CHAPTER 5

BUSINESS-TO-BUSINESS STRATEGIES: FROM ELECTRONIC DATA INTERCHANGE TO ELECTRONIC COMMERCE

LEARNING OBJECTIVES

In this chapter, you will learn about:

- Strategies that businesses use to improve purchasing, logistics, and other support activities
- Electronic data interchange and how it works
- How businesses have moved some of their electronic data interchange operations to the Internet
- Supply chain management and how businesses are using Internet technologies to improve it
- Electronic marketplaces and portals that make purchase-sale negotiations easier and more efficient

INTRODUCTION

General Electric (GE) is one of the largest and most successful companies in the world. It engages in a wide range of businesses around the world, including the production of appliances and electrical and electronic products, broadcasting, and a variety of financial and insurance activities. One of its oldest lines of business is **GE Lighting**, which produces more than 30,000 different kinds of light bulbs in its 28 North American plants and other locations around the world. The raw materials used in making light bulbs are

fairly standard items: glass, aluminum, various insulating plastics, and filament materials. However, a major portion of each light bulb's cost is the money that GE Lighting spends on indirect materials and parts for the machines used to fabricate and assemble the bulbs. These indirect materials and parts must conform to detailed specifications that GE stores on more than 3 million blueprints and other design drawings.

Because the technologies for making light bulbs are mature and well known, GE Lighting can solicit bids from a variety of suppliers for indirect materials and machinery replacement parts without worrying about the possible disclosure of trade secrets. Unfortunately, the bidding process at GE Lighting had become very slow and inefficient. Each transaction required the Purchasing Department to request the relevant blueprints, photocopy them, attach them to other material specification documents, and mail the whole package to suppliers that might be interested in bidding on the item. It would often take Purchasing personnel more than four weeks to gather the information, send it to potential suppliers, obtain and evaluate suppliers' bids, negotiate with the chosen suppliers, and place an order. These long delays were limiting GE Lighting's flexibility and ability to respond to requests from its customers.

By applying the tools of electronic commerce to these purchase transactions, GE Lighting was able to make major improvements to the entire parts acquisition process. Today, Purchasing personnel have access to a procurement system through their desktop computers. When they need to buy replacement parts for a machine, they create a new purchase file that includes basic quantity, delivery date, and delivery location information. Then, from a list generated by a continually updated supplier database, they select suppliers from which they request quotes. Finally, they attach electronic copies of all necessary blueprints and engineering drawings, which are now digitized and stored in another database; with a mouse click, they send the entire bid package off in an encrypted format to all the

selected suppliers. Assembling the bid package now takes hours instead of a week or more. Suppliers are asked to respond within a short time period—usually a week—through the Internet. The Purchasing staff member can evaluate the returned bids and award a contract online, completing the entire process in about 10 days.

The most significant savings for GE Lighting were in process-time reduction—from four weeks or more to 10 days—and in the elimination of paper and the costs of handling paper. However, the company also realized other benefits. Because the online system made it easier to send out bid packages, the Purchasing Department could send out more bids to a wider range of suppliers. In particular, many foreign suppliers that had been difficult to reach with mailed bid packages could be included in the solicitation for quotes. The increased competition drove down prices; GE Lighting has saved up to 20 percent on many of these items since moving the bid process online. Suppliers welcome the reduced time lag between submitting the bid and learning whether GE Lighting will award them the contract; this makes their production planning easier.

PURCHASING, LOGISTICS, AND SUPPORT ACTIVITIES

In the previous two chapters, you learned about strategy issues that arise when businesses and other organizations provide information to potential customers. In terms of the value chain model described in Chapter 1, you learned about the primary activities: identify customers, market and sell, and deliver. You also became familiar with a number of business models for selling on the Web. Although many of these business models are used in business-to-business electronic commerce, the emphasis in Chapters 3 and 4 was on business-to-consumer advertising, promotion, and sales activities.

In this chapter, you will learn how companies use electronic commerce to improve their purchasing and logistics primary activities, and all of their support activities (which include finance and administration, human resources, and technology development). You can refer to Figure 1-9 in Chapter 1 for a review of primary activities and support activities. While the work might not be as glamorous as designing a Web site or creating an advertising campaign, the potential for cost reductions and business process improvements in purchasing, logistics, and support activities is tremendous. Although governments seldom sell products or services to customers, they perform many functions for

the individual citizens, businesses, and other organizations that they serve. Governments increasingly are using electronic commerce to improve the efficiency with which they undertake their own support activities and serve their stakeholders better. These electronic commerce activities are collectively referred to as **e-government**.

As Internet technologies become commonplace in businesses, the potential for synergies increases. Many of these synergies are forming the basis for second-wave electronic commerce opportunities. You will learn about a number of these second-wave opportunities in this chapter.

An emerging necessary characteristic of purchasing, logistics, and support activities is flexibility. A purchasing or logistics strategy that works this year may not work next year. Fortunately, economic organizations are evolving from the hierarchical structures used since the Industrial Revolution to new, more flexible network structures. These network structures are, in many cases, made possible by the transaction cost reductions that companies realize when they use Internet and Web technologies to carry out business processes.

Purchasing Activities

Purchasing activities include identifying vendors, evaluating vendors, selecting specific products, placing orders, and resolving any issues that arise after receiving the ordered goods or services. These issues might include late deliveries, incorrect quantities, incorrect items, and defective items. By monitoring all relevant elements of purchase transactions, purchasing managers can play an important role in maintaining and improving product quality and reducing cost. In Chapter 1, you learned how companies can organize their strategic business unit activities using an industry value chain. The part of an industry value chain that precedes a particular strategic business unit is often called a **supply chain**. A company's supply chain for a particular product or service includes all the activities undertaken by every predecessor in the value chain to design, produce, promote, market, deliver, and support each individual component of that product or service. For example, the supply chain of an automobile manufacturer includes every activity undertaken by each individual component supplier, including engine manufacturers, steel fabricators, glass manufacturers, wiring harness assemblers, and thousands of others.

The Purchasing Department within most companies traditionally has been charged with buying all of these components at the lowest price possible. Usually, Purchasing staff did this by identifying qualified vendors and asking them to prepare bids that described what they would supply and how much they would charge. The Purchasing staff would then select the lowest bid that still met the quality standards for the component. This bidding process led to a very competitive environment with a large number of suppliers; this process focused excessively on the cost of individual components and ignored the total supply chain costs, including the cost to the manufacturing organization of dealing with such a large number of suppliers. As you learned in Chapter 1, many managers call this function "procurement" instead of "purchasing" to distinguish the broader range of responsibilities. Procurement generally includes all purchasing activities, plus the monitoring of all elements of purchase transactions. It also includes managing and developing relationships with key suppliers. Another term that is used to describe procurement

activities is supply management. In many companies, procurement staff must have high levels of product knowledge to identify and evaluate appropriate suppliers. The part of procurement activity devoted to identifying suppliers and determining the qualifications of those suppliers is called **sourcing**. In Chapter 1, you learned that the use of Internet technologies in procurement activities is called e-procurement. Similarly, the use of Internet technologies in sourcing activities is called **e-sourcing**. Specialized Web purchasing sites can be particularly useful to procurement professionals responsible for sourcing. The business purchasing process is usually much more complex than most consumer purchasing processes. Figure 5-1 shows the steps in a typical business purchasing process.

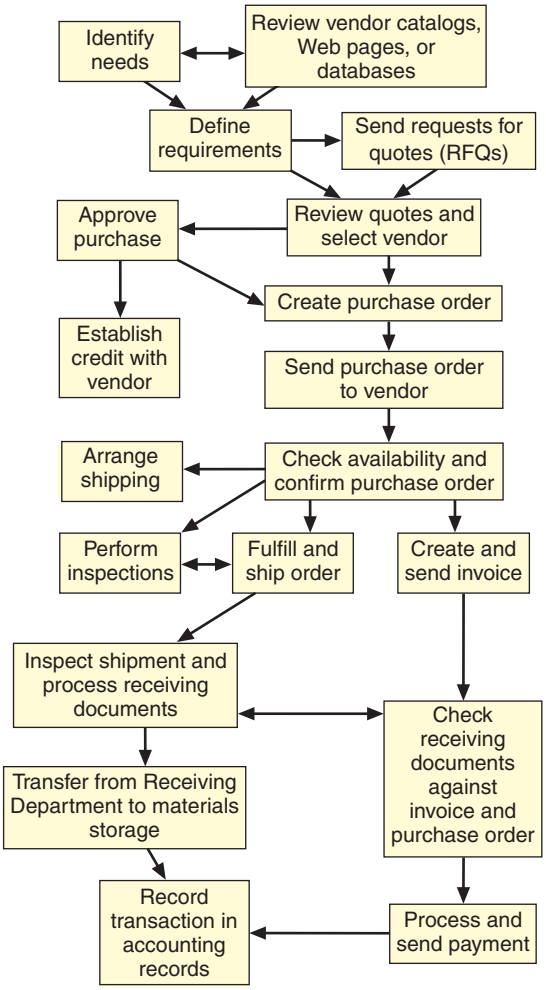


FIGURE 5-1 Steps in a typical business purchase process

As you can see, the business purchasing process includes many steps. The business purchasing process also requires a number of people to coordinate their individual activities as part of the process. In large companies, the Procurement Department that supervises the purchasing process may include hundreds of employees who supervise the purchasing of materials, inventory for resale, supplies, and all of the other items that the company needs to buy. The total dollar amount of the goods and services that a company buys during a year is called its **spend**. In large companies, the spend can be many billions of dollars. Managing the spend in those companies is an important function and can be a key element in a company's overall profitability.

In 2002, Motorola implemented a set of Internet technologies in its procurement operation. Motorola's spend is about $48 billion; it involves 1 million purchase orders and 6 million inventory receipts. Motorola estimates that it saved $2.5 billion by using the new Internet technologies to accomplish a variety of procurement tasks more efficiently and at lower cost.

For many years, the National Association of Purchasing Management has been the main organization for procurement professionals. In 2002, the association changed its name to the **Institute for Supply Management (ISM)**. ISM runs conferences, publishes a monthly journal (***Inside Supply Management***), and offers helpful information on its Web site. Many of the articles in recent issues of the journal have dealt with electronic commerce. Full-time students who want to learn more about supply management can join ISM at no cost.

Direct vs. Indirect Materials Purchasing

Businesses make a distinction between direct and indirect materials. **Direct materials** are those materials that become part of the finished product in a manufacturing process. Steel manufacturers, for example, consider the iron ore that they buy to be a direct material. The procurement process for direct materials is an important part of any manufacturing business because the cost of direct materials is usually a very large part of the cost of the finished product. Large manufacturing companies, such as auto manufacturers, engage in two types of direct materials purchasing. In the first type, called **replenishment purchasing** (or **contract purchasing**), the company negotiates long-term contracts for most of the materials that it will need. For example, an auto manufacturer estimates how many cars it will make during a year and contracts with two or three steel mills to supply most of the steel it will need to build those cars. By negotiating the contracts in advance and guaranteeing the purchase, the auto manufacturer obtains low prices and good delivery terms. Of course, actual demand never matches expected demand perfectly. If demand is higher than the auto company's estimate, it must buy additional steel during the year. These purchases are made in a loosely organized market that includes steel mills, warehouses, speculators (who buy and sell contracts for future delivery of steel), and companies that have excess steel that they purchased on contract (demand for their products was lower than they had anticipated). This market is called a **spot market**, and buying in this market, the second type of direct materials purchasing, is called **spot purchasing**. **Indirect materials** are all other materials that the company purchases, including factory supplies such as sandpaper, hand tools, and replacement parts for manufacturing machinery.

Large companies usually assign responsibility for purchasing direct and indirect materials to separate departments. Most companies include the purchase of nonmanufacturing goods and services—such as office supplies, computer hardware and software, and travel

expenses—in the responsibilities of the indirect materials Procurement Department. Many vendors that manufacture general industrial merchandise and standard machine tools for a variety of industries have created Web sites through which their customers can purchase materials. A number of customers buy these indirect materials products on a recurring basis, and many of them are commodities, that is, standard items that buyers usually select using price as their main criterion. These indirect materials items are often called **maintenance, repair, and operating** (**MRO**) supplies. Increasingly, procurement professionals are using the terms "indirect materials" and "MRO supplies" interchangeably. Most companies have a difficult time controlling MRO spending from a centralized procurement office because many MRO purchases are numerous and small in dollar value. One way that Procurement Departments control MRO spending is by issuing **purchasing cards** (usually called **p-cards**). These cards, which resemble credit cards, give individual managers the ability to make multiple small purchases at their discretion while providing cost-tracking information to the procurement office.

