PART THREE

Key System Applications for the Digital Age

Chapter 9
Achieving Operational Excellence and Customer Intimacy: Enterprise Applications

Chapter 10
E-Commerce: Digital Markets, Digital Goods

Chapter 11
Managing Knowledge

Chapter 12
Enhancing Decision Making

Part Three examines the core information system applications businesses are using today to improve operational excellence and decision making. These applications include enterprise systems; systems for supply chain management, customer relationship management, and knowledge management; e-commerce applications; and business-intelligence systems. This part answers questions such as: How can enterprise applications improve business performance? How do firms use e-commerce to extend the reach of their businesses? How can systems improve decision making and help companies make better use of their knowledge assets?

Achieving Operational Excellence and Customer Intimacy: Enterprise Applications

CHAPTER 9

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. How do enterprise systems help businesses achieve operational excellence?
2. How do supply chain management systems coordinate planning, production, and logistics with suppliers?
3. How do customer relationship management systems help firms achieve customer intimacy?
4. What are the challenges posed by enterprise applications and how are enterprise applications taking advantage of new technologies?

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CHAPTER CASES

Statoil Fuel and Retail Competes Using Enterprise Systems
DP World Takes Port Management to the Next Level with RFID
Customer Relationship Management Heads to the Cloud
WIM Industries: From MRP to ERP

VIDEO CASES

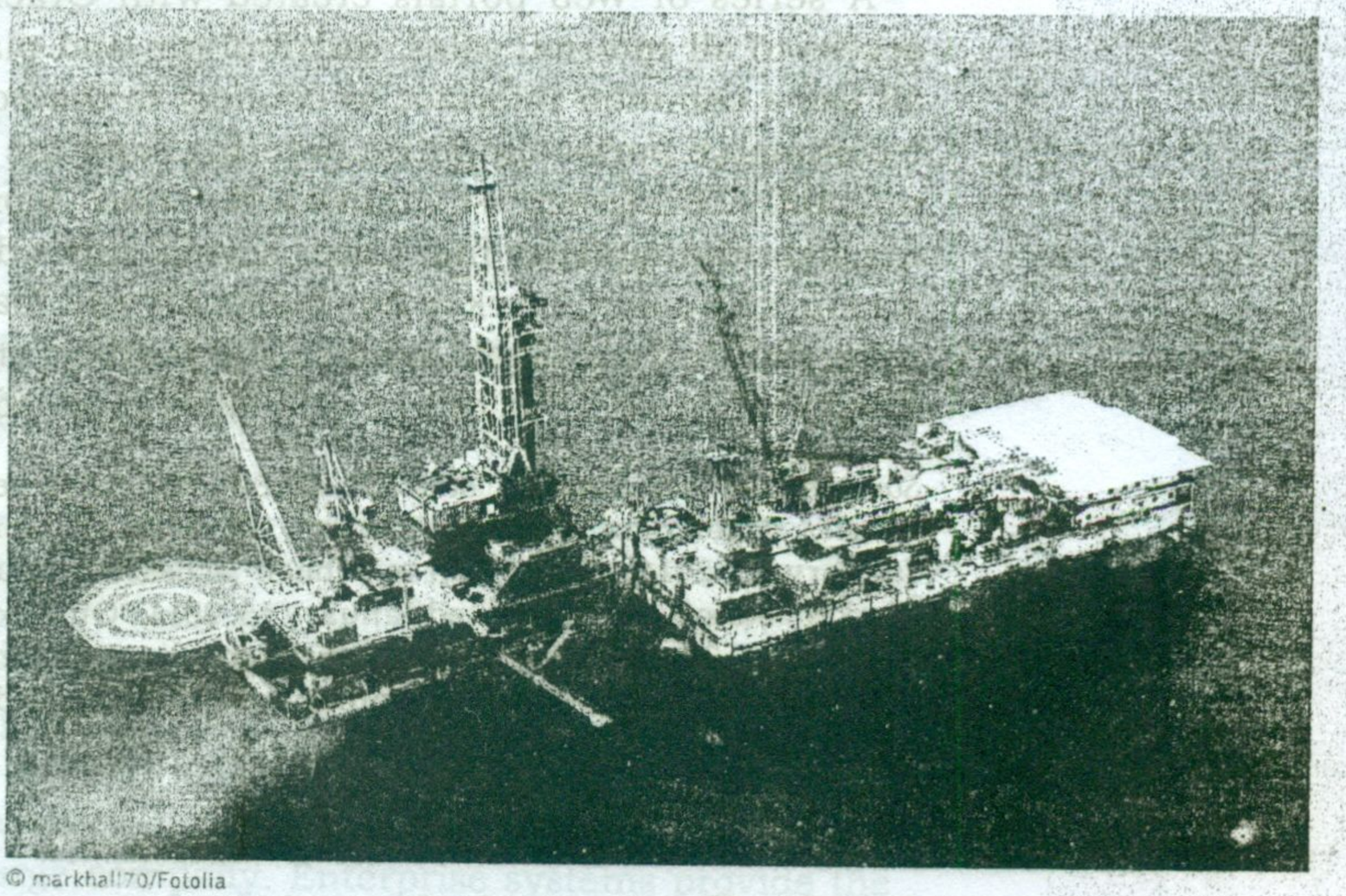
Workday: Enterprise Cloud Software-as-a-Service (SaaS)
Evolution Homecare Manages Patients with Microsoft Dynamics CRM
Instructional Video:
GSMS Protects Patients By Serializing Every Bottle of Drugs

STATOIL FUEL AND RETAIL COMPETES USING ENTERPRISE SYSTEMS

When Alimentation Couche-Tard purchased Statoil Fuel and Retail (SFR) in April 2012, it was the Canadian convenience store giant's most ambitious acquisition to date (€2.058 billion). SFR, a division of Statoil, the Norwegian State Oil Company, had been spun off from its parent in October 2010. The purchase added 2,300 retail fuel stations—most full-service with a convenience store—to its over 6,200 stores throughout North America and expanded Couche-Tard's reach to eight European countries—Norway, Sweden, Denmark, Poland, Estonia, Latvia, Lithuania, and Russia.

SFR operates in both the B2C (sales to consumers) and B2B (sales to other businesses) sectors. Fuel products including gasoline blends, diesel fuels, biofuels, and LPG (liquefied petroleum gas) generate 70 percent of its business. The full-service retail stations offer product lines that differ according to operator and location factors. Some prefer a product mix that concentrates on auto supplies and services while others focus on food-related products, beverages, and even fast-food. SFR's 12 terminals, 38 depots, and 400 road tankers provide bulk sales to commercial customers, including bus and car rental companies, road construction crews, and independent resellers. In addition, SFR sells stationary energy, marine fuel, more than 750 lubricants, and various chemicals, and it delivers aviation fuel to 85 airports in ten countries.

Couche-Tard welcomed both the opportunities and the challenges of its acquisition. While its increased size and global presence could be leveraged to exact cost savings from suppliers, retail fuel stations always operate on slim margins, necessitating continual cost savings efforts. Immediate synergies between Couche-Tard and SFR could not completely cover the remaining expenses from SFR's split from Statoil, rebranding efforts, and the replacement



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of an antiquated IT infrastructure and enterprise resource planning (ERP) system. The old system used different processes in each country and market, resulting in over 5,000 custom software objects for the IT department to manage and massive operational inefficiencies.

SFR needed to maximize supply chain efficiency for its three closely related value chains—the fuel value chain, the grocery value chain, and the lubricants value chain. All corporate functions that provided shared services to the value chains had to be standardized and workplace activities coordinated for its 18,500 employees. Finally, SFR managers wanted an advanced pricing method for fuel sales to maximize profits in its core low-margin business.

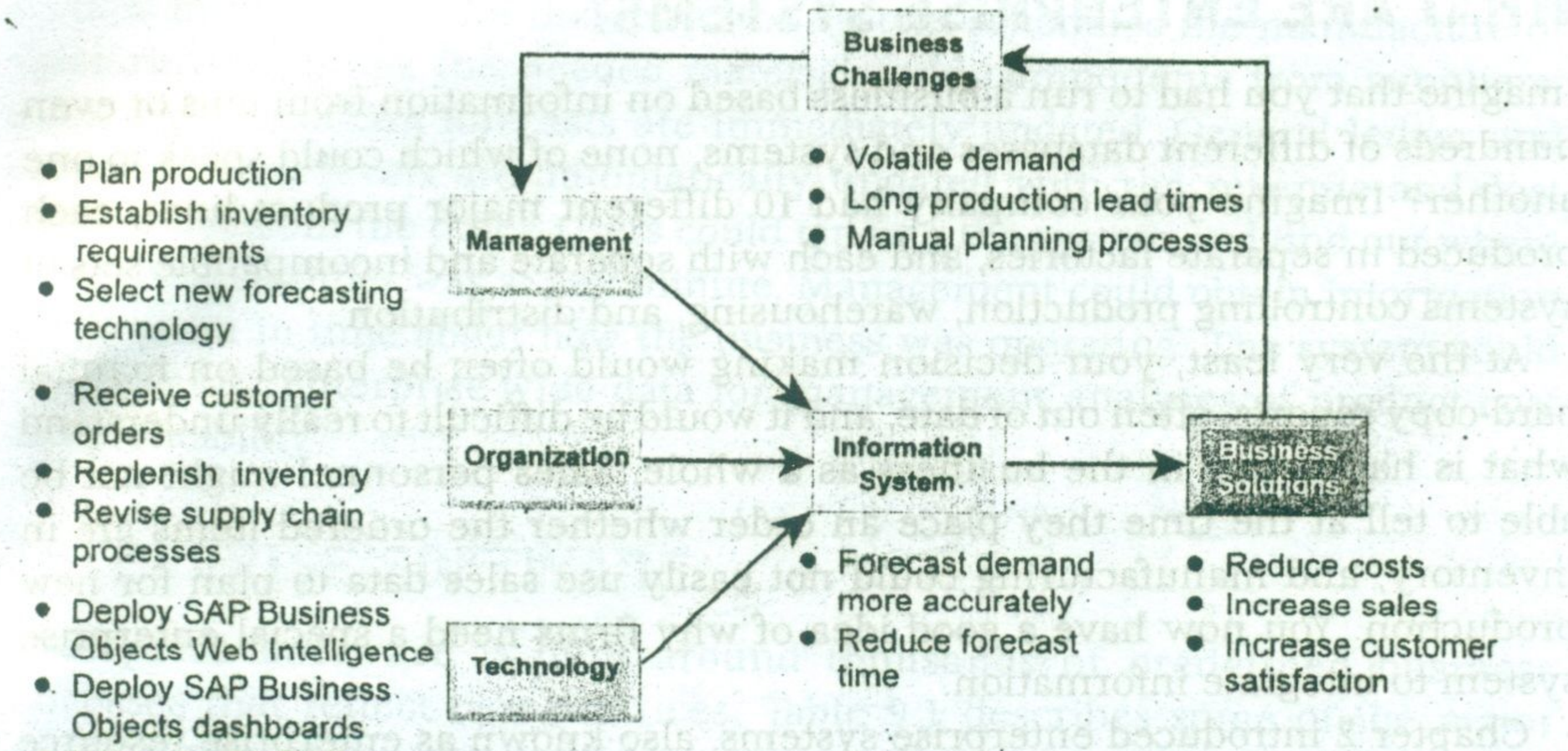
Oracle's JD Edwards EnterpriseOne enterprise resource planning system was chosen as the basic platform, and a Web services interface was developed within the ERP system to convert all data into a single format. Replacing numerous separate legacy systems with a single ERP forces managers to develop common data definitions. This common source of master data now drives all transactions throughout the supply chains, as well as financial and other reports generated by the Oracle Business Intelligence Suite. Stock availability and average sales at each service station feed a real-time planning program that projects expected demand and feeds the data to a third-party distribution planning system. Onboard computers convey product types and quantities to tanker drivers at terminals and delivery locations. Fuel restocking, delivery, and confirmation occur automatically. Supplies are quickly transferred from depots or between stations to meet fluctuating demand. With the value chains optimized, inventory holding costs are minimized.

To coordinate workplace activities, Oracle Fusion Middleware integrates data management and communication across social, mobile, and cloud technologies and among multiple systems and regions. Called the "Connect Project," the software coordinates dozens of interfaces throughout the supply chain, implements a consistent fuel pricing structure, and manages multiple complicated excise taxes and regulations. The project was implemented in Sweden in June and in Denmark and Norway in October 2013. Scandinavia accounts for over 80 percent of SFR's revenue. Rollout is expected to be complete in 2014.

A series of Web portals created with Oracle WebCenter Portal provide access to all internal sales, distribution, and planning systems. Fuel stations all use a common interface to connect to the point-of-sale system, and a new e-commerce portal simplifies ordering from the depots and is expected to significantly strengthen e-commerce revenue. A proprietary demand-based pricing algorithm updates fuel prices several times daily based on nearby competitors in each micro-market. For managers and marketing personnel, this means most and least profitable stations and markets are identified and incentive and discounting initiatives can be accurately targeted.

Sources: "Our Operations," statoilfuelretail.com, accessed January 15, 2014; "Statoil Fuel & Retail," statoil.com, accessed January 15, 2014; "History," statoilfuelretail.com, accessed January 15, 2014; "From Well to Wheel," accessed January 15, 2014; "The Fuel and Retail Market," statoil.com, accessed January 15, 2014; "Our Company," couche-tard.com, accessed January 15, 2014; "2013 Annual Report," couche-tard.com, accessed January 15, 2014; David Baum, "Statoil Fuel & Retail Automates Planning and Distribution Operations in Eight Countries," oracle.com, November 2013.

Statoil's efforts to standardize and integrate corporate functions into the supply chain and coordinate workplace activity illustrate the impact of ERP systems on supply chain management (SCM). SFR did not have a single source of business



data nor uniform methods for handling many critical SCM functions. Inventory holding costs were unnecessarily high, the IT department was strained, and lack of coordination was negatively impacting workplace productivity.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. All transactions throughout SFR's supply chains are now in a common and consistent format that feeds directly into SFR's reporting software. The integrated ERP environment enables real-time planning based on stock availability and average sales at each service station, and a real-time fuel value chain can now accommodate variable demand from both consumer and business customers.

Benchmarks against which to assess future results by country, terminal, or market are being developed using the advanced pricing method developed by the Connect team. On the B2B side, managers will be able to quickly assess the effects of pricing structures and even sales reps will be able to evaluate the effects of purchasing terms.

Here are some questions to think about: How did SFR's lack of standardized processes affect its business operations? How were SFR's employees and supply chain management affected by the adoption of standardized interfaces? Why did SFR retain its legacy systems instead of replacing them entirely?

9.1 How Do Enterprise Systems Help Businesses Achieve Operational Excellence?

Around the globe, companies are increasingly becoming more connected, both internally and with other companies. If you run a business, you'll want to be able to react instantaneously when a customer places a large order or when a shipment from a supplier is delayed. You may also want to know the impact of these events on every part of the business and how the business is performing at any point in time, especially if you're running a large company. Enterprise systems provide the integration to make this possible. Let's look at how they work and what they can do for the firm.

WHAT ARE ENTERPRISE SYSTEMS?

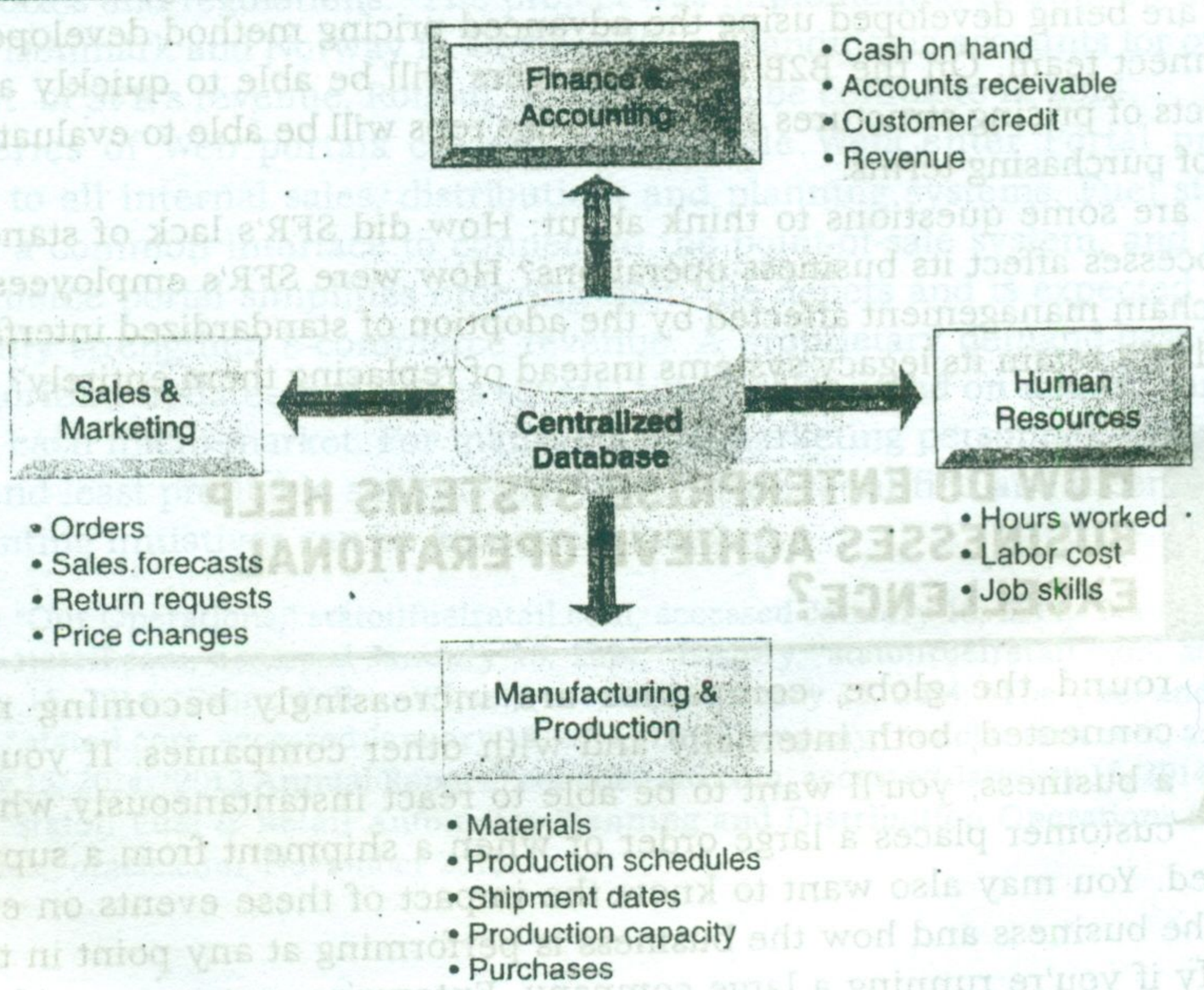
Imagine that you had to run a business based on information from tens or even hundreds of different databases and systems, none of which could speak to one another? Imagine your company had 10 different major product lines, each produced in separate factories, and each with separate and incompatible sets of systems controlling production, warehousing, and distribution.

At the very least, your decision making would often be based on manual hard-copy reports, often out of date, and it would be difficult to really understand what is happening in the business as a whole. Sales personnel might not be able to tell at the time they place an order whether the ordered items are in inventory, and manufacturing could not easily use sales data to plan for new production. You now have a good idea of why firms need a special enterprise system to integrate information.

Chapter 2 introduced enterprise systems, also known as enterprise resource planning (ERP) systems, which are based on a suite of integrated software modules and a common central database. The database collects data from many different divisions and departments in a firm, and from a large number of key business processes in manufacturing and production, finance and accounting, sales and marketing, and human resources, making the data available for applications that support nearly all of an organization's internal business activities. When new information is entered by one process, the information is made immediately available to other business processes (see Figure 9.1).

If a sales representative places an order for tire rims, for example, the system verifies the customer's credit limit, schedules the shipment, identifies the best shipping route, and reserves the necessary items from inventory. If inventory

FIGURE 9.1 HOW ENTERPRISE SYSTEMS WORK



Enterprise systems feature a set of integrated software modules and a central database that enables data to be shared by many different business processes and functional areas throughout the enterprise.

stock is insufficient to fill the order, the system schedules the manufacture of more rims, ordering the needed materials and components from suppliers. Sales and production forecasts are immediately updated. General ledger and corporate cash levels are automatically updated with the revenue and cost information from the order. Users could tap into the system and find out where that particular order was at any minute. Management could obtain information at any point in time about how the business was operating. The system could also generate enterprise-wide data for management analyses of product cost and profitability.

ENTERPRISE SOFTWARE

Enterprise software is built around thousands of predefined business processes that reflect best practices. Table 9.1 describes some of the major business processes supported by enterprise software.

Companies implementing this software would have to first select the functions of the system they wished to use and then map their business processes to the predefined business processes in the software. (One of our Learning Tracks shows how SAP enterprise software handles the procurement process for a new piece of equipment.) A firm would use configuration tables provided by the software manufacturer to tailor a particular aspect of the system to the way it does business. For example, the firm could use these tables to select whether it wants to track revenue by product line, geographical unit, or distribution channel.

If the enterprise software does not support the way the organization does business, companies can rewrite some of the software to support the way their business processes work. However, enterprise software is unusually complex, and extensive customization may degrade system performance, compromising the information and process integration that are the main benefits of the system. If companies want to reap the maximum benefits from enterprise software, they must change the way they work to conform to the business processes defined by the software.

To implement a new enterprise system, Tasty Baking Company identified its existing business processes and then translated them into the business processes built into the SAP ERP software it had selected. To ensure it obtained the maximum benefits from the enterprise software, Tasty Baking Company deliberately planned for customizing less than 5 percent of the system and made very few changes to the SAP software itself. It used as many tools and

TABLE 9.1 BUSINESS PROCESSES SUPPORTED BY ENTERPRISE SYSTEMS

Financial and accounting processes, including general ledger, accounts payable, accounts receivable, fixed assets, cash management and forecasting, product-cost accounting, cost-center accounting, asset accounting, tax accounting, credit management, and financial reporting
Human resources processes, including personnel administration, time accounting, payroll, personnel planning and development, benefits accounting, applicant tracking, time management, compensation, workforce planning, performance management, and travel expense reporting.
Manufacturing and production processes, including procurement, inventory management, purchasing, shipping, production planning, production scheduling, material requirements planning, quality control, distribution, transportation execution, and plant and equipment maintenance.
Sales and marketing processes, including order processing, quotations, contracts, product configuration, pricing, billing, credit checking, incentive and commission management, and sales planning.

features that were already built into the SAP software as it could. SAP has more than 3,000 configuration tables for its enterprise software.

Leading enterprise software vendors include SAP, Oracle, IBM, Infor Global Solutions, and Microsoft. There are versions of enterprise software packages designed for small and medium-sized businesses and on-demand versions, including software services running in the cloud (see Section 9.4).

BUSINESS VALUE OF ENTERPRISE SYSTEMS

Enterprise systems provide value both by increasing operational efficiency and by providing firmwide information to help managers make better decisions. Large companies with many operating units in different locations have used enterprise systems to enforce standard practices and data so that everyone does business the same way worldwide.

Coca-Cola, for instance, implemented a SAP enterprise system to standardize and coordinate important business processes in 200 countries. Lack of standard, company-wide business processes prevented the company from leveraging its worldwide buying power to obtain lower prices for raw materials and from reacting rapidly to market changes.

Enterprise systems help firms respond rapidly to customer requests for information or products. Because the system integrates order, manufacturing, and delivery data, manufacturing is better informed about producing only what customers have ordered, procuring exactly the right amount of components or raw materials to fill actual orders, staging production, and minimizing the time that components or finished products are in inventory.

Alcoa, the world's leading producer of aluminum and aluminum products with operations spanning 31 countries and over 200 locations, had initially been organized around lines of business, each of which had its own set of information systems. Many of these systems were redundant and inefficient. Alcoa's costs for executing requisition-to-pay and financial processes were much higher and its cycle times were longer than those of other companies in its industry. (Cycle time refers to the total elapsed time from the beginning to the end of a process.) The company could not operate as a single worldwide entity.

After implementing enterprise software from Oracle, Alcoa eliminated many redundant processes and systems. The enterprise system helped Alcoa reduce requisition-to-pay cycle time by verifying receipt of goods and automatically generating receipts for payment. Alcoa's accounts payable transaction processing dropped 89 percent. Alcoa was able to centralize financial and procurement activities, which helped the company reduce nearly 20 percent of its worldwide costs.

Enterprise systems provide much valuable information for improving management decision making. Corporate headquarters has access to up-to-the-minute data on sales, inventory, and production, and uses this information to create more accurate sales and production forecasts. Enterprise software includes analytical tools for using data captured by the system to evaluate overall organizational performance. Enterprise system data have common standardized definitions and formats that are accepted by the entire organization. Performance figures mean the same thing across the company. Enterprise systems allow senior management to easily find out at any moment how a particular organizational unit is performing, determine which products are most or least profitable, and calculate costs for the company as a whole.

For example, Alcoa's enterprise system includes functionality for global human resources management that shows correlations between investment in

employee training and quality, measures the company-wide costs of delivering services to employees, and measures the effectiveness of employee recruitment, compensation, and training..

9.2 How do supply chain management systems coordinate planning, production, and logistics with suppliers?

If you manage a small firm that makes a few products or sells a few services, chances are you will have a small number of suppliers. You could coordinate your supplier orders and deliveries using a telephone and fax machine. But if you manage a firm that produces more complex products and services, then you will have hundreds of suppliers, and each of your suppliers will have its own set of suppliers. Suddenly, you are in a situation where you will need to coordinate the activities of hundreds or even thousands of other firms in order to produce your products and services. Supply chain management (SCM) systems, which we introduced in Chapter 2, are an answer to the problems of supply chain complexity and scale.

THE SUPPLY CHAIN

A firm's **supply chain** is a network of organizations and business processes for procuring raw materials, transforming these materials into intermediate and finished products, and distributing the finished products to customers. It links suppliers, manufacturing plants, distribution centers, retail outlets, and customers to supply goods and services from source through consumption. Materials, information, and payments flow through the supply chain in both directions.

