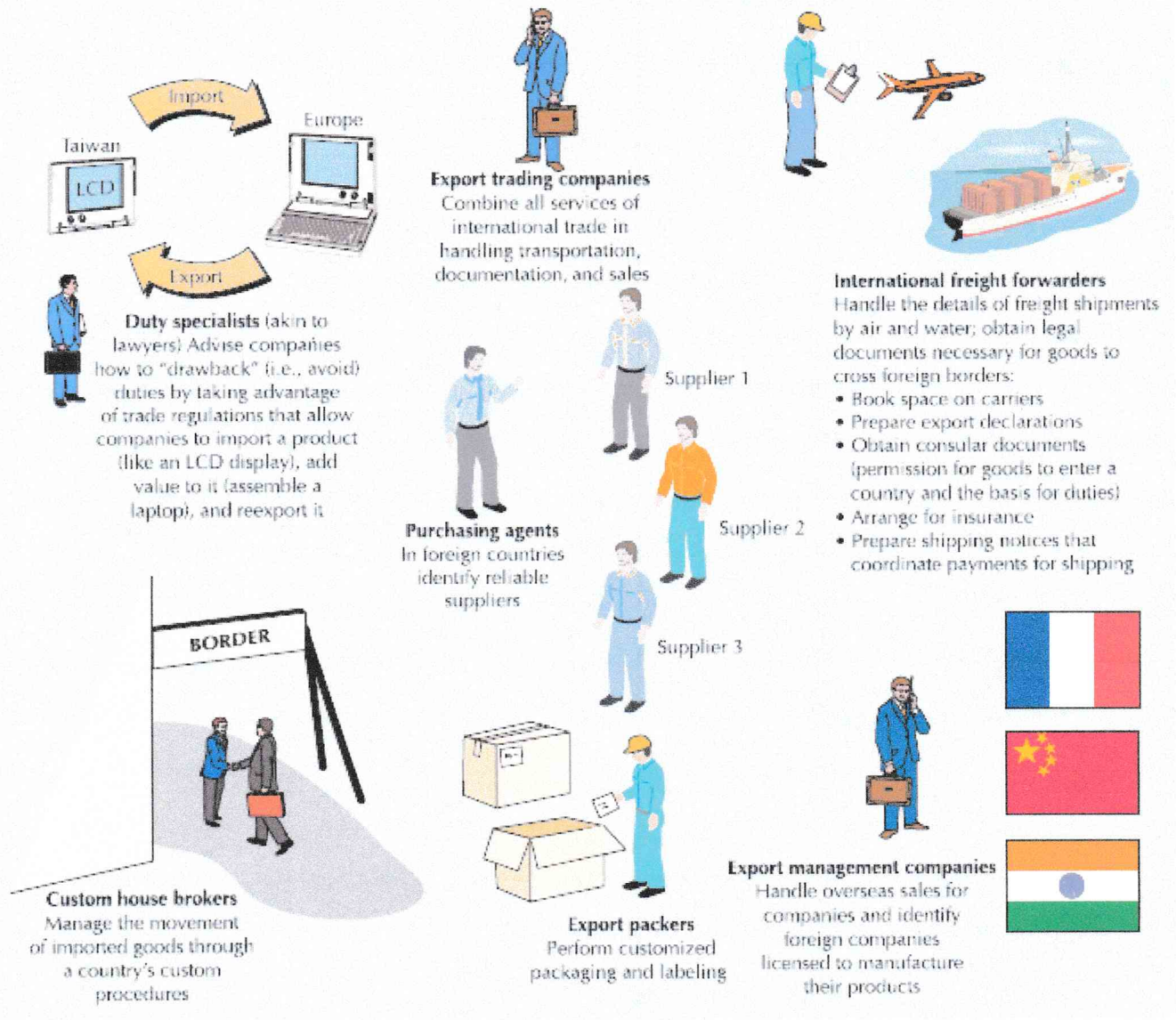
Tariffs (duties) Taxes on imported goods.

Two of the most prominent international groups that trade with the United States are NAFTA, the North American Free Trade Agreement, and EU, the European Union trade group.