By using a Web site to process orders, the vendors in this market can save the costs of printing and shipping catalogs and handling telephone orders. They can also keep price and quantity information continually updated, which would be impossible to do in a printed catalog. Some industry analysts estimate that the cost to process an MRO order through a Web site can be less than one-tenth of the cost of handling the same order by telephone.

Two of the largest MRO suppliers in the world are **McMaster-Carr** and **W.W. Grainger**. The W.W. Grainger Web site offers more than 220,000 different products for sale. Grainger's Web store, which appears in Figure 5-2, offers visitors a variety of ways to access information about and order Grainger products.

A visitor can enter the online catalog, use the product search box at the top of the page, or search by clicking a hyperlink to one of the categories listed in the middle of the page.

Office equipment and supplies are also items that are used by a wide variety of businesses. Market leaders **Office Depot** and **Staples** each have well-designed Web sites devoted to helping business Purchasing Departments buy these routine items as easily as possible. On their business-to-business Web sites, **Digi-Key** and **InOne** sell electronic parts, and **Global Computer Supplies** sells computers and related items.

Logistics Activities

The classic objective of logistics has always been to provide the right goods in the right quantities in the right place at the right time. Logistics management is an important support activity for both the sales and the purchasing activities in a company. Businesses need to ensure that the products they sell to customers are delivered on time and that the raw materials they buy from vendors and use to create their products arrive when needed. The management of materials as they go from the raw materials storage area through production processes to become finished goods is also an important part of logistics.

Logistics activities include managing the inbound movements of materials and supplies and the outbound movements of finished goods and services. Thus, receiving, warehousing, controlling inventory, scheduling and controlling vehicles, and distributing finished goods are all logistics activities. The Web and the Internet are providing an increasing number of opportunities to manage these activities better as they lower transaction

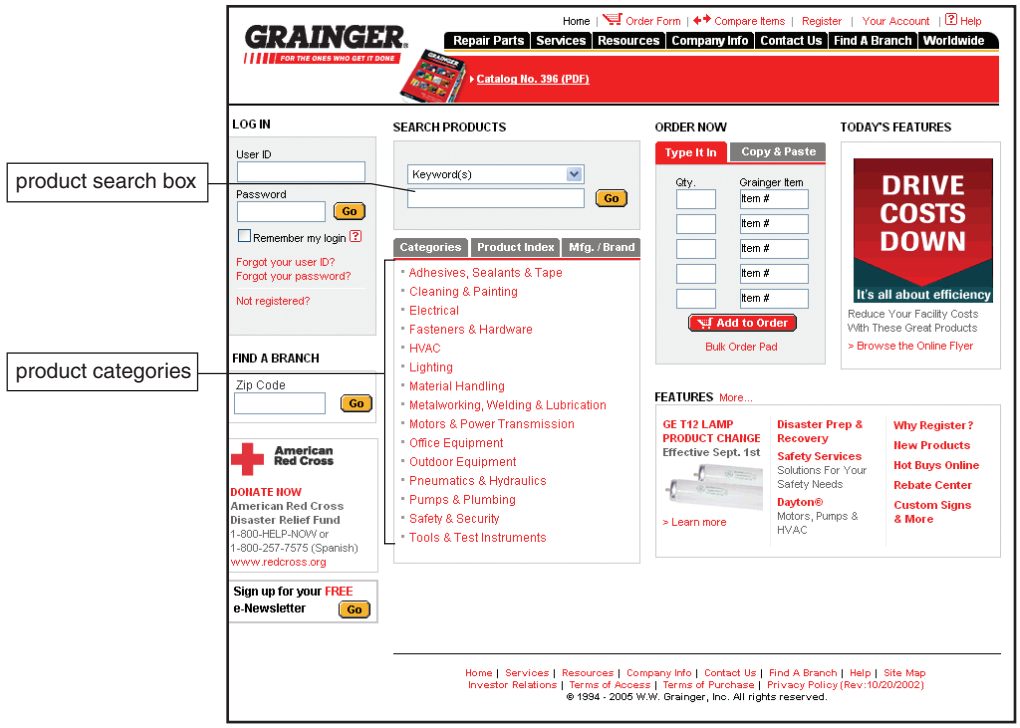


FIGURE 5-2 Grainger.com Web store

costs and provide constant connectivity between firms engaged in logistics management. Web-enabled automated warehousing operations are saving companies millions of dollars each year, and major transportation companies such as **Schneider National**, **Ryder System**, and **J.B. Hunt** now want to be seen by their customers as information management firms as well as freight carriers.

For example, the Schneider Track and Trace system delivers real-time shipment information to Web browsers on its customers' computers. This system shows the customer which freight carrier is transporting a shipment, where the shipment is, and when it should arrive at its destination. J.B. Hunt, which operates more than 70,000 trucks, trailers, and containers, implemented a Web site that lets its customers track their shipments themselves. With customers doing their own tracking, J.B. Hunt needs far fewer customer service representatives. Also, J.B. Hunt found that its customers could monitor their own shipments more effectively than the company. Thus, this Web site saves more than $12,000 per week in labor and lost shipment costs. When transportation and freight companies engage in the business of operating all or a large portion of a customer's materials movement activities, the company is called a **third-party logistics (3PL) provider**. For example, Ryder has a multiyear contract to design, manage, and operate all of Whirlpool's inbound freight activities and is considered a 3PL provider to Whirlpool.

FedEx has freight-tracking Web pages available to its customers, as does UPS. Firms

that run their own trucking operations have implemented tracking systems that use global positioning satellite (GPS) technology to monitor vehicle movements. These freight-handling companies are also moving into the 3PL provider business as a way to generate additional revenue from the investment they made in information technology to support their core businesses. The marriage of GPS and portable computing technologies with the Internet is an excellent example of second-wave electronic commerce.

Support Activities

Support activities include the general categories of finance and administration, human resources, and technology development. Finance and administration includes activities such as making payments, processing payments received from customers, planning capital expenditures, and budgeting and planning to ensure that sufficient funds will be available to meet the organization's obligations as they come due. The operation of the computing infrastructure of the organization is also an administration activity. Human resources activities include hiring, training, and evaluating employees; administering benefits; and complying with government record-keeping regulations. Technology development can include a wide variety of activities, depending on the nature of the business or organization. It can include networking research scientists into virtual collaborative workgroups, posting research results, publishing research papers online, and providing connections to outside sources of research and development services.

A few years ago Allegiance was growing rapidly and hiring more than 100 people each month to staff its sales offices throughout the United States. Each new hire had to receive a full briefing on medical, dental, and retirement benefits plans, and then he or she had to select from among several options for each. Because Allegiance was growing so rapidly, its human resources staff was spread thin and could not be in every sales office for every hire. The company turned to **Online Benefits**, a firm that duplicates its clients' human resources functions on a password-protected Web site that is accessible to clients' employees. The employees can then access their employers' benefits information, find the answers to frequently asked questions, and even perform complex benefit option calculations. Other firms that offer support activities services include **DocumentMail**, which offers document storage services, and **PayMaxx**, which offers payroll processing. Larger firms are building these types of functions into their intranets. These larger firms are also including Web-enabled sales support and sales force automation functions in their extranets.

One common support activity that underlies multiple primary activities is training. In many companies, the Human Resources Department handles training. Other companies may decentralize this function and have individual departments administer it. For example, insurance firms expend large amounts of resources on sales training. In most insurance companies, the Sales and Marketing Department administers this training. By putting training materials on the company intranet, insurance companies can distribute the training materials to many different sales offices, yet coordinate the use of those materials in the corporate headquarters sales office.

In 1999, the Swedish telecommunications giant Ericsson launched an extranet for current and former employees, families of those employees, and employees of approved business partners. Ericsson has more than 100,000 employees scattered across the globe. One part of this extranet included a Web site that enabled current employees, retirees, and

other recipients of payments from the company's medical and retirement plans to efficiently track their benefits. Another part of the extranet included a Web site that was designed to facilitate knowledge management. **Knowledge management** is the intentional collection, classification, and dissemination of information about a company, its products, and its processes. This type of knowledge is developed over time by individuals working for or with a company and is often difficult to gather and distill.

Ericsson managers hope that their knowledge network will generate new ideas, help solve problems, and improve business processes throughout the international organization. Designers of the system have identified their biggest challenge: to direct the information they collect in the extranet to projects and product development activities that will benefit from that information.

BroadVision, a software development and consulting firm, installed an internal system called K-Net, or Knowledge Network, that organizes all information sources used regularly by its employees. It found that many of its employees were visiting between 10 and 20 Web sites each day in the course of doing their jobs. K-Net brings together all of the information that each employee needs and combines it into one dashboard-style interface presented on a Web browser. Much of the interface is customized for individual employees, although some parts of the interface—such as health insurance, vacation days, and other human resources information—are standardized for all employees. BroadVision has found the K-Net system to be so useful that it is partnering with Bank of America, Hewlett-Packard, and Amadeus (a European travel services company) to develop a version of K-Net to sell to other companies. You can learn more about knowledge management in general at the **KMWorld** Web site. In Chapter 9, you will learn about software that companies can use to build knowledge management systems.

E-Government

Although governments do not typically sell products or services to customers, they perform many functions for their stakeholders. Many of these functions can be enhanced by the use of electronic commerce. Governments also operate businesslike activities; for example, they employ people, buy supplies from vendors, and distribute benefit payments of many kinds. They also collect a variety of taxes and fees from their constituents (you will learn more about how governments use the Web in administering their tax laws in Chapter 7). The use of electronic commerce by governments and government agencies to perform these functions is often called e-government.

In 2000, the U.S. government's Financial Management Service (FMS) opened its **Pay.gov** Web site. The FMS is the agency responsible for receiving the government's tax, license, and other fee revenue (more than $2 trillion per year). It is also responsible for paying out more than $1.2 trillion per year in Social Security benefits, veterans benefits, tax refunds, and other disbursements. Federal agencies can link their Web sites to Pay.gov, which lets site visitors pay taxes and fees they owe to these agencies using their credit cards, debit cards, or various forms of electronic funds transfer. The U.S. government's Bureau of Public Debt operates the **TreasuryDirect** site, which allows individuals to buy savings bonds and financial institutions to buy treasury bills, bonds, and notes.

Following the terrorist attacks of September 11, 2001, the U.S. government became aware of a lack of activity coordination and information sharing among several of its agencies, including the Federal Bureau of Investigation (FBI), the Central Intelligence Agency (CIA), and the

Bureau of Customs and Border Protection. A number of initiatives that use Internet technologies are under way to increase the availability of information within and among these agencies under the auspices of the new **Department of Homeland Security (DHS)**.

Other countries' national governments are finding that e-government can reduce administrative costs and provide better service to stakeholders. In the United Kingdom, the **Department for Work and Pensions** Web site provides information on unemployment, pension, and social security benefits. Smaller countries are also launching Web sites, such as Singapore's **SINGOV** site, that provide information to stakeholders and ways for citizens to interact with their governments online.

State governments are also creating Web sites for conducting business and interacting with their stakeholders. In 2001, the state of California opened its one-stop portal site, **my.ca.gov**, which appears in Figure 5-3.

FIGURE 5-3 State of California portal site my.ca.gov

This site gives visitors access to virtually every California government agency and state operation. Site visitors can transact a wide array of business with the state, from renewing a driver's license to reserving a camp site. The goal of the site is to give constituents one site through which they can conduct all of their business with the state of California. For businesses, the site offers the full text of all California business laws and regulations. It also provides information about how to sell to and buy from the state and its agencies.

Many other U.S. state governments (and, in other countries, provincial or regional governments) have, or are currently developing, similar Web sites. States can reduce the cost of providing services while providing those services more efficiently by using Web technologies to serve their stakeholders. The most common services offered by states and similar regional governments are: access to the text of state laws and regulations, renewal of licenses, promotion of the state to businesses considering new locations, job listings, promotion of tourism in the state, tax forms and filing information, and information for companies that want to do business with the state. The state of New York has separate Web sites for individuals living or working in the state (**New York State Citizen Guide**) and for companies that do business with the state (**e-bizNYS**).

Many local governments now have Web sites that offer residents a variety of information. The Web sites of larger cities (such as **Minneapolis** or **New Orleans**) include transcripts of city council meetings, local laws and regulations, business license and tax administration functions, and promotional information about the city for new residents or businesses seeking new locations. Smaller cities, towns, and villages are also using the Web to communicate with residents (see the **Cheviot, Ohio** Web site for one example). These local government Web sites have been proven to be useful general communication tools. In the aftermath of Hurricane Katrina in 2005, the New Orleans Web site carried a daily message from the mayor and continually updated information about which parts of the city were open to returning evacuees.