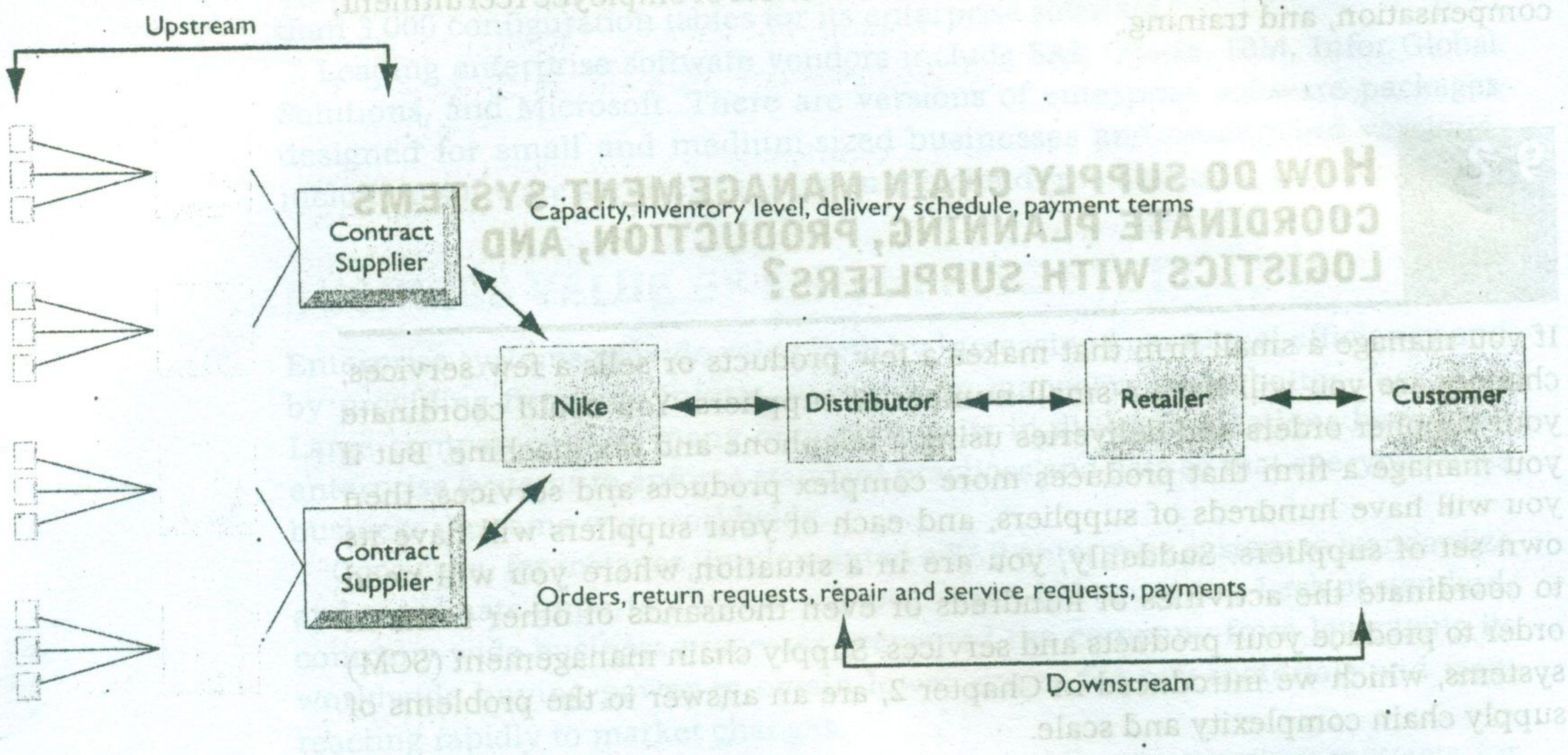
Goods start out as raw materials and, as they move through the supply chain, are transformed into intermediate products (also referred to as components or parts), and finally, into finished products. The finished products are shipped to distribution centers and from there to retailers and customers. Returned items flow in the reverse direction from the buyer back to the seller.

Let's look at the supply chain for Nike sneakers as an example. Nike designs, markets, and sells sneakers, socks, athletic clothing, and accessories throughout the world. Its primary suppliers are contract manufacturers with factories in China, Thailand, Indonesia, Brazil, and other countries. These companies fashion Nike's finished products.

Nike's contract suppliers do not manufacture sneakers from scratch. They obtain components for the sneakers—the laces, eyelets, uppers, and soles—from other suppliers and then assemble them into finished sneakers. These suppliers in turn have their own suppliers. For example, the suppliers of soles have suppliers for synthetic rubber, suppliers for chemicals used to melt the rubber for molding, and suppliers for the molds into which to pour the rubber. Suppliers of laces have suppliers for their thread, for dyes, and for the plastic lace tips.

Figure 9.2 provides a simplified illustration of Nike's supply chain for sneakers; it shows the flow of information and materials among suppliers, Nike, Nike's distributors, retailers, and customers. Nike's contract manufacturers are its primary suppliers. The suppliers of soles, eyelets, uppers, and laces are the secondary (Tier 2) suppliers. Suppliers to these suppliers are the tertiary (Tier 3) suppliers.

FIGURE 9.2 NIKE'S SUPPLY CHAIN



This figure illustrates the major entities in Nike's supply chain and the flow of information upstream and downstream to coordinate the activities involved in buying, making, and moving a product. Shown here is a simplified supply chain, with the upstream portion focusing only on the suppliers for sneakers and sneaker soles.

The *upstream* portion of the supply chain includes the company's suppliers, the suppliers' suppliers, and the processes for managing relationships with them. The *downstream* portion consists of the organizations and processes for distributing and delivering products to the final customers. Companies doing manufacturing, such as Nike's contract suppliers of sneakers, also manage their own *internal supply chain processes* for transforming materials, components, and services furnished by their suppliers into finished products or intermediate products (components or parts) for their customers and for managing materials and inventory.

The supply chain illustrated in Figure 9.2 has been simplified. It only shows two contract manufacturers for sneakers and only the upstream supply chain for sneaker soles. Nike has hundreds of contract manufacturers turning out finished sneakers, socks, and athletic clothing, each with its own set of suppliers. The upstream portion of Nike's supply chain would actually comprise thousands of entities. Nike also has numerous distributors and many thousands of retail stores where its shoes are sold, so the downstream portion of its supply chain is also large and complex.

INFORMATION SYSTEMS AND SUPPLY CHAIN MANAGEMENT

Inefficiencies in the supply chain, such as parts shortages, underutilized plant capacity, excessive finished goods inventory, or high transportation costs, are caused by inaccurate or untimely information. For example, manufacturers

may keep too many parts in inventory because they do not know exactly when they will receive their next shipments from their suppliers. Suppliers may order too few raw materials because they do not have precise information on demand. These supply chain inefficiencies waste as much as 25 percent of a company's operating costs.

If a manufacturer had perfect information about exactly how many units of product customers wanted, when they wanted them, and when they could be produced, it would be possible to implement a highly efficient **just-in-time strategy**. Components would arrive exactly at the moment they were needed and finished goods would be shipped as they left the assembly line.

In a supply chain, however, uncertainties arise because many events cannot be foreseen—uncertain product demand, late shipments from suppliers, defective parts or raw materials, or production process breakdowns. To satisfy customers, manufacturers often deal with such uncertainties and unforeseen events by keeping more material or products in inventory than what they think they may actually need. The *safety stock* acts as a buffer for the lack of flexibility in the supply chain. Although excess inventory is expensive, low fill rates are also costly because business may be lost from canceled orders.

One recurring problem in supply chain management is the **bullwhip effect**, in which information about the demand for a product gets distorted as it passes from one entity to the next across the supply chain. A slight rise in demand for an item might cause different members in the supply chain—distributors, manufacturers, suppliers, secondary suppliers (suppliers' suppliers), and tertiary suppliers (suppliers' suppliers' suppliers)—to stockpile inventory so each has enough "just in case." These changes ripple throughout the supply chain, magnifying what started out as a small change from planned orders, creating excess inventory, production, warehousing, and shipping costs (see Figure 9.3).

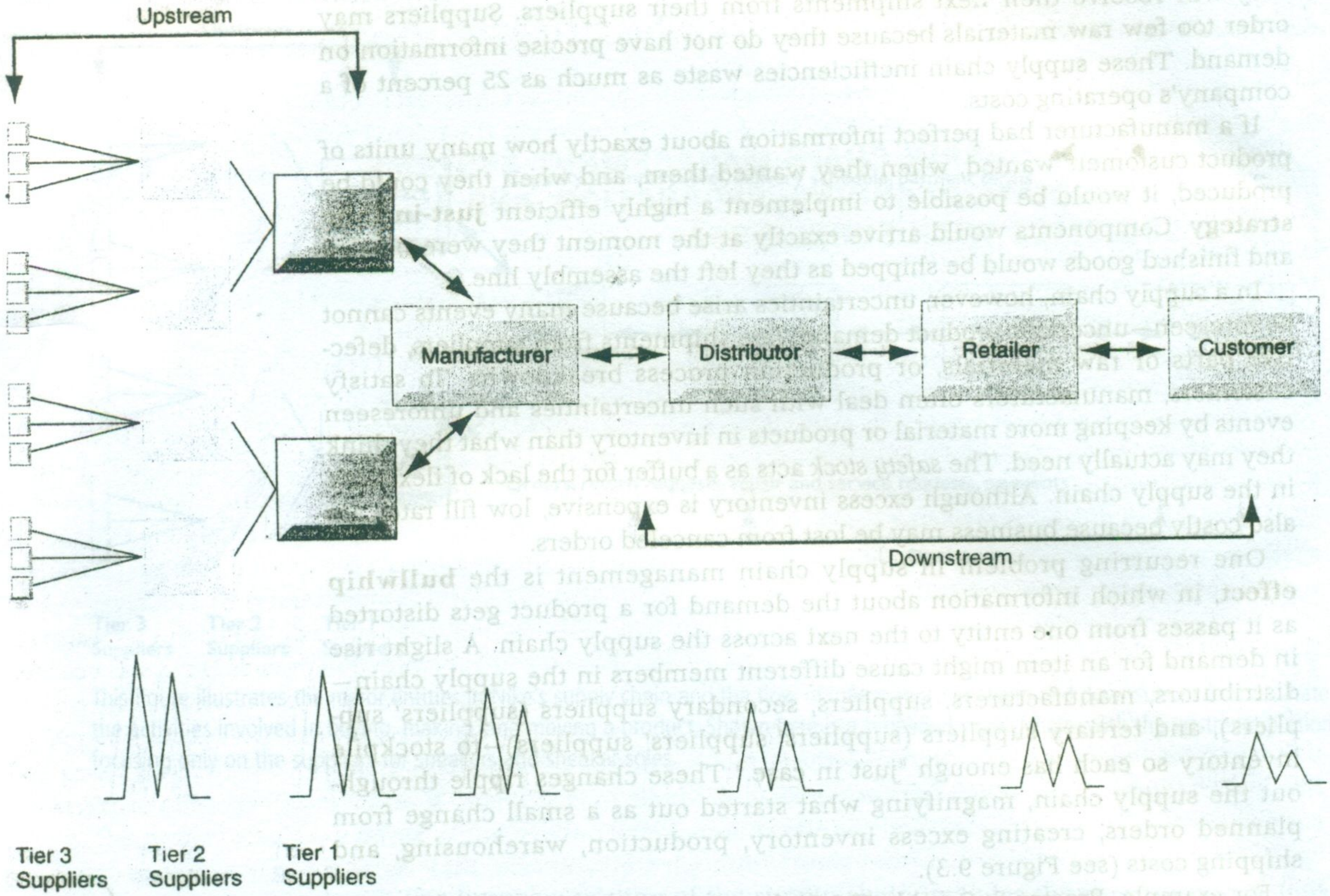
For example, Procter & Gamble (P&G) found it had excessively high inventories of its Pampers disposable diapers at various points along its supply chain because of such distorted information. Although customer purchases in stores were fairly stable, orders from distributors would spike when P&G offered aggressive price promotions. Pampers and Pampers' components accumulated in warehouses along the supply chain to meet demand that did not actually exist. To eliminate this problem, P&G revised its marketing, sales, and supply chain processes and used more accurate demand forecasting.

The bullwhip effect is tamed by reducing uncertainties about demand and supply when all members of the supply chain have accurate and up-to-date information. If all supply chain members share dynamic information about inventory levels, schedules, forecasts, and shipments, they have more precise knowledge about how to adjust their sourcing, manufacturing, and distribution plans. Supply chain management systems provide the kind of information that helps members of the supply chain make better purchasing and scheduling decisions.

SUPPLY CHAIN MANAGEMENT SOFTWARE

Supply chain software is classified as either software to help businesses plan their supply chains (supply chain planning) or software to help them execute the supply chain steps (supply chain execution). **Supply chain planning systems** enable the firm to model its existing supply chain, generate demand forecasts for products, and develop optimal sourcing and manufacturing plans.

FIGURE 9.3 THE BULLWHIP EFFECT



Inaccurate information can cause minor fluctuations in demand for a product to be amplified as one moves further back in the supply chain. Minor fluctuations in retail sales for a product can create excess inventory for distributors, manufacturers, and suppliers.

Such systems help companies make better decisions such as determining how much of a specific product to manufacture in a given time period; establishing inventory levels for raw materials, intermediate products, and finished goods; determining where to store finished goods; and identifying the transportation mode to use for product delivery.

For example, if a large customer places a larger order than usual or changes that order on short notice, it can have a widespread impact throughout the supply chain. Additional raw materials or a different mix of raw materials may need to be ordered from suppliers. Manufacturing may have to change job scheduling. A transportation carrier may have to reschedule deliveries. Supply chain planning software makes the necessary adjustments to production and distribution plans. Information about changes is shared among the relevant supply chain members so that their work can be coordinated. One of the most important—and complex—supply chain planning functions is **demand planning**, which determines how much product a business needs to make to satisfy all of its customers' demands (see the Interactive Session on Management). JDA Software, SAP, and Oracle all offer supply chain management solutions.

INTERACTIVE SESSION: MANAGEMENT

DP WORLD TAKES PORT MANAGEMENT TO THE NEXT LEVEL

DP (Dubai Ports) World has reason to be proud of its accomplishment of becoming one of the leading terminal operators in the world. Today, DP World has 60 terminals across 6 continents, and 11 new terminals are under development. The firm employs an international professional team of more than 30,000 people to serve customers in some of the most dynamic economies in the world.

DP World has adopted a customer-centric approach to enhancing its customers' supply chains by providing quality, innovative services to effectively manage container, bulk, and other terminal cargo. The firm invests heavily in terminal infrastructures, technologies, and people to best serve its customers.

Like other global port and terminal operators, DP World helps shippers around the world address the often complex and costly challenges of managing the supply chain. One of the typical problems encountered in container terminal operations is traffic congestion at port entry points. This congestion is often due to delays introduced by lengthy procedures and paper-based logistics. In response, DP World has introduced many IT-based solutions to enhance terminal capacity utilization. These solutions include the electronic custom release of cargo, electronic data interchange (EDI) reporting, twoway digital radio communications, and the "e-token" advanced booking system.

DP World management wanted to take things a step further and decided to make the loading and unloading of containers operate on "just in time" principles to improve container turnaround. It found that radio frequency identification (RFID) technology was an effective way of increasing the efficiency of truck movements through port access gates. Today, DP World uses RFID-enabled automatic gate systems at the port terminals it operates in Dubai and Australia. According to Mohammed Al Muallem, managing director of DP World UAE, the introduction of an automated gate system would not only eliminate traffic congestion but would also help to eliminate a number of lengthy procedures, increasing productivity at the ports, and improving customer satisfaction. This will in turn increase the turnaround of shipping goods.

Prior to the RFID deployment, DP World spent several months performing proof-of-concept trials involving several competing RFID suppliers. Because of the rugged environmental conditions at the ports, DP World required that 99.5 percent of all tags be read successfully, which was a key challenge for many vendors. After extensive testing and evaluation, DP World selected Identec Solutions, a global leader in active wireless tracking solutions, as its RFID supplier.

How does the RFID tracking system work? Trucks that visit a port terminal are equipped with active RFID tags supplied by Identec Solutions that are fixed on the rear chassis. As a truck moves towards the gate, its unique tag ID number is read by an RFID reader, which is integrated with an automated gate system. At the gate, an optical character recognition (OCR) system determines if the truck is loaded with a container, identifies the ID number of the truck's container, and reads the truck license plate number as a backup identification. The system uses the supplied information to automatically issue a ticket to the driver that specifies the lane the truck should proceed to in order to load or unload the container. The system can also automatically determine if the truck is on time, which is essential information for the efficient pickup and drop off of containers. As the truck leaves the gate, the RFID tag is read once again, and the driver receives a receipt for the completed transaction.

RFID has enabled DP World to increase the productivity of container handoffs, speed the entry and exit of trucks through terminal gates, and increase fuel efficiency. Victoria Rose, regional office project coordinator at DP World Sydney maintained that RFID would improve gate efficiency through improved truck management, reducing queues and congestion around gates, and removing the number of trucks from public roads by streamlining procedures.

Identec's RFID-based solution has also enabled DP World to improve customer satisfaction by enhancing the efficiency of customers' supply chains through smoother, faster, and more effective delivery of their containers at terminal gates. The elimination of lengthy paper transactions and manual inspections at gates and the reduction in manual data input errors demonstrate DP World's customer-centric approach to delivering a superior level of service. The technology also allows trans-

port companies to save time, increase revenues, and reduce costs.

DP World's use of RFID has also helped it to tighten security by providing better accuracy on inbound and outbound truck movements through the terminals. For instance, the system can automatically check whether a truck has a booking and whether it is authorized to enter the port.

As a next step, DP World will consider expanding its use of RFID-enabled scanning and tracking technology to further optimize supply chain flow. In the future, Rose hopes DP World will focus on investigating its use within the yard, and how data captured can be used.

In 2014, DP World was still going strong, acquiring Economic Zones World for $2.6 billion in cash. Their main goal was to acquire the Jebel Ali Free Zone, a 22-square mile plot of land near DP World's Dubai container port. DP World's RFID technologies will be essential to optimizing the use of this new acquisition.

Sources: Simeon Kerr, "DP World to Buy Jebel Ali for $2.6bn from Dubai World," *Financial Times*, November 13, 2014; Dave Friedlos, "RFID Boosts DP World's Productivity in Australia," *RFID Journal*, July 27, 2009, www.rfidjournal.com/article/view/5086, accessed October 20, 2010; Rhea Wessel, "DP World Ramps Up Its Dubai Deployment," *RFID Journal*, August 13, 2009, www.rfidjournal.com/article/view/5130, accessed October 20, 2010; "DP World UAE Implements Automated Gate System at Jebel Ali Port," *The Zone*, May–June 2008, www.jafza.ae/mediafiles/2008/10/23/20081023_Issue-11.pdf, accessed October 20, 2010, p. 11; DP World, www.dpworld.com, accessed October 20, 2010; Identec Solutions, www.identecsolutions.com, accessed October 20, 2010.

Case contributed by Faouzi Kamoun, The University of Dubai.

CASE STUDY QUESTIONS

1. How did Identec Solutions' RFID-based technology help DP World increase the efficiency and effectiveness of its customers' supply chains?
2. Describe two improvements that resulted from implementing the Identec RFID-based solution.
3. How does the concept of supply chain execution relate to this interactive session?
4. What managerial, organizational, and technological challenges might DP World have faced in the early stages of the RFID project's deployment?

Supply chain execution systems manage the flow of products through distribution centers and warehouses to ensure that products are delivered to the right locations in the most efficient manner. They track the physical status of goods, the management of materials, warehouse and transportation operations, and financial information involving all parties. An example is

the Warehouse Management System (WMS) used by Haworth Incorporated. Haworth is a world-leading manufacturer and designer of office furniture, with distribution centers in four different states. The WMS tracks and controls the flow of finished goods from Haworth's distribution centers to its customers. Acting on shipping plans for customer orders, the WMS directs the movement of goods based on immediate conditions for space, equipment, inventory, and personnel.

GLOBAL SUPPLY CHAINS AND THE INTERNET

Before the Internet, supply chain coordination was hampered by the difficulties of making information flow smoothly among disparate internal supply chain systems for purchasing, materials management, manufacturing, and distribution. It was also difficult to share information with external supply chain partners because the systems of suppliers, distributors, or logistics providers were based on incompatible technology platforms and standards. Enterprise and supply chain management systems enhanced with Internet technology supply some of this integration.

A manager uses a Web interface to tap into suppliers' systems to determine whether inventory and production capabilities match demand for the firm's products. Business partners use Web-based supply chain management tools to collaborate online on forecasts. Sales representatives access suppliers' production schedules and logistics information to monitor customers' order status.

Global Supply Chain Issues

More and more companies are entering international markets, outsourcing manufacturing operations, and obtaining supplies from other countries as well as selling abroad. Their supply chains extend across multiple countries and regions. There are additional complexities and challenges to managing a global supply chain.

Global supply chains typically span greater geographic distances and time differences than domestic supply chains, and have participants from a number of different countries. Performance standards may vary from region to region or from nation to nation. Supply chain management may need to reflect foreign government regulations and cultural differences.

The Internet helps companies manage many aspects of their global supply chains, including sourcing, transportation, communications, and international finance. Today's apparel industry, for example, relies heavily on outsourcing to contract manufacturers in China and other low-wage countries. Apparel companies are starting to use the Web to manage their global supply chain and production issues. (Review the discussion of Li & Fung in Chapter 3.)

In addition to contract manufacturing, globalization has encouraged outsourcing warehouse management, transportation management, and related operations to third-party logistics providers, such as UPS Supply Chain Solutions and Schneider Logistics Services. These logistics services offer Web-based software to give their customers a better view of their global supply chains. Customers are able to check a secure Web site to monitor inventory and shipments, helping them run their global supply chains more efficiently.

Demand-Driven Supply Chains: From Push to Pull Manufacturing and Efficient Customer Response

In addition to reducing costs, supply chain management systems facilitate efficient customer response, enabling the workings of the business to be

driven more by customer demand. (We introduced efficient customer response systems in Chapter 3.)

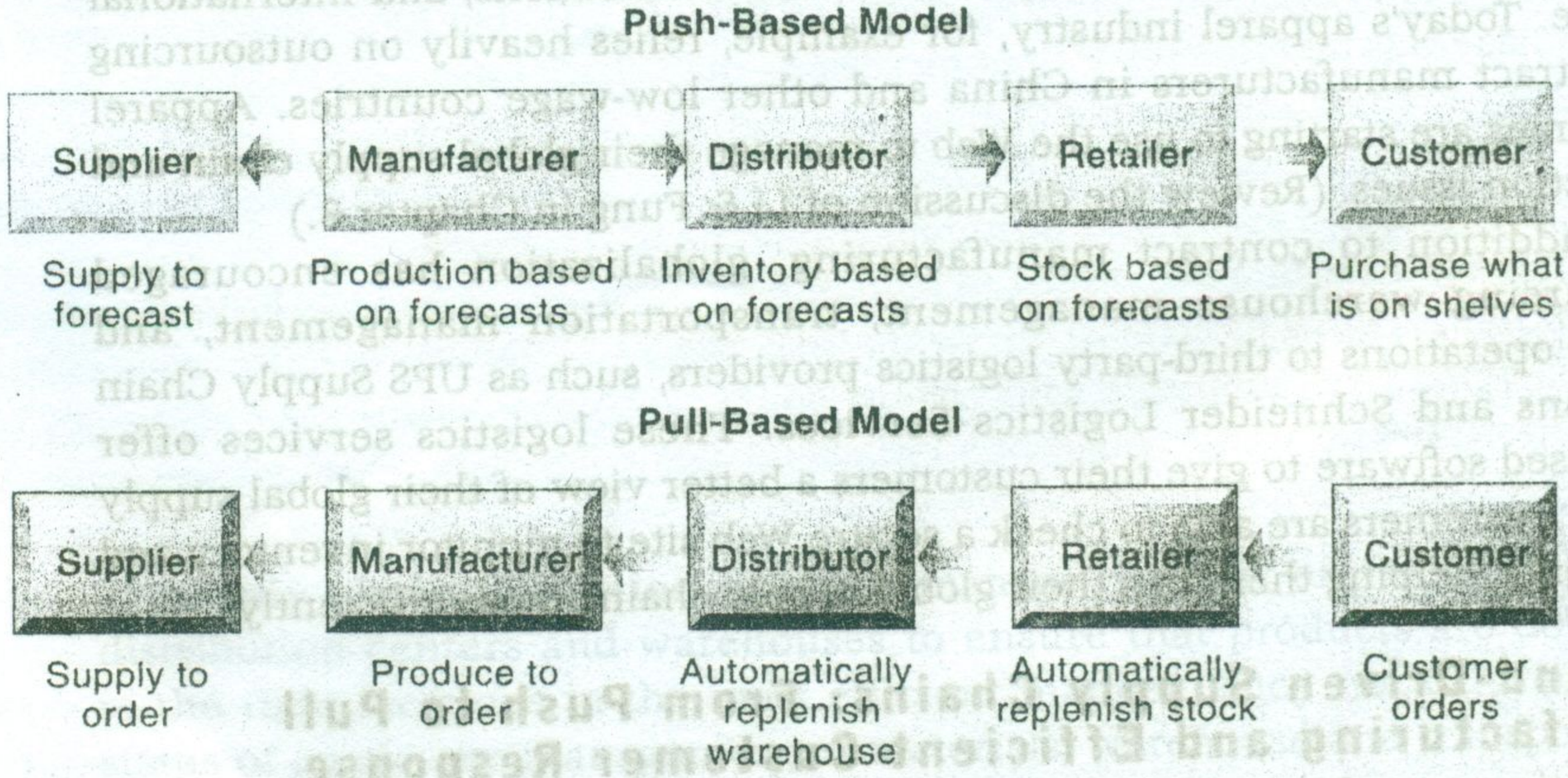
Earlier supply chain management systems were driven by a push-based model (also known as build-to-stock). In a **push-based model**, production master schedules are based on forecasts or best guesses of demand for products, and products are "pushed" to customers. With new flows of information made possible by Web-based tools, supply chain management more easily follows a pull-based model. In a **pull-based model**, also known as a demand-driven or build-to-order model, actual customer orders or purchases trigger events in the supply chain. Transactions to produce and deliver only what customers have ordered move up the supply chain from retailers to distributors to manufacturers and eventually to suppliers. Only products to fulfill these orders move back down the supply chain to the retailer. Manufacturers use only actual order demand information to drive their production schedules and the procurement of components or raw materials, as illustrated in Figure 9.4. Walmart's continuous replenishment system described in Chapter 3 is an example of the pull-based model.