The World Trade Organization (WTO) is an international organization dealing with the global rules of trade. It ensures that trade flows as smoothly and freely as possible among its 161 members. The trade agreements and rules are negotiated and signed by governments, and their purpose is to help exporters and importers conduct business. Most-favored-nation trade (MFN) status is an arrangement in which WTO member countries must extend to other members the most favorable treatment given to any trading partner. For example, MFN status for China translates into lower duties on goods entering the United States, and fewer trade regulations for companies.

To overcome the obstacles and problems of global supply chain management, many companies hire one or more international **trade specialists**. [Figure 11.5](#) summarizes the activities of different types of trade specialists.

Trade specialists Include freight forwarders, customs house brokers, export packers, and export management and trading companies.



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FIGURE 11.5 International Trade Specialists

Landed Cost

In global trade **landed cost** is the total cost of producing, storing, and transporting a product to the site of consumption or another port. It can include such costs as brokerage and logistics fees, port fees, custom duties, tariffs, taxes, insurance, currency conversion, and handling fees; as many as 80 components can be included in landed cost. However, 85% of these components fall into two broad categories: (1) transportation cost and duty, and (2) governmental charges such as **value added tax (VAT)** and excise tax. Landed costs are important because the duty assessed by different governments incorporates varying portions of landed costs. For example, for U.S. imports, duty is charged free on board (FOB) the factory. This means that transportation costs from the point of entry into the United States to the factory destination are not calculated as part of the import duty charge. However, in other countries the duty assessed can include the cost of transportation from beginning to end.

Landed cost The total cost of producing, storing, and transporting a product to its destination or port.

Value-added tax (VAT) An indirect tax assessed on the increase in value of a good at any stage of the production process from raw material to final product.

By knowing the landed cost of a product before it is purchased, a company can make more informed decisions, while poorly projected landed costs can balloon the price of a product move. Accurately estimating true landed costs helps avoid “clicker shock.” Clicker shock

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occurs when an overseas customer places an order with a company that does not have the capability of calculating landed cost. Then the order gets shipped, and along the way tariffs get added on top—in some cases this can double the original purchase price.

Web-Based International Trade Logistics Systems

As we have indicated, global supply chain management involves a stunningly complex matrix of language barriers, currency conversions, international trade agreements, taxes, tariffs, embargoes, duties, quotas, document requirements, local rules, and new trading partners. These factors require an automated information technology solution for any company with any real volume of international shipments. International trade logistics (ITL) companies use web-based software products that link directly to customers' websites to eliminate or reduce the obstacles to global trade. They convert language and currency from the U.S. system into those used by many of the United States's trading partners, giving potential buyers in other nations easy access to product and price information. ITL systems also provide information on tariffs, duties, and customs processes and some link with financial institutions to facilitate letters of credit and payment. Through the use of extensive databases these systems can attach the appropriate weights, measurements, and unit prices to individual products ordered over the Web. These systems can also incorporate transportation costs and conversion rates so that purchasers can electronically see the landed cost of ordering a product and having it delivered. Some ITL systems use a landed cost search engine that calculates shipping costs online while a company enters an order so it will know exactly what the costs will be in U.S. funds. They also track global shipments.

Through their websites and software products, ITL companies do many of the things international trade specialists do (Figure 11.5). They let their customers know which international companies they can do business with and which companies can do business with them. They identify export and import restrictions between buyers and vendors. They provide the documents required to export and import products, and they determine the duties, taxes, and landed costs and other government charges associated with importing a product.

Livingston International (www.livingstonintl.com) is an example of a global trade management company that enables customers through its web-based software products to calculate landed costs, screen for restricted parties, generate shipment documentation, and manage duties, and it also handles repairs and returns. It has an online library of trade regulations for different countries.



The Port of Singapore handles over 10 million TEUs (20-foot container equivalent units) annually at three container terminals. The Brani terminal has 9 berths, 31 quay cranes, and a capacity of 5.5 million TEUs. The Port of Singapore has been the world's busiest port in terms of shipping tonnage since 1986.