New York City (**MyNYC.gov**) hired a management consulting firm to help review the city's ability to respond to terrorist attacks such as those of September 11, 2001. The review noted a number of weaknesses in the coordination of communications and data access among the New York Police Department, the Fire Department of New York, and other city departments. In response to the review, New York City revised its information systems to allow better coordination of activities during large-scale emergencies. Many New York City departments can now access each others' databases through Web interfaces that use electronic commerce technologies. You can learn more about applications of Internet technologies in state and local governments by reviewing articles on e.Republic's **Government Technology** Web site.

Network Model of Economic Organization

In Chapter 1, you learned about the three different forms of economic organization: markets, hierarchies, and networks. One trend that is becoming clear in purchasing, logistics, and support activities is the shift away from hierarchical structures toward network structures. The traditional purchasing model had one hierarchically structured firm negotiating purchase terms with several similarly structured supplier firms, playing each supplier against the others. As is typical in a network organization, more businesses are now

giving their Procurement Departments new tools to negotiate with suppliers, including the possibility of forming strategic alliances. For example, a buying firm might enter into an alliance with a supplier to develop new technology that will reduce overall product costs. The technology development might be done by a third firm using research conducted by a fourth firm. Such alliances and outsourcing contracts are examples of the move toward network economic structures that you learned about in Chapter 1.

While reading the previous sections in this chapter, you might have noticed that companies can have other firms perform various support activities for them. Again, these are examples of firms moving to a network model of economic organization. Imagine a business that uses one supplier to manage its payroll, another to administer its employee benefits plans, and a third to handle its document storage needs. The document storage service supplier might store the documents of the payroll service supplier and the benefits administration firm. The payroll service supplier might handle the payroll for the benefits administration firm. A fourth firm might provide online backup storage for the files of the other three companies. Of course, the payroll firm and the employee benefits firm might form a marketing partnership to sell both of their services to particular market segments. The document storage firm and the online backup storage firm might form a similar strategic alliance. Some researchers who study the interaction of firms within an industry value chain are beginning to use the term "**supply web**" instead of "supply chain" because many industry value chains no longer consist of a single sequence of companies linked in a single line, but include many parallel lines that are interconnected in a web or network configuration.

Highly specialized firms can now exist and trade services very efficiently on the Web. The Web is enabling this shift from hierarchical to network forms of economic organization. These emerging networks of firms are more flexible and can respond to changes in the economic environment much more quickly than hierarchically structured businesses. You can learn more about the economics of networked organizations at the **Network Economics** Web site maintained by the University of California, Berkeley. The roots of Web technology for business-to-business transactions, however, lie in a very hierarchically structured approach to interfirm information transfer: electronic data interchange.

ELECTRONIC DATA INTERCHANGE

You learned in Chapter 1 that electronic data interchange (EDI) is a computer-to-computer transfer of business information between two businesses that uses a standard format of some kind. The two businesses that are exchanging information are trading partners. Firms that exchange data in specific standard formats are said to be **EDI compatible**. The business information exchanged is often transaction data; however, it can also include other information related to transactions, such as price quotes and order status inquiries. Transaction data in business-to-business transactions includes the information traditionally included on paper invoices, purchase orders, requests for quotations, bills of lading, and receiving reports. The data on these five types of forms accounts for more than 75 percent of all information exchanged by trading partners in the United States. Thus, EDI was the first form of electronic commerce to be widely used in business—some 20 years before anyone used the term "electronic commerce" to describe anything!

It is very important that you understand what EDI is designed to accomplish and how it came to be the preferred way for businesses to exchange information, because most B2B electronic commerce is an adaptation of EDI or is based on EDI principles. Another important reason for being familiar with EDI is that EDI is still the method used for most electronic B2B transactions. According to one study (see the article by Richard Villars cited in For Further Study and Research at the end of this chapter), the dollar amount of EDI transactions in 2002 was three times the total amount of all other B2B electronic transactions. This section provides you with a brief history of EDI and explains how it works. It also explains why conducting EDI is better than processing mountains of paper transactions.

Early Business Information Interchange Efforts

The emergence of large business organizations in the late 1800s and early 1900s brought with it the need to create formal records of business transactions. In the 1950s, companies began to use computers to store and process internal transaction records, but the information flows between businesses continued to be printed on paper; purchase orders, invoices, bills of lading, checks, remittance advices, and other standard forms were used to document transactions.

The process of using a person or computer to generate a paper form, mailing that form, and then having another person enter the data into the trading partner's computer was slow, inefficient, expensive, redundant, and unreliable. By the 1960s, businesses that engaged in large volumes of transactions with each other had begun exchanging transaction information on punched cards or magnetic tape. Advances in data communications technology during the 1960s and 1970s allowed trading partners to transfer data over telephone lines instead of shipping punched cards or magnetic tapes to each other.

Although these information transfer agreements between trading partners increased efficiency and reduced errors, they were not an ideal solution. Because the data translation programs that one trading partner wrote usually would not work for other trading partners, each company participating in this information exchange had to make a substantial investment in computing infrastructure. Only large trading partners could afford this investment, and even those companies had to perform a significant number of transactions to justify the cost. Smaller or lower-volume trading partners could not afford to participate in the benefits of these paper-free exchanges.

In 1968, a number of freight and shipping companies joined together to form the Transportation Data Coordinating Committee (TDCC), which was charged with exploring ways to reduce the paperwork burden that shippers and carriers faced. The TDCC created a standardized information set that included all the data elements that shippers commonly included on bills of lading, freight invoices, shipping manifests, and other paper forms. Instead of printing a paper form, shippers could convert information about shipments into a computer file that conformed to the TDCC standard format. The shipper could electronically transmit that computer file to any freight company that had adopted the TDCC format. The freight company translated the TDCC format into data it could use in its own information systems. The savings from not printing and handling forms, not entering the data twice, and not having to worry about error-correction procedures were significant for most shippers and freight carriers.

Although these early industry-specific data interchange efforts were very helpful, their benefits were limited to members of the industries that created standard-setting groups. In

addition, most businesses that are in a particular industry buy goods and services from businesses that are in other industries. For example, a machinery manufacturer might buy materials from steel mills, paint distributors, electrical assembly contractors, and container manufacturers. Also, almost every business needs to buy office supplies and the services of freight and transportation companies. Thus, full realization of EDI's economies and efficiencies required standards that could be used by companies in all industries.

Emergence of Broader EDI Standards

After a decade of fragmented attempts at setting broader EDI standards, a number of industry groups and several large companies decided to mount a major effort to create a set of cross-industry standards for electronic components, mechanical equipment, and other widely used items. The **American National Standards Institute (ANSI**) has been the coordinating body for standards in the United States since 1918. **ANSI** does not set standards itself, but it has created a set of procedures for the development of national standards and it accredits committees that follow those procedures.

In 1979, ANSI chartered a new committee to develop uniform EDI standards. This committee is called the **Accredited Standards Committee X12 (ASC X12)**. The **ASC X12** committee meets three times each year to develop and maintain EDI standards. The committee and its subcommittees include information systems professionals from more than 800 businesses and other organizations. Membership is open to organizations and individuals who have an interest in the standards. The administrative body that coordinates ASC X12 activities is the **Data Interchange Standards Association (DISA)**.

The ASC X12 standard has benefited from the participation of members from a wide variety of industries. The standard currently includes specifications for several hundred **transaction sets**, which are the names of the formats for specific business data interchanges. Figure 5-4 lists some of the more commonly used ASC X12 transaction sets.

Although the X12 standards were quickly adopted by major firms in the United States, in many cases, businesses in other countries continued to use their own national standards. In the mid-1980s, the United Nations Economic Commission for Europe invited both North American and European EDI experts to work together on designing a common set of EDI standards based on the successful experiences of U.S. firms in using the ASC X12 standards. In 1987, the United Nations published its first standards under the title **EDI for Administration, Commerce, and Transport (EDIFACT**, or **UN/EDIFACT)**. As you can see from Figure 5-5 (on page 234), a number of the commonly used UN/EDIFACT standard transaction sets are similar to those in the ASC X12 standard.

The ASC X12 organization and the UN/EDIFACT group agreed in late 2000 to develop one common set of international standards; however, no date for implementation of the common standards has been set. Both organizations created their transaction sets by extracting the information items from the paper forms used to document business transactions. Some critics of the current EDI standards argue that this reliance on forms has made it difficult for businesses to integrate EDI data flows into their business process-oriented information systems. Unfortunately, changing EDI transaction sets to follow business processes instead of paper transaction forms would require a complete redesign of standards that have become part of many organizations' computing infrastructures over the past 30 years.

104 - Air Shipment Information
110 - Air Freight Details and Invoice
125 - Multilevel Railcar Load Details
151 - Electronic Filing of Tax Return Data Acknowledgement
170 - Revenue Receipts Statement
180 - Return Merchandise Authorization and Notification
204 - Motor Carrier Shipment Information
210 - Motor Carrier Freight Details and Invoice
213 - Motor Carrier Shipment Status Inquiryry
214 - Transportation Carrier Shipment Status Message
304 - Shipping Instructions
317 - Delivery/Pickup Order
325 - Consolidation of Goods in Container
350 - U.S. Customs Release Information
404 - Rail Carrier Shipment Information
410 - Rail Carrier Freight Details and Invoice
421 - Estimated Time of Arrival and Car Scheduling
440 - Shipment Weights
466 - Rate Request
511 - Requisition
810 - Invoice
812 - Credit/Debit Adjustment
813 - Electronic Filing of Tax Return Data
820 - Payment Order/Remittance Advice
828 - Debit Authorization
829 - Payment Cancellation Request
840 - Request for Quotation
841 - Specifications/Technical Information
842 - Nonconformance Report
843 - Response to Request for Quotation
846 - Inventory Inquiry/Advice
847 - Material Claim
850 - Purchase Order
853 - Routing and Carrier Instruction
854 - Shipment Delivery Discrepancy Information
855 - Purchase Order Acknowledgment
856 - Ship Notice/Manifest
857 - Shipment and Billing Notice
859 - Freight Invoice
860 - Purchase Order Change Request–Buyer Initiated
861 - Receiving Advice/Acceptance Certificate
865 - Purchase Order Change Acknowledgment/Request–Seller-Initiated
867 - Product Transfer and Resale Report
869 - Order Status Inquiry
870 - Order Status Report
879 - Price Change
893 - Item Information Request
920 - Loss or Damage Claim–General Commodities
924 - Loss or Damage Claim–Motor Vehicle
997 - Functional Acknowledgment
998 - Set Cancellation

FIGURE 5-4 Commonly used ASC X12 transaction sets

How EDI Works

Although the basic idea behind EDI is straightforward, its implementation can be complicated, even in fairly simple business situations. For example, consider a company that needs a replacement for one of its metal-cutting machines. This section describes the steps involved in making this purchase using a paper-based system, and then explains how the process would change using EDI. In both of these examples, assume that the vendor uses its own vehicles instead of a common carrier to deliver the purchased machine.

Paper-Based Purchasing Process

The buyer and the vendor in this example are not using any integrated software for business processes internally; thus, each information processing step results in the production of a paper document that must be delivered to the department handling the next step. Information transfer between the buyer and vendor is also paper-based and can be delivered by mail, courier, or fax. The information flows that occur in the paper-based version of the purchasing process example are shown in Figure 5-6 (on page 235).