The Internet and Internet technology make it possible to move from sequential supply chains, where information and materials flow sequentially from company to company, to concurrent supply chains, where information flows in many directions simultaneously among members of a supply chain network. Complex supply networks of manufacturers, logistics suppliers, outsourced manufacturers, retailers, and distributors are able to adjust immediately to changes in schedules or orders. Ultimately, the Internet could create a "digital logistics nervous system" throughout the supply chain (see Figure 9.5).

BUSINESS VALUE OF SUPPLY CHAIN MANAGEMENT SYSTEMS

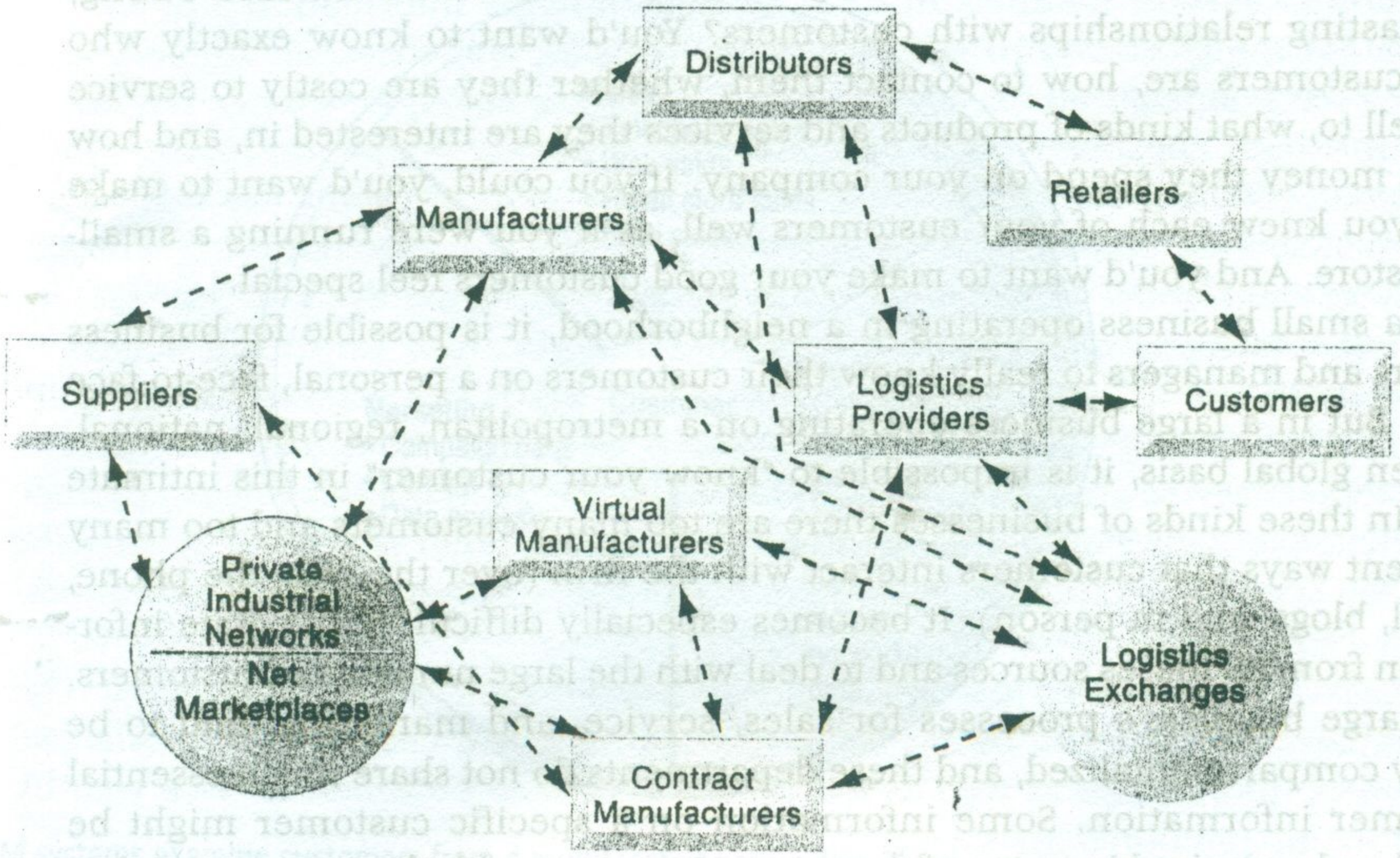
You have just seen how supply chain management systems enable firms to streamline both their internal and external supply chain processes and provide management with more accurate information about what to produce, store, and

FIGURE 9.4 PUSH- VERSUS PULL-BASED SUPPLY CHAIN MODELS



The difference between push- and pull-based models is summarized by the slogan "Make what we sell, not sell what we make."

FIGURE 9.5 THE EMERGING INTERNET-DRIVEN SUPPLY CHAIN



The difference between push- and pull-based models is summarized by the slogan "Make what we sell, not sell what we make."

move. By implementing a networked and integrated supply chain management system, companies match supply to demand, reduce inventory levels, improve delivery service, speed product time to market, and use assets more effectively.

Total supply chain costs represent the majority of operating expenses for many businesses and in some industries approach 75 percent of the total operating budget. Reducing supply chain costs has a major impact on firm profitability.

In addition to reducing costs, supply chain management systems help increase sales. If a product is not available when a customer wants it, customers often try to purchase it from someone else. More precise control of the supply chain enhances the firm's ability to have the right product available for customer purchases at the right time.

9.3 How do customer relationship management systems help firms achieve customer intimacy?

You've probably heard phrases such as "the customer is always right" or "the customer comes first." Today these words ring truer than ever. Because competitive advantage based on an innovative new product or service is often very short lived, companies are realizing that their most enduring competitive strength may be their relationships with their customers. Some say that the basis of competition has switched from who sells the most products and services to who "owns" the customer, and that customer relationships represent a firm's most valuable asset.

WHAT IS CUSTOMER RELATIONSHIP MANAGEMENT?

What kinds of information would you need to build and nurture strong, long-lasting relationships with customers? You'd want to know exactly who your customers are, how to contact them, whether they are costly to service and sell to, what kinds of products and services they are interested in, and how much money they spend on your company. If you could, you'd want to make sure you knew each of your customers well, as if you were running a small-town store. And you'd want to make your good customers feel special.

In a small business operating in a neighborhood, it is possible for business owners and managers to really know their customers on a personal, face-to-face basis. But in a large business operating on a metropolitan, regional, national, or even global basis, it is impossible to "know your customer" in this intimate way. In these kinds of businesses there are too many customers and too many different ways that customers interact with the firm (over the Web, the phone, e-mail, blogs, and in person). It becomes especially difficult to integrate information from all theses sources and to deal with the large numbers of customers.

A large business's processes for sales, service, and marketing tend to be highly compartmentalized, and these departments do not share much essential customer information. Some information on a specific customer might be stored and organized in terms of that person's account with the company. Other pieces of information about the same customer might be organized by products that were purchased. There is no way to consolidate all of this information to provide a unified view of a customer across the company.

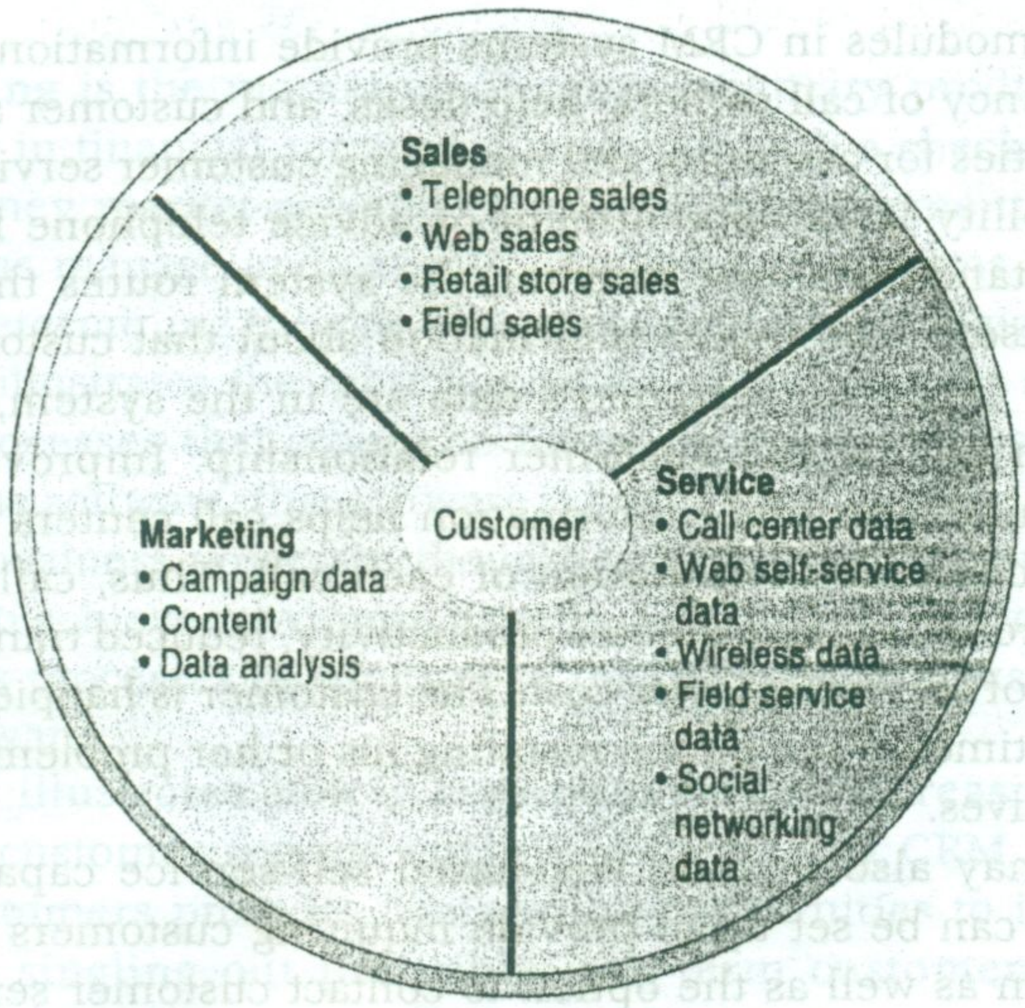
This is where customer relationship management systems help. Customer relationship management (CRM) systems, which we introduced in Chapter 2, capture and integrate customer data from all over the organization, consolidate the data, analyze the data, and then distribute the results to various systems and customer touch points across the enterprise. A **touch point** (also known as a contact point) is a method of interaction with the customer, such as telephone, e-mail, customer service desk, conventional mail, Facebook, Twitter, Web site, wireless device, or retail store. Well-designed CRM systems provide a single enterprise view of customers that is useful for improving both sales and customer service (see Figure 9.6.)

Good CRM systems provide data and analytical tools for answering questions such as these: What is the value of a particular customer to the firm over his or her lifetime? Who are our most loyal customers? It can cost six times more to sell to a new customer than to an existing customer. Who are our most profitable customers? What do these profitable customers want to buy? Firms use the answers to these questions to acquire new customers, provide better service and support to existing customers, customize their offerings more precisely to customer preferences, and provide ongoing value to retain profitable customers.

CUSTOMER RELATIONSHIP MANAGEMENT SOFTWARE

Commercial CRM software packages range from niche tools that perform limited functions, such as personalizing Web sites for specific customers, to large-scale enterprise applications that capture myriad interactions with customers, analyze them with sophisticated reporting tools, and link to other major enterprise applications, such as supply chain management and enterprise systems. The more comprehensive CRM packages contain modules for **partner relationship management (PRM)** and **employee relationship management (ERM)**.

FIGURE 9.6 CUSTOMER RELATIONSHIP MANAGEMENT (CRM)



CRM systems examine customers from a multifaceted perspective. These systems use a set of integrated applications to address all aspects of the customer relationship, including customer service, sales, and marketing.

PRM uses many of the same data, tools, and systems as customer relationship management to enhance collaboration between a company and its selling partners. If a company does not sell directly to customers but rather works through distributors or retailers, PRM helps these channels sell to customers directly. It provides a company and its selling partners with the ability to trade information and distribute leads and data about customers, integrating lead generation, pricing, promotions, order configurations, and availability. It also provides a firm with tools to assess its partners' performances so it can make sure its best partners receive the support they need to close more business.

ERM software deals with employee issues that are closely related to CRM, such as setting objectives, employee performance management, performance-based compensation, and employee training. Major CRM application software vendors include Oracle, SAP, Salesforce.com, and Microsoft Dynamics CRM.

Customer relationship management systems typically provide software and online tools for sales, customer service, and marketing. We briefly describe some of these capabilities.

Sales Force Automation (SFA)

Sales force automation modules in CRM systems help sales staff increase their productivity by focusing sales efforts on the most profitable customers, those who are good candidates for sales and services. CRM systems provide sales prospect and contact information, product information, product configuration capabilities, and sales quote generation capabilities. Such software can assemble information about a particular customer's past purchases to help the salesperson make personalized recommendations. CRM software enables sales, marketing, and delivery departments to easily share customer and prospect information. It increases each salesperson's efficiency by reducing the cost per sale as well as the cost of acquiring new customers and retaining old ones. CRM software also has capabilities for sales forecasting, territory management, and team selling.

Customer Service

Customer service modules in CRM systems provide information and tools to increase the efficiency of call centers, help desks, and customer support staff. They have capabilities for assigning and managing customer service requests.

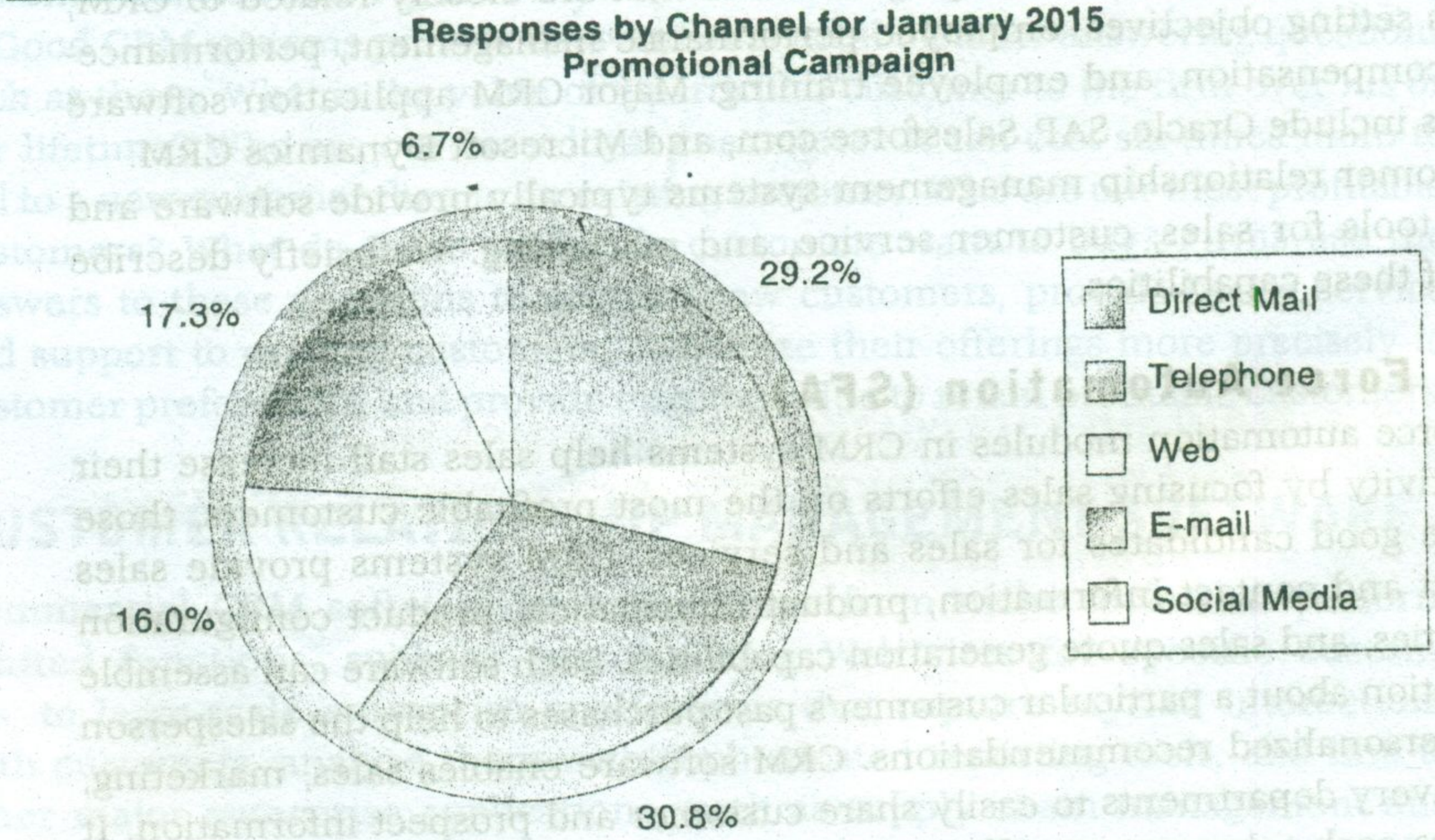
One such capability is an appointment or advice telephone line: When a customer calls a standard phone number, the system routes the call to the correct service person, who inputs information about that customer into the system only once. Once the customer's data are in the system, any service representative can handle the customer relationship. Improved access to consistent and accurate customer information helps call centers handle more calls per day and decrease the duration of each call. Thus, call centers and customer service groups achieve greater productivity, reduced transaction time, and higher quality of service at lower cost. The customer is happier because he or she spends less time on the phone restating his or her problem to customer service representatives.

CRM systems may also include Web-based self-service capabilities: The company Web site can be set up to provide inquiring customers personalized support information as well as the option to contact customer service staff by phone for additional assistance.

Marketing

CRM systems support direct-marketing campaigns by providing capabilities for capturing prospect and customer data, for providing product and service information, for qualifying leads for targeted marketing, and for scheduling and tracking direct-marketing mailings or e-mail (see Figure 9.7). Marketing modules also include tools for analyzing marketing and customer data, identifying profitable and unprofitable customers, designing products and services to

FIGURE 9.7 HOW CRM SYSTEMS SUPPORT MARKETING



Customer relationship management software provides a single point for users to manage and evaluate marketing campaigns across multiple channels, including e-mail, direct mail, telephone, the Web, and social media.

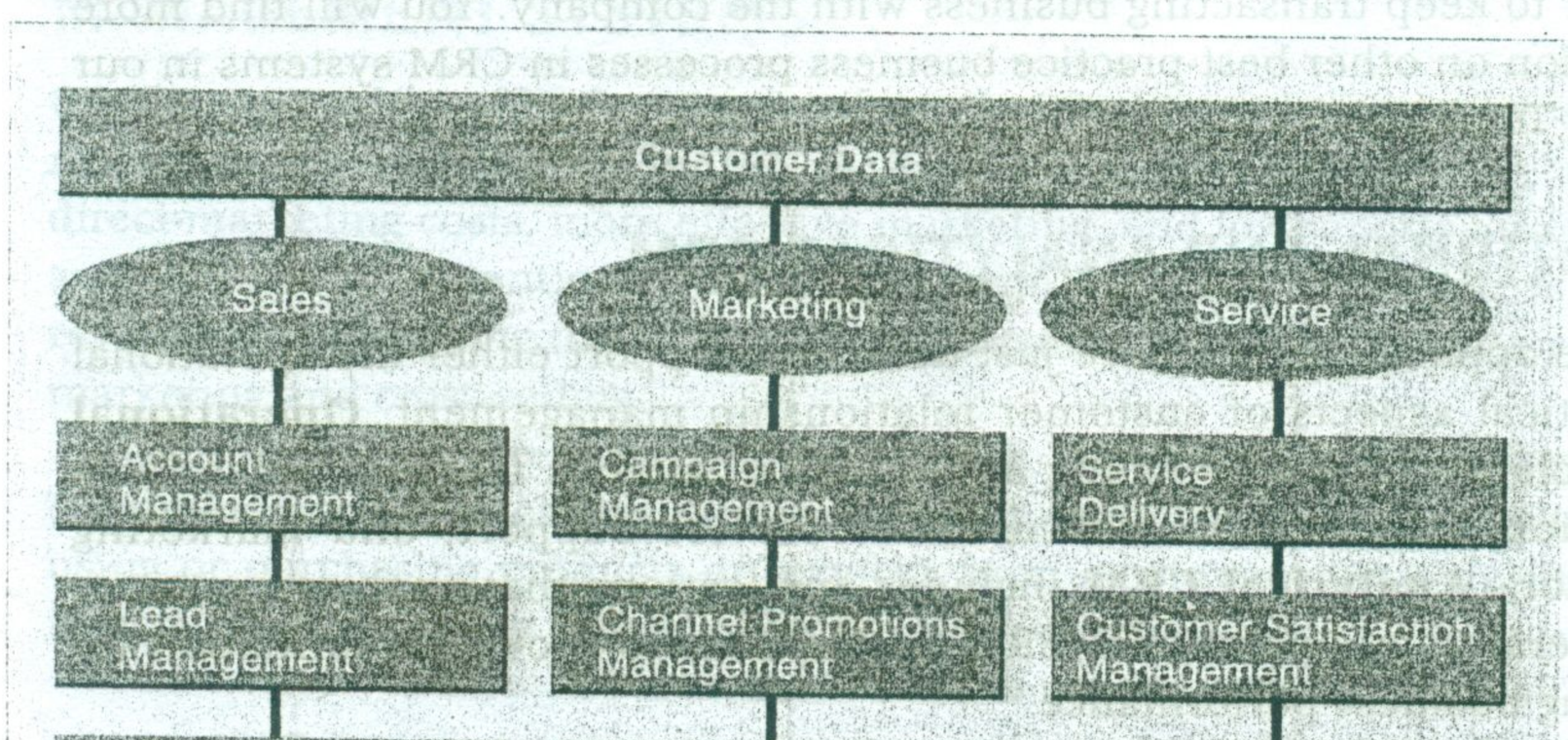
satisfy specific customer needs and interests, and identifying opportunities for cross-selling.

Cross-selling is the marketing of complementary products to customers. (For example, in financial services, a customer with a checking account might be sold a money market account or a home improvement loan.) CRM tools also help firms manage and execute marketing campaigns at all stages, from planning to determining the rate of success for each campaign.

Figure 9.8 illustrates the most important capabilities for sales, service, and marketing processes that would be found in major CRM software products. Like enterprise software, this software is business-process driven, incorporating hundreds of business processes thought to represent best practices in each of these areas. To achieve maximum benefit, companies need to revise and model their business processes to conform to the best-practice business processes in the CRM software.

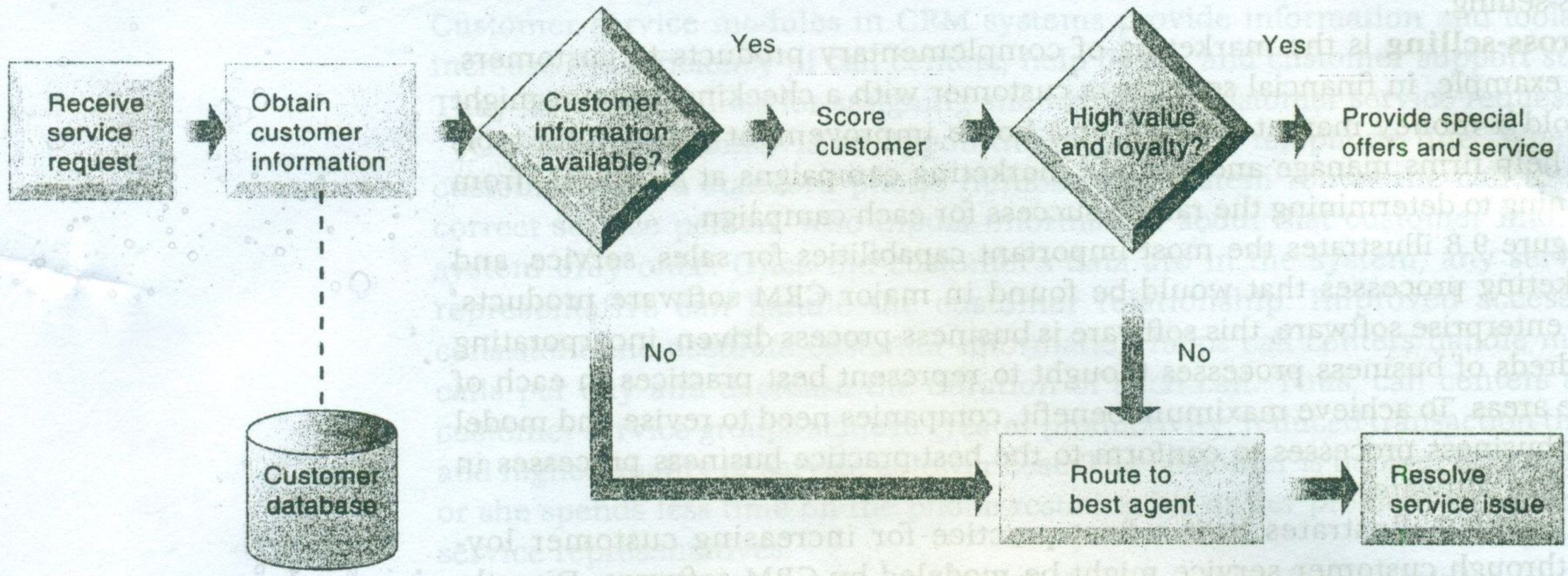
Figure 9.9 illustrates how a best practice for increasing customer loyalty through customer service might be modeled by CRM software. Directly servicing customers provides firms with opportunities to increase customer retention by singling out profitable long-term customers for preferential treatment. CRM software can assign each customer a score based on that person's value and loyalty to the company and provide that information to help call centers route each customer's service request to agents who can best

FIGURE 9.8 CRM SOFTWARE CAPABILITIES



The major CRM software products support business processes in sales, service, and marketing, integrating customer information from many different sources. Included is support for both the operational and analytical aspects of CRM.