Fan Jun/Xinhua/Zuma Press

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Along the Supply Chain

Hewlett-Packard Sustainability Initiatives in China

Hewlett-Packard is a company recognized for its commitment to helping its global supply chain partners, specifically in China, make continual improvement in their sustainable processes. Up until 2010, HP manufacturing and assembly factories had been mainly in coastal regions of China. This was common practice among electronics and tech companies; Chinese manufacturing incubated in Shanghai and Hong Kong—cities ideally located for exports. However, a constant challenge was a shortage of locally based labor, which caused huge migratory labor flows, resulting in workers traveling long distances from inland China to jobs in coastal cities. By 2010 two-thirds of HP's labor supply was not from coastal provinces, which meant that workers were migrating seasonally and forced to work far away from their homes and families. The situation was stressful for workers who did not receive the same rights as workers in the local provinces, and who were not accustomed to local dialects and cuisine outside of their home provinces. HP also began to notice inflationary pressures on workers' living expenses because of rising food and energy prices, all of which contributed to high staff turnover and absenteeism. In response, HP decided to encourage its suppliers to build new facilities in Chongqing, over 1000 miles west of Shanghai, with an urban population approaching 13 million, and an additional 15 million workers in nearby rural areas. HP's "Go West" strategy incorporates all three elements of human, economic, and environmental sustainability, and it also builds resiliency into the supply chain by not locating all of its factories in one area of coastal China, which was a risk. By relocating its suppliers to Chongqing, HP was able to reduce its costs, increase staff retention, and improve the working conditions of the tens of thousands of workers in its suppliers' factories who no longer needed to move from their homes to coastal cities to find work. Approximately 80% of its Chongqing workers are local or from the surrounding province; its suppliers employ 80,000 workers in Chongqing, making over 20 million laptops and 15 million printers a year.

However, moving manufacturing to Chongqing in inland China brought with it some logistical challenges since it was so far away from coastal ports. HP worked with the Chinese government (who provided incentives) to develop a new freight railway line rail route to ship products from Chongqing to markets in Europe. The rail line mirrors the fabled Silk Road, the ancient web of routes used to transport spices, gems, and silk fabric by camel from China to markets in Europe between about 115 BC to AD 1450. The modern-day version spans almost 7000 miles, covers two continents, and crosses six countries. It takes about three weeks for HP's express trains to complete a one-way journey to HP's European distribution center, in Oostrum, the Netherlands, traveling at speeds of up to 50 miles per hour and safeguarded by armed security guards. The rail cost is about one-third the price of air transport. It also saves time—shipping products by rail takes approximately three weeks—less time than the 35 days required to transport products by sea from Shanghai. Rail transportation also reduces HP's carbon footprint from transport by up to 95%, reduces oil consumption for sea transport, and results in one-thirtieth of the carbon footprint associated with air freight.

Another HP sustainability initiative in China is their "Student and Dispatch Worker Standard for Supplier Facilities in the People's Republic of China," to address the

significant increase in the use of student and temporary workers in China. Many factories in China have long relied on high school students, vocational school students, and temporary workers to cope with periodic surges in orders as factory labor becomes increasingly scarce. Students complained of being ordered by school administrators to put in very long hours on short notice at jobs with no relevance to their studies; local governments sometimes ordered schools to provide labor, and the factories management paid school administrators a bonus. Enforcing workplace rules in China is difficult, as Chinese laws on labor practices are often ignored by some manufacturers as they struggle to keep up with production demand amid labor shortages, and the nation's labor force has begun to slowly shrink because of the rigorous one-child policy through the 1980s and 1990s. HP's policy requires that all student work be voluntary, local regulations on student workers are met, only limited numbers of student workers can be used for HP production (below 20% of the total workforce), and students are employed in roles that further their education. Further, students and temporary workers must be able to leave work at any time upon reasonable notice without negative repercussions, and they must have access to reliable and reprisal-free grievance mechanisms. HP monitors progress through key performance indicators that track student and young workers, which Chinese suppliers report to HP monthly.

Using the Internet research the recent sustainability initiatives in China of several other large global companies.

Source: Source: The Hewlett-Packard website at <http://www.hp.com>.