AUTHOR	-	Authorization	IFTCCA	-	Forwarding/Transport Shipment Charge Calculation
BOPCUS	-	Balance of Payment Customer Transaction Report	IFTDGN	-	Dangerous Goods Notification
BOPDIR	-	Direct Balance of Payment Declaration	IFTFCC	-	International Transport Freight Costs/Other Charges
BOPINF	-	Balance of Payment Information from Customer	IFTMAN	-	Arrival Notice
COARRI	-	Container Discharge/Loading Report	INVOIC	-	Invoice
COHAOR	-	Container Special Handling Order	INVRPT	-	Inventory Report
CONAPW	-	Advice on Pending Works	ORDCHG	-	Purchase Order Change Request
CONDPV	-	Direct Payment Valuation	ORDERS	-	Purchase Order
CONITT	-	Invitation to Tender	ORDRSP	-	Purchase Order Response
CONPVA	-	Payment Valuation	PAXLST	-	Passenger List
CONQVA	-	Quantity Valuation	PAYMUL	-	Multiple Payment Order
COPRAR	-	Container Discharge/Loading Order	PAYORD	-	Payment Order
COREOR	-	Container Release Order	PRODEX	-	Product Exchange Reconciliation
COSTCO	-	Container Stuffing/Stripping Confirmation	QALITY	-	Quality Data
COSTOR	-	Container Stuffing/Stripping Order	QUOTES	-	Quote
CREADV	-	Credit Advice	RECADV	-	Receiving Advice
CUSDEC	-	Customs Declaration	REMADV	-	Remittance Advice
CUSRES	-	Customs Response	REQDOC	-	Request for Document
DEBADV	-	Debit Advice	REQOTE	-	Request for Quote
DELFOR	-	Delivery Schedule	SSREGW	-	Notification of Registration of a Worker
HANMOV	-	Cargo/Goods Handling and Movement	STATAC	-	Statement of Account
IFCSUM	-	Forwarding and Consolidation Summary	SUPRES	-	Supplier Response

FIGURE 5-5 Commonly used UN/EDIFACT transaction sets

Once the production manager in the operating unit decides that the metal-cutting machine needs to be replaced, the following process begins:

- The production manager completes a purchase requisition form and sends it to Purchasing. This requisition describes the machine that is needed to perform the metal-cutting operation.
- Purchasing contacts vendors to negotiate price and terms of delivery. When Purchasing has selected a vendor, it prepares a purchase order and forwards it to the mail room.
- Purchasing also sends one copy of the purchase order to the Receiving Department so that Receiving can plan to accept delivery when scheduled; Purchasing sends another copy to Accounting to advise it of the financial implications of the order.
- The mail room sends the purchase order it received from Purchasing to the selected vendor by mail or courier.
- The vendor's mail room receives the purchase order and forwards it to its Sales Department.
- The vendor's Sales Department prepares a sales order that it sends to its Accounting Department and a work order that it sends to Manufacturing. The work order describes the machine's specifications and authorizes Manufacturing to begin work on it.

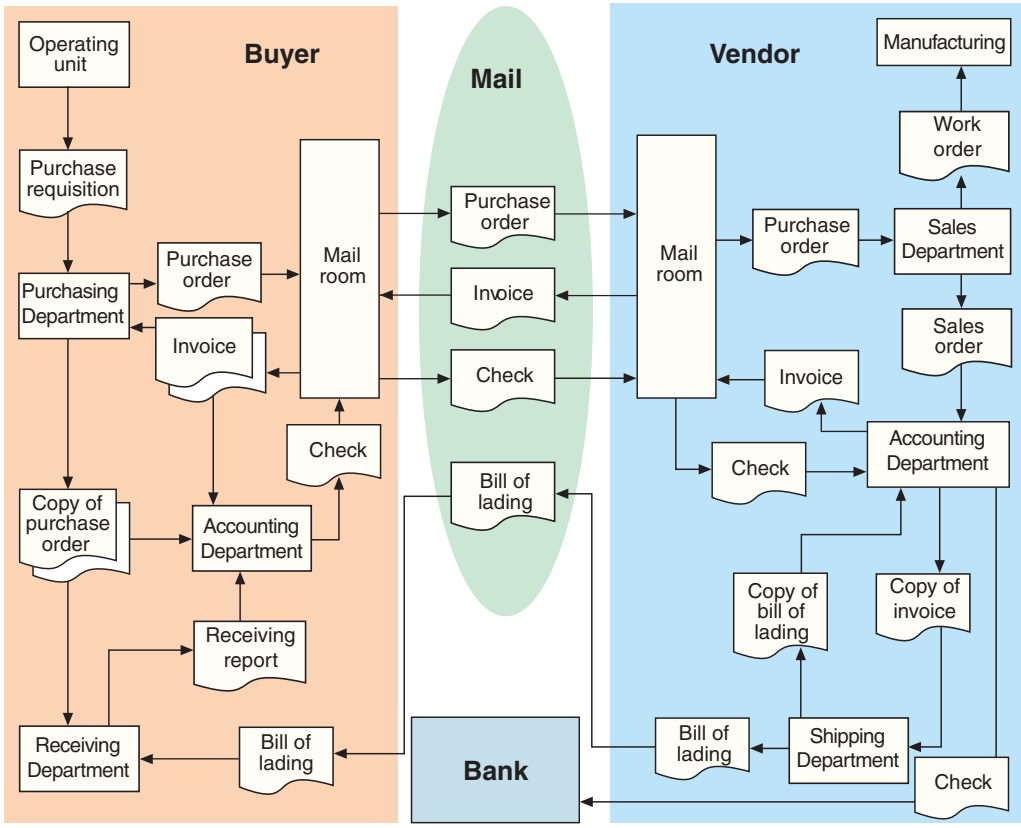


FIGURE 5-6 Information flows in a paper-based purchasing process

- When the machine is completed, Manufacturing notifies Accounting and sends the machine to shipping.
- The Accounting Department sends the original invoice to the mail room and a copy of the invoice to the Shipping Department.
- The mail room sends the invoice to the buyer by mail or courier.
- The vendor's Shipping Department uses its copy of the invoice to create a bill of lading and sends it with the machine to the buyer.
- The buyer's mail room receives the invoice at about the same time as its Receiving Department receives the machine with its bill of lading.
- The buyer's mail room sends one copy of the invoice to Purchasing so the Purchasing Department knows that the machine was received, and sends the original invoice to Accounting.
- The buyer's Receiving Department checks the machine against the bill of lading and its copy of the purchase order. If the machine is in good condition and matches the specifications on the bill of lading and the purchase order, Receiving completes a receiving report and delivers the machine to the operating unit.
- Receiving sends a completed receiving report to Accounting.

- Accounting makes sure that all details on its copy of the purchase order, the receiving report, and the original invoice match. If they do, Accounting issues a check and forwards it to the mail room.
- The buyer's mail room sends the check by mail or courier to the vendor.
- The vendor's mail room receives the check and sends it to Accounting.
- Accounting compares the check to its copies of the invoice, bill of lading, and sales order. If all details match, Accounting deposits the check in the vendor's bank and records the payment received.

EDI Purchasing Process

The information flows that occur in the EDI version of this sample purchasing process are shown in Figure 5-7. The mail service has been replaced with the data communications of an EDI network, and the flows of paper within the buyer's and vendor's organizations have been replaced with computers running EDI translation software.

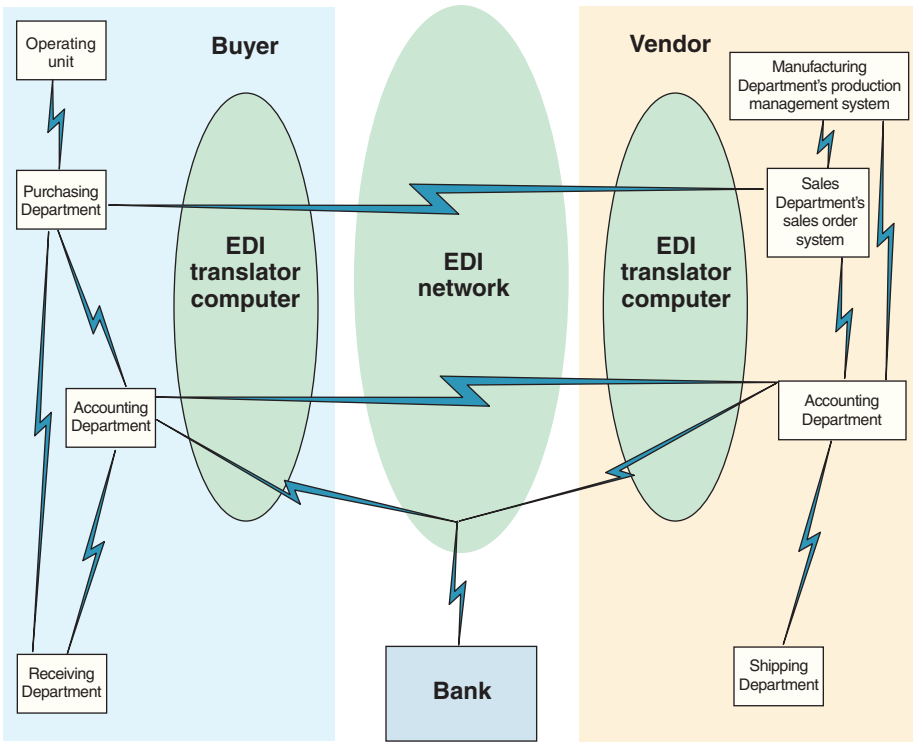


FIGURE 5-7 Information flows in an EDI purchasing process

In the EDI purchasing process, when the operating unit manager decides that the metal-cutting machine needs to be replaced, the following process begins:

- The operating unit manager sends an electronic message to its Purchasing Department. This message describes the machine that is needed to perform the metal-cutting operation.
- Purchasing contacts vendors by telephone, e-mail, or through their Web sites to negotiate price and terms of delivery. After selecting a vendor, Purchasing sends a message to the Sales Department announcing the selection.
- The buyer's EDI translator computer converts this message to a standard format purchase order transaction set, and then forwards the message through an EDI network to the vendor.
- Purchasing also sends one electronic message to the buyer's Receiving Department so it can plan to accept delivery when it is scheduled; Purchasing sends another electronic message to the buyer's Accounting Department that includes details such as the agreed purchase price.
- The vendor's EDI translator computer receives the purchase order transaction set message and converts it to the file format used by the vendor's information systems.
- The converted purchase order details appear in the Sales Department's sales order system and are automatically forwarded to the production management system in Manufacturing and to the accounting system.
- The information that was automatically forwarded to Manufacturing describes the machine's specifications and authorizes Manufacturing to begin work on it.
- When the machine is completed, Manufacturing notifies Accounting and sends the machine to the vendor's Shipping Department.
- The vendor's Shipping Department sends an electronic message to its Accounting Department indicating that the machine is ready to ship.
- The vendor's Accounting Department sends a message to its EDI translator computer, which converts the message to the standard invoice transaction set and forwards it through the EDI network to the buyer.
- The buyer's EDI translator computer receives the invoice transaction set before its Receiving Department receives the machine. The computer then converts the invoice data to a format that the buyer's information systems can use. The invoice data becomes immediately available to both the buyer's Accounting and Receiving Departments.
- When the machine arrives, the buyer's Receiving Department checks the machine against the invoice information on its computer system. If the machine is in good condition and matches the specifications shown in the buyer's system, Receiving sends a message to Accounting confirming that the machine has been received in good order. It then delivers the machine to the operating unit.
- The buyer's Accounting Department system compares all details in the purchase order data, receiving data, and decoded invoice transaction set from the

vendor. If all the details match, the accounting system notifies its bank to reduce the buyer's account and increase the vendor's account by the amount of the invoice. The EDI network may provide services that perform this task.

Value-Added Networks

As you can see by comparing the paper-based purchasing process in Figure 5-6 to the EDI purchasing process in Figure 5-7, the departments are exchanging the same messages among themselves, but EDI reduces paper flow and streamlines the interchange of information among departments within a company and between companies. These efficiencies were responsible for the benefits described in the GE Lighting example presented in the introduction to this chapter. The three key elements shown in Figure 5-7 that alter the process so dramatically are the EDI network (instead of the mail service) that connects the two companies and the two EDI translator computers that handle the conversion of data from the formats used internally by the buyer and the vendor to standard EDI transaction sets. Trading partners can implement the EDI network and EDI translation processes in several ways. Each of these ways uses one of two basic approaches: direct connection or indirect connection.

The first approach, called **direct connection EDI**, requires each business in the network to operate its own on-site EDI translator computer (as shown in Figure 5-7). These EDI translator computers are then connected directly to each other using modems and dial-up telephone lines or dedicated leased lines. The dial-up option becomes troublesome when customers or vendors are located in different time zones, and when transactions are time-sensitive or high in volume. The dedicated leased-line option can become very expensive for businesses that must maintain many connections with customers or vendors. Trading partners that use different communications protocols can make either of the direct connection methods difficult to implement.

Instead of connecting directly to each of its trading partners, a company might decide to use the services of a value-added network. As you learned in Chapter 1, a value-added network (VAN) is a company that provides communications equipment, software, and skills needed to receive, store, and forward electronic messages that contain EDI transaction sets. To use the services of a VAN, a company must install EDI translator software that is compatible with the VAN. Often, the VAN supplies this software as part of its operating agreement.

To send an EDI transaction set to a trading partner, the VAN customer connects to the VAN using a dedicated or dial-up telephone line and then forwards the EDI-formatted message to the VAN. The VAN logs the message and delivers it to the trading partner's mailbox on the VAN computer. The trading partner then dials in to the VAN and retrieves its EDI-formatted messages from that mailbox. This approach is called **indirect connection EDI** because the trading partners pass messages through the VAN instead of connecting their computers directly to each other. Figures 5-8 and 5-9 show the differences between direct connection EDI and indirect connection EDI using a VAN.