FIGURE 9.9 CUSTOMER LOYALTY MANAGEMENT PROCESS MAP



This process map shows how a best practice for promoting customer loyalty through customer service would be modeled by customer relationship management software. The CRM software helps firms identify high-value customers for preferential treatment.

handle that customer's needs. The system would automatically provide the service agent with a detailed profile of that customer that includes his or her score for value and loyalty. The service agent would use this information to present special offers or additional service to the customer to encourage the customer to keep transacting business with the company. You will find more information on other best-practice business processes in CRM systems in our Learning Tracks.

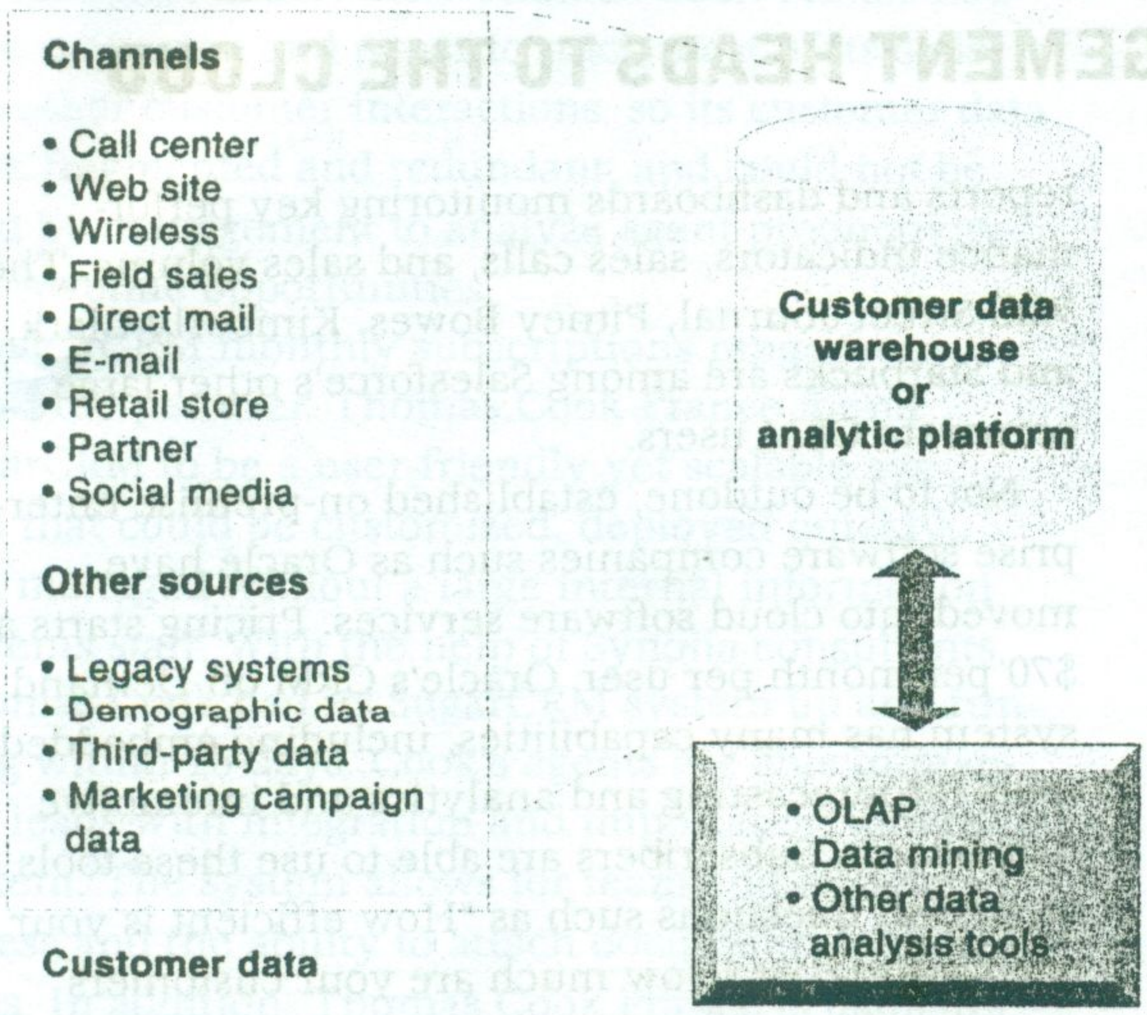
OPERATIONAL AND ANALYTICAL CRM

All of the applications we have just described support either the operational or analytical aspects of customer relationship management. **Operational CRM** includes customer-facing applications, such as tools for sales force automation, call center and customer service support, and marketing automation. **Analytical CRM** includes applications that analyze customer data generated by operational CRM applications to provide information for improving business performance.

Analytical CRM applications are based on data from operational CRM systems, customer touch points, and other sources that have been organized in data warehouses or analytic platforms for use in online analytical processing (OLAP), data mining, and other data analysis techniques (see Chapter 6). Customer data collected by the organization might be combined with data from other sources, such as customer lists for direct-marketing campaigns purchased from other companies or demographic data. Such data are analyzed to identify buying patterns, to create segments for targeted marketing, and to pinpoint profitable and unprofitable customers (see Figure 9.10 and the Interactive Session on Organizations).

Another important output of analytical CRM is the customer's lifetime value to the firm. **Customer lifetime value (CLTV)** is based on the relationship between the revenue produced by a specific customer, the expenses incurred in acquiring and servicing that customer, and the expected life of the relationship between the customer and the company.

FIGURE 9.10 ANALYTICAL CRM



Analytical CRM uses a customer data warehouse or analytic platform and tools to analyze customer data collected from the firm's customer touch points and from other sources.

BUSINESS VALUE OF CUSTOMER RELATIONSHIP MANAGEMENT SYSTEMS

Companies with effective customer relationship management systems realize many benefits, including increased customer satisfaction, reduced direct-marketing costs, more effective marketing, and lower costs for customer acquisition and retention. Information from CRM systems increases sales revenue by identifying the most profitable customers and segments for focused marketing and cross-selling.

Customer churn is reduced as sales, service, and marketing better respond to customer needs. The **churn rate** measures the number of customers who stop using or purchasing products or services from a company. It is an important indicator of the growth or decline of a firm's customer base.

9.4 WHAT ARE THE CHALLENGES POSED BY ENTERPRISE APPLICATIONS AND HOW ARE ENTERPRISE APPLICATIONS TAKING ADVANTAGE OF NEW TECHNOLOGIES?

Many firms have implemented enterprise systems and systems for supply chain and customer relationship management because they are such powerful instruments for achieving operational excellence and enhancing decision making. But precisely because they are so powerful in changing the way the organization works, they are challenging to implement. Let's briefly examine some of these challenges, as well as new ways of obtaining value from these systems.

INTERACTIVE SESSION: ORGANIZATIONS

CUSTOMER RELATIONSHIP MANAGEMENT HEADS TO THE CLOUD

Salesforce.com is the most successful enterprise-scale software as a service (SaaS) and the undisputed global leader in cloud-based customer relationship management (CRM) systems. Users can access Salesforce applications anywhere through an Internet-enabled mobile device or a connected computer. Subscriptions start as low as $15 per user per month for the pared-down Group version for small sales and marketing teams, with monthly subscriptions for large enterprises ranging from $65–$250 per user.

Salesforce has over 100,000 customers. Small businesses find the on-demand model especially appealing because there are no large up-front hardware and software investments or lengthy implementations on corporate computer systems. Fireclay Tile, a 37-employee environmentally friendly sustainable tile manufacturer, adopted Salesforce and realized multiple benefits. Salesforce's e-mail and Web-to-lead capabilities helped the company quadruple new sales leads. (Web-to-lead automatically adds leads collected from the Web to the company's master database.) A task feature automatically generates specific tasks based on the type of lead (architect, contractor, dealer, or homeowner) and the stage in the sales process. The system automates customer service functions including order confirmations, follow-up customer satisfaction surveys, and shipping notifications

Salesforce's social tools enable Fireclay to compete successfully against large flooring manufacturers and other custom tile producers by providing superior customer service. The company uses Salesforce.com to maintain customer profiles, so its sales, service, and production teams have complete customer views as soon as leads come in from the Web. Fireclay's internal social network based on Salesforce Chatter helps employees track orders and work closely together to meet customer needs. Customer satisfaction has increased by 90 percent.

But Salesforce.com also appeals to large companies. Dr. Pepper Snapple Group adopted Salesforce CRM to replace an outmoded Excel application that required extensive manual data input to compile reports on more than 50 beverage brands and to track sales performance against objectives in real time. The system now tracks field activities for more than 10,000 accounts, with automated reports and dashboards monitoring key performance indicators, sales calls, and sales volume. The Wall Street Journal, Pitney Bowes, Kimberly-Clark, and Starbucks are among Salesforce's other large corporate CRM users.

Not to be outdone, established on-premise enterprise software companies such as Oracle have moved into cloud software services. Pricing starts at $70 per month per user. Oracle's CRM on Demand system has many capabilities, including embedded tools for forecasting and analytics and interactive dashboards. Subscribers are able to use these tools to answer questions such as "How efficient is your sales effort?" or "How much are your customers spending?"

GRT Hotels & Resorts, a leading hotel group in South India with 10 hotels, used Oracle CRM on Demand to create a centralized CRM system for all of its properties. The system makes it possible for all the hotels in the group to share customer data, such as room and rate preferences, and to create unified marketing programs that eliminate unnecessary price competition between the company's hotels. GRT believes that by making customer behavior data available for forecasting sales and by creating more targeted marketing campaigns, the CRM system has increased productivity by about 25 percent. Managers are able to monitor the number of customer calls that employees answer each month regarding bookings and general hotel information to identify underperformers. GRT management believes that using a hosted CRM service with a monthly fee costs 65 percent less than if it had purchased and maintained its own CRM software. Moreover, Oracle's centralized, secure Web-based CRM application ensures that confidential data, such as promotion plans, cannot be removed by GRT employees when they leave the organization.

While traditional enterprise software vendors like Oracle are using their market-leading position to penetrate the cloud-based application market, newcomers such as SugarCRM have found success even among larger companies. Thomas Cook France, a subsidiary of the worldwide Thomas Cook Group Travel plc, is an example. Thomas Cook France has 1,700 employees and is the second largest travel company in France, providing leisure travel programs for groups of 15 travelers. The company

is able to distinguish itself among competitors and Internet travel services by providing an outstanding customer experience. Thomas Cook France had been using pen and paper to track most of its calls and other customer interactions, so its customer data were fragmented and redundant, and could not be used by management to analyze agent productivity and revenue opportunities.

SugarCRM monthly subscriptions range from $30–$100 per user. Thomas Cook France found SugarCRM to be a user-friendly yet scalable system that could be customized, deployed quickly, and managed without a large internal information systems staff. With the help of Synolia consultants, Thomas Cook had its SugarCRM system up and running within 15 days. Cook's agents are able to manage leads with integration and importation into their system. The system allows for team and role-based access and the ability to attach documents to contacts. In addition, Thomas Cook France is using the CRM software for high-level outbound e-mail marketing efforts, FAQ modules, and dashboards that drive immediate business activities and also analyze high-level business issues.

Not all companies experience gains of that magnitude, and cloud computing does have drawbacks. Many companies are concerned about maintaining control of their data and security. Although cloud computing companies are prepared to handle these issues, availability assurances and service level agreements are not always available. Companies that manage their CRM apps with a cloud infrastructure have no guarantees that their data will be available at all times, or even that the provider will still exist in the future, although CRM vendors have taken great pains to address these issues.

Sources: "Salesforce.com Inc. 10-K Report," March 9, 2012; Ziff Davis," SMB On Demand CRM Comparison Guide, January 2012; "Fireclay Heats Up Its Small Business as a Social Enterprise," www.salesforce.com, accessed July 17, 2012; "GRT Hotels & Resorts Increases Productivity by 25%, Improves Customer Service and Resource Allocation with Centralized CRM System," www.oracle.com, May 1, 2012; www.sugarcrm.com, accessed July 17, 2012; and "Thomas Cook Begins a Successful CRM Voyage with SugarCRM and Synolia," SugarCRM, 2010.

CASE STUDY QUESTIONS

1. What types of companies are most likely to adopt cloud-based CRM software services? Why? What companies might not be well-suited for this type of software?
2. What are the advantages and disadvantages of using cloud-based enterprise applications?
3. What management, organization, and technology issues should be addressed in deciding whether to use a conventional CRM system versus a cloud-based version?

ENTERPRISE APPLICATION CHALLENGES

Promises of dramatic reductions in inventory costs, order-to-delivery time, more efficient customer response, and higher product and customer profitability make enterprise systems and systems for supply chain management and customer relationship management very alluring. But to obtain this value, you must clearly understand how your business has to change to use these systems effectively.

Enterprise applications involve complex pieces of software that are very expensive to purchase and implement. It might take a large Fortune 500 company several years to complete a large-scale implementation of an enterprise system or a system for SCM or CRM. According to a 2014 survey

of 192 companies conducted by Panorama Consulting Solutions, the average cost of an ERP project was $2.8 million. Projects took a little over 16 months to complete, and 66 percent of the projects delivered 50 percent or less of the expected benefits (Panorama, 2014). Changes in project scope and additional customization work add to implementation delays and costs.

Enterprise applications require not only deep-seated technological changes but also fundamental changes in the way the business operates. Companies must make sweeping changes to their business processes to work with the software. Employees must accept new job functions and responsibilities. They must learn how to perform a new set of work activities and understand how the information they enter into the system can affect other parts of the company. This requires new organizational learning and should also be factored into ERP implementation costs.

Supply chain management systems require multiple organizations to share information and business processes. Each participant in the system may have to change some of its processes and the way it uses information to create a system that best serves the supply chain as a whole.

Some firms experienced enormous operating problems and losses when they first implemented enterprise applications because they didn't understand how much organizational change was required. For example, Kmart had trouble getting products to store shelves when it first implemented i2 Technologies supply chain management software. The i2 software did not work well with Kmart's promotion-driven business model, which created sharp downward spikes in demand for products. Overstock.com's order tracking system went down for a full week when the company replaced a homegrown system with an Oracle enterprise system. The company rushed to implement the software, and did not properly synchronize the Oracle software's process for recording customer refunds with its accounts receivable system. These problems contributed to a third-quarter loss of $14.5 million that year.

Enterprise applications also introduce "switching costs." Once you adopt an enterprise application from a single vendor, such as SAP, Oracle, or others, it is very costly to switch vendors, and your firm becomes dependent on the vendor to upgrade its product and maintain your installation.

Enterprise applications are based on organization-wide definitions of data. You'll need to understand exactly how your business uses its data and how the data would be organized in a customer relationship management, supply chain management, or enterprise system. CRM systems typically require some data cleansing work.

Enterprise software vendors are addressing these problems by offering pared-down versions of their software and "fast-start" programs for small and medium-sized businesses and best-practice guidelines for larger companies. Companies are also achieving more flexibility by using cloud applications for functions not addressed by the basic enterprise software so that they are not constrained by a single "do-it-all" type of system (Drobik and Rayner, 2013).

Companies adopting enterprise applications can also save time and money by keeping customizations to a minimum. For example, Kennametal, a $2 billion metal-cutting tools company in Pennsylvania, had spent $10 million over 13 years maintaining an ERP system with over 6,400 customizations. The company has now replaced it with a "plain vanilla," noncustomized version of SAP enterprise software and changed its business processes to conform to the software.

NEXT-GENERATION ENTERPRISE APPLICATIONS

Today, enterprise application vendors are delivering more value by becoming more flexible, Web-enabled mobile, and capable of integration with other systems. Stand-alone enterprise systems, customer relationship management systems, and supply chain management systems are becoming a thing of the past. The major enterprise software vendors have created what they call *enterprise solutions*, *enterprise suites*, or e-business suites to make their customer relationship management, supply chain management, and enterprise systems work closely with each other, and link to systems of customers and suppliers. SAP Business Suite, Oracle E-Business Suite, and Microsoft Dynamics Suite (aimed at mid-sized companies) are examples, and they now utilize Web services and service-oriented architecture (SOA) (see Chapter 5).

SAP's next-generation enterprise applications incorporate SOA standards and are able to link SAP's own applications and Web services developed by independent software vendors. Oracle also has included SOA and business process management capabilities in its Fusion middleware products. Businesses can use these tools to create platforms for new or improved business processes that integrate information from multiple applications.

Next-generation enterprise applications also include open source and cloud solutions, as well as more functionality available on mobile platforms. Open source products such as Compiere, Apache Open for Business (OFBiz), and Openbravo do not offer as many capabilities as large commercial enterprise software, but are attractive to companies such as small manufacturers because of their low cost.

For small- and medium-sized businesses in selected countries, SAP offers cloud-based versions of its Business One Cloud and Business ByDesign enterprise software solutions. Cloud-based enterprise systems are also offered by smaller vendors such as NetSuite and Plex Systems, but they are not as popular as cloud-based CRM products. The undisputed global market leader in cloud-based CRM systems is Salesforce.com, with over 100,000 customers. Salesforce.com delivers its service through Internet-connected computers or mobile devices and it is widely used by small, medium, and large enterprises. As cloud-based products mature, more companies will be choosing to run all or part of their enterprise applications in the cloud on an as-needed basis.

Social CRM and Business Intelligence

CRM software vendors are enhancing their products to take advantage of social networking technologies. These social enhancements help firms identify new ideas more rapidly, improve team productivity, and deepen interactions with customers (see the Chapter 10 ending case study).

Employees who interact with customers via social networking sites such as Facebook and Twitter are often able to provide customer service functions much faster and at lower cost than by using telephone conversations or e-mail. Customers who are active social media users increasingly want—and expect—businesses to respond to their questions and complaints through this channel.

Social CRM tools enable a business to connect customer conversations and relationships from social networking sites to CRM processes. The leading CRM vendors now offer such tools to link data from social networks into their CRM software. SAP, Salesforce.com and Oracle CRM products now feature technology to monitor, track, and analyze social media activity in Facebook, LinkedIn, Twitter, YouTube, and other sites. Business intelligence and analytics software vendors such as SAS also have capablities for social media analytics (with

several measures of customer engagement across a variety of social networks), along with campaign management tools for testing and optimizing both social and traditional Web-based campaigns.

Salesforce.com connected its system for tracking leads in the sales process with social-listening and social-media marketing tools, enabling users to tailor their social-marketing dollars to core customers and observe the resulting comments. If an ad agency wants to run a targeted Facebook or Twitter ad, these capabilities make it possible to aim the ad specifically at people in the client's lead pipeline, who are already being tracked in the CRM system. Users will be able to view tweets as they take place in real time and perhaps uncover new leads. They can also manage multiple campaigns and compare them all to figure out which ones generate the highest click-through rates and cost per click.

Business Intelligence in Enterprise Applications Enterprise application vendors have added business intelligence features to help managers obtain more meaningful information from the massive amounts of data generated by these systems. Included are tools for flexible reporting, ad hoc analysis, interactive dashboards, what-if scenario analysis, and data visualization. Rather than requiring users to leave an application and launch separate reporting and analytics tools, the vendors are starting to embed analytics within the context of the application itself. They are also offering complementary stand-alone analytics products, such as SAP BusinessObjects and Oracle Business Intelligence Enterprise Edition.

The major enterprise application vendors also offer portions of their products that work on mobile handhelds. You can find out more about this topic in our Chapter 7 Learning Track on Wireless Applications for Customer Relationship Management, Supply Chain Management, and Healthcare.

Review Summary

1. *How do enterprise systems help businesses achieve operational excellence?*

Enterprise software is based on a suite of integrated software modules and a common central database. The database collects data from and feeds the data into numerous applications that can support nearly all of an organization's internal business activities. When new information is entered by one process, the information is made available immediately to other business processes.

Enterprise systems support organizational centralization by enforcing uniform data standards and business processes throughout the company and a single unified technology platform. The firmwide data generated by enterprise systems helps managers evaluate organizational performance.

2. *How do supply chain management systems coordinate planning, production, and logistics with suppliers?*

Supply chain management (SCM) systems automate the flow of information among members of the supply chain so they can use it to make better decisions about when and how much to purchase, produce, or ship. More accurate information from supply chain management systems reduces uncertainty and the impact of the bullwhip effect.

Supply chain management software includes software for supply chain planning and for supply chain execution. Internet technology facilitates the management of global supply chains by providing the connectivity for organizations in different countries to share supply chain information. Improved communication among supply chain members also facilitates efficient customer response and movement toward a demand-driven model.

3. *How do customer relationship management systems help firms achieve customer intimacy?*

Customer relationship management (CRM) systems integrate and automate customer-facing processes in sales, marketing, and customer service, providing an enterprise-wide view of customers. Companies can use this customer knowledge when they interact with customers to provide them with better service or to sell new products and services. These systems also identify profitable or nonprofitable customers or opportunities to reduce the churn rate.

The major customer relationship management software packages provide capabilities for both operational CRM and analytical CRM. They often include modules for managing relationships with selling partners (partner relationship management) and for employee relationship management.

4. *What are the challenges posed by enterprise applications and how are enterprise applications taking advantage of new technologies?*

Enterprise applications are difficult to implement. They require extensive organizational change, large new software investments, and careful assessment of how these systems will enhance organizational performance. Enterprise applications cannot provide value if they are implemented atop flawed processes or if firms do not know how to use these systems to measure performance improvements. Employees require training to prepare for new procedures and roles. Attention to data management is essential.

Enterprise applications are now more flexible, Web-enabled, and capable of integration with other systems, using Web services and service-oriented architecture (SOA). They also have open source and on-demand versions and are able to run in cloud infrastructures or on mobile platforms. CRM software has added social networking capabilities to enhance internal collaboration, deepen interactions with customers, and utilize data from social networking sites. Open source, mobile, and cloud versions of some of these products are becoming available.

Key Terms

Analytical CRM, 398
Bullwhip effect, 387
Churn rate, 399
Cross-selling, 397
Customer lifetime value (CLTV), 398
Demand planning, 388
Employee relationship management (ERM), 394
Enterprise software, 383
Just-in-time strategy, 387
Operational CRM, 398
Partner relationship management (PRM), 394
Pull-based model, 392
Push-based model, 392
Social CRM, 403
Supply chain, 385
Supply chain execution systems, 390
Supply chain planning systems, 387
Touch point, 394

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Go to **mymislab.com** to complete the problems marked with this icon .

Review Questions

9-1 How do enterprise systems help businesses achieve operational excellence?

- Define an enterprise system and explain how enterprise software works.
- List the business processes supported by enterprise systems.

9-2 How do supply chain management systems coordinate planning, production, and logistics with suppliers?

- Define a supply chain and identify each of its components.
- Describe some of the issues that arise with supply chains and explain what causes them.
- Define and compare supply chain planning systems and supply chain execution systems.

- Describe the challenges of global supply chains and how Internet technology can help companies manage them better.
- Distinguish between a push-based and a pull-based model of supply chain management and explain how contemporary supply chain management systems facilitate a pull-based model.

9-3 How do customer relationship management systems help firms achieve customer intimacy?

- Define customer relationship management and explain why customer relationships are so important today.
- Describe how partner relationship management (PRM) and employee relationship management (ERM) are related to customer relationship management (CRM).
- Describe the tools and capabilities of customer relationship management software for sales, marketing, and customer service.
- Distinguish between operational and analytical CRM.

9-4 What are the challenges posed by enterprise applications and how are enterprise applications taking advantage of new technologies?

- List and describe the challenges posed by enterprise applications.
- Explain how these challenges can be addressed.
- Describe how business intelligence features are being used in enterprise applications
- How are enterprise applications taking advantage of SOA, Web services, open source software, and wireless technology?
- Define social CRM and explain how customer relationship management systems are using social networking.

Discussion Questions

✪ **9-5** Supply chain management is less about managing the physical movement of goods and more about managing information. Discuss the implications of this statement.

✪ **9-6** If a company wants to implement an enterprise application, it had better do its homework. Discuss the implications of this statement.

✪ **9-7** What advantages does a firm gain by implementing a social CRM application?

Hands-On MIS Projects

The projects in this section give you hands-on experience analyzing business process integration, suggesting supply chain management and customer relationship management applications, using database software to manage customer service requests, and evaluating supply chain management business services.

Management Decision Problems

9-8 Mercedes-Benz Retail Group UK Ltd, with a network of 18 retail sites, nine used car sites, and seven smart centers across London, Birmingham and Manchester, wanted to learn more about its customers. How could CRM and PRM systems help solve this problem?

9-9 Office Depot is a global supplier of office supply products and services in 59 countries. The company tries to offer a wider range of office supplies at lower cost than other retailers by using just-in-time replenishment and tight inventory control systems. It uses information from a demand forecasting system and point-of-sale data to replenish its inventory in its 2,200 retail stores around the world. Explain how these systems help Office Depot minimize costs and any other benefits they provide. Identify and describe other supply chain management applications that would be especially helpful to Office Depot.

Improving Decision Making: Using Database Software to Manage Customer Service Requests

Software skills: Database design; querying and reporting
Business skills: Customer service analysis

9-10 In this exercise, you'll use database software to develop an application that tracks customer service requests and analyzes customer data to identify customers meriting priority treatment.

Prime Service is a large service company that provides maintenance and repair services for close to 1,200 commercial businesses in New York, New Jersey, and Connecticut. Its customers include businesses of all sizes. Customers with service needs call into its customer service department with requests for repairing heating ducts, broken windows, leaky roofs, broken water pipes, and other problems. The company assigns each request a number and writes down the service request number, the identification number of the customer account, the date of the request, the type of equipment requiring repair, and a brief description of the problem. The service requests are handled on a first-come-first-served basis. After the service work has been completed, Prime calculates the cost of the work, enters the price on the service request form, and bills the client. This arrangement treats the most important and profitable clients—those with accounts of more than $70,000—no differently from its clients with small accounts. Managment would like to find a way to provide its best customers with better service. Management would also like to know which types of service problems occur most frequently so that it can make sure it has adequate resources to address them.

Prime Service has a small database with client account information, which can be found in MyMISLab™. Use database software to design a solution that would enable Prime's customer service representatives to identify the most important customers so that they could receive priority service. Your solution will require more than one table. Populate your database with at least 10 service requests. Create several reports that would be of interest to management, such as a list of the highest—and lowest—priority accounts and a report showing the most frequently occurring service problems. Create a report listing service calls that customer service representatives should respond to first on a specific date.