Trends in Globalization for U.S. Companies

Two significant changes that prompted many U.S. companies to expand globally were the passage of NAFTA, which opened up business opportunities with Mexico, and the admission of China into the World Trade Organization. Approximately 700 of the *Fortune* 1000 companies have a portion of their operations, production components, or affiliates in Mexico. Besides cheap labor, Mexico is also close to the United States, and thus Mexican companies can meet the just-in-time requirements of many U.S. companies. However, Mexico's economic gains also lead to more jobs and increased worker skills, and as a result, higher wages, which, in turn, has led U.S. and foreign companies away from Mexico to China with its even lower wage rates. The hourly manufacturing wage rate in China is around \$2 to \$3, compared to approximately \$7 in Mexico, \$9 in Singapore, \$9 in Taiwan, \$36 in Japan, and \$25 in the United States. As companies have moved their manufacturing into China because of lower labor costs, new

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low-cost Chinese suppliers have also emerged, and United States, Japanese, Taiwanese, and Korean suppliers (among others) have set up operations in China as well. This is basically the same pattern followed previously in Japan in the 1960s and 1970s and later in Korea, Taiwan, and Singapore (see photo) before Mexico became a global hot spot.

Both Mexico and China have positive and negative aspects in terms of supply chain development for U.S. companies. You can ship from Mexico to the United States in about eight hours; however, it takes 21 to 23 days to ship from China. Many people speak English in Mexico, and many Americans speak Spanish; the same situation does not exist in China (although English is becoming more prevalent). Government regulations, especially in terms of business ownership, are sometimes restrictive in China, but in China a company can work 24 hours a day, 7 days a week, compared to an average workweek in Mexico of approximately 44 hours. Trade regulations and tariffs are increasingly being lowered in Mexico and China. Quality is a problem in both Mexico and China, where it can vary dramatically between companies. Chinese and Mexican suppliers generally lack quality-management systems, and do not often use statistical process control or have ISO certification, unless they are imposed by their global customers.

China's Role in the Global Supply Chain

It has become commonplace for companies in the United States and abroad to develop a global supply chain by sourcing in low-cost countries, and no country has received more attention as a supplier than China. China has become one of the world's premier sources of supply. Walmart, for example, has more than 50,000 suppliers in China. Not only are companies looking to China as a low-cost supplier of goods and services, but some companies are relocating their procurement operations to China. IBM moved its global purchasing headquarters from Westchester County, New York, to Shenzhen, China—the first time IBM located the headquarters of one of its global corporate functions outside the United States. It relocated, in part, to help the company develop stronger relationships with its suppliers in China, and to have more control over quality and logistics.

Companies are looking to China (as well as other emerging low-cost sources of supply such as Central/Eastern Europe, India, Bangladesh, the Philippines, and Pacific Rim countries) for several reasons. First there is an abundance of low-wage labor; China has a labor market of 750 million people, and the country's average hourly wage, although increasing, is still lower than in most other emerging markets. The average worker earns about \$2 to \$3 an hour, and migrant workers (who account for one-fifth of the labor market) typically earn less than \$200 per month. Almost half of China's population has a middle-school or greater education. Most companies that are global sourcing also want to position their source countries as future markets, and China is one of the world's fastest-growing markets, and the world's second largest economy. China's exports increased by 500% and were almost \$9 trillion in the first decade of this century. China's retail spending has been increasing by as much 12% to 16% annually in recent years. China has introduced a number of regulatory changes that has liberalized its market.

Traditionally, China exported consumer goods, clothing, and textiles; however, it is now increasingly exporting products with a higher technology content as its manufacturing sector matures. This is what most low-cost emerging countries do: ramp up with labor-intensive manufacturing and then migrate slowly toward more skilled, higher-value products and services. In particular, high-tech industries are looking to China as a low-cost supplier. Because high-tech companies operate on razor-thin margins, with intense competition and very fast

product life-cycles, they have no choice but to look to countries like China as a source of low-cost supply. The Microsoft Xbox game system was first built in Mexico and Hungary, but production was shifted to China. Laptop computer manufacturing in Taiwan is moving to China.

United States companies generally follow one of several models in doing business in China. One option is to employ local third-party trading agents such as Chinese import and export companies (like Li & Fung) to help identify local suppliers, negotiate prices, and arrange logistics. Companies can develop their own international procurement offices that have specialized teams performing different sourcing functions like logistics. This has proven to be the most successful, especially for large manufacturing firms.

Sourcing from China is not without challenges. Dramatic differences in organization, cultural relationships, and technology can result in significant problems to overcome. Many U.S.