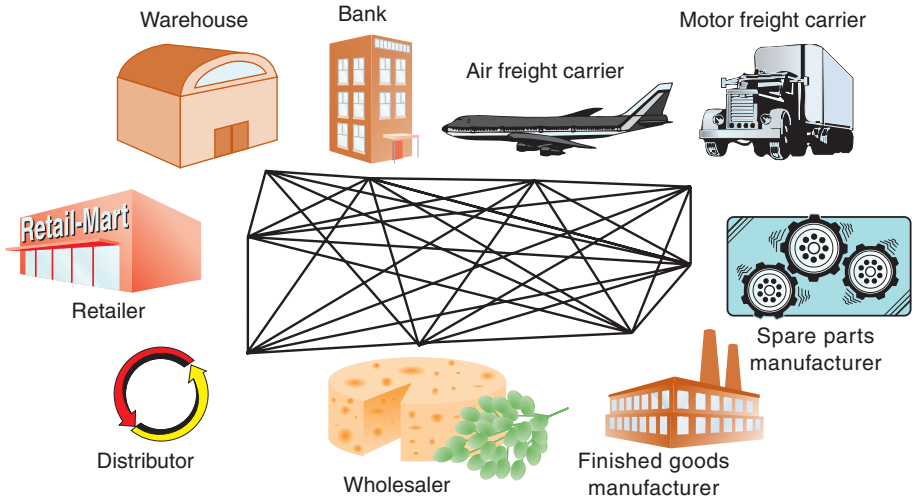


FIGURE 5-8 Direct connection EDI

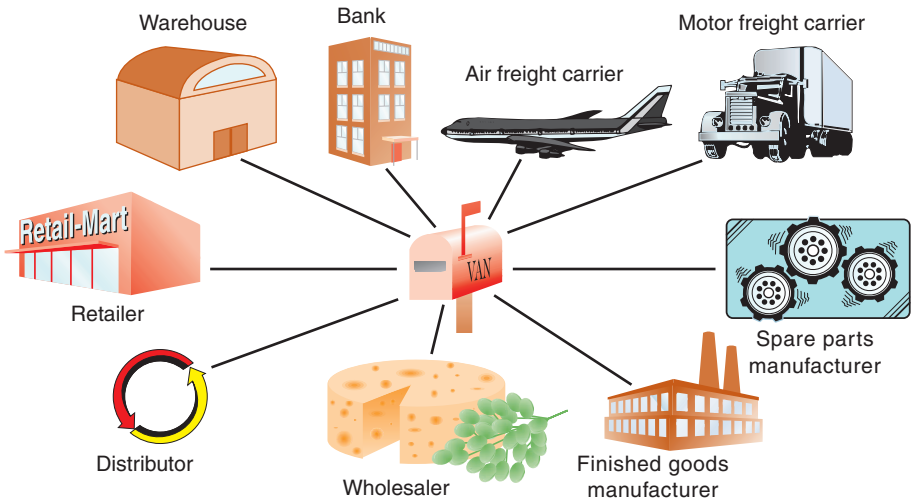


FIGURE 5-9 Indirect connection EDI through a VAN

Companies that provide VAN services include **Descartes VAN Services**, **EC/EDI**, **GPAS**, **IBM Global Services**, **Kleinschmidt**, and the **Sterling Information Broker**. Advantages of using a VAN are as follows:

- Users need to support only the VAN's one communications protocol instead of many possible protocols used by trading partners.
- The VAN records message activity in an audit log. This VAN audit log becomes an independent record of transactions, and this record can be helpful in resolving disputes between trading partners.

- The VAN can provide translation between different transaction sets used by trading partners (for example, the VAN can translate an ASC X12 set into a UN/EDIFACT set).
- The VAN can perform automatic compliance checking to ensure that the transaction set is in the specified EDI format.

VANs do have some disadvantages, however. One major issue is cost. Most VANs require an enrollment fee, a monthly maintenance fee, and a transaction fee. The transaction fee can be based on transaction volume, transaction length, or both. Trading partners with few transactions often find it difficult to justify the high fixed costs of the enrollment and monthly maintenance fees. For example, the up-front cost of implementing indirect connection EDI, including software, VAN enrollment fee, and hardware, can exceed $20,000. Other trading partners with high transaction volumes find the VAN's ongoing transaction-based fees prohibitive.

In the past, many vendors were forced into bearing the high costs of participating in EDI to satisfy the needs of one or two large customers. This happened frequently to suppliers of the auto industry and the retail merchandising industry. Using VANs can become cumbersome and expensive for companies that want to do business with a number of trading partners, each using different VANs. Although some VANs do offer the service of exchanging messages with other VANs, the cost of this service can be unpredictable. Also, inter-VAN transfers do not always provide a clear audit trail for use in dispute resolution. Firms precluded from adopting EDI by its high cost welcomed the Internet as a low-cost communications medium that could help them overcome some of the disadvantages of traditional EDI.

EDI ON THE INTERNET

As the Internet gained prominence as a tool for conducting business, trading partners using EDI began to view the Internet as a potential replacement for the expensive leased lines and dial-up connections required to support both direct and VAN-aided EDI. Companies that had been unable to afford EDI began to look at the Internet as an enabling technology that might get them back in the game of selling to large customers that demanded EDI capabilities from their suppliers.

The major roadblocks to conducting EDI over the Internet initially were concerns about security and the Internet's general inability to provide audit logs and third-party verification of message transmission and delivery. As the basic TCP/IP structure of the Internet was enhanced with secure protocols and other encryption schemes (you will learn about these in Chapter 10), businesses worried less about security issues; however, concerns still existed. The lack of third-party verification continues to be an issue because the Internet has no built-in facility for it. Because EDI transactions are business contracts and often involve large amounts of money, the issue of nonrepudiation is significant. **Nonrepudiation** is the ability to establish that a particular transaction actually occurred. It prevents either party from repudiating, or denying, the transaction's validity or existence. In the past, the nonrepudiation function was provided either by a VAN's audit logs for indirect connection EDI or a comparison of the trading partners' message logs for direct connection EDI.

Open Architecture of the Internet

In the mid-1990s, a number of firms began providing EDI services on the Internet. Companies that originally provided traditional VAN services now offer EDI on the Internet, along with a number of new companies that entered the market with their Internet EDI services. EDI on the Internet is called **Internet EDI** or **Web EDI**. It is also called **open EDI** because the Internet is an open architecture network, as you learned in Chapter 2. Many of the new EDI offerings go beyond traditional EDI and help trading partners accomplish information interchanges that are more complex than the EDI standard transaction sets. Internet EDI has grown rapidly, but has not replaced traditional EDI because so many large companies have significant investments in the computing infrastructure they use for traditional EDI. Most VANs today offer Internet EDI services, but they continue to provide traditional EDI services.

The open architecture of the Internet allows trading partners virtually unlimited opportunities for customizing their information interchanges. Tools such as XML are helping trading partners be even more flexible in exchanging detailed information. Several groups, including an ASC X12 task group, have attempted to convert the ASC X12 EDI data elements and transaction set structures to XML in a way that retains a one-to-one mapping between the existing ASC X12 and the new XML data elements. These efforts have yielded the **Context Inspired Component Architecture (CICA)**, which is a set of standards for assembling business messages that provides a predictable structure for the content of those messages but that also provides more flexibility than EDI transaction sets. In 2003, ASC X12 announced that CICA would be the basis for its future development of electronic business message standards using XML. The implementation of new ASC X12 standards for XML has been delayed while an XML specification for electronic business called ebXML is refined. Meanwhile, EDI and XML are both used in many businesses to handle the electronic exchange of transaction information. A number of companies use both approaches simultaneously and several companies (including a few VANs) offer data conversion services that translate EDI transaction sets to and from XML. You can learn more about the ebXML development effort by following the link to **ebXML.org** in the Online Companion.

Other firms are extending their internal networks (intranets) to their trading partners, which turns the intranets into extranets. Technologies such as virtual private networks (VPNs), which you learned about in Chapter 2, are providing the security that makes such extranets increasingly attractive. For example, Nintendo USA uses an EDI-based product registration system to prevent fraudulent returns. The system allows retailers to send the serial numbers of Nintendo products that they have sold directly to Nintendo USA. This system worked well for large retailers, but the benefits did not offset the costs for smaller toy stores. Therefore, in 1998, Nintendo expanded the registration system to include non-EDI adopters. Nintendo bought a software package from IPNet that captures serial number and other warranty information at the cash register and then sends it over the Internet to Nintendo; this allows smaller retailers to now have the benefits of EDI at a much lower cost than traditional EDI.

Financial EDI

Although Internet EDI is growing and offering new, flexible information interchange solutions for many trading partners, some elements of EDI remain difficult to transfer to the Internet. The EDI transaction sets that provide instructions to a trading partner's bank are called **financial EDI (FEDI)**. All banks have the ability to perform electronic funds transfers (EFTs), which are the movement of money from one bank account to another. You learned about EFTs in Chapter 1. The bank accounts involved in EFTs may be customer accounts or the accounts that banks keep on their own behalf with each other. When EFTs involve two banks, they are executed using an **automated clearing house (ACH)** system, which is a service that banks use to manage their accounts with each other. In the United States, banks can use the ACH operated by the U.S. Federal Reserve Banks or one of the private ACHs operated by a group of banks or a separate company. **EDI-capable banks** are banks that are equipped to exchange payment and remittance data through VANs. Some banks also offer VAN services for nonfinancial transactions. These banks are called **value-added banks (VABs)**. Nonbank VANs that can translate financial transaction sets into ACH formats and transmit them to banks that are not EDI capable are sometimes called **financial VANs (FVANs)**.

Many companies are reluctant to use the Internet to transmit FEDI transaction sets that contain transfer instructions for large amounts of money—in some cases, millions of dollars—because of the perceived low level of security on the Internet. FEDI transaction sets are negotiable instruments—the electronic equivalent of checks. The reliability of FEDI itself is an issue, too. Because FEDI uses the Internet, it can be exposed to problems that are less likely to occur on the dedicated leased telephone lines used for connecting to a VAN. For example, if an Internet router outage delays an instruction to transfer $10 million, a trading partner could easily lose a day's interest on the funds. Thus, companies that have established indirect connection EDI through a VAN are likely to continue doing so to ensure added security for FEDI transaction sets, even though the cost of using a VAN is much higher than the cost of using the Internet for FEDI. You will learn more about payment processing for all types of transactions in Chapter 11.

EDI was the original form of electronic commerce, and it appears that it will continue to evolve and be a part of the electronic commerce boom on the Internet. Many articles in the business and information technology press over the past six years have announced the impending death of EDI. However, large companies have a huge investment in EDI systems and trained personnel. They are reluctant to change their business processes and move to Internet EDI or other proposed intercompany transaction processing approaches based on XML technologies. As these systems grow older, however, the move away from EDI will gradually occur. Total EDI transaction volume is growing steadily at a rate of about 5 percent each year and is expected to exceed $2.6 trillion by 2007. The share of EDI carried by traditional VANs has been declining. In 1997, traditional VANs carried more than 95 percent of all EDI traffic. Experts predict that VANs' share of the transaction volume will decline to about 10 percent by 2007. This shift reflects an expected increase in the number of smaller businesses that can afford to engage in Internet EDI now that an expensive VAN and dedicated leased telephone lines are no longer required.

SUPPLY CHAIN MANAGEMENT USING INTERNET TECHNOLOGIES

You learned earlier in this chapter that the part of an industry value chain that precedes a particular strategic business unit is called a supply chain. Many companies use strategic alliances, partnerships, and long-term contracts to create relationships with other companies in the supply chains for the products that they manufacture or sell. In many cases, companies are able to reduce costs by developing close relationships with a few suppliers rather than negotiating with a large number of suppliers each time they need to buy materials or supplies. When companies integrate their supply management and logistics activities across multiple participants in a particular product's supply chain, the job of managing that integration is called **supply chain management**. The ultimate goal of supply chain management is to achieve a higher-quality or lower-cost product at the end of the chain.

Value Creation in the Supply Chain

In recent years, businesses have realized that they can save money and increase product quality by taking a more active role in negotiations with suppliers. By engaging suppliers in cooperative, long-term relationships, companies have found that they can work together with these suppliers to identify new ways to provide their own customers with faster, cheaper, and better service. By coordinating the efforts of supply chain participants, firms that engage in supply chain management are reaching beyond the limits of their own organization's hierarchical structure and creating a new network form of organization among the members of the supply chain.

Supply chain management was originally developed as a way to reduce costs. It focused on very specific elements in the supply chain and tried to identify opportunities for process efficiency. Today, supply chain management is used to add value in the form of benefits to the ultimate consumer at the end of the supply chain. This requires a more holistic view of the entire supply chain than had been common in the early days of supply chain management.