Achieving Operational Excellence: Evaluating Supply Chain Management Services

Software skills: Web browser and presentation software
Business skills: Evaluating supply chain management services

9-11 In addition to carrying goods from one place to another, some trucking companies provide supply chain management services and help their customers manage their information. In this project, you'll use the Web to research and evaluate two of these business services. Investigate the Web sites of two companies, UPS Logistics and Schneider Logistics, to see how these companies' services can be used for supply chain management. Then respond to the following questions:

- What supply chain processes can each of these companies support for their clients?
- How can customers use the Web sites of each company to help them with supply chain management?
- Compare the supply chain management services provided by these companies. Which company would you select to help your firm manage its supply chain? Why?

Collaboration and Teamwork Project

9-12 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Docs, Google Sites, Google +, or other open-source collaboration tools to complete the assignment.

WIM Industries: From MRP to ERP

CASE STUDY

Welding Industries Malaysia (WIM) is the only local Malasian company that manufactures welding machines for commercial use. WIM's remarkable success story, which includes surviving the 1997/8 financial crisis and the rise of competition from China, is attributable to the very effective enterprise resource planning (ERP) system it has adopted. In the past, WIM was using an materials resource planning (MRP) system, but this system, while a large advance over paper-based management techniques, nevertheless created many problems as the company's operations expanded. MRP systems do not integrated information from various divisions within a company, but instead automate processes and information within departments. For WIM this meant there was no platform with which to integrate data from different departments, there was a prevalence of data duplication and redundancy, and inconsistent data were supplied to managers. In addition to this, the departments within the company were acting as separate entities and information was not being shared. The growing size of the firm and the corresponding increase in the sizes of departments also bogged down the flow of information. There were no predefined standards for data communications and information was often lost. In the absence of an enterprise-wide approach to information, WIM had a diffficult time meeting production schedules. The lack of communication of vital information resulted in a loss of crucial resources; that is, people, material, and machinery. Senior management could not obtain a complete view of the company as a whole, but instead had to rely on *piecemeal reports from each division.* As Keng Foon Leong, General Manager, WIM, explained, "The local MRP system had the manufacturing modules, but it couldn't manage huge data. We could not see our material movement on our previous system". Overall productivity of the manufacturing process was falling, employees were disengaged and customers did not return. This set alarm bells ringing..

Based on the problems in their existing system, the management at WIM developed a set of objectives to guide the development of a new system. The objectives included an increase in the visibility and sharing of all reports on manufacturing; improved coordination across functional departments to increase efficiency; better management of procurement and inventory processes; the facilitation of day-to-day management; and the 24x7 availability of financial information of the entire firm. Management also demanded standardization of data formats across the company, and greater accuracy, along with remote access and improved security. They also decided that the inclusion of best practices and other vital information could lead to an increase in productivity and greater ownership.

After careful assessment, WIM decided to hire the services of Epicor Software Corporation for their ERP needs. Epicor is a software solutions provider to various enterprises in the manufacturing, distribution, retail, and service industries. Epicor has over 40 years of experience and has more than 20,000 customers in over 150 countries. "We reviewed a number of ERP vendors. We looked at each system and its functionality. Epicor stood out with its ability to link to our operations and provide the data we needed" said Leong. The first step was to put together a functional team comprising project management, IT systems managers, and executive management. The project management team defined the scope of the ERP system, assessed available resources at WIM, and budgeted the cost of implementation. The executive team ensured that the resulting system achieved business objectives and strategies, while technical expertise and support was provided by the IT team. A communication plan was designed to keep each individual member informed about current progress and the next steps in the plan. This was an essential part of change management at WIM. The system was implemented using a phased approach, since Epicor believes that key functionalities of the system need to be implemented in the first phase, followed by less major processes in the second phase, and so on.

ERP at WIM has changed the way the firm functions. The role of ERP in managing manufacturing processes now extends from procurement all the way to consumption. Holistic information on material, machinery, and labor, such as the cost structure of all raw materials, can now be accurately assessed. WIM is now able to utilize its resources to reap maximum profits. ERP has also integrated different departments at WIM, resulting in increased efficiency in operations at the firm. The manufacturing process can now be effectively and minutely planned using ERP, through the identification of the tasks

and activities underlying each process, and the time required to complete them. The start and end times of sequences are estimated, and this enables the manufacturing process to be carried out smoothly, with any delays being immediately flagged up for further action, thus minimizing downtime. Better planning also facilitates effective monitoring of the process. In addition to these positive outcomes, the complexity of risk management and issue management is reduced thanks to the increased visibility of process information.

The implemtation of Epicor's ERP software has helped WIM to scale up its operations. As Leong explains, "Epicor provides us with greater visibility over our material movement and having an advanced MRP system within a comprehensive solution like Epicor is very important to the business." The success of any manufacturing company also lies in how inventory is utilized. The software tracks and controls all procurement activities, schedules production processes, manages costs, and generates information that helps WIM to manage its inventory. It accurately forecasts the demand for materials and provides clear visibility into the lead time of ordered material. WIM purchases materials near the time of consumption, which leads to a reduction in maintenance of inventory levels in the organization. For instance, when quantities of a particular raw material exceed the minimum level or the maximum level respectively, an email alert is generated by the system to notify users, who can then decide whether to requision further quantities.

Furthermore, accurate information from all departments is recorded on the system, and this allows WIM to measure performance against key indicators in order to improve the quality of its business. As Leong notes, "Epicor has helped us to save money because we can make business decisions more clearly. We know that the data is accurate and the reports are correct. We can call on the Epicor system to support our decision-making process and let us make decisions faster and justify our spending."

Sources: http://www.epicor.com; http://www.wim.com.my/; http://weldingindustries.infotoday.com.my/

CASE STUDY QUESTIONS

9-13 Why did WIM feel the need to implement an ERP system?

9-14 What goals was the ERP system used to achieve at WIM? Critically analyze how these goals helped WIM to overcome obsctacles they had faced earlier.

9-15 How has Epicor's ERP system helped WIM to make its production process more efficient?

9-16 How did WIM manage the change from a local MRP system to Epicor's ERP system?

MyMISLab

Go to **mymislab.com** for the following Assisted-graded writing questions.

9-17 What are 3 reasons why a company would want to implement an enterprise resource planning (ERP) system and two reasons why it might not want to do so.

9-18 What are the sources of data for analytical CRM systems? Provide three examples of outputs from analytical CRM systems.

Chapter 9 References

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CHAPTER CASES

Video Cases

Part 1: Marketspace and Community
Part 2: Marketspace B2B Marketplace
Part 3: Digital Goods

Online Learning Resources

Visit the Laudon e-commerce website for additional cases, tutorials, and other online resources.

CHAPTER 10

E-commerce: Digital Markets, Digital Goods

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

- What are the fundamental features of e-commerce, digital markets, and digital goods?
- What are the principal e-commerce business and revenue models?
- How has e-commerce transformed marketing?
- How has e-commerce affected business-to-business transactions?
- What is the role of m-commerce in business and what are the most important m-commerce applications?
- What issues must be addressed when building an e-commerce presence?

E-commerce: Digital Markets, Digital Goods

CHAPTER 10

LEARNING OBJECTIVES

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4. How has e-commerce affected business-to-business transactions?
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6. What issues must be addressed when building an e-commerce presence?

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CHAPTER CASES

Otto Group: Profits from Prediction
Can Pandora Succeed with Freemium?
Will Mobile Technology Put Orbitz in the Lead?
To Pay or Not to Pay: Zagat's Dilemma

VIDEO CASES

Groupon: Deals Galore
Etsy: A Marketplace and Community
Ford AutoXchange B2B Marketplace

OTTO GROUP: PROFITS FROM PREDICTION

Otto Group is the world's largest mail order company, the second largest online retailer in Europe behind Amazon, and the third largest online retailer in the world. In 2013 Otto Group generated €12 billion in total global revenue, and over €6 billion in online global sales, nearly all of which is generated in Europe. By comparison, in 2013 Amazon had online sales in Europe of €13.6 billion, and total global sales of approximately €45 billion. For perspective, China's online retail giant, Alibaba, generated €116 billion in 2012. Founded in 1949 in Hamburg by Werner Otto as a catalog merchant selling 28 styles of shoes, by 2013 Otto Group was composed of 123 companies operating in more than twenty countries, employing over 53,000 people. Otto carries more than 1.8 million items and 3600 brands on its sites every day.

Though Otto Group originated in Germany, in the 1990s, the company began an aggressive acquisition program throughout Europe, North America, and China. You may not recognize the Otto Group corporate name, but you will recognize some of its better known brands, including Crate and Barrel (U.S. furnishing), Bombay Co. (U.S. furniture), s.Oliver (German fashion), Eddie Bauer (U.S. fashion), Tom Tailor (Europe fashion), and 3 Suisses (French mail order fashion).

Otto Group's aggressive acquisition growth strategy has created its own set of challenges. Purchasing over 100 companies in the past few decades, it has inherited a bewildering array of products, accounting systems, multiple sales channels, and market dynamics. Geography added additional complexity for managers trying to deliver products to consumers in a timely manner.



Predicting demand became a major issue. The traditional retail marketing system was sometimes in error: shelves throughout the Otto Group could be filled with goods that did not sell, creating large losses. Other shelves could be empty because the traditional system could not respond to hot trends in a timely manner. In the traditional retail system, dynamic pricing (lowering prices to clear overstock items, or raising prices on really hot fashions) was impossible. In the past, Otto had used various offline regression analysis programs to predict demand, but they were often too late and slow to respond to real-time market changes.

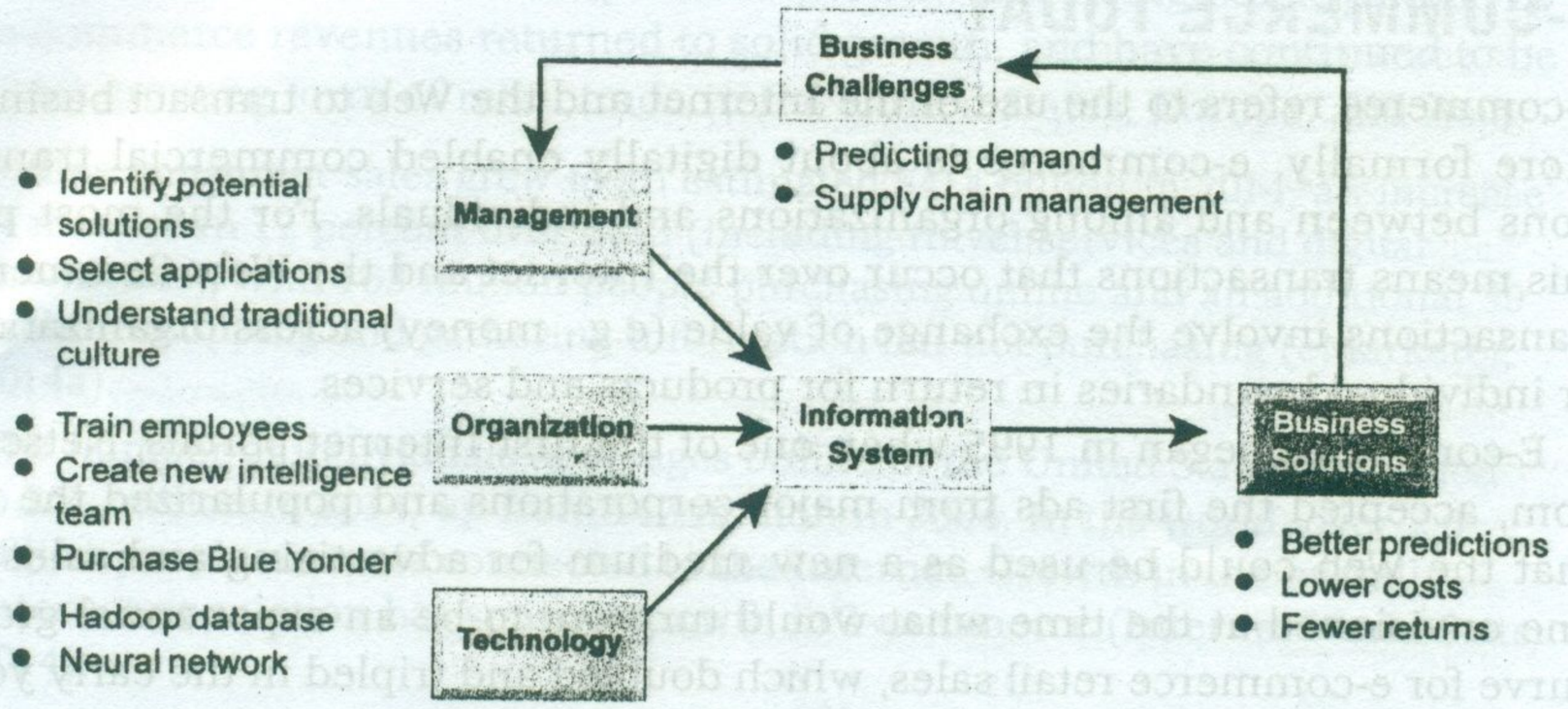
The Otto Group turned to Big Data and predictive analytics to help it achieve real-time market decision making. It worked with Teradata Inc. (San Diego) to create a data warehouse containing literally terabytes of customer data from its online and catalog operations in twenty countries. The Teradata Portfolio for Hadoop software provides flexible Big Data storage for firms using SQL and non-SQL databases. It allows firms to analyze social media, documents, text, images, and other non-structured data. For instance, when yellow blouses are mentioned on thousands of Twitter posts followed by Otto's customers in France, based on prior knowledge of the relationship between Twitter posts and its own sales to followers, it may want to expand its inventory of yellow blouses in France.

To analyze and understand its huge collection of customer data, Otto Group purchased a software company now named Blue Yonder software, a leading provider of forecasting and data pattern recognition, or what is called "predictive analytics." Using an artificial intelligence program to recognize patterns in very large data sets, Blue Yonder's NeuroBayes software is used by firms to discover patterns in data by analyzing up to petabytes of information per second.

Using predictive analytics and Big Data repositories, Otto Group has been able to increase its ability to forecast demand by 40%, and it claims to have reaped tens of millions of euros in savings. Otto calculates annually over one billion individual consumer predictions which it aggregates to predict demand for its 40,000 online and catalog products. Leftover merchandise has been reduced by 20 percent. Predicting how many items will be returned has become more precise and has helped the company understand why they are returned. The firm can use the same systems to engage in dynamic pricing, changing prices in accordance with aggregate demand, as well as individual propensities to spend.

Implementing a data-driven approach to marketing has also introduced cultural and organizational challenges. Otto's experienced merchandisers and buyers have a long history of making correct decisions when it comes to selecting products to sell, and the price points that motivate consumers. To ensure predictive analytics and data-driven decision making is used throughout the firm whenever possible, Otto Group created a central business intelligence team. This was a major cultural shift within the firm. Time will tell if the central business intelligence team can outperform Otto's human professionals, or if they will learn and work together to produce better results.

Sources: "E-Commerce Turnover: Otto Group Clears 6 bn € Hurdle," Ottogroup.com, June 3, 2014; Vanessa Houlder, "Amazon's European Sales Rise 14% To €13.6bn," Ft.com, May 25, 2014; Blue Yonder GmbH & Co., "Otto Improves Its Prediction Quality by up to 50% with Blue Yonder," blue-yonder.com/solutions, December 11, 2013; Lindsay Clarke, "German Retailer Otto Invests in Neural Software to Net Future Sales," *Computer Weekly*, November 9, 2012; Dan Conway, "Terradata Delivers Industry's First Flexible, Comprehensive Hadoop Portfolio," Terradata.com/News-Releases, June 26, 2013; and Lindsay Clarke, "Analysis: How Tesco and Otto Are Using Data to Forecast Demand," *Retail Week*, October 10, 2013.



The chapter-opening diagram calls attention to important points raised by his case and this chapter. Otto's primary challenge is understanding and predicting the demand for thousands of products it sells online and through catalogs in twenty countries. If it could solve this challenge it could make its supply chain more effective and responsive, reduce returns, lower overall costs, and increase its profit margins. To solve this challenge Otto turned to new database technology and new analytic software for analyzing non-structured customer data. To implement its new approach to demand prediction and buying, it created a new organizational unit and retrained employees in how to take advantage of the new technologies. These results allow the firm to make its supply chain more responsive and efficient.

Here are some questions to think about: How did the global nature of Otto's business present problems for the company? How did analyzing big data change the way the company ran its business?

10.1 WHAT ARE THE UNIQUE FEATURES OF E-COMMERCE, DIGITAL MARKETS, AND DIGITAL GOODS?

Bought an iTunes track lately, streamed a Netflix movie to your home TV, purchased a book at Amazon, or a diamond at Blue Nile? If so, you've engaged in e-commerce. In 2014, an estimated 196 million Americans went shopping online, and 163 million purchased something online as did millions of others worldwide. And although most purchases still take place through traditional channels, e-commerce continues to grow rapidly and to transform the way many companies do business. In 2014, e-commerce consumer sales of goods, services, and content will reach 470 billion, about 6.5 percent of all retail sales, and they are growing at 12 percent annually (compared to 3.5 percent for traditional retailers) (eMarketer, 2014a). In just the past two years, e-commerce has expanded from the desktop and home computer to mobile devices, from an isolated activity to a new social commerce, and from a Fortune 1000 commerce with a national audience to local merchants and consumers whose location is known to mobile devices. At the top 100 e-commerce retail sites, more than half of online shoppers arrive from their smartphones, although most continue to purchase using a PC or tablet. The key words for understanding this new e-commerce in 2014 are "social, mobile, local."

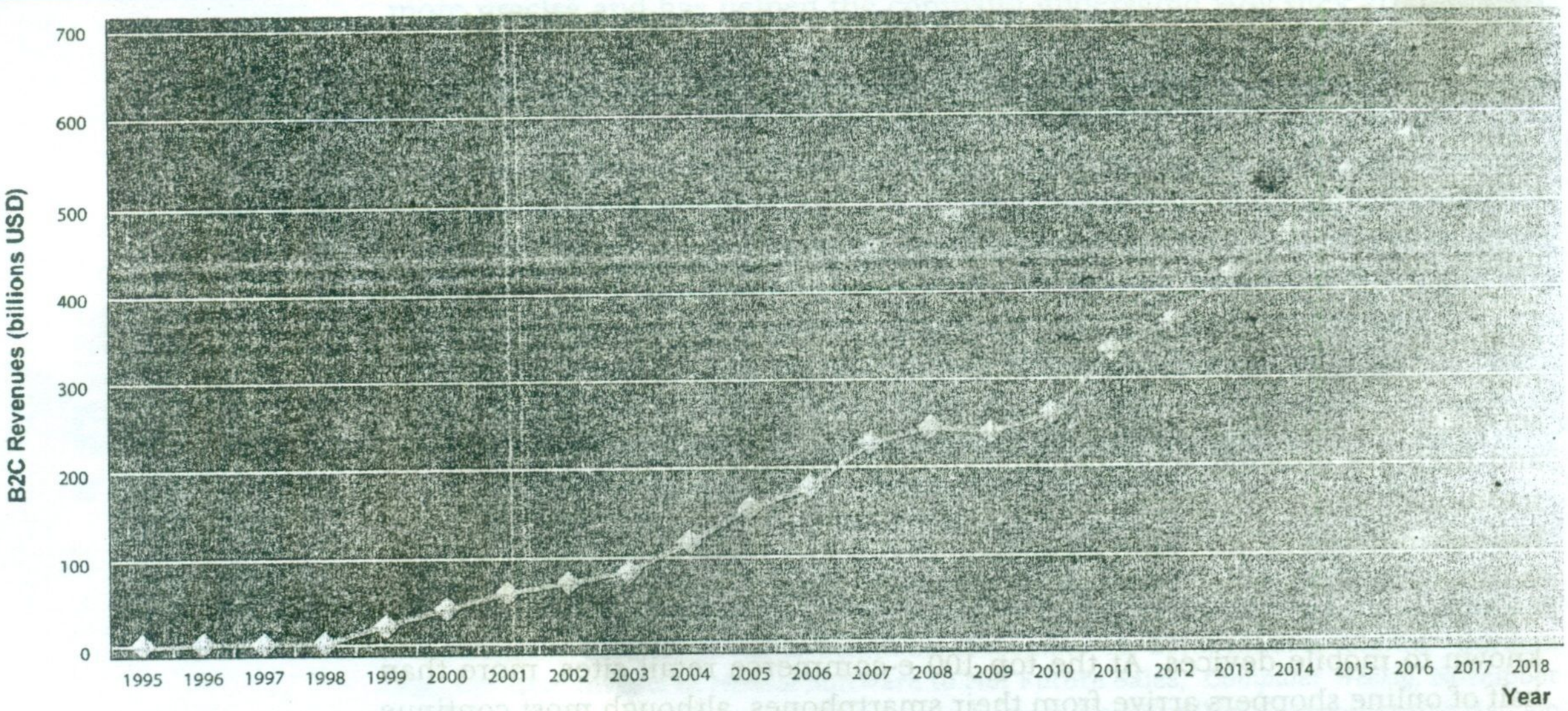
E-COMMERCE TODAY

E-commerce refers to the use of the Internet and the Web to transact business. More formally, e-commerce is about digitally enabled commercial transactions between and among organizations and individuals. For the most part, this means transactions that occur over the Internet and the Web. Commercial transactions involve the exchange of value (e.g., money) across organizational or individual boundaries in return for products and services.

E-commerce began in 1995 when one of the first Internet portals, Netscape.com, accepted the first ads from major corporations and popularized the idea that the Web could be used as a new medium for advertising and sales. No one envisioned at the time what would turn out to be an exponential growth curve for e-commerce retail sales, which doubled and tripled in the early years. E-commerce grew at double-digit rates until the recession of 2008–2009 when growth slowed to a crawl. In 2009, e-commerce revenues were flat (Figure 10.1), not bad considering that traditional retail sales were shrinking by 5 percent annually. In fact, e-commerce during the recession was the only stable segment in retail. Some online retailers forged ahead at a record pace: Amazon's 2009 revenues were up 25 percent over 2008 sales. Despite the continuing slow growth in 2013, the number of online buyers increased by 5 percent to 155 million, and the number of online retail transactions was up 8 percent. Amazon's sales grew to $74 billion in 2013, up an incredible 24 percent from 2012!

Mirroring the history of many technological innovations, such as the telephone, radio, and television, the very rapid growth in e-commerce in the early years created a market bubble in e-commerce stocks. Like all bubbles, the "dot-com" bubble burst (in March 2001). A large number of e-commerce companies failed during this process. Yet for many others, such as Amazon, eBay, Expedia, and Google, the results have been more positive: soaring revenues,

FIGURE 10.1 THE GROWTH OF E-COMMERCE



Retail e-commerce revenues grew 15–25 percent per year until the recession of 2008–2009, when they slowed measurably. In 2014, e-commerce revenues are growing again at an estimated 12 percent annually.

fine-tuned business models that produce profits, and rising stock prices. By 2006, e-commerce revenues returned to solid growth, and have continued to be the fastest growing form of retail trade in the United States, Europe, and Asia.

- Online consumer sales grew to an estimated $414 billion in 2014, an increase of more than 12 percent over 2013 (including travel services and digital downloads), with 163 million people purchasing online and an additional 39 million shopping and gathering information but not purchasing (eMarketer, 2014a).
- The number of individuals of all ages online in the United States expanded to 251 million in 2014, up from 147 million in 2004. In the world, over 2.8 billion people are now connected to the Internet. Growth in the overall Internet population has spurred growth in e-commerce (Internet World Stats, 2014).
- Approximately 90 million households have broadband access to the Internet in 2014, representing about 74 percent of all households.
- About 167 million Americans now access the Internet using a smartphone such as an iPhone, Android, or BlackBerry. Mobile e-commerce has begun a rapid growth based on apps, ringtones, downloaded entertainment, and location-based services. Mobile commerce will add up to about $84 billion in 2014 (roughly triple 2010's revenue). Amazon sold an estimated $11 billion in retail goods to mobile users in 2013. In a few years, mobile phones will be the most common Internet access device. Currently half of all mobile phone users access the Internet using their phones.
- On an average day, an estimated 212 million adult U.S. Internet users go online. About 152 million send e-mail, 152 million use a search engine, and 117 million get news. Around 124 million use a social network, 62 million do online banking, 73 million watch an online video, and 44 million look for information on Wikipedia (Pew Internet & American Life Project, 2014).
- B2B e-commerce (use of the Internet for business-to-business commerce and collaboration among business partners) expanded to more than $5.7 trillion. Table 10.1 highlights these new e-commerce developments.

THE NEW E-COMMERCE: SOCIAL, MOBILE, LOCAL

One of the biggest changes is the extent to which e-commerce has become more social, mobile, and local. Online marketing consisted largely of creating a corporate Web site, buying display ads on Yahoo, purchasing ad words on Google, and sending e-mails. The workhorse of online marketing was the display ad. It still is. But it's increasingly being replaced by video ads which are far more effective. Display ads from the very beginning of the Internet were based on television ads where brand messages were flashed before millions of users who were not expected to respond immediately, ask questions, or make observations. If the ads did not work, the solution was often to repeat the ad. The primary measure of success was how many "eyeballs" (unique visitors) a Web site produced, and how many "impressions" a marketing campaign generated. (An impression was one ad shown to one person.) Both of these measures were carry overs from the world of television, which measures marketing in terms of audience size and ad views.