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companies have spent years and resources building a network of reliable, high-quality suppliers, and disrupting that system in order to global outsource (often to remain competitive) can be a daunting task. Simply getting reliable information about Chinese suppliers in order to compare companies is much more difficult than in the United States. Information technology is less advanced and sophisticated in China than in the United States. Cultural relationships are more difficult to establish in China than in the United States. Guanxi (or personal relationships) will frequently trump commercial considerations in the negotiation process and in doing business. Worker turnover rates among low-skilled workers are extremely high, averaging 30%–40% annually, and the turnover rate among new university graduates is also extremely high compared to industrialized nations. The piracy of U.S. intellectual properties is increasingly problematic.

Although China has become a burgeoning global supplier market, the country's underdeveloped transportation infrastructure, fragmented distribution systems, lack of sophisticated technology, limited logistics skills, regulatory restrictions, and local protectionism hinder efficient logistics and make supply chain management a challenge. Companies entering the Chinese market often find they cannot manage transportation and distribution as they might in their home country. The government-controlled rail service is China's cheapest distribution mode; however, capacity shortages often occur, although there has been significant investment in the railway infrastructure with over \$350 billion spent between 2009 and 2012, and over \$2 trillion on infrastructure projects between 2014 and 2016. Roads are the preferred mode of distribution for packaged finished goods; however, demand exceeds capacities, and China's road transport industry is fragmented although improving. Airfreight is subject to high prices, inadequate capacity, fragmented routes, and limited information exchange between airlines and freight forwarders. Ocean and inland water transport is the most developed distribution mode in China, and China's shipping companies rank among the world's largest. However, inland water distribution is sometimes underutilized because ports often cannot process and manage cargo efficiently, bureaucratic delays and theft are common, and some ports cannot accommodate larger vessels. Distribution is also hampered by poor warehousing, which is predominantly government controlled. Warehouse designs are inefficient with low ceilings and poor lighting, and goods are usually handled manually without warehouse automation.

Logistics oversight in China is shared by different government entities such as various planning and trade commissions, and this shared responsibility creates problems with things like customs clearance including excessive paperwork, inefficient procedures, and short business hours. Complicated and excessive regulatory controls are also common. Foreign trade companies must sell goods through distributors and cannot sell directly to stores, and they are forbidden to own distribution channels. A foreign company can sell goods manufactured in China, but it cannot sell or distribute goods imported into the country, including those produced by a company's plants outside of China. Thus, foreign companies must rely on small local distribution companies to move goods. Regulations also have created a shortage of third-party logistics providers.

However, despite these problems China's distribution and logistics sector is growing and improving rapidly. Trillions of dollars are being spent annually on new highways, airport construction and expansion, inland water transportation, and the construction of distribution and logistics centers. China's emergence as an economic power has forced the country to progressively remove regulations and restrictions that prevent foreign companies from

participating in transportation and distribution functions, which has made it possible for foreign companies to establish subsidiaries and offices that manage a variety of supply chain functions. The demand for third-party logistics service providers has also expanded the outsourcing of logistics and transportation.

Reverse Globalization and Nearshoring

U.S. and European companies expanded their supply chains and shifting operations into Asia, and specifically China, because of cheaper labor and raw materials. However, the trend toward partnering with Asian and Far Eastern suppliers shows signs of reversing itself as the gloss of global sourcing has begun to tarnish for some companies. With an improved infrastructure and a higher standard of living, China is rapidly approaching a level of parity with other developed nations, mirroring a transition experienced in the past by other foreign countries like Japan, Taiwan, and India. Wage rates in Asia are steadily rising, thus negating one of the primary reasons for global sourcing. While Far Eastern and Asian countries are instituting new laws and port and trade regulations, countries in Latin America, South America, and Canada are investing more in education and infrastructure and developing larger and more modern port facilities, making it more appealing to source in this hemisphere. Volatile oil prices have made it more costly to ship items long distances and more difficult to predict costs; oil prices now account for nearly half of total freight costs. Shipping products over long distances while companies are demanding faster delivery times in a JIT-type competitive environment have contributed to an increase in containerization and faster ship speeds, which have increased fuel consumption. Increases in global transport costs have now effectively offset many of the trade liberalization agreements of the last 30 years.