Businesses that engage in supply chain management work to establish long-term relationships with a small number of very capable suppliers. These suppliers, called **tier one suppliers**, in turn develop long-term relationships with a larger number of suppliers that provide components and raw materials to them. These **tier two suppliers** manage relationships with the next level of suppliers, called **tier three suppliers**, that provide them with components and raw materials. A key element of these relationships is trust between the parties. The long-term relationships created among participants in the supply chain are called **supply alliances**. The level of information sharing that must take place among the supply chain participants can be a major barrier to entering into these alliances. Firms are not accustomed to disclosing detailed operating information and often perceive that information disclosure might hurt the firm by placing it at a competitive disadvantage.

Dell Computer is one company that has been able to reduce supply chain costs by sharing information with its suppliers. The moment Dell receives an order from a customer, it makes that information available to its tier one suppliers, who can then better plan their production based on Dell's exact demand trends. For example, a supplier of disk drives can change its production plans immediately when it sees a shift in Dell's customer orders from

computers with one size disk drive to another, usually larger, size disk drive. This prevents the supplier from overproducing the smaller drive, which reduces the supplier's costs (for unsold drives) and costs in the supply chain overall (the supplier does not need to charge more for the disk drives it does sell to Dell to recover the cost of the unsold drives).

In exchange for the stability of the closer, long-term relationships, buyers expect annual price reductions and quality improvements from suppliers at each stage of the supply chain. However, all supply chain participants share information and work together to create value. Ideally, the supply chain coordination creates enough value that each level of supplier can share the benefits of reduced cost and more efficient operations. Supply chain management has been gaining momentum during the past decade and is supported by major purchasing groups such as the **Supply Chain Council**. By working together, supply chain members can reduce costs and increase the value of the product or service to the ultimate consumer.

One area in which differences in organizational goals often arise is described by Marshall Fisher in his 1997 *Harvard Business Review* article. He explains that firms often organize themselves to achieve either efficient process goals or market-responsive flexibility goals. Some companies structure themselves to be efficient producers, whereas others structure themselves to be flexible producers. The kinds of things that allow a firm to be an efficient, low-cost producer are exactly the things that prevent a firm from being flexible enough to respond to market changes. For example, the efficient producer invests in expensive machines that can stamp out large numbers of low-cost items. This investment drives down the cost of production, but makes it difficult for the producer to be flexible. A large investment in specialized machinery prevents that producer from reconfiguring the plant layout. If even one member of the supply chain for a product that requires flexible production operates as an efficient producer (instead of as a flexible producer), every other firm in the supply chain suffers. The efficient producer creates bottlenecks that hamper the best efforts of all other supply chain members. Clear communication up and down the supply chain can keep each participant informed of what the ultimate consumer demands. The participants can then plot a strategy to meet those demands.

Clear communications, and quick responses to those communications, are key elements of successful supply chain management. Technologies, and especially the technologies of the Internet and the Web, can be very effective communications enhancers. For the first time, firms can effectively manage the details of their own internal processes and the processes of other members of their supply chains. Software that uses the Internet can help all members of the supply chain review past performance, monitor current performance, and predict when and how much of certain products need to be produced. Figure 5-10 lists the advantages of using Internet technologies in supply chain management. The only major disadvantage of using Internet technologies in supply chain management is the cost of the technologies. In most cases, however, the advantages provide value that greatly exceeds the cost of implementing and maintaining the technologies.

Suppliers can:

- Share information about customer demand fluctuations
- Receive rapid notification of product design changes and adjustments
- Provide specifications and drawings more efficiently
- Increase the speed of processing transactions
- Reduce the cost of handling transactions
- Reduce errors in entering transaction data
- Share information about defect rates and types

FIGURE 5-10 Advantages of using Internet technologies in supply chain management

Increasing Supply Chain Efficiencies

Many companies are using Internet and Web technologies to manage supply chains in ways that yield increases in efficiency throughout the chain. These companies have found ways to increase process speed, reduce costs, and increase manufacturing flexibility so that they can respond to changes in the quantity and nature of ultimate consumer demand.

For example, **Boeing**, the largest producer of commercial aircraft in the world, faces a huge task in keeping its production on schedule. Each airplane requires more than 1 million individual parts and assemblies, and each airplane is custom configured to meet the purchasing airline's exact specifications. These parts and assemblies must be completed and delivered on schedule or the production process comes to a halt.

In 1997, production and scheduling errors required Boeing to shut down two entire assembly operations for several weeks, costing the company more than $1.5 billion. To prevent this from ever happening again, Boeing invested in a number of new information systems that increase production efficiency by providing planning and control over logistics in every element of its supply chain. Using EDI and Internet links, Boeing is working with suppliers so that they can provide exactly the right part or assembly at exactly the right time. Even before starting an airplane into production, Boeing makes the engineering specifications and drawings available to its suppliers through secure Internet connections. As work on the airplane progresses, Boeing keeps every member of the supply chain continually informed of completion milestones achieved and necessary schedule changes.

By its second year of using these new systems, Boeing had cut in half the time needed to complete individual assembly processes. It has realized similar reductions in part defect costs. The combined effects of these increased efficiencies are helping Boeing do a much better job of meeting its customers' needs. Instead of waiting 36 months for delivery, customers can now have their new airplanes in 10 to 12 months.

To further benefit its customers, Boeing launched a spare parts Web site, **Boeing PART** (part analysis and requirements tracking). More than 500 airlines that are Boeing customers do not use EDI to order replacement parts. Boeing PART lets these customers register and then order parts using their Web browsers. The site is processing thousands of transactions each day at a significantly lower cost to Boeing than if it were handling faxes, telephone calls, and mailed purchase orders. Boeing can deliver most parts ordered through Boeing PART on the same or next day.

Although **Dell Computer** has become famous for its use of the Web to sell custom-configured computers to individuals and businesses, it has also used technology-enabled supply chain management to give customers exactly what they want. Dell reduced the amount of inventory it keeps on hand from three weeks' sales to six days' sales. Ultimately, Dell wants to see inventory levels measured in minutes. By increasing the amount of information it has about its customers, Dell has been able to dramatically reduce the amount of inventory it must hold. Dell has also shared this information with members of its supply chain.

Dell's top suppliers have access to a secure Web site that shows them Dell's latest sales forecasts, along with other information about planned product changes, defect rates, and warranty claims. In addition, the Web site tells suppliers who Dell's customers are and what they are buying. All of this information helps these tier one suppliers plan their production much better than they could otherwise. The information sharing goes in both directions in Dell's supply chain: Tier one suppliers are required to provide Dell with current information on their defect rates and production problems. As a result, all members of the supply chain work together to reduce inventories, increase quality, and provide high value to the ultimate consumer. Much of this cooperative work requires a high level of trust. To enhance this trust and develop a sense of community, Dell maintains bulletin boards as an open forum in which its supply chain members can share their experiences in dealing with Dell and with each other.

For Boeing, Dell, and other firms, the use of Internet and Web technologies in managing supply chains has yielded significantly increased process speed, reduced costs, and increased flexibility. All of these attributes combine to allow a coordinated supply chain to produce products and services that better meet the needs of the ultimate consumer.

Using Materials-Tracking Technologies with EDI and Electronic Commerce

Tracking materials as they move from one company to another and as they move within the company has always been a troublesome task. Companies have been using optical scanners and bar codes for many years to help track the movement of materials. In many industries, the integration of bar coding and EDI has become prevalent. Figure 5-11 shows a typical bar-coded shipping label that is used in the auto industry. Each bar-coded element is a representation of a segment in the ASC X12 transaction set number 856, Ship Notice/Manifest. If you examine the figure carefully, you can see that five of the 856 transaction set's segments have been bar-coded (including Part Number, Quantity Shipped, Purchase Order Number, Serial Number, and Packing List Number).

These bar codes allow companies to scan materials as they are received and to track them as they move from the materials warehouse into production. Companies can use this bar-coded information along with information from their EDI systems to manage inventory flows and forecast materials needs across their supply chains.

In the second wave of electronic commerce, companies are integrating new types of tracking into their Internet-based materials-tracking systems. The most promising technology now being used is **radio frequency identification devices (RFIDs)**, which are small chips that use radio transmissions to track inventory. RFID technology has existed for many years, but until recently, it required each RFID to have its own power supply (usually a battery).

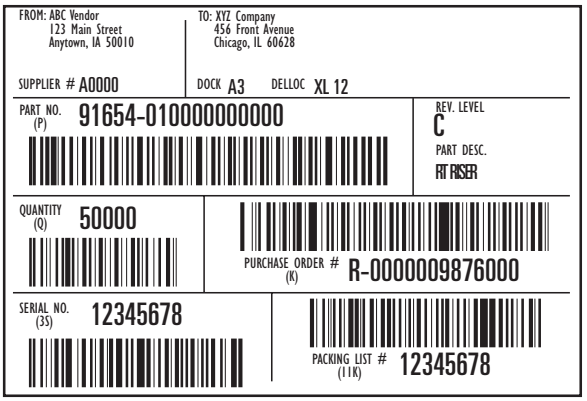
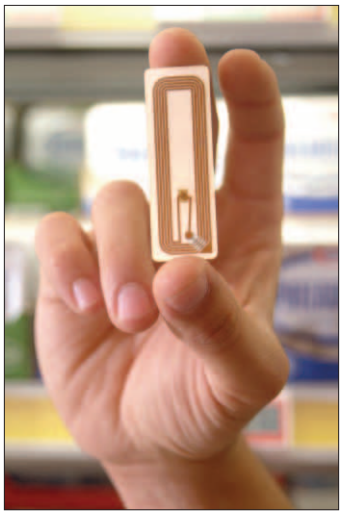


FIGURE 5-11 Shipping label with bar-coded segments from ASC X12 transaction set 856, Ship Notice/Manifest

The new development in RFID technology is the passive RFID tag, which can be made cheaply and in very small sizes. A passive RFID tag does not need a power source. It receives a radio signal from a nearby transmitter and extracts a tiny amount of power from that signal. It uses the power it extracts to send a signal back to the transmitter. That signal includes information about the inventory item to which the RFID tag has been affixed. RFID tags are small enough to be installed on the face of credit cards or sewn into clothing items. In 2003, Wal-Mart began testing the use of RFID tags on its merchandise for inventory tracking and control. You can learn more about current developments in this technology by visiting the ***RFID Journal*** online. Figure 5-12 shows a typical passive RFID tag.



Courtesy, Moeller-Horcher. Source: Metro

FIGURE 5-12 Passive RFID tag

Creating an Ultimate Consumer Orientation in the Supply Chain

One of the main goals of supply chain management is to help each company in the chain focus on meeting the needs of the consumer at the end of the supply chain. Companies in industries with long supply chains have, in the past, often found it difficult to maintain this customer focus, which is often called an **ultimate consumer orientation**. Instead, companies have directed their efforts toward meeting the needs of the next member in the supply chain. This short-sighted approach can cause companies to miss opportunities to add value in subsequent steps of the chain.

One company that pioneered the use of Internet technology to go beyond the next step in its value chain is Michelin North America. Michelin has a highly respected brand name and reputation in the tire business. However, most consumers rely on local tire dealers to make specific recommendations when they need replacement tires for their vehicles. Michelin spends a great deal of money on direct advertising to its ultimate consumers. This advertising is directed at maintaining Michelin's powerful brand and convincing the consumer of the value of Michelin tires. The advertising and brand building effort can be wasted, however, if the consumer goes to a local tire dealer who recommends another brand.

Michelin launched an electronic commerce initiative in 1995 called BIB NET (after the company's famous "Michelin Man" mascot, whose name is Bibendum). The goal of this initiative was to sell more Michelin tires to consumers, but the initiative was directed at Michelin's tire dealers, not the ultimate consumers. BIB NET was an extranet that allowed tire dealers to access tire specifications, inventory status, and promotional information about Michelin products through a simple-to-use Web browser interface. Before BIB NET, dealers calling Michelin for product information were sometimes placed on hold. A dealer who is talking to a customer cannot afford to wait on hold. By giving dealers the power to access Michelin product information directly and immediately, Michelin saved money (maintaining a Web page is much less expensive than answering thousands of phone calls) and gave dealers better service. Dealers using BIB NET are much less likely to recommend a competitor's tires to their customers.

Because Internet technologies are tools that improve communications at a very low cost, they are ideal aids for enhancing the creation of a highly coordinated and effective supply chain. A number of polls and studies confirm that most information technology and purchasing managers believe that information technology is helping to improve their firms' relationships with suppliers and supply chain management initiatives.