From Eyeballs to Conversations

After 2007, all this changed with the rapid growth of Facebook and other social sites, the explosive growth of smartphones beginning with Apple iPhone, and the growing interest in local marketing. What's different about the new world of

TABLE 10.1 THE GROWTH OF E-COMMERCE

BUSINESS TRANSFORMATION
E-commerce remains the fastest growing form of commerce when compared to physical retail stores, services, and entertainment.
Social, mobile, and local commerce have become the fastest growing forms of e-commerce.
The first wave of e-commerce transformed the business world of books, music, and air travel. In the second wave, nine new industries are facing a similar transformation scenario: marketing and advertising, telecommunications, movies, television, jewelry and luxury goods, real estate, online travel, bill payments, and software.
The breadth of e-commerce offerings grows, especially in the services economy of social networking, travel, entertainment, retail apparel, jewelry, appliances, and home furnishings.
The online demographics of shoppers broaden to match that of ordinary shoppers.
Pure e-commerce business models are refined further to achieve higher levels of profitability, whereas traditional retail brands, such as Sears, JCPenney, L.L.Bean, and Walmart, use e-commerce to retain their dominant retail positions.
Small businesses and entrepreneurs continue to flood the e-commerce marketplace, often riding on the infrastructures created by industry giants, such as Amazon, Apple, and Google, and increasingly taking advantage of cloud-based computing resources.
Mobile e-commerce begins to take off in the United States with location-based services and entertainment downloads including e-books, movies, music and television shows.
TECHNOLOGY FOUNDATIONS
Wireless Internet connections (Wi-Fi, WiMax, and 3G/4G smartphones) grow rapidly.
Powerful smartphones, and tablet computers, music, Web surfing, and entertainment as well as voice communication. Podcasting and streaming take off as mediums for distribution of video, radio, and user-generated content.
Mobile devices expand to include Apple Watch, Google Glass, and wearable computers.
The Internet broadband foundation becomes stronger in households and businesses as transmission prices fall. More than 89 million households had broadband cable or DSL access to the Internet in 2014, about 74 percent of all households in the United States (eMarketer, 2014c).
Social networking software and sites such as Facebook, Google +, Twitter, LinkedIn, and others become a major new platform for e-commerce, marketing, and advertising. Facebook hits 1.2 billion users worldwide, and 151 million in the United States (Facebook, 2014).
New Internet-based models of computing, such as smartphone apps, cloud computing, software as a service (SaaS), and Web 2.0 software greatly reduce the cost of e-commerce Web sites.
NEW BUSINESS MODELS EMERGE
More than half the Internet user population have joined an online social network, contribute to social bookmarking sites, create blogs, and share photos. Together these sites create a massive online audience as large as television that is attractive to marketers. In 2014, social networking accounts for an estimated 25 percent of online time.
The traditional advertising industry is disrupted as online advertising grows twice as fast as TV and print advertising; Google, Yahoo, and Facebook display nearly 1 trillion ads a year.
Social sharing e-commerce sites like Uber and Airbnb extend the the market creator business model to new areas.
Newspapers and other traditional media adopt online, interactive models but are losing advertising revenues to the online players despite gaining online readers. The New York Times adopts a paywall for its online edition and succeeds in capturing 850,000 subscribers. Book publishing thrives because of the growth in e-books, and the appeal of traditional books.
Online entertainment business models offering television, movies, music, and games with cooperation among the major copyright owners in Hollywood and New York and with Internet distributors like Apple, Amazon, Google, YouTube, and Facebook.

social-mobile-local e-commerce are the dual and related concepts of "conversations" and "engagement." Marketing in this new period is based on firms engaging in multiple online conversations with their customers, potential customers, and even critics. Your brand is being talked about on the Web and social media (that's the conversation part), and marketing your firm, building and restoring your brands, requires you to locate, identify, and participate in these conversations. Social marketing means all things social like listening, discussing, interacting, empathizing, and engaging. The emphasis in online marketing has shifted from a focus on eyeballs to a focus on participating in customer-oriented conversations. In this sense, social marketing is not simply a "new ad channel," but a collection of technology-based tools for communicating with shoppers.

In the past, firms could tightly control their brand messaging, and lead consumers down a funnel of cues that ended in a purchase. That is not true of social marketing. Consumer purchase decisions are increasingly driven by the conversations, choices, tastes, and opinions of their social network. Social marketing is all about firms participating in and shaping this social process.

From the Desktop to the Smartphone

Traditional online marketing (browser-based, search and display ads, e-mail, and games) still constitutes the majority (65 percent) of all online marketing ($51 billion), but it's growing much more slowly than social-mobile-local marketing. The marketing dollars are following customers and shoppers from the PC to mobile devices.

Social, mobile, and local e-commerce are connected. As mobile devices become more powerful, they are more useful for accessing Facebook and other social sites. As mobile devices become more widely adopted, they can be used by customers to find local merchants, and by merchants to alert customers in their neighborhood of special offers.

WHY E-COMMERCE IS DIFFERENT

Why has e-commerce grown so rapidly? The answer lies in the unique nature of the Internet and the Web. Simply put, the Internet and e-commerce technologies are much richer and more powerful than previous technology revolutions like radio, television, and the telephone. Table 10.2 describes the unique features of the Internet and Web as a commercial medium. Let's explore each of these unique features in more detail.

Ubiquity

In traditional commerce, a marketplace is a physical place, such as a retail store, that you visit to transact business. E-commerce is ubiquitous, meaning that it is available just about everywhere, at all times. It makes it possible to shop from your desktop, at home, at work, or even from your car, using smartphones. The result is called a **marketspace**—a marketplace extended beyond traditional boundaries and removed from a temporal and geographic location.

From a consumer point of view, ubiquity reduces **transaction costs**—the costs of participating in a market. To transact business, it is no longer necessary that you spend time or money traveling to a market, and much less mental effort is required to make a purchase.

Global Reach

E-commerce technology permits commercial transactions to cross cultural and national boundaries far more conveniently and cost effectively than is true in

TABLE 10.2 EIGHT UNIQUE FEATURES OF E-COMMERCE TECHNOLOGY

E-COMMERCE TECHNOLOGY DIMENSION	BUSINESS SIGNIFICANCE
Ubiquity. Internet/Web technology is available everywhere: at work, at home, and elsewhere via desktop and mobile devices. Mobile devices extend service to local areas and merchants.	The marketplace is extended beyond traditional boundaries and is removed from a temporal and geographic location. "Marketspace" is created; shopping can take place anytime, anywhere. Customer convenience is enhanced, and shopping costs are reduced.
Global Reach. The technology reaches across national boundaries, around the earth.	Commerce is enabled across cultural and national boundaries seamlessly and without modification. The marketspace includes, potentially, billions of consumers and millions of businesses worldwide.
Universal Standards. There is one set of technology standards, namely Internet standards.	With one set of technical standards across the globe, disparate computer systems can easily communicate with each other.
Richness. Video, audio, and text messages are possible.	Video, audio, and text marketing messages are integrated into a single marketing message and consumer experience.
Interactivity. The technology works through interaction with the user.	Consumers are engaged in a dialog that dynamically adjusts the experience to the individual, and makes the consumer a co-participant in the process of delivering goods to the market.
Information Density. The technology reduces information costs and raises quality.	Information processing, storage, and communication costs drop dramatically, whereas currency, accuracy, and timeliness improve greatly. Information becomes plentiful, cheap, and more accurate.
Personalization/Customization. The technology allows personalized messages to be delivered to individuals as well as groups.	Personalization of marketing messages and customization of products and services are based on individual characteristics.
Social Technology. The technology supports content generation and social networking.	New Internet social and business models enable user content creation and distribution, and support social networks.

traditional commerce. As a result, the potential market size for e-commerce merchants is roughly equal to the size of the world's online population (estimated to be more than 2 billion).

In contrast, most traditional commerce is local or regional—it involves local merchants or national merchants with local outlets. Television, radio stations and newspapers, for instance, are primarily local and regional institutions with limited, but powerful, national networks that can attract a national audience but not easily cross national boundaries to a global audience.

Universal Standards

One strikingly unusual feature of e-commerce technologies is that the technical standards of the Internet and, therefore, the technical standards for conducting e-commerce are universal standards. They are shared by all nations around the world and enable any computer to link with any other computer regardless of the technology platform each is using. In contrast, most traditional commerce technologies differ from one nation to the next. For instance, television and radio standards differ around the world, as does cellular telephone technology.

The universal technical standards of the Internet and e-commerce greatly lower **market entry costs**—the cost merchants must pay simply to bring their goods to market. At the same time, for consumers, universal standards reduce **search costs**—the effort required to find suitable products.

Richness

Information **richness** refers to the complexity and content of a message. Traditional markets, national sales forces, and small retail stores have great richness: They are able to provide personal, face-to-face service using aural and visual cues when making a sale. The richness of traditional markets makes them powerful selling or commercial environments. Prior to the development of the Web, there was a trade-off between richness and reach: The larger the audience reached, the less rich the message. The Web makes it possible to deliver rich messages with text, audio, and video simultaneously to large numbers of people.

Interactivity

Unlike any of the commercial technologies of the twentieth century, with the possible exception of the telephone, e-commerce technologies are interactive, meaning they allow for two-way communication between merchant and consumer. Television, for instance, cannot ask viewers any questions or enter into conversations with them, and it cannot request that customer information be entered into a form. In contrast, all of these activities are possible on an e-commerce Web site. Interactivity allows an online merchant to engage a consumer in ways similar to a face-to-face experience but on a massive, global scale.

Information Density

The Internet and the Web vastly increase **information density**—the total amount and quality of information available to all market participants, consumers, and merchants alike. E-commerce technologies reduce information collection, storage, processing, and communication costs while greatly increasing the currency, accuracy, and timeliness of information.

Information density in e-commerce markets make prices and costs more transparent. **Price transparency** refers to the ease with which consumers can find out the variety of prices in a market; **cost transparency** refers to the ability of consumers to discover the actual costs merchants pay for products.

There are advantages for merchants as well. Online merchants can discover much more about consumers than in the past. This allows merchants to segment the market into groups that are willing to pay different prices and permits the merchants to engage in **price discrimination**—selling the same goods, or nearly the same goods, to different targeted groups at different prices. For instance, an online merchant can discover a consumer's avid interest in expensive, exotic vacations and then pitch high-end vacation plans to that consumer at a premium price, knowing this person is willing to pay extra for such a vacation. At the same time, the online merchant can pitch the same vacation plan at a lower price to a more price-sensitive consumer. Information density also helps merchants differentiate their products in terms of cost, brand, and quality.

Personalization/Customization

E-commerce technologies permit **personalization**: Merchants can target their marketing messages to specific individuals by adjusting the message

to a person's clickstream behavior, name, interests, and past purchases. The technology also permits **customization**—changing the delivered product or service based on a user's preferences or prior behavior. Given the interactive nature of e-commerce technology, much information about the consumer can be gathered in the marketplace at the moment of purchase. With the increase in information density, a great deal of information about the consumer's past purchases and behavior can be stored and used by online merchants.

The result is a level of personalization and customization unthinkable with traditional commerce technologies. For instance, you may be able to shape what you see on television by selecting a channel, but you cannot change the content of the channel you have chosen. In contrast, the *Wall Street Journal* Online allows you to select the type of news stories you want to see first and gives you the opportunity to be alerted when certain events happen.

Social Technology: User Content Generation and Social Networking

In contrast to previous technologies, the Internet and e-commerce technologies have evolved to be much more social by allowing users to create and share with their personal friends (and a larger worldwide community) content in the form of text, videos, music, or photos. Using these forms of communication, users are able to create new social networks and strengthen existing ones.

All previous mass media in modern history, including the printing press, use a broadcast model (one-to-many) where content is created in a central location by experts (professional writers, editors, directors, and producers) and audiences are concentrated in huge numbers to consume a standardized product. The new Internet and e-commerce empower users to create and distribute content on a large scale, and permit users to program their own content consumption. The Internet provides a unique many-to-many model of mass communications.

KEY CONCEPTS IN E-COMMERCE: DIGITAL MARKETS AND DIGITAL GOODS IN A GLOBAL MARKETPLACE

The location, timing, and revenue models of business are based in some part on the cost and distribution of information. The Internet has created a digital marketplace where millions of people all over the world are able to exchange massive amounts of information directly, instantly, and for free. As a result, the Internet has changed the way companies conduct business and increased their global reach.

The Internet reduces information asymmetry. An **information asymmetry** exists when one party in a transaction has more information that is important for the transaction than the other party. That information helps determine their relative bargaining power. In digital markets, consumers and suppliers can "see" the prices being charged for goods, and in that sense digital markets are said to be more "transparent" than traditional markets.

For example, before auto retailing sites appeared on the Web, there was a significant information asymmetry between auto dealers and customers. Only the auto dealers knew the manufacturers' prices, and it was difficult for consumers to shop around for the best price. Auto dealers' profit margins depended on this asymmetry of information. Today's consumers have access to a legion of Web sites providing competitive pricing information, and three-fourths of U.S. auto buyers use the Internet to shop around for the best deal. Thus, the Web has reduced the information asymmetry surrounding an

auto purchase. The Internet has also helped businesses seeking to purchase from other businesses reduce information asymmetries and locate better prices and terms.

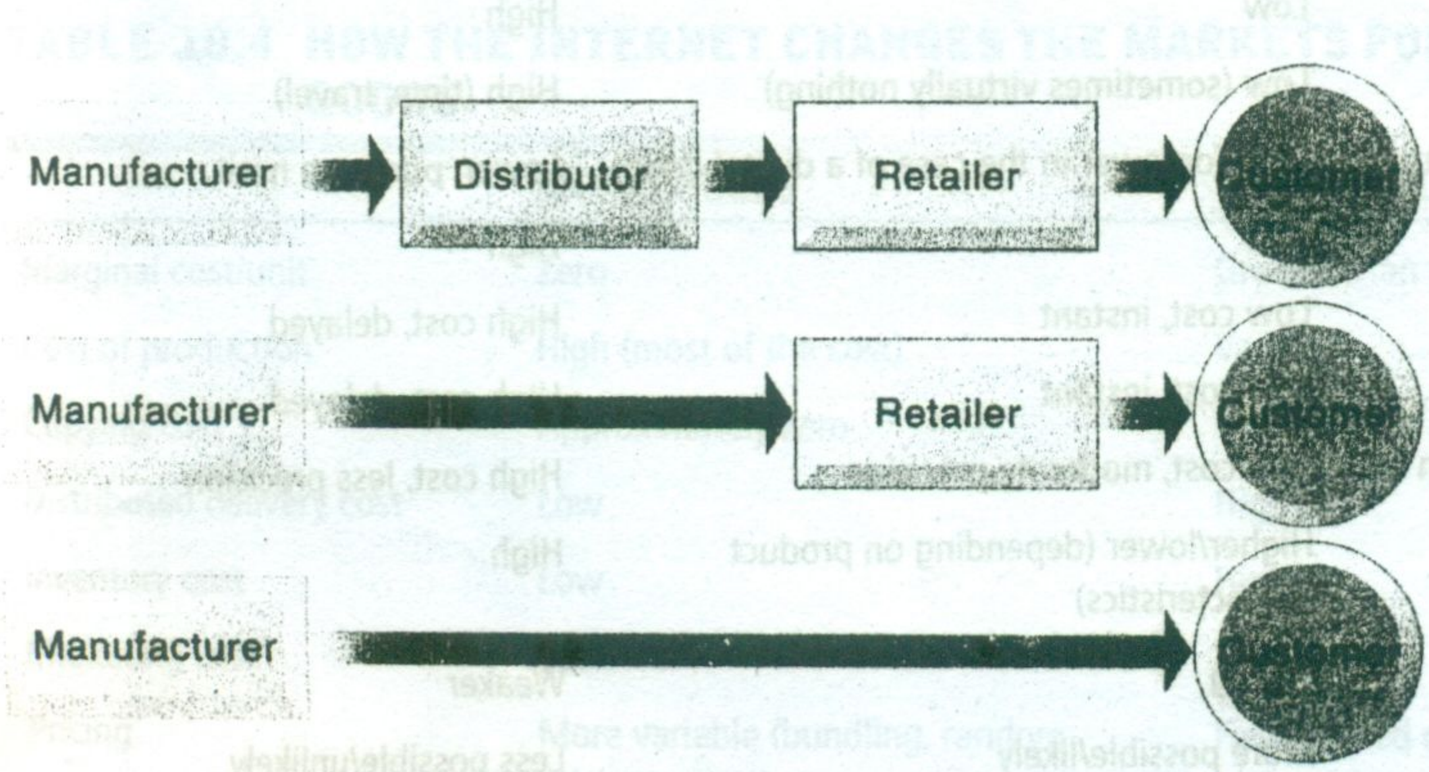
Digital markets are very flexible and efficient because they operate with reduced search and transaction costs, lower **menu costs** (merchants' costs of changing prices), greater price discrimination, and the ability to change prices dynamically based on market conditions. In **dynamic pricing**, the price of a product varies depending on the demand characteristics of the customer or the supply situation of the seller. For instance, online retailers from Amazon to Walmart change prices on many products based on time of day, demand for the product, and users' prior visits to their sites. Using big data analytics, some online firms can adjust prices at the individual level based on behavioral targeting parameters, such as whether the consumer is a price haggler (who will receive a lower price offer) versus a person who accepts offered prices and does not search for lower prices. Prices can also vary by zip code, with higher prices set for poor sections of a community.

These new digital markets may either reduce or increase switching costs, depending on the nature of the product or service being sold, and they may cause some extra delay in gratification. Unlike a physical market, you can't immediately consume a product such as clothing purchased over the Web (although immediate consumption is possible with digital music downloads and other digital products.)

Digital markets provide many opportunities to sell directly to the consumer, bypassing intermediaries, such as distributors or retail outlets. Eliminating intermediaries in the distribution channel can significantly lower purchase transaction costs. To pay for all the steps in a traditional distribution channel, a product may have to be priced as high as 135 percent of its original cost to manufacture.

Figure 10.2 illustrates how much savings result from eliminating each of these layers in the distribution process. By selling directly to consumers or reducing the number of intermediaries, companies are able to raise profits while charging lower prices. The removal of organizations or business process layers responsible for intermediary steps in a value chain is called **disintermediation**.

FIGURE 10.2 THE BENEFITS OF DISINTERMEDIATION TO THE CONSUMER



The typical distribution channel has several intermediary layers, each of which adds to the final cost of a product, such as a sweater. Removing layers lowers the final cost to the customer.

Disintermediation is affecting the market for services. Airlines and hotels operating their own reservation sites online earn more per ticket because they have eliminated travel agents as intermediaries. Table 10.3 summarizes the differences between digital markets and traditional markets.

Digital Goods

The Internet digital marketplace has greatly expanded sales of **digital goods**. Digital goods are goods that can be delivered over a digital network. Music tracks, video, Hollywood movies, software, newspapers, magazines, and books can all be expressed, stored, delivered, and sold as purely digital products. For the most part, digital goods are "intellectual property" which is defined as "works of the mind." Intellectual property is protected from misappropriation by copyright, patent, and trade secret laws (see Chapter 4). Today, all these products are delivered as digital streams or downloads, while their physical counterparts decline in sales.

In general, for digital goods, the marginal cost of producing another unit is about zero (it costs nothing to make a copy of a music file). However, the cost of producing the original first unit is relatively high—in fact, it is nearly the total cost of the product because there are few other costs of inventory and distribution. Costs of delivery over the Internet are very low, marketing costs often remain the same, and pricing can be highly variable. (On the Internet, the merchant can change prices as often as desired because of low menu costs.)

The impact of the Internet on the market for these kinds of digital goods is nothing short of revolutionary, and we see the results around us every day. Businesses dependent on physical products for sales—such as bookstores, music stores, book publishers, music labels, and film studios—face the possibility of declining sales and even destruction of their businesses. Newspapers and magazines subscriptions to hard copies are declining, while online readership and subscriptions are expanding.

Total record label industry revenues have fallen from $14 billion in 1999, to $7.1 billion estimated in 2013, a drop of 50 percent, due almost entirely to the decline in CD album sales, and the growth of digital music services (both legal

TABLE 10.3 DIGITAL MARKETS COMPARED TO TRADITIONAL MARKETS

	DIGITAL MARKETS	TRADITIONAL MARKETS
Information asymmetry	Asymmetry reduced	Asymmetry high
Search costs	Low	High
Transaction costs	Low (sometimes virtually nothing)	High (time, travel)
Delayed gratification	High (or lower in the case of a digital good)	Lower: purchase now
Menu costs	Low	High
Dynamic pricing	Low cost, instant	High cost, delayed
Price discrimination	Low cost, instant	High cost, delayed
Market segmentation	Low cost, moderate precision	High cost, less precision
Switching costs	Higher/lower (depending on product characteristics)	High
Network effects	Strong	Weaker
Disintermediation	More possible/likely	Less possible/unlikely

and illegal music piracy). On the plus side, the Apple iTunes Store has sold 35 billion songs for 99 cents each since opening in 2003, providing the industry with a digital distribution model that has restored some of the revenues lost to digital music channels. Since iTunes, illegal downloading has been cut in half, and legitimate online music sales are estimated to be approximately $4 billion in 2014. As cloud streaming services expand, illegal downloading will decline further. In that sense, Apple, along with other Internet distributors, saved the record labels from extinction. In 2013, digital music sales accounted for over 64 percent of all music revenues. Yet the music labels make only about 32 cents from a single track download and only .003 cents for a streamed track (with the hope that sales of tracks or CDs will result).

Hollywood has not been similarly disrupted by digital distribution platforms, in part because it is more difficult to download high-quality, pirated copies of full-length movies. To avoid the fate of the music industry, Hollywood has struck lucrative distribution deals with Netflix, Google, Amazon, and Apple, making it convenient to download and pay for high quality movies. Content is still king. Google and Apple may own the pipes and the devices, but without compelling content, they are not very profitable. Nevertheless, these arrangements are not enough to compensate entirely for the loss in DVD sales, which fell 50 percent from 2006 to 2013, although this is changing rapidly as the online distributors like Netflix pay billions for high-quality Hollywood content. In 2014, for the first time, consumers will view more and pay more for Web-based movie downloads, rentals, and streams than for DVDs or related physical products. As with television, the demand for feature-length Hollywood movies appears to be expanding in part because of the growth of smartphones and tablets making it easier to watch movies in more locations. In addition, the surprising resurgence of music videos, led by the Web site VEVO, is attracting millions of younger viewers on smartphones and tablets. Online movies began a growth spurt in 2010 as broadband services spread throughout the country. In 2011, movie viewing doubled in a single year. In 2014, about 73 million Internet users are expected to view movies, about one-third of the adult Internet audience. While this rapid growth will not continue forever, there is little doubt that the Internet is becoming a movie distribution and television channel that rivals cable television, and someday may replace cable television entirely. Table 10.4 describes digital goods and how they differ from traditional physical goods.

TABLE 10.4 HOW THE INTERNET CHANGES THE MARKETS FOR DIGITAL GOODS

	DIGITAL GOODS	TRADITIONAL GOODS
Marginal cost/unit	Zero	Greater than zero , high
Cost of production	High (most of the cost)	Variable
Copying cost	Approximately zero	Greater than zero, high
Distributed delivery cost	Low	High
Inventory cost	Low	High
Marketing cost	Variable	Variable
Pricing	More variable (bundling, random pricing games)	Fixed, based on unit costs

10.2 WHAT ARE THE PRINCIPAL E-COMMERCE BUSINESS AND REVENUE MODELS?

E-commerce has grown from a few advertisements on early Web portals in 1995 to over 9 percent of all retail sales in 2014 (an estimated $470 billion), surpassing the mail order catalog business. E-commerce is a fascinating combination of business models and new information technologies. Let's start with a basic understanding of the types of e-commerce, and then describe e-commerce business and revenue models.

TYPES OF E-COMMERCE

There are many ways to classify electronic commerce transactions—one is by looking at the nature of the participants. The three major electronic commerce categories are business-to-consumer (B2C) e-commerce, business-to-business (B2B) e-commerce, and consumer-to-consumer (C2C) e-commerce.

- **Business-to-consumer (B2C)** electronic commerce involves retailing products and services to individual shoppers. BarnesandNoble.com, which sells books, software, and music to individual consumers, is an example of B2C e-commerce.
- **Business-to-business (B2B)** electronic commerce involves sales of goods and services among businesses. ChemConnect's Web site for buying and selling chemicals and plastics is an example of B2B e-commerce.
- **Consumer-to-consumer (C2C)** electronic commerce involves consumers selling directly to consumers. For example, eBay, the giant Web auction site, enables people to sell their goods to other consumers by auctioning their merchandise off to the highest bidder, or for a fixed price. Craigslist is the most widely used platform used by consumers to buy from and sell directly to others.

Another way of classifying electronic commerce transactions is in terms of the platforms used by participants in a transaction. Until recently, most e-commerce transactions took place using a personal computer connected to the Internet over wired networks. Several wireless mobile alternatives have emerged: smartphones, tablet computers like iPads, dedicated e-readers like the Kindle, and smartphones and small tablet computers using Wi-Fi wireless networks. The use of handheld wireless devices for purchasing goods and services from any location is termed **mobile commerce** or **m-commerce**. Both business-to-business and business-to-consumer e-commerce transactions can take place using m-commerce technology, which we discuss in detail in Section 10.3.

E-COMMERCE BUSINESS MODELS

Changes in the economics of information described earlier have created the conditions for entirely new business models to appear, while destroying older business models. Table 10.5 describes some of the most important Internet business models that have emerged. All, in one way or another, use the Internet to add extra value to existing products and services or to provide the foundation for new products and services.

Portal

Portals are gateways to the Web, and are often defined as those sites which users set as their home page. Some definitions of a portal include search engines

TABLE 10.5 INTERNET BUSINESS MODELS

CATEGORY	DESCRIPTION	EXAMPLES
E-tailer	Sells physical products directly to consumers or to individual businesses.	Amazon RedEnvelope.com
Transaction broker	Saves users money and time by processing online sales transactions and generating a fee each time a transaction occurs.	ETrade.com Expedia
Market creator	Provides a digital environment where buyers and sellers can meet, search for products, display products, and establish prices for those products. Can serve consumers or B2B e-commerce, generating revenue from transaction fees.	eBay Priceline.com Exostar Elemica
Content provider	Creates revenue by providing digital content, such as news, music, photos, or video, over the Web. The customer may pay to access the content, or revenue may be generated by selling advertising space.	WSJ.com GettyImages.com iTunes.com Games.com
Community provider	Provides an online meeting place where people with similar interests can communicate and find useful information.	Facebook Google+ iVillage, Twitter
Portal	Provides initial point of entry to the Web along with specialized content and other services.	Yahoo Bing Google
Service provider	Provides Web 2.0 applications such as photo sharing, video sharing, and user-generated content as services. Provides other services such as online data storage and backup.	Google Apps Photobucket.com Dropbox

like Google and Bing even if few make these sites their home page. Portals such as Yahoo, Facebook, MSN, and AOL offer powerful Web search tools as well as an integrated package of content and services, such as news, e-mail, instant messaging, maps, calendars, shopping, music downloads, video streaming, and more, all in one place. Initially, portals were primarily "gateways" to the Internet. Today, however, the portal business model provides a destination site where users start their Web searching and linger to read news, find entertainment, meet other people, and, of course, be exposed to advertising which provides the revenues to support the portal. Portals generate revenue primarily by attracting very large audiences, charging advertisers for display ad placement (similar to traditional newspapers), collecting referral fees for steering customers to other sites, and charging for premium services. In 2014, portals (not including Google or Bing) generated an estimated $14.2 billion in display ad revenues. For comparison, search ads generated $13.8 billion, and video ads generated $4.5 billion. Although there are hundreds of portal/search engine sites, the top four portals (Yahoo, Facebook, MSN, and AOL) gather more than 95 percent of the Internet portal traffic because of their superior brand recognition (comScore, 2014a; eMarketer, 2014b).