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Along the Supply Chain

U.S. Nearshoring in Central and South America

U.S. companies that are increasingly concerned about problems with extended Asian supply chains, and Chinese suppliers in particular, are looking more closely at reverse globalization and near shore suppliers. Chinese wages are growing at a rate of 15% to 20% per year. In 2004 India had 70% of the world's outsourcing market, but by 2015 it was 44%; North American nearshore outsourcing is growing at an annual rate of 10.5% while offshore outsourcing is growing at a 4% rate. There are a number of reasons for the growing attractiveness of nearshoring in Central and South America for U.S. companies. Latin American countries fall in the same time zone as the United States, which allows for real time communication, work, and travel. There is a large, highly skilled pool of college-educated talent in Latin America. Brazil has the most JAVA programmers in the world, and a large number of Latin American professionals attended universities in the United States. Spanish is the second language in the United States, spoken by an estimated 45 million people. Many Latin American countries have signed trade agreements with the United States that guarantee intellectual property (IP) rights while China and India pose a real threat for IP piracy.

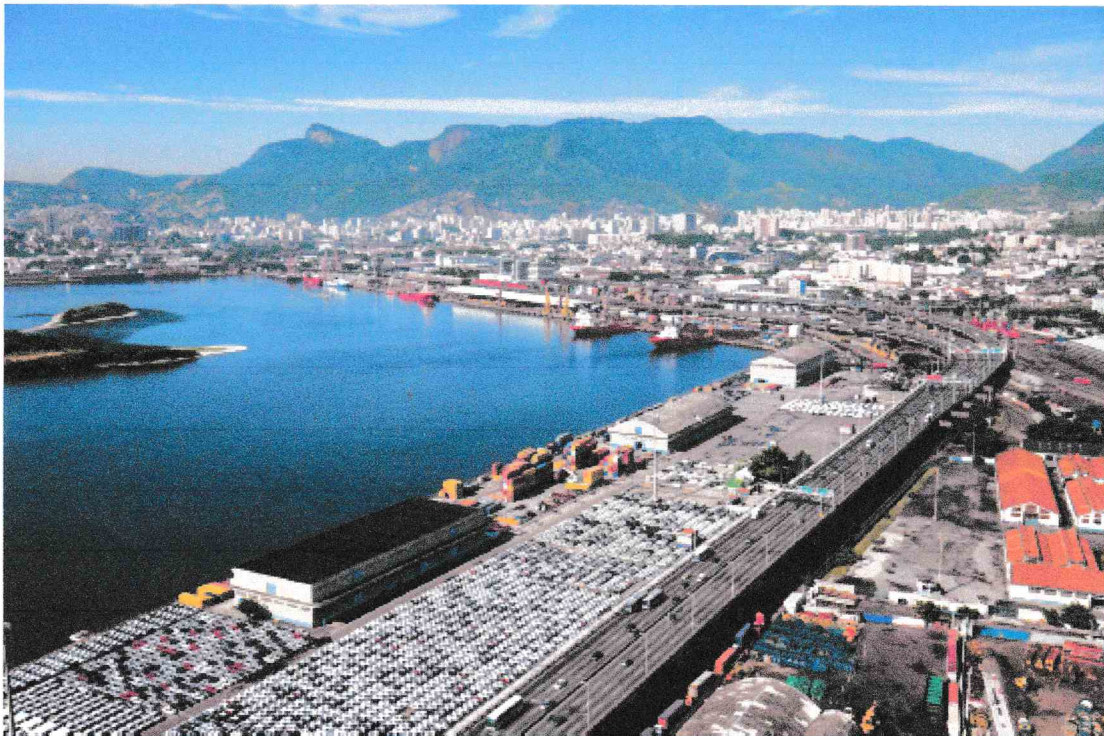
Brazil, for example, offers a number of advantages to U.S. companies as a nearshore supplier and as a consumer market. Since 2000, Brazilian exports have grown at an annual rate of 17%, positioning it as one of the world's foremost emerging economies and global trading partners. With annual exports over \$161 billion it is the twenty-fourth leading exporter in the world, and enjoys a trade balance of over \$35 billion. Brazil has become a potential supply chain source for U.S. companies because of several factors. The country's electrical system is based mainly on hydroelectric power, which is inexpensive and sustainable. It has a favorable climate for agro-commodities, which has increased productivity compared to other northern hemisphere countries for almost all crops. It has a wealth of natural resource reserves including petroleum, making it relatively independent of resource shortages that have plagued other countries. Brazil has an established sustainable ethanol production and distribution network that provides more than 80% of the energy for passenger vehicles produced and sold in the country, and making it probably the first country that will be independent of fossil fuels for its light vehicle fleet. It has a well-established local supply base of small industrial companies that support a variety of industry sectors. It has substantially lower labor costs compared to developed countries. Although China is a major sourcing and consumer market for many U.S. and European companies, Brazil's closeness to the United States in geography, distance, and time zone results in comparatively less risky, less expensive, more sustainable supply chains (see photo). Shipping routes do not pass through global hot spots in the Mideast; freight rates are 30% lower than rates from Asia; and there are lower carbon emissions. In addition, the western culture of Brazilian businessmen is more closely related to that of North Americans and Western Europeans. Brazil, as well as the rest of Latin America, does have some drawbacks: the manufacturing wage rates are still significantly higher than China and Asia; the industrial capacity in some sectors is not sufficient to supply some U.S. manufacturing industries; advanced technology skills are insufficient in some hi-tech industry sectors; and the country's infrastructure is lacking and any exporter will likely be required to make a