Building and Maintaining Trust in the Supply Chain

The major issue that most companies must deal with in forming supply chain alliances is developing trust. Continual communication and information sharing are key elements in building trust. Because the Internet and the Web provide excellent ways to communicate and share information, they offer new avenues for building trust. Most procurement professionals have built trust on years of doing business with the same vendors. In many industries, vendors send sales representatives to call on buyers regularly. Vendors also participate actively in trade shows and conferences. By giving buyers frequent opportunities to interact with vendor representatives, vendors help build trust.

Vendors are finding that the Web gives them an opportunity to stay in contact with their customers more easily and less expensively. Although most buyers still see sales representatives regularly, e-mail and the Web give them nearly instant access to their sales representative and other vendor personnel. By providing comprehensive information at a moment's notice, vendors can build buyers' trust in the vendor's ability to deliver products and provide the personalized service that buyers need. Many supply chain management researchers are working on new ways to accumulate information about supplier performance and report that information to supply chain partners. This type of monitoring and reporting could help companies establish trust more quickly. Many issues, such as the objectivity and validity of performance measurements, must still be resolved before these information networks become generally accepted and used by the supply chain community. The task of developing information exchange resources that can provide supplier performance summaries is one of the great challenges that B2B electronic commerce faces as it moves into its second wave.

ELECTRONIC MARKETPLACES AND PORTALS

As the Web emerged in the mid-1990s, many business researchers and consultants believed that it would provide an opportunity for companies to establish information hubs for each major industry. These industry hubs would offer news, research reports, analyses of trends, and in-depth reports on companies in the industry—much as specialized industry trade magazines had provided in print format for years. In addition to information, these hubs would offer marketplaces and auctions in which companies in the industry could contact each other and transact business. Because these hubs would offer a doorway (or portal) to the Internet for industry members, and because these hubs would be vertically integrated (that is, each hub would offer services to just one industry), these planned enterprises were called **vertical portals**, or **vortals**. These are types of portals, which you learned about in Chapter 3.

As with many electronic commerce predictions, the prediction that vertical portals would change business forever did not turn out to be exactly correct. In this section, you will learn how B2B electronic marketplaces were conceived, developed, and operated as this sector of electronic commerce matured from 1997 through the present.

Independent Industry Marketplaces

The first companies to launch industry hubs that followed the vertical portal model created trading exchanges that were focused on a particular industry. These vertical portals became known by various names that highlighted different elements of their collective nature, including **industry marketplaces** (focused on a single industry), **independent exchanges** (not controlled by a company that was an established buyer or seller in the industry), or **public marketplaces** (open to new buyers and sellers just entering the industry). These portals are also known collectively as **independent industry marketplaces**. Ventro opened its first industry marketplace, Chemdex, in early 1997 to trade in bulk chemicals. To leverage the high investment it had made in trading exchange technology, Ventro followed Chemdex with other Web marketplaces, including Promedix in specialty medical supplies, Amphire Solutions in food service, MarketMile in general business

products and services, and a number of others. Other companies were quick to follow in Ventro's chosen markets and many others. **SciQuest** founded an industry marketplace in life science chemicals. The home page of **ChemConnect.com**, which is a surviving industry marketplace in the bulk chemicals market, appears in Figure 5-13.

FIGURE 5-13 ChemConnect home page

The number of new entrants into these businesses grew rapidly during the next two years. By mid-2000, there were more than 2200 independent exchanges in a wide variety of industries. For example, there were 200 exchanges operating in the metals industry alone (see Learning from Failures: MetalSite). As venture capital funding became scarce for companies that were not earning profits—and virtually all of these marketplaces were not earning profits—many of them closed. By 2002, there were fewer than 100 industry marketplaces still operating. Ventro, for example, has closed all of the dozens of marketplaces it had opened during the boom years. It simply did not make economic sense to have more

than one or two independent marketplaces in any particular industry. Some of the industry pioneers who closed their industry marketplace operations, such as Ventro, began selling the software and technology that they developed to run their marketplaces. Their new customers were operators of other B2B marketplace models that arose to take business away from the independent marketplaces. You will learn about four of these models—private stores, customer portals, private company marketplaces, and industry consortia-sponsored marketplaces—in the remainder of this section.

LEARNING FROM FAILURES

METALSITE

Although a number of small steel manufacturing plants (called minimills) have opened in the past 20 years, most of the world's steel is still produced in very large steel mills. In these steel mills, it is economical to produce steel only in large batches. Because of the high cost of reconfiguring machinery, a steel mill set up to create one type of steel (for example, rolled sheets) requires significant time and money to change over to produce another type of steel (for example, bar steel). To minimize these changeover costs, steel mills produce steel products in large batches to meet estimated demand rather than actual orders. Because production quantities are designed to meet estimated demand instead of actual demand, steel mills often have overproduction of some items.

Companies such as Bethlehem Steel, with annual revenues of more than $4 billion and 14,000 employees, solved this problem in the past by sending faxes to potential buyers of their excess production. Buyers would respond with a bid on the product in which they were interested, and Bethlehem would negotiate with them to determine price and delivery terms.

In 1998, MetalSite was one of the first metal trading exchanges to begin doing business on the Web. These exchanges offered manufacturers such as Bethlehem an efficient way to reach a larger market for their excess production. By mid-2000, there were more than 200 metal exchanges operating on the Web. These exchanges were following a reintermediation strategy; that is, they were entering the supply chain of the steel industry to provide some added value that had not existed in the supply chain before. However, most industry analysts agreed that there was no need for more than one or two exchanges in the steel industry. In 2001, metal trading exchange sites began to fail.

MetalSite had grown rapidly. With more than $35 million of investors' money, MetalSite was able to sign up 24,000 registered users and by mid-2001, was trading about $30 million worth of steel each month. However, its commissions of between 1 percent and 2 percent on each trade did not yield enough money to cover operating costs. The steel business was in a downturn along with the rest of the U.S. economy, and the downward pressure on commissions from competing exchanges was increasing rapidly. The major steel companies were discussing ways to form alliances to operate their own exchanges. After three years of operation and a desperate last-minute search for new investors, MetalSite closed in August 2001.

continued

MetalSite had entered a business that could not support more than a few companies, and it was unable to become one of the survivors. The lesson from MetalSite's experience is that a reintermediation strategy must add significant value to the supply chain, and the company pursuing that strategy must be able to construct significant barriers that competitors must overcome to enter the business. MetalSite was unable to do either and thus failed. Many other B2B exchange sites that found themselves in similar competitive situations have also failed.

Private Stores and Customer Portals

As established companies in various industries watched new businesses open marketplaces, they became concerned that these independent operators would take control of transactions from them in supply chains—control that the established companies had spent years developing. Large companies that sell to many relatively small customers can exert great power in negotiating price, quality, and delivery terms with those customers. These sellers feared that industry marketplaces would dilute that power.

Many of these large sellers had already invested heavily in Web sites that they believed would meet the needs of their customers better than any industry marketplace would. For example, Cisco and Dell offer private stores for each of their major customers within their selling Web sites. A **private store** has a password-protected entrance and offers negotiated price reductions on a limited selection of products—usually those that the customer has agreed to purchase in certain minimum quantities. Other companies, such as Grainger, provide additional services for customers on their selling Web sites. These **customer portal** sites offer private stores along with services such as part number cross-referencing, product usage guidelines, safety information, and other services that would be needlessly duplicated if the sellers were to participate in an industry marketplace.

Private Company Marketplaces

Similarly, large companies that purchase from relatively small vendors can exert similar power over those vendors in purchasing negotiations. The Procurement Departments of these companies can invest in procurement software from companies such as Ariba and CommerceOne (you will learn more about all types of electronic commerce software in Chapter 9). This software, generally referred to as **e-procurement software**, allows a company to manage its purchasing function through a Web interface. It automates many of the authorizations and other steps, described in Figure 5-1, that are part of business procurement operations. Although e-procurement software was originally designed to help manage the MRO procurement process, recent releases of this software have begun to include other marketplace functions, such as request for quote posting areas, auctions, and integrated support for purchasing direct materials. Most industry observers expect these features to be improved and expanded in future versions.

Companies that implement e-procurement software usually require their suppliers to bid on their business. For example, an office supplies provider would create a schedule of prices at which it would sell to the company. The company would then compare that pricing to bids from other suppliers. The selected supplier would provide product price and

description information to the company, which would insert that information into its e-procurement software. This permits authorized employees to order office supplies at the negotiated prices through a Web interface.

When industry marketplaces opened for business, these larger companies were reluctant to abandon their investments in e-procurement software or to make the software work with industry marketplaces' software—especially in the early years of industry marketplaces when there were many of them in each industry. These companies use their power in the supply chain to force suppliers to deal with them on their own terms rather than negotiate with suppliers in an industry marketplace.

As marketplace software became more reliable, many of these companies purchased software and technology consulting services from companies, such as Ventro and e-Steel, that had abandoned their industry marketplace businesses and were offering the software they had developed to companies that wanted to develop private marketplaces. A **private company marketplace** is a marketplace that provides auctions, request for quote postings, and other features (many of which are similar to those of e-procurement software) to companies that want to operate their own marketplaces. United Technologies, which annually sells more than $35 billion of high-technology products and services to the aerospace and building systems industries, was one of the first major companies to open a private company marketplace, launching its site in 1996. Since then, United Technologies has purchased more than $10 billion in goods through its private marketplace and estimates that it has saved more than $2 billion through lower prices and transaction cost savings on those purchases.

Industry Consortia-Sponsored Marketplaces

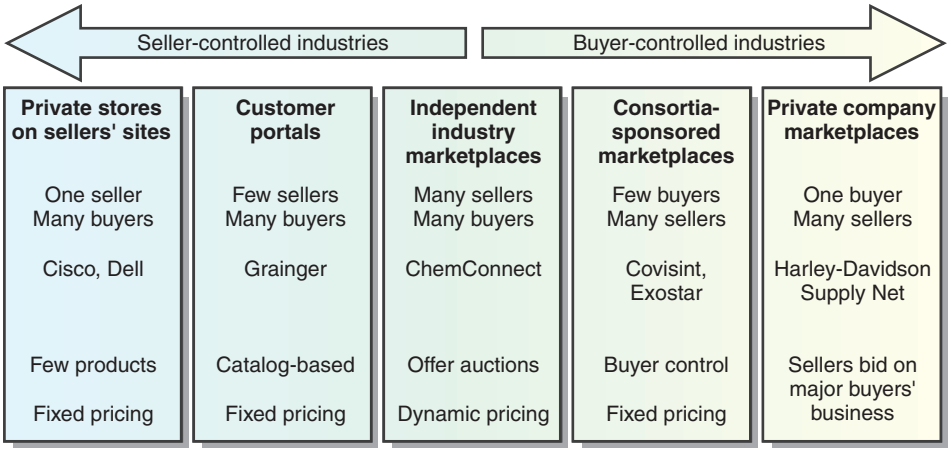
Some companies had relatively strong negotiating positions in their industry supply chains, but did not have enough power to force suppliers to deal with them through a private company marketplace. These companies began to form consortia to sponsor marketplaces. An **industry consortia-sponsored marketplace** is a marketplace formed by several large buyers in a particular industry.

One of the first such marketplaces was Covisint, which was created in 2000 by a consortium of DaimlerChrysler, Ford, and General Motors. Several thousand auto industry suppliers now belong to **Covisint**. In the hotel industry, Marriott, Hyatt, and three other major hotel chains formed a consortium to create the **Avendra** marketplace. Boeing led a group of companies in the aerospace industry to create the **Exostar** marketplace. In the consumer packaged goods industry, Procter & Gamble joined with Sara Lee, Coca Cola, and several other companies to launch the **Transora** marketplace.

These consortia-based marketplaces—along with private company marketplaces, private Web stores, and customer portals—have taken a large part of the market from the industry marketplaces that appeared to be so promising in the early days of B2B electronic commerce. One concern that suppliers have when using an industry marketplace is its ownership structure. For example, Covisint was created by a consortium of buyers in the auto industry. In 2004, the consortium decided to sell Covisint to an independent operator, Compuware, that had no ties to the founding companies. Covisint was sold, at least in part, to convince suppliers that the marketplace would not be operated to keep them at a bargaining disadvantage with the large buyers in that industry.

On the other hand, some marketplaces have found that including industry participants in their ownership is helpful. ChemConnect, the independant industry marketplace you learned about earlier in this chapter, sold ownership interests to about 40 companies in the chemicals industry.

Figure 5-14 summarizes the characteristics of five general forms of marketplaces that exist in B2B electronic commerce today. The information in the figure comes from several sources, but the structure of the figure is adapted from one presented by Warren Raisch, a Web marketplace consultant, in his book *The eMarketplace*.