E-tailer

Online retail stores, often called **e-tailers**, come in all sizes, from giant Amazon with 2013 revenues of more than $74.5 billion, to tiny local stores that have Web sites. An e-tailer is similar to the typical bricks-and-mortar storefront, except that customers only need to connect to the Internet to check their inventory

and place an order. Altogether, online retail will generate about $304 billion in revenues for 2014. The value proposition of e-tailers is to provide convenient, low-cost shopping 24/7, offering large selections and consumer choice. Some e-tailers, such as Walmart.com or Staples.com, referred to as "bricks-and-clicks," are subsidiaries or divisions of existing physical stores and carry the same products. Others, however, operate only in the virtual world, without any ties to physical locations. Amazon, BlueNile.com, and Drugstore.com are examples of this type of e-tailer. Several other variations of e-tailers—such as online versions of direct mail catalogs, online malls, and manufacturer-direct online sales—also exist.

Content Provider

While e-commerce began as a retail product channel, it has increasingly turned into a global content channel. "Content" is defined broadly to include all forms of intellectual property. **Intellectual property** refers to all forms of human expression that can be put into a tangible medium such as text, CDs, or DVDs, or stored on any digital (or other) media, including the Web. Content providers distribute information content—such as digital video, music, photos, text, and artwork—over the Web. The value proposition of online content providers is that consumers can conveniently find a wide range of content online and purchase this content inexpensively, to be played or viewed on multiple computer devices or smartphones.

Providers do not have to be the creators of the content (although sometimes they are, like Disney.com), and are more likely to be Internet-based distributors of content produced and created by others. For example, Apple sells music tracks at its iTunes Store, but it does not create or commission new music.

The phenomenal popularity of the iTunes Store, and Apple's Internet-connected devices like the iPhone, iPod, and iPad, have enabled new forms of digital content delivery from podcasting to mobile streaming. **Podcasting** is a method of publishing audio or video broadcasts via the Internet, allowing subscribing users to download audio or video files onto their personal computers or portable music players. **Streaming** is a publishing method for music and video files that flows a continuous stream of content to a user's device without being stored locally on the device.

Estimates vary, but total online media is the fastest growing segment within e-commerce, growing at an estimated 20 percent annual rate.

Transaction Broker

Sites that process transactions for consumers normally handled in person, by phone, or by mail are transaction brokers. The largest industries using this model are financial services and travel services. The online transaction broker's primary value propositions are savings of money and time, as well as providing an extraordinary inventory of financial products and travel packages, in a single location. Online stock brokers and travel booking services charge fees that are considerably less than traditional versions of these services. Fidelity Financial Services, and Expedia, are the largest online financial and travel service firms based on a transaction broker model.

Market Creator

Market creators build a digital environment in which buyers and sellers can meet, display products, search for products, and establish prices. The value proposition of online market creators is that they provide a platform where sellers can easily display their wares and where purchasers can buy directly

from sellers. Online auction markets like eBay and Priceline are good examples of the market creator business model. Another example is Amazon's Merchants platform (and similar programs at eBay) where merchants are allowed to set up stores on Amazon's Web site and sell goods at fixed prices to consumers. This is reminiscent of open air markets where the market creator operates a facility (a town square) where merchants and consumers meet. The so-called **sharing economy**, and Web sites like Uber and Airbnb, is based on the idea of a market creator building a digital platform where supply meets demand, e.g. spare auto capacity finds individuals who want transportation. Uber and Airbnb are clearly not sharing anything (sharing does not involve a transfer of cash), but the moniker is popular nevertheless. Crowdsource funding markets like Kickstarter.com and Mosaic Inc. bring together private equity investors and entrepreneurs in a funding marketplace (Cardwell, 2013). Both are examples of B2B financial market places.

Service Provider

While e-tailers sell products online, service providers offer services online. There's been an explosion in online services. Web 2.0 applications, photo sharing, and online sites for data backup and storage all use a service provider business model. Software is no longer a physical product with a CD in a box, but increasingly software as a service (SaaS) that you subscribe to online rather than purchase from a retailer, or an app that you download. Google has led the way in developing online software service applications such as Google Apps, Google Sites, Gmail, and online data storage services. Salesforce.com is a major provider of cloud-based software for customer management.

Community Provider (Social Networks)

Community providers are sites that create a digital online environment where people with similar interests can transact (buy and sell goods); share interests, photos, videos; communicate with like-minded people; receive interest-related information; and even play out fantasies by adopting online personalities called avatars. The social networking sites Facebook, Google +, Tumblr, LinkedIn, and Twitter; online communities such as iVillage; and hundreds of other smaller, niche sites such as Doostang and Sportsvite all offer users community-building tools and services. Social networking sites have been the fastest growing Web sites in recent years, often doubling their audience size in a year.

E-COMMERCE REVENUE MODELS

A firm's **revenue model** describes how the firm will earn revenue, generate profits, and produce a superior return on investment. Although there are many different e-commerce revenue models that have been developed, most companies rely on one, or some combination, of the following six revenue models: advertising, sales, subscription, free/freemium, transaction fee, and affiliate.

Advertising Revenue Model

In the **advertising revenue model**, a Web site generates revenue by attracting a large audience of visitors who can then be exposed to advertisements. The advertising model is the most widely used revenue model in e-commerce, and arguably, without advertising revenues, the Web would be a vastly different experience from what it is now. Content on the Web—everything from news to videos and opinions—is "free" to visitors because advertisers pay the production and distribution costs in return for the right to expose visitors to ads. Companies

will spend an estimated $51 billion on online advertising in 2014, (in the form of a paid message on a Web site, paid search listing, video, app, game, or other online medium, such as instant messaging). About $18 billion of this will involve spending for mobile ads, the fastest growing ad platform. In the last five years, advertisers have increased online spending and cut outlays on traditional channels such as radio and newspapers. In 2014, online advertising will grow at 18 percent and constitute about 28 percent of all advertising in the United States. Television advertising has also expanded along with online advertising revenues and remains the largest advertising platform with about $68 billion in ad revenues in 2014 (eMarketer, 2014b).

Web sites with the largest viewership or that attract a highly specialized, differentiated viewership and are able to retain user attention ("stickiness") are able to charge higher advertising rates. Yahoo, for instance, derives nearly all its revenue from display ads (banner ads), and video ads, and to a lesser extent search engine text ads. Ninety-five percent of Google's revenue derives from advertising, including selling keywords (AdWord), selling ad spaces (AdSense), and selling display ad spaces to advertisers (DoubleClick). Facebook will display one-third of the trillion display ads shown on all sites in 2014. Facebook's users spend an average of over 6 hours a week on the site, far longer than any of the other portal sites.

Sales Revenue Model

In the **sales revenue model**, companies derive revenue by selling goods, information, or services to customers. Companies such as Amazon (which sells books, music, and other products), LLBean.com, and Gap.com, all have sales revenue models. Content providers make money by charging for downloads of entire files such as music tracks (iTunes Store) or books or for downloading music and/or video streams (Hulu.com TV shows). Apple has pioneered and strengthened the acceptance of micropayments. **Micropayment systems** provide content providers with a cost-effective method for processing high volumes of very small monetary transactions (anywhere from 25 cents to $5.00 per transaction). The largest micropayment system on the Web is Apple's iTunes Store, which has more than 500 million credit customers who frequently purchase individual music tracks for 99 cents. There is a Learning Track with more detail on micropayment and other e-commerce payment systems, including Bitcoin.

Subscription Revenue Model

In the **subscription revenue model**, a Web site offering content or services charges a subscription fee for access to some or all of its offerings on an ongoing basis. Content providers often use this revenue model. For instance, the online version of Consumer Reports provides access to premium content, such as detailed ratings, reviews, and recommendations, only to subscribers, who have a choice of paying a $6.95 monthly subscription fee or a $30.00 annual fee. Netflix is one of the most successful subscriber sites with more that 44 million customers by the end of 2013. The New York Times has about 1.1 million online paid subscribers, and the Wall Street Journal about 900,000 in 2014. To be successful, the subscription model requires that the content be perceived as having high added value, differentiated, and not readily available elsewhere nor easily replicated. Companies successfully offering content or services online on a subscription basis include Match.com and eHarmony (dating services), Ancestry.com and Genealogy.com (genealogy research), Microsoft's Xbox Live, and Pandora.com (music).

Free/Freemium Revenue Model

In the **free/freemium revenue model**, firms offer basic services or content for free, while charging a premium for advanced or special features. For example, Google offers free applications but charges for premium services. Pandora, the subscription radio service, offers a free service with limited play time and advertising, and a premium service with unlimited play (see the Interactive Session on Organizations). The Flickr photo-sharing service offers free basic services for sharing photos with friends and family, and also sells a $24.95 "premium" package that provides users unlimited storage, high-definition video storage and playback, and freedom from display advertising. Spotify music service also uses a fremium business model. The idea is to attract very large audiences with free services, and then to convert some of this audience to pay a subscription for premium services. One problem with this model is converting people from being "free loaders" into paying customers. "Free" can be a powerful model for losing money. None of the fremium music streaming sites have earned a profit to date. In fact they are finding the free service with ad revenue is more profitable than the paid subscriber part of their business.

Transaction Fee Revenue Model

In the **transaction fee revenue model**, a company receives a fee for enabling or executing a transaction. For example, eBay provides an online auction marketplace and receives a small transaction fee from a seller if the seller is successful in selling an item. E*Trade, an online stockbroker, receives transaction fees each time it executes a stock transaction on behalf of a customer. The transaction revenue model enjoys wide acceptance in part because the true cost of using the platform is not immediately apparent to the user.

Affiliate Revenue Model

In the **affiliate revenue model**, Web sites (called "affiliate Web sites") send visitors to other Web sites in return for a referral fee or percentage of the revenue from any resulting sales. Referral fees are also referred to as "lead generation fees." For example, MyPoints makes money by connecting companies to potential customers by offering special deals to its members. When members take advantage of an offer and make a purchase, they earn "points" they can redeem for free products and services, and MyPoints receives a referral fee. Community feedback sites such as Epinions and Yelp receive much of their revenue from steering potential customers to Web sites where they make a purchase. Amazon uses affiliates who steer business to the Amazon Web site by placing the Amazon logo on their blogs. Personal blogs often contain display ads as a part of affiliate programs. Some bloggers are paid directly by manufacturers, or receive free products, for speaking highly of products and providing links to sales channels. Commercial bloggers are in essence affiliates paid to send customers to retail sites.

10.3 How has e-commerce transformed marketing?

While e-commerce and the Internet have changed entire industries and enabled new business models, no industry has been more affected than marketing and marketing communications.

INTERACTIVE SESSION: ORGANIZATIONS

CAN PANDORA SUCCEED WITH FREEMIUM?

Pandora is the Internet's most successful subscription radio service. In May 2014, Pandora had 77 million registered users. Pandora accounts for over 9 percent of total U.S. radio listening hours. The music is delivered to users from a cloud server, and is not stored on user devices.

It's easy to see why Pandora is so popular. Users are able to hear only the music they like. Each user selects a genre of music based on a favorite musician or vocalist, and a computer algorithm puts together a "personal radio station" that plays the music of the selected artist plus closely related music by different artists. The algorithm uses more than 450 factors to classify songs, such as the tempo and number of vocalists. These classifications, in conjunction with other signals from users, help Pandora's algorithms select the next song to play. Users do not control what they hear.

People love Pandora, but the question is whether this popularity can be translated into profits. How can Pandora compete with other online music subscription services and online stations that have been making music available for free, sometimes without advertising? "Free" illegally downloaded music has also been a significant factor, as has been iTunes, charging 99 cents per song with no ad support. At the time of Pandora's founding (2005), iTunes was already a roaring success.

Pandora's first business model was to give away 10 hours of free music and then ask subscribers to pay $36 per month for a year once they used up their 10 free hours. Result: 100,000 people listened to their 10 hours for free and then refused to pay for the annual service. Facing financial collapse, in November 2005 Pandora introduced an ad-supported option. In 2006, Pandora added a "Buy" button to each song being played and struck deals with Amazon, iTunes, and other online retail sites. Pandora now gets an affiliate fee for directing listeners to sites where users can buy the music. In 2008, Pandora added an iPhone app to allow users to sign up from their smartphones and listen all day if they wanted. Today, 70 percent of Pandora's advertising revenue comes from mobile.

In late 2009 the company launched Pandora One, a premium service that offered no advertising, higher quality streaming music, a desktop app, and fewer usage limits. The service costs $4.99 per month. A very small percentage of Pandora listeners have opted to pay for music subscriptions, with the vast majority opting for the free service with ads. In fiscal 2013 Pandora's total revenue was $427.1 million, of which $375.2 million (88 percent) came from advertising.

Pandora has been touted as a leading example of the "freemium" revenue business model, in which a business gives away some services for free and relies on a small percentage of customers to pay for premium versions of the same service. If a market is very large, getting just 1 percent of that market to pay could be very lucrative—under certain circumstances. Although freemium is an efficient way of amassing a large group of potential customers, companies, including Pandora, have found that it challenging to convert people enjoying the free service into customers willing to pay. A freemium model works best when a business incurs very low marginal cost, approaching zero, for each free user of its services, when a business can be supported by the percentage of customers willing to pay, and when there are other revenues like advertising fees that can make up for shortfalls in subscriber revenues.

In Pandora's case, it appears that revenues will continue to come overwhelmingly from advertising, and management is not worried. For the past few years, management has considered ads as having much more revenue-generating potential than paid subscriptions and is not pushing the ad-free service. By continually refining its algorithms, Pandora is able to increase user listening hours substantially. The more time people spend with Pandora, the more opportunities there are for Pandora to deliver ads and generate ad revenue. The average Pandora user listens to 19 hours of music per month.

Pandora is now intensively mining the data collected about its users for clues about the kinds of ads most likely to engage them. Pandora collects data about listener preferences from direct feedback such as likes and dislikes (indicated by thumbs up or down on the Pandora site) and "skip this song" requests, as well as data about which device people are using to listen to Pandora music, such as mobile phones or desktop computers. Pandora uses these inputs to select songs people will want to stick around for, and listen to. Pandora has honed its algorithms so they can analyze billions more sig-

nals from users generated over billions of listening minutes per month. Pandora is also trying to figure out when people are listening in groups such as car pools and dinner parties, which might justify Pandora charging higher prices for songs heard by groups rather than single individuals.

The company is looking for correlations between users' listening habits and the kinds of ads that would appeal to these users. People's music, movie, or book choices may provide insight into their political belief, religious faith, or other personal issues. Pandora has developed a political ad-targeting system that has been used in presidential, congressional, and gubernatorial campaigns that can use users' song preferences to predict their political party of choice.

As impressive as these numbers are, Pandora (along with other streaming subscription services) is still struggling to show a profit. There are infrastructure costs and royalties to pay for content from the music labels. Pandora's royalty rates are less flexible than those of its competitor Spotify, which signed individual song royalty agreements with each record label. Pandora could be paying even higher rates when its current royalty contracts expire in 2015. About 61 percent of Pandora's revenue is currently allocated to paying royalties. Advertising can only be leveraged so far, because users who opt for free ad-supported services generally do not tolerate heavy ad loads. Apple launched its iTunes radio service for the Fall of 2013 that will compete directly with Pandora. ITunes radio has both free ad-supported options, and a subscription service for $25 per year, undercutting Pandora's annual subscription fee of $60. Can Pandora's business model succeed?

Sources: Michael Hickins, "Pandora's Improved Algorithms Yield More Listening Hours," *Wall Street Journal*, April 1, 2014; Pandora, "Pandora Announces May 2014 Audience Metrics," June 4, 2014; Natasha Singer, " Listen to Pandora, and It Listens Back," *New York Times*, January 4, 2014; Ben Sisario, "A Stream of Music, Not Revenue," *New York Times*, December 12, 2013; Glenn Peoples, "Pandora's Business Model: Is It Sustainable?" Billboard.com, August 7, 2013; Kylie Bylin, "Can Pandora Find A Business Model That Works?" Hypebot.com, accessed August 25, 2013; Paul Verna, "Internet Radio: Marketers Move In," eMarketer, February 2013; Jim Edwards, "This Crucial Detail In Spotify's Business Model Could Kill Pandora," Business Insider, July 11, 2012; and Sarah E. Needleman and Angus Loten, "When Freemium Fails," *Wall Street Journal*, August 22, 2012.

CASE STUDY QUESTIONS

1. Analyze Pandora using the value chain and competitive forces models. What competitive forces does the company have to deal with? What is its customer value proposition?
2. Explain how Pandora's "freemium" business model works. How does the company generate revenue?
3. Can Pandora succeed with its "freemium" model? Why or why not? What people, organization, and technology factors affect its success with this business model?

The Internet provides marketers with new ways of identifying and communicating with millions of potential customers at costs far lower than traditional media, including search engine marketing, data mining, recommender systems, and targeted e-mail. The Internet enables **long tail marketing**. Before the Internet, reaching a large audience was very expensive, and marketers had to focus on attracting the largest number of consumers with popular hit products, whether music, Hollywood movies, books, or cars. In contrast, the Internet allows marketers to inexpensively find potential customers for products where demand is very low. For instance, the Internet makes it possible to sell independent music profitably to very small audiences. There's always some demand for almost any product. Put a string of such long tail sales together and you have a profitable business.

The Internet also provides new ways—often instantaneous and spontaneous—to gather information from customers, adjust product offerings, and increase customer value. Table 10.6 describes the leading marketing and advertising formats used in e-commerce.

TABLE 10.6 ONLINE MARKETING AND ADVERTISING FORMATS (BILLIONS)

MARKETING FORMAT	2013 REVENUE	DESCRIPTION
Search engine	$22.8	Text ads targeted at precisely what the customer is looking for at the moment of shopping and purchasing. Sales oriented.
Display ads	$22.3	Banner ads (pop-ups and leave-behinds) with interactive features; increasingly behaviorally targeted to individual Web activity. Brand development and sales. Includes blog display ads.
Video	$6	Fastest-growing format, engaging and entertaining; behaviorally targeted, interactive. Branding and sales.
Classified	$2.9	Job, real estate, and services ads; interactive, rich media, and personalized to user searches. Sales and branding.
Rich media	$3.1	Animations, games, and puzzles. Interactive, targeted, and entertaining. Branding orientation.
Lead generation	$2	Marketing firms that gather sales and marketing leads online, and then sell them to online marketers for a variety of campaign types. Sales or branding orientation.
Sponsorships	$1.9	Online games, puzzles, contests, and coupon sites sponsored by firms to promote products. Sales orientation.
E-mail	$.25	Effective, targeted marketing tool with interactive and rich media potential. Sales oriented.

BEHAVIORAL TARGETING

Many e-commerce marketing firms use **behavioral targeting** techniques to increase the effectiveness of banners, rich media, and video ads. Behavioral targeting refers to tracking the clickstreams (history of clicking behavior) of individuals on thousands of Web sites for the purpose of understanding their interests and intentions, and exposing them to advertisements that are uniquely suited to their behavior. Proponents believe this more precise understanding of the customer leads to more efficient marketing (the firm pays for ads only to those shoppers who are most interested in their products) and larger sales and revenues. Unfortunately, behavioral targeting of millions of Web users also leads to the invasion of personal privacy without user consent. When consumers lose trust in their Web experience, they tend not to purchase anything. There is a growing backlash against the aggressive uses of personal information as consumers seek out safer havens for purchasing and messaging. SnapChat offers disappearing messages, and even Facebook has retreated by making its default for new posts to be "for friends only." (Wood, 2014).

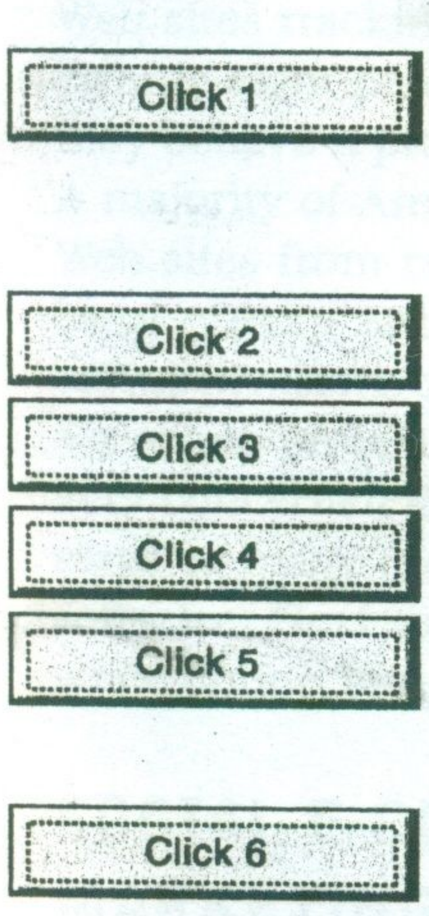
Popular Web sites have hundreds of beacon programs on their home pages which collect data on visitors behavior, and report that behavior to their databases. There the information is often sold to data brokers, firms who collect billions of data elements on every U.S. consumer and household, frequently combining online with off-line purchase information. The data brokers in turn

sell this information to advertisers who want to place ads on Web pages. A recent Federal Trade Commission report on nine data brokers found that one data broker's database had information on 1.4 billion consumer transactions and over 700 billion aggregated data elements. Another data broker had 3,000 data measures for nearly every consumer in the U.S. (FTC, 2014).

Behavioral targeting takes place at two levels: at individual Web sites or from within apps, and on various advertising networks that track users across thousands of Web sites. All Web sites collect data on visitor browser activity and store it in a database. They have tools to record the site that users visited prior to coming to the Web site, where these users go when they leave that site, the type of operating system they use, browser information, and even some location data. They also record the specific pages visited on the particular site, the time spent on each page of the site, the types of pages visited, and what the visitors purchased (see Figure 10.3). Firms analyze this information about customer interests and behavior to develop precise profiles of existing and potential customers. In addition, most major Web sites have hundreds of tracking programs on their home pages, which track your clickstream behavior across the Web by following you from site to site and re-target ads to you by showing you the same ads on different sites. The leading online advertising networks are Google's DoubleClick, Yahoo's RightMedia, and AOL's Ad Network. Ad networks represent publishers who have space to sell, and advertisers who want to market online. The lubricant of this trade is information on millions of Web shoppers, which helps advertisers target their ads to precisely the groups and individuals they desire.

This information enables firms to understand how well their Web site is working, create unique personalized Web pages that display content or ads for products or services of special interest to each user, improve the customer's

FIGURE 10.3 WEB SITE VISITOR TRACKING



The shopper clicks on the home page. The store can tell that the shopper arrived from the Yahoo! portal at 2:30 PM (which might help determine staffing for customer service centers) and how long she lingered on the home page (which might indicate trouble navigating the site). Tracking beacons load cookies on the shopper's browser to follow her across the Web.

The shopper clicks on blouses, clicks to select a woman's white blouse, then clicks to view the same item in pink. The shopper clicks to select this item in a size 10 in pink and clicks to place it in her shopping cart. This information can help the store determine which sizes and colors are most popular. If the visitor moves to a different site, ads for pink blouses will appear from the same or different vendor.

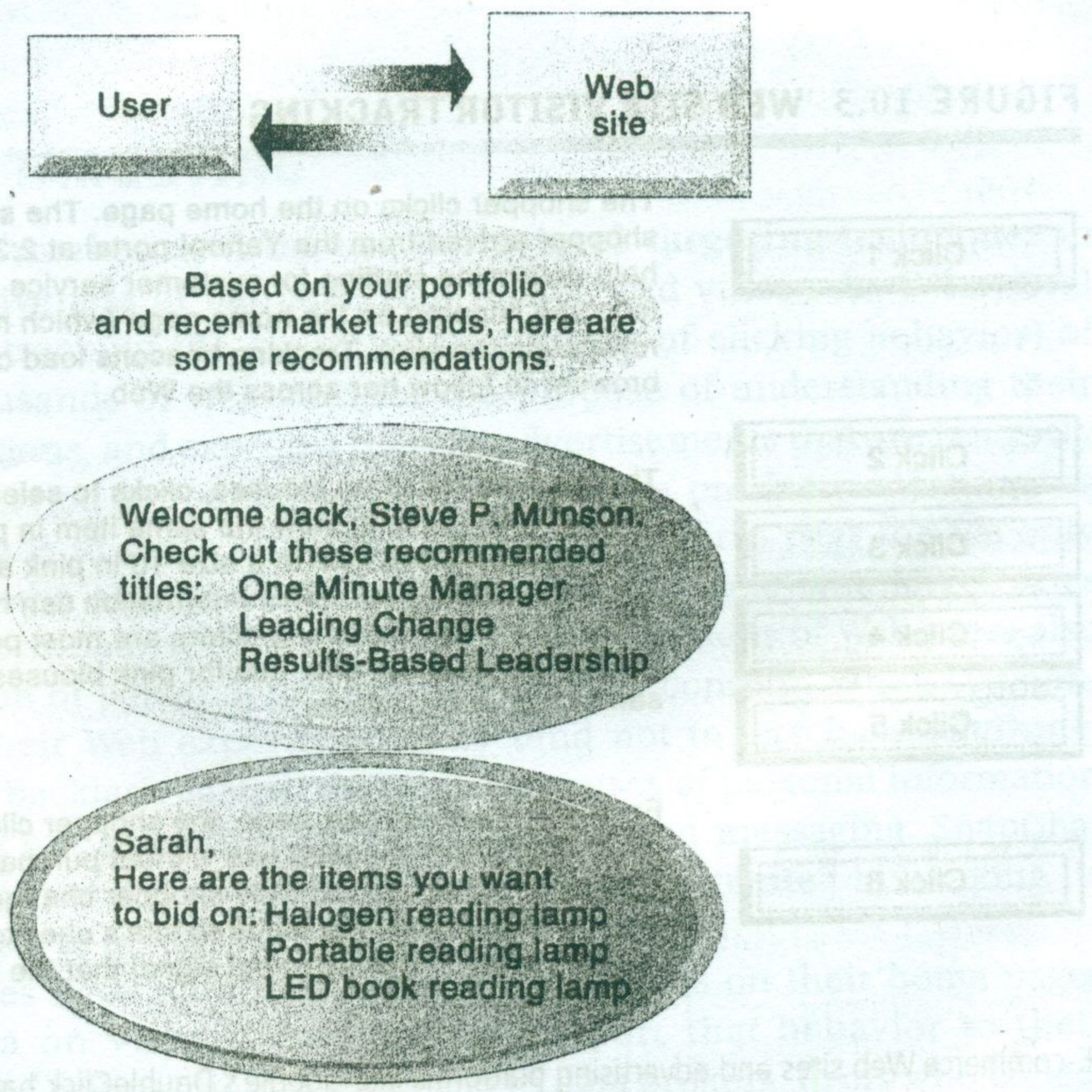
From the shopping cart page, the shopper clicks to close the browser to leave the Web site without purchasing the blouse. This action could indicate the shopper changed her mind or that she had a problem with the Web site's checkout and payment process. Such behavior might signal that the Web site was not well designed.

E-commerce Web sites and advertising platforms like Google's DoubleClick have tools to track a shopper's every step through an online store and then across the Web as shoppers move from site to site. Close examination of customer behavior at a Web site selling women's clothing shows what the store might learn at each step and what actions it could take to increase sales.

experience, and create additional value through a better understanding of the shopper (see Figure 10.4). By using personalization technology to modify the Web pages presented to each customer, marketers achieve some of the benefits of using individual salespeople at dramatically lower costs. For instance, General Motors will show a Chevrolet banner ad to women emphasizing safety and utility, while men will receive different ads emphasizing power and ruggedness.

What if you are a large national advertising company with many different clients trying to reach millions of consumers? What if you were a large global manufacturer trying to reach potential consumers for your products? With millions of Web sites, working with each one would be impractical. Advertising networks solve this problem by creating a network of several thousand of the most popular Web sites visited by millions of people, tracking the behavior of these users across the entire network, building profiles of each user, and then selling these profiles to advertisers. Popular Web sites download dozens of Web tracking cookies, bugs, and beacons, which report user online behavior to remote servers without the users' knowledge. Looking for young, single consumers, with college degrees, living in the Northeast, in the 18–34 age range who are interested in purchasing a European car? Not a problem. Advertising networks can identify and deliver hundreds of thousands of people who fit this profile and expose them to ads for European cars as they move from one Web site to another. Estimates vary, but behaviorally targeted ads are generally 10 times more likely to produce a consumer response than a randomly chosen banner or video ad (see Figure 10.5). So-called ad exchanges use this same technology to auction access to people with specific profiles to

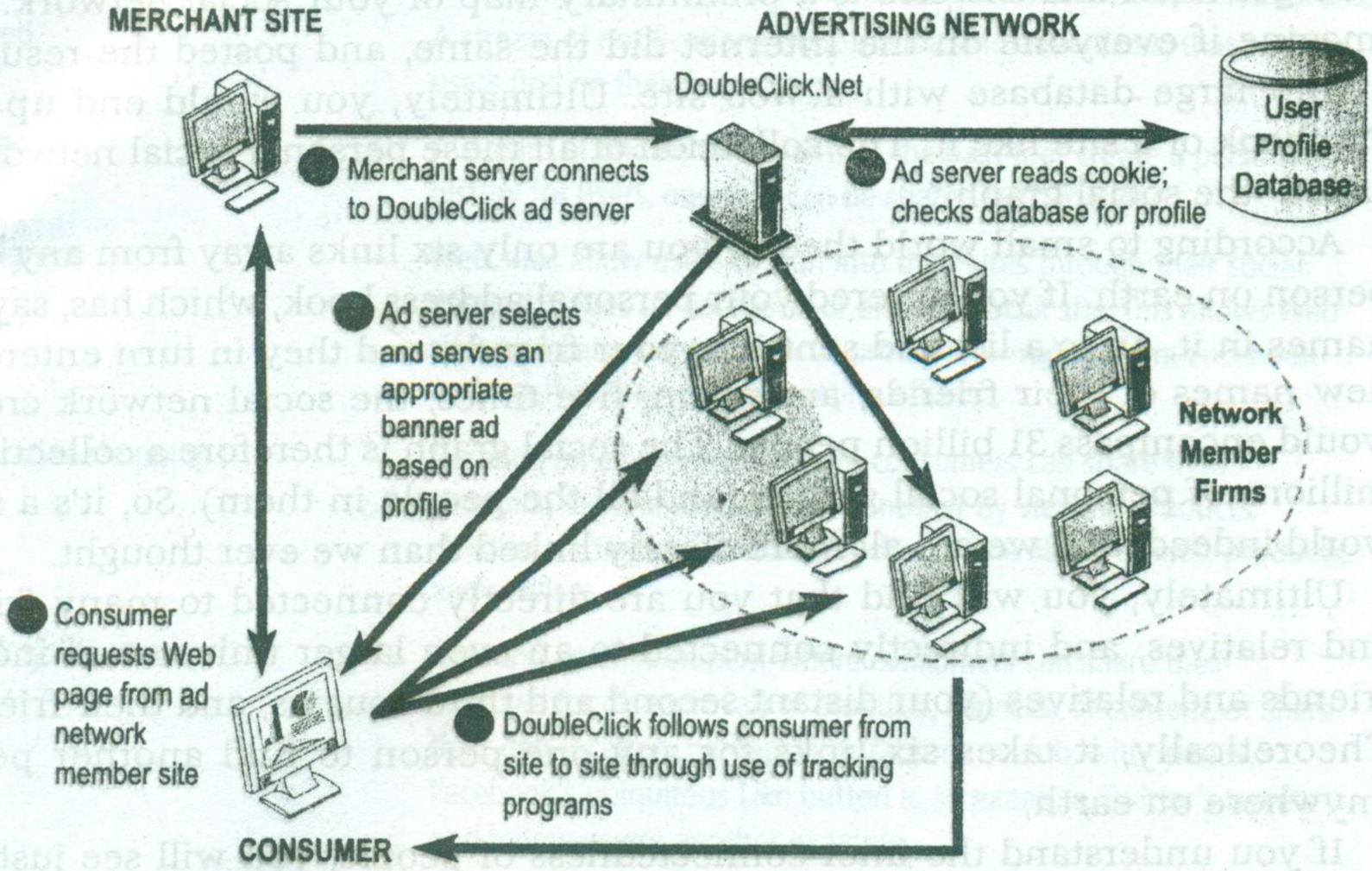
FIGURE 10.4 WEB SITE PERSONALIZATION



Firms can create unique personalized Web pages that display content or ads for products or services of special interest to individual users, improving the customer experience and creating additional value.

F-28/B

FIGURE 10.5 HOW AN ADVERTISING NETWORK SUCH AS DOUBLECLICK WORKS



Advertising networks and their use of tracking programs have become controversial among privacy advocates because of their ability to track individual consumers across the Internet.

advertisers in a few milliseconds. In 2014, about 25 percent of online display ads are targeted, and the rest depend on the context of the pages shoppers visit, the estimated demographics of visitors, or so-called "blast and scatter" advertising, which is placed randomly on any available page with minimal targeting, such as time of day or season. Several surveys have reported that over 75 percent of American consumers do not approve of behaviorally targeted ads.

Two-thirds (68 percent) of Internet users disapprove of search engines and Web sites tracking their online behavior in order to aim targeted ads at them. Twenty-eight percent of those surveyed approve of behavioral targeting because they believe it produces more relevant ads and information (Pew Internet, 2012). A majority of Americans want a "Do Not Track" option in browsers that will stop Web sites from collecting information about their online behavior (Hoofnagle, et. al., 2012). According to a recent survey, Americans' privacy concerns about online invasions of privacy are growing stronger, leading to people taking concrete actions to protect themselves (Pew Research Center, 2013). Over 50 percent are very concerned about the wealth of personal data online; 86 percent have taken steps to mask their online behavior; 25 percent of Web users use ad-blocking software. Next to hackers, Americans try to avoid advertisers pursuing them while online, and 64 percent block cookies to make tracking more difficult.

SOCIAL E-COMMERCE AND SOCIAL NETWORK MARKETING

Social e-commerce is commerce based on the idea of the digital **social graph**. The digital social graph is a mapping of all significant online social relationships. The social graph is synonymous with the idea of a "social network" used to describe offline relationships. You can map your own social graph (network) by drawing lines from yourself to the 10 closest people you know. If they know

one another, draw lines between these people. If you are ambitious, ask these 10 friends to list and draw in the names of the 10 people closest to them. What emerges from this exercise is a preliminary map of your social network. Now imagine if everyone on the Internet did the same, and posted the results to a very large database with a Web site. Ultimately, you would end up with Facebook or a site like it. The collection of all these personal social networks is called "the social graph."

According to small world theory, you are only six links away from any other person on earth. If you entered your personal address book, which has, say, 100 names in it, on to a list and sent it to your friends, and they in turn entered 50 new names of their friends, and so on, five times, the social network created would encompass 31 billion people! The social graph is therefore a collection of millions of personal social graphs (and all the people in them). So, it's a small world indeed, and we are all more closely linked than we ever thought.

Ultimately, you will find that you are directly connected to many friends and relatives, and indirectly connected to an even larger universe of indirect friends and relatives (your distant second and third cousins, and their friends). Theoretically, it takes six links for any one person to find another person anywhere on earth.

If you understand the inter-connectedness of people, you will see just how important this concept is to e-commerce: The products and services you buy will influence the decisions of your friends, and their decisions will in turn influence you. If you are a marketer trying to build and strengthen a brand, the implication is clear: Take advantage of the fact that people are enmeshed in social networks, share interests and values, and communicate and influence one another. As a marketer, your target audience is not a million isolated people watching a TV show, but the social network of people who watch the show, and the viewers' personal networks. Table 10.7 describes the features of social commerce that are driving its growth.

In 2014, one of the fastest growing media for branding and marketing is social media. In 2014, companies will spend $6.7 billion using social networks like Facebook to reach millions of consumers who spend hours a day on the Facebook site. Facebook accounts for 90 percent of all social marketing in the Untied States. Expenditures for social media marketing are much smaller than television, magazines, and even newspapers, but this will change in the future.

Social networks in the offline world are collections of people who voluntarily communicate with one another over an extended period of time. Online social networks, such as Facebook, LinkedIn, Twitter, Tumblr, and Google+, along with other sites with social components, are Web sites that enable users to communicate with one another, form group and individual relationships, and share interests, values, and ideas. Individuals establish online profiles with text and photos, creating an online profile of how they want others to see them, and then invite their friends to link to their profile. The network grows by word of mouth and through e-mail links. One of the most ubiquitous graphical elements on Web sites is Facebook's Like button, which allows users to tell their friends they like a product, service, or content. Facebook processes around 50 million Likes a day, or 1.5 billion a year.

While Facebook, with 137 million U.S. monthly visitors, receives most of the public attention given to social networking, the other top four social sites are also growing, but at slower rates than in the past. Facebook user growth has slowed in the United States. LinkedIn growth slowed in 2013 to 40 percent, and it has 48 million visitors a month in 2014. Twitter grew only 11 percent in 2013 to reach 37 million; the social blogging site Tumblr reached 23 million people a month; and

TABLE 10.7 FEATURES OF SOCIAL COMMERCE

SOCIAL COMMERCE FEATURE	DESCRIPTION
Newsfeed	A stream of notifications from friends, and advertisers, that social users find on their home pages.
Timelines	A stream of photos and events in the past that create a personal history for users, one that can be shared with friends.
Social sign-on	Web sites allow users to sign into their sites through their social network pages on Facebook or another social site. This allows Web sites to receive valuable social profile information from Facebook and use it in their own marketing efforts.
Collaborative shopping	Creating an environment where consumers can share their shopping experiences with one another by viewing products, chatting, or texting. Friends can chat online about brands, products, and services.
Network notification	Creating an environment where consumers can share their approval (or disapproval) of products, services, or content, or share their geo-location, perhaps a restaurant or club, with friends. Facebook's ubiquitous Like button is an example. Twitter's tweets and followers are another example.
Social search (recommendations)	Enabling an environment where consumers can ask their friends for advice on purchases of products, services, and content. While Google can help you find things, social search can help you evaluate the quality of things by listening to the evaluations of your friends, or their friends. For instance, Amazon's social recommender system can use your Facebook social profile to recommend products.

Pinterest hit the top 50 Web sites with 26 million. MySpace, in contrast, has been shrinking for years, and attracted only 5.4 million visitors monthly. According to ComScore, about 30 percent of the total time spent online in the United States was spent on social network sites, and it is the most common online activity. (ComScore, 2014). The fastest growing smartphone applications are social network apps: nearly half of smartphone users visit social sites daily. More than 58 percent of all visits to Facebook in 2014 come from smartphones.

At **social shopping** sites like Pinterest, Kaboodle, ThisNext, and Stylehive, you can swap shopping ideas with friends. Facebook offers the Like button and Google the +1 button to let your friends know you admire something, and in some cases, purchased something online. Online communities are also ideal venues to employ viral marketing techniques. Online viral marketing is like traditional word-of-mouth marketing except that the word can spread across an online community at the speed of light, and go much further geographically than a small network of friends.

The Wisdom of Crowds

Creating sites where thousands, even millions, of people can interact offers business firms new ways to market and advertise, and to discover who likes (or hates) their products. In a phenomenon called "**the wisdom of crowds**," some argue that large numbers of people can make better decisions about a wide range of topics or products than a single person or even a small committee of experts.

Obviously this is not always the case, but it can happen in interesting ways. In marketing, the wisdom of crowds concept suggests that firms should consult with thousands of their customers first as a way of establishing a relationship with them, and second, to better understand how their products and services are used and appreciated (or rejected). Actively soliciting the comments of your customers builds trust and sends the message to your customers that you care what they are thinking, and that you need their advice.

Beyond merely soliciting advice, firms can be actively helped in solving some business problems using what is called **crowdsourcing**. For instance, in 2006, Netflix announced a contest in which it offered to pay $1 million to the person or team who comes up with a method for improving by 10 percent Netflix's prediction of what movies customers would like as measured against their actual choices. By 2009, Netflix received 44,014 entries from 5,169 teams in 186 countries. The winning team improved a key part of Netflix's business: a recommender system that recommends to its customers what new movies to order based on their personal past movie choices and the choices of millions of other customers who are like them. In 2012, BMW launched a crowdsourcing project to enlist the aid of customers in designing an urban vehicle for 2025. Kickstarter.com is arguably one of the most famous e-commerce crowdfunding sites where visitors invest in start-up companies. Other examples include Caterpillar working with customers to design better machinery, and Pepsico using Super Bowl 2013 viewers to build an online video (Boulton, 2013).

Firms can also use the wisdom of crowds in the form of prediction markets. **Prediction Markets** are established as peer-to-peer betting markets where participants make bets on specific outcomes of, say, quarterly sales of a new product, designs for new products, or political elections. The world's largest commercial prediction market is Betfair, where you bet for or against specific outcomes on football games, horse races, and whether or not the Dow Jones will go up or down in a single day. Iowa Electronic Markets (IEM) is an academic market focused on elections. You can place bets on the outcome of local and national elections. In the United States, the largest prediction market is Intrade.com, where users can buy or sell shares in predictions.

Marketing via social media is still in its early stages, and companies are experimenting in hopes of finding a winning formula. Social interactions and customer sentiment are not always easy to manage, presenting new challenges for companies eager to protect their brands. The chapter-ending case study provides specific examples of companies' social marketing efforts using Facebook and Twitter.

10.4 How has e-commerce affected business-to-business transactions?

The trade between business firms (business-to-business commerce or B2B) represents a huge marketplace. The total amount of B2B trade in the United States in 2014 is estimated to be about $13.8 trillion, with B2B e-commerce (online B2B) contributing about $5.7 trillion of that amount (U.S. Census Bureau, 2013; authors' estimates). By 2017, B2B e-commerce is expected to grow to about $7.8 trillion in the United States. The process of conducting trade among business firms is complex and requires significant human intervention, and therefore, it consumes significant resources. Some firms estimate that each corporate purchase order for support products costs them,

on average, at least $100 in administrative overhead. Administrative overhead includes processing paper, approving purchase decisions, spending time using the telephone and fax machines to search for products and arrange for purchases, arranging for shipping, and receiving the goods. Across the economy, this adds up to trillions of dollars annually being spent for procurement processes that could potentially be automated. If even just a portion of inter-firm trade were automated, and parts of the entire procurement process assisted by the Internet, literally trillions of dollars might be released for more productive uses, consumer prices potentially would fall, productivity would increase, and the economic wealth of the nation would expand. This is the promise of B2B e-commerce. The challenge of B2B e-commerce is changing existing patterns and systems of procurement, and designing and implementing new Internet-based B2B solutions.

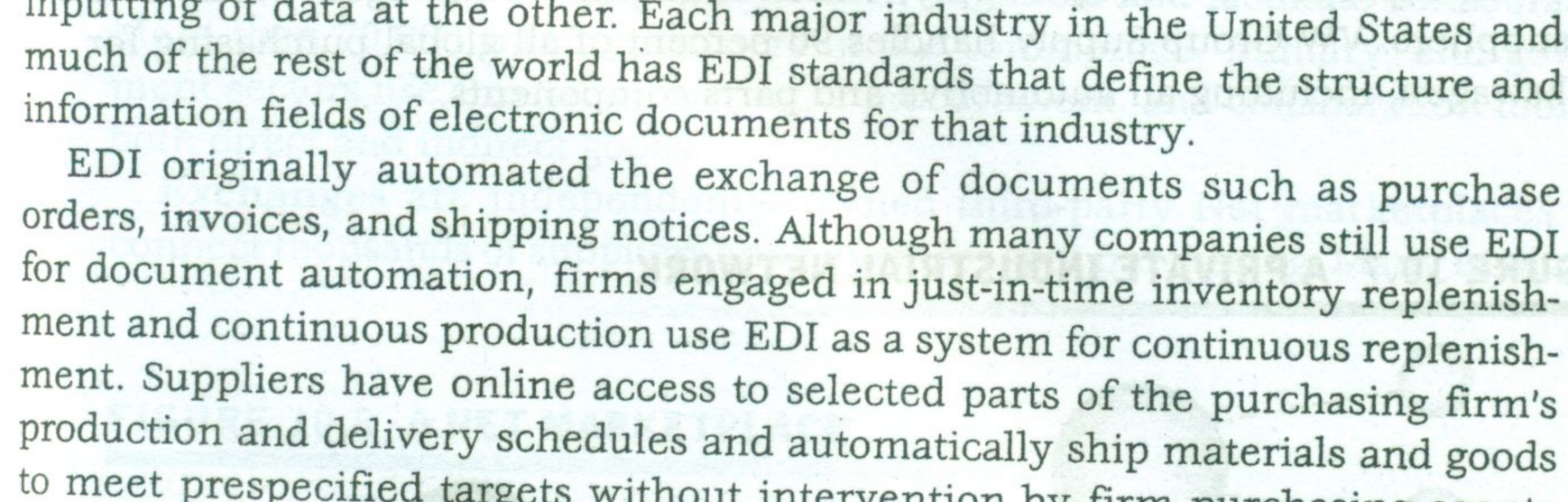
ELECTRONIC DATA INTERCHANGE (EDI)

Business-to-business e-commerce refers to the commercial transactions that occur among business firms. Increasingly, these transactions are flowing through a variety of different Internet-enabled mechanisms. About 80 percent of online B2B e-commerce is still based on proprietary systems for **electronic data interchange (EDI)**. Electronic data interchange enables the computer-to-computer exchange between two organizations of standard transactions such as invoices, bills of lading, shipment schedules, or purchase orders. Transactions are automatically transmitted from one information system to another through a network, eliminating the printing and handling of paper at one end and the inputting of data at the other. Each major industry in the United States and much of the rest of the world has EDI standards that define the structure and information fields of electronic documents for that industry.

EDI originally automated the exchange of documents such as purchase orders, invoices, and shipping notices. Although many companies still use EDI for document automation, firms engaged in just-in-time inventory replenishment and continuous production use EDI as a system for continuous replenishment. Suppliers have online access to selected parts of the purchasing firm's production and delivery schedules and automatically ship materials and goods to meet prespecified targets without intervention by firm purchasing agents (see Figure 10.6).

Although many organizations still use private networks for EDI, they are increasingly Web-enabled because Internet technology provides a much more

FIGURE 10.6 ELECTRONIC DATA INTERCHANGE (EDI)



Companies use EDI to automate transactions for B2B e-commerce and continuous inventory replenishment. Suppliers can automatically send data about shipments to purchasing firms. The purchasing firms can use EDI to provide production and inventory requirements and payment data to suppliers.

flexible and low-cost platform for linking to other firms. Businesses are able to extend digital technology to a wider range of activities and broaden their circle of trading partners.

Take procurement, for example. Procurement involves not only purchasing goods and materials but also sourcing, negotiating with suppliers, paying for goods, and making delivery arrangements. Businesses can now use the Internet to locate the lowest-cost supplier, search online catalogs of supplier products, negotiate with suppliers, place orders, make payments, and arrange transportation. They are not limited to partners linked by traditional EDI networks.

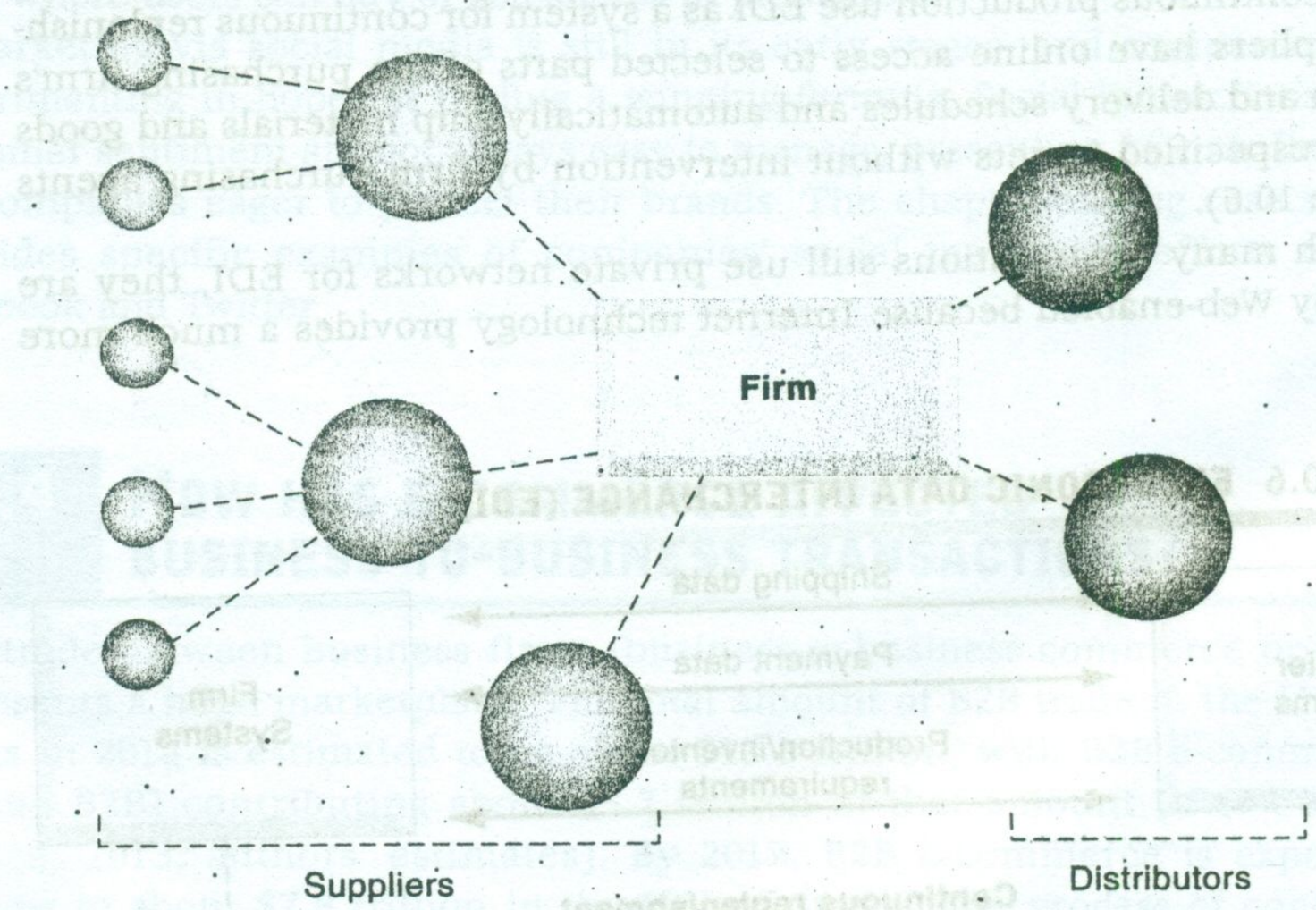
NEW WAYS OF B2B BUYING AND SELLING

The Internet and Web technology enable businesses to create new electronic storefronts for selling to other businesses with multimedia graphic displays and interactive features similar to those for B2C commerce. Alternatively, businesses can use Internet technology to create extranets or electronic marketplaces for linking to other businesses for purchase and sale transactions.

Private industrial networks typically consist of a large firm using a secure Web site to link to its suppliers and other key business partners (see Figure 10.7). The network is owned by the buyer, and it permits the firm and designated suppliers, distributors, and other business partners to share product design and development, marketing, production scheduling, inventory management, and unstructured communication, including graphics and e-mail. Another term for a private industrial network is a **private exchange**.

An example is VW Group Supply, which links the Volkswagen Group and its suppliers. VW Group Supply handles 90 percent of all global purchasing for Volkswagen, including all automotive and parts components