significant investment in shipping capacity and reliability. Still, Brazil and Latin America offer enough positive benefits for many U.S. companies to start looking south for a new supply chain member.

Investigate and discuss some of the other countries that might be possible near shore supply sources for the United States in the future.

Source: Based on Ricardo Ruiz-Huidobro and Markus Stricker, "Brazil, A Country of Regeneration," *Inside Supply Management*, vol. 20, (9: September 2009), pp. 26–28. and, Jake Ryan, "Why Nearshoring is a Better Option for North American Companies," *Material Handling & Logistics* (at <http://mhlnews.com>), (November 19, 2014).

Combined with these factors are the continuing unreliability of delivery times in longer global supply chains and quality failures, in China in particular. Surveys show that companies are increasingly concerned about the risk of poor product and supply chain quality (for example, the problem of lead paint in toys produced in China), and the infringement on intellectual property and security breaches in China. Long lead times resulting from distance and uncertainties in the shipping processes for global sourcing mean ordering far in advance, which can backfire if the product market changes or the economy sours. It is often difficult for U.S. companies to gain visibility into the financial health of foreign suppliers; during the recent global recession many overseas suppliers went bankrupt, creating supply chain delays for U.S. buyers. All of these factors—increasing oil prices, higher foreign wage rates, increasing raw material costs, poor quality, and long delivery times—have made what's referred to as near-shore sourcing, and redesigning supply chains with multilocal operations, in this hemisphere more attractive.



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Brazil has 36 deep water ports, making it an attractive “near shore supplier” for the United States. Rio de Janeiro is the third busiest port in Brazil in terms of cargo volume and container movement; the port of Santos is the largest.

luoman/iStockphoto

Gartner’s annual survey of Top 25 supply chains, which includes companies like Apple, Dell, Amazon, Cisco, Walmart, and Procter & Gamble, indicates that an emerging trend among companies with top-ranked supply chains was a reassessment of the tradeoff between global economies of scale and the demand for local responsiveness, and as a result, they are exploring redesigning their supply chains to support a more regionalized approach. Although these companies’ supply chains may be designed to address a global marketplace, manufacturing and supply capabilities are often being situated at numerous regional localities, rather than in a central location like China. This change is being driven by several factors including local government incentives, organized labor concessions, high annual wage increases and rising logistics expenses in China, combined with the demand to be more responsive to local markets and to reduce supply chain risks.

Although wage rates are higher, many U.S. companies are moving operations and facilities back to the United States, are partnering with U.S. suppliers or suppliers in this hemisphere, including South America, Mexico and the Caribbean, and some are insourcing. Near-shoring allows companies to reduce or avoid many of the risks associated with global sourcing, and shorter supply chains enable companies to gain more control and flexibility. Some companies, embracing customer concerns about service quality, are moving customer service and ordering processes from India back to the United States; even though it’s more costly, maintaining customers and customer satisfaction is being recognized as the more important consideration.

Security Within Global Supply Chains

The events of 9/11 affected global supply chains as they did much else in our lives. The two primary modes of transport in global supply chains are airfreight and ocean carriers, both of which enter the United States through portals from the outside world and thus are obvious security risks. The U.S. government in concert with countries around the world has adopted security measures that, besides increasing security, have added time to supply chain schedules and increased supply chain costs. Air and ocean carriers must file an advance manifest with the U.S. government 24 hours before loading the containers on a U.S.-bound ship or airplane so the government can conduct “risk screening.” This 24-hour rule requires extensive documentation at the airport or seaport of origin, which can extend supply chain

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time by three to four days. Even if shipments reach the U.S. port on time, stricter customs inspections can leave the shipment tied up for hours or days. For example, food imports can be diverted for inspections for possible bioterrorism alterations. For airfreight, a delay of three or four days would negate the benefit of shipping by air at all. As a result of new security measures after 9/11, inventory levels increased almost 5%, requiring more than \$75 billion in extra working capital, as companies coped with delays with buffer inventory. The cost of insuring U.S. imports increased from \$36 billion in 2001 to over \$40 billion in 2002. The Brookings Institute has estimated that the cost of slowing the delivery of imported goods by one day because of additional security checks is approximately \$7 billion per year. These costs do not even include the costs of new people, technologies, equipment, surveillance, communication, and security systems, and training necessary for screening at airports and seaports around the world.

In 2003 the U.S. Customs and Border Protection (CPB) agency was established as part of the Department of Homeland Security to ensure that all imports and exports are legal and comply with U.S. laws and regulations. The CPB has implemented a comprehensive cargo security system designed to protect national security that includes the 24-hour manifest rule, a container security initiative, a customs-trade partnership against terrorism (C-PAT), nonintrusion inspection techniques, automated targeting systems, the national targeting center, and recently the secure freight initiative. The secure freight initiative, announced in 2008, went into effect in January 2010. Also known as the “10 + 2” initiative, it is intended to reduce the risk of terrorism by using the latest tracking and tracing, and communication and reporting, technologies. It provides for a detailed security account of goods and materials shipped into the United States, called the Importer Security Filing (ISF), that distinguishes between potentially risky cargo and lower risk cargo, and more efficiently allocates agency resources to focus on true security threats. ISF 10 + 2 is mandatory for all importers; it includes 10 specific data elements related to container manufacturer, seller, buyer, content, importer, schedule, origin, and destination, that must be electronically filed 24 hours before loading any container on a ship bound for the United States. The “+2” are data files which the carrier must file within 48 hours of the departure time, and includes the location of all containers on the ship and information on the movement of containers and any status changes as they move through the supply chain. 10 + 2 was expected to increase annual supply chain shipping costs from \$400 million to \$700 million as a result of government filing fees and the additional reporting information required.

Key Terms

continuous replenishment Supplying orders in a short period of time according to a predetermined schedule.

core competencies The activities that a company does best.

cross-docking Crossing of goods from one loading dock to another without being placed in storage.

e-auction A company posts items it wants to purchase on an Internet e-marketplace for suppliers to bid on.

e-marketplaces Websites where companies and suppliers conduct business-to-business activities.

e-procurement Business-to-business commerce in which purchases are made directly through a supplier's website.

intermodal transportation Combines several modes of transportation.

landed cost Total cost of producing, storing, and transporting a product to the site of consumption.

logistics The transportation and distribution of goods and services.

nation groups Nations joined together into trading groups.

on-demand (direct-response) delivery Requires the supplier to deliver goods when demanded by the customer.

order fulfillment The process of ensuring on-time delivery of a customer's order.

outsourcing Purchasing goods and services that were originally produced in-house from an outside supplier.

postponement Moving some final manufacturing steps like final assembly or product customization into the warehouse or distribution center.

procurement Purchasing goods and services from suppliers.

sourcing The selection of suppliers.

spend analysis A formal process for analyzing procurement data to lower costs.

tariffs (duties) Taxes on imported goods.

trade specialists Specialists who help manage transportation and distribution operations in foreign countries.

value added tax (VAT) An indirect tax on the increase in value of a good at any stage in the supply chain from raw material to final product.

vendor-managed inventory (VMI) A system in which manufacturers instead of distributors generate orders.

warehouse management system (WMS) An automated system that runs the day-to-day operations of a warehouse or distribution center and keeps track of inventory.