Adapted from: Raisch, W. 2001. *The eMarketplace, p. 225.*

FIGURE 5-14 Characteristics of B2B marketplaces

Although the figure shows five distinct B2B marketplace categories, the lines between them are not always clear. For example, Dell has from time to time sold other companies' products on its private store site, which would make it more like a customer portal than a private store. As the B2B marketplace industry matures, it is unlikely that one type of marketplace will become dominant. Most B2B experts believe that a variety of marketplaces with the characteristics of these five general categories will continue to exist for some time.

Summary

In this chapter, you learned that companies are using Internet and Web technologies in a variety of ways to improve their purchasing and logistics primary activities. Businesses are also making similar improvements in a wide range of support activities such as human resources, accounting, and technology development. Companies and other large organizations, such as government agencies, are finding it more important than ever to extend the reach of their enterprise planning and control activities beyond their organizations' legal definitions to include parts of other organizations. This emerging network model of organization was introduced in Chapter 1 and is used in this chapter to describe the growth in interorganizational communications and coordination.

EDI, the first example of electronic commerce, was first developed by freight companies to reduce the paperwork burden of processing repetitive transactions. The spread of EDI to virtually all large companies over the past 30 years has led smaller businesses to seek an affordable way to participate in EDI. The Internet is now providing the inexpensive communications channel that EDI lacked for so many years and is allowing smaller companies to participate in Internet EDI.

The increase in communications capabilities offered by the Internet and the Web is, and will continue to be, an important force driving the adoption of supply chain management techniques in a variety of industries. Supply chain management incorporates several elements that can be implemented and enhanced through the use of the Internet and the Web. Increasingly, firms are connecting with their supply chain alliance partners and other companies, such as 3PL providers, to become more efficient and provide more value to the ultimate consumer of their value chains' products and services.

The emergence of industry electronic marketplaces in the mid-1990s gave way to the development of several different models for B2B electronic commerce, including private stores, customer portals, private marketplaces, and industry consortia-sponsored marketplaces. Today, all four of these models continue to coexist with the original industry marketplace model. Although industry consortia-sponsored marketplaces appear to be the most successful today, most B2B experts believe that all five models will continue to exist in one industry or another for the foreseeable future.

Key Terms

Accredited Standards Committee X12 (ASC X12)

American National Standards Institute (ANSI)

Automated clearing house (ACH)

Context Inspired Component Architecture (CICA)

Contract purchasing

Customer portal

Direct connection EDI

Direct materials

EDI-capable banks

EDI compatible

EDI for Administration, Commerce, and Transport (EDIFACT, or UN/EDIFACT)

E-government

E-procurement software

E-sourcing

Financial EDI (FEDI)

Financial VANs (FVANs)

Independent exchange

Independent industry marketplace
Indirect connection EDI
Indirect materials
Industry consortia-sponsored marketplace
Industry marketplace
Internet EDI
Knowledge management
Maintenance, repair, and operating (MRO)
Nonrepudiation
Open EDI
Private company marketplace
Private store
Public marketplace
Purchasing card (p-card)
Radio frequency identification device (RFID)
Replenishment purchasing
Sourcing
Spend
Spot market
Spot purchasing
Supply alliances
Supply chain
Supply chain management
Supply web
Third-party logistics (3PL) provider
Tier one suppliers
Tier three suppliers
Tier two suppliers
Transaction sets
Ultimate consumer orientation
Value-added banks (VABs)
Vertical portal (vortal)
Web EDI

Review Questions

RQ1. Define "direct materials" and "indirect materials." List reasons for a large company having two separate departments to manage the purchasing of each.

RQ2. Which industries were the first to establish standard EDI transaction sets? In about 100 words, state why, in your opinion, these industries were more interested in setting standards than other industries.

RQ3. Define "knowledge management." In one paragraph, describe three advantages that a management consulting firm could gain over its competitors by creating an internal knowledge management system.

RQ4. Companies in a particular supply chain can work together to eliminate costs from the supply chain. In many cases, these cost savings are not shared evenly among the companies in the supply chain. Using research resources on the Web or in your library, identify an industry in which savings are not shared equally. In two or three paragraphs, explain why some supply chain participants in your chosen industry can obtain more benefit than others from cost reductions in the supply chain.

RQ5. In about 300 words, describe the reasons a buyer might have for wanting to participate in an industry consortium marketplace instead of setting up its own private company marketplace.

Exercises

E1. Use the **Thomas Register of American Manufacturers** Web site (Note: free registration is required to access this site) to locate an industrial product with which you are completely unfamiliar. Note how many companies offer that product, have catalogs or Web sites, offer online ordering, and offer literature by fax. Summarize what you learn about the product and its availability on the Web in a report of approximately 400 words.

Note: Your instructor might ask you to prepare a formal presentation of your findings in class.

E2. You work for Andrew Wheeler, who is the president of Fabro-Max, a small plastic parts fabricator. He wants you to look into improving customer interactions through Internet EDI. You know that a number of companies that provide VAN services for companies engaging in EDI, such as **Descartes VAN Services**, **EC/EDI**, **GPAS**, **IBM Global Services**, and **Kleinschmidt**, also offer Internet EDI services. Some of these VAN operators are targeting smaller businesses that, in the past, would not have been able to afford to implement EDI. Choose two VAN providers from this list, or that you find on the Web, and examine their Web sites. For the two VAN providers that you choose, determine whether they are offering Internet EDI services. Also decide whether, in your opinion, their Web sites are targeting smaller businesses such as Andrew's. In a memo to Andrew of approximately 150 words, summarize your findings for the two VAN providers you chose.

E3. A number of standard-setting organizations offer memberships to business firms. You are working for Grace Henry, chief information officer (CIO) of Flex-Electric, a medium-size company that manufactures components for electronic medical and laboratory instruments. Grace asks you to investigate the benefits of joining an industry standard-setting organization, **RosettaNet**. Prepare a memo to Grace in which you outline the purposes of the organization and the costs and benefits of becoming a member. Close your memo with a recommendation regarding whether your company should join the organization.

Cases

C1. Harley-Davidson

Harley-Davidson manufactures high-end motorcycles and sells them worldwide. The company sells more than $4 billion in motorcycles and related products each year, and has one of the most recognized brands in the world. However, business was not always so good for the company. In the 1980s, the company was on the brink of bankruptcy. Facing increasing competition from Japanese and German manufacturers, Harley-Davidson had allowed its quality standards and cost controls to slip. In a legendary business turnaround, the company rebuilt itself. Harley-Davidson completely changed its supply chain to fulfill the expectations of its brand-aware customers.

Over a period of several years, Harley-Davidson reduced its number of suppliers from 4000 to fewer than 350. More importantly, it began to work with those suppliers to reduce costs throughout the supply chain. Each supplier is expected to find ways (with the help and cooperation of Harley-Davidson) to reduce manufacturing costs and improve quality every year. This was the only way Harley-Davidson believed it could avoid moving its factories to lower cost locations in other countries. The efforts paid off and the company still manufactures its motorcycles only in the United States.

In 2000, the company decided to focus its cost reduction and quality improvement efforts on its information technology infrastructure. Since it had been so successful in working with its suppliers to reduce manufacturing costs and improve quality, Harley-Davidson wanted to do the same thing with information technology. By using Internet technologies to share information throughout the supply chain, the company hoped to find opportunities for efficiencies and cost reductions at all stages of the process of creating motorcycles.

When the company first talked with its suppliers about its information technology initiative, those suppliers noted that each of Harley-Davidson's main factories used different invoices, production schedules, and purchasing procedures. The suppliers explained that this created difficulties for them when they dealt with more than one factory and increased their cost of doing business with Harley-Davidson. Thus, one of the first things the company did was to standardize forms and procedures. Then it moved to require all suppliers to use EDI. For smaller suppliers, the company set up a Web site that had Internet EDI capabilities. The smaller suppliers could simply log in to the Web site and conduct EDI transactions through their Web browsers.

This Web browser interface grew to become a complete extranet portal called **Harley-Davidson Supply Net**. All suppliers now use the portal to consolidate orders, track production schedule changes, obtain inventory forecasts in real time, and obtain payments for materials shipped. The portal also allows suppliers to obtain product testing information, part specifications, and product design drawings.

Key elements in both EDI and the Web portal systems have been bar codes and scanners. Most individual parts and all shipments are bar coded. The bar-code information is integrated with the materials tracking, invoicing, and payment information in the systems and is made available, as appropriate, to suppliers. Harley-Davidson uses bar-code standards developed by the **Automotive Industry Action Group**.

Required:

1. Become familiar with RFID technology and its potential uses in Harley-Davidson's supply chain using the information presented in this chapter and information you obtain through the Online Companion links, your favorite search engine, and your library. In about 400 words, evaluate the advantages and disadvantages for Harley-Davidson of replacing its bar codes and scanners technology with RFID.
2. Develop and present a timetable for adoption of RFID technology with specific recommendations on where it should be implemented first. Justify the time delays you propose in the adoption of RFID at each stage of the supply chain.

Note: Your instructor might assign you to a group to complete this case, and might ask you to prepare a formal presentation of your results to your class.

C2. American Packaging Machinery

American Packaging Machinery (APM) is a company that provides repair and maintenance services to companies that operate large packaging systems. Packaging systems are arrangements of machinery that place items in containers such as boxes or bags and apply plastic shrink wrap to the containers. These machines must be adjusted regularly, and they have hundreds of parts that can wear out or fail. APM offers service contracts on most major packaging systems. A typical service contract provides for an APM technician to make regular visits to the customer site to perform preventive maintenance. The service contract also includes a certain number of

emergency repair visits per year. APM also sends technicians to perform repairs for companies that do not have service contracts.

APM technicians are paid by the hour, with additional pay for overtime hours and time they work outside of standard working hours, such as weekends and holidays. APM technicians are members of a labor union, the International Brotherhood of Electrical Workers (IBEW), which negotiates pay rates and working conditions for the technicians. APM subtracts union dues from each technician's weekly paycheck and submits the total dues collected each week to the IBEW regional office. The union contract currently provides that APM technicians are covered by a medical insurance plan underwritten by the Prudential Trust Insurance Company. Although APM pays most of the insurance premium, technicians do pay a part of the premium cost. This contribution to the premium is withheld from their paychecks each week.

You are the director of electronic commerce for APM and you report to Laura Adams, APM's chief information officer. Laura asks for your help in outlining a new automated system she wants to install, which would use EDI and EFTs to handle APM's technician payroll and related transactions. She has provided the following narrative that describes how the system will work:

1. Technicians will record their time worked by entering the start and stop times for each job into a program that runs on their handheld computers (the technicians already use these handheld computers to look up wiring and mechanical diagrams for the machinery on which they work and to receive their job assignments). The time worked information will be transmitted from the handheld computer to APM's Payroll Department.
2. The Payroll Department will summarize the time worked information and send it to supervisors' desktop computers. Each supervisor will indicate an authorization for each technician's time worked, overtime, and holiday/weekend hours. That authorization will be returned by the system each day to the Payroll Department.
3. The Payroll Department will summarize the time worked information each week and calculate gross pay, deductions, and net pay for each employee. The deductions include the federal and state taxes that must be withheld by law, the contribution to the medical insurance premium, and the union dues that are withheld under the IBEW union contract.
4. The Payroll Department will send an electronic summary of the payroll information, including deductions, to the Accounting Department, which will prepare payroll tax returns and make the necessary entries in the APM accounting system to record payroll and the related tax expenses.
5. The Payroll Department will send electronic authorizations to APM's bank to make the necessary EFTs to deposit: the amount of each technician's net pay to that technician's bank account; the amount of each tax withheld to the account of the appropriate government agency; the amount of the total contributions to the medical insurance premium to the insurance company's account; and the amount of the union dues withheld to the IBEW's account. Most of these accounts are at other banks.
6. The Payroll Department will send electronic notifications to Prudential Trust and the IBEW regional office, notifying them of the transferred amounts each week.

7. The Payroll Department will send an electronic summary of the hours worked by each technician and the amount of gross pay, including overtime and holiday/weekend pay, to the APM union steward's desktop computer. The union steward is an APM technician who is elected by the technicians to monitor the terms of the union contract and handle any grievances that arise between the technicians and APM management.

Required:

1. Draw a diagram of the proposed payroll EDI and EFT system (you can use Figure 5-7 as a guide).
2. List and briefly describe any problems or issues that you think might arise in the implementation of this system.
3. Provide a rationale and recommendation as to which, if any, elements of this system you think APM should hire an outside company to implement.

Note: Your instructor might assign you to a group to complete this case, and might ask you to prepare a formal presentation of your results to your class.

For Further Study and Research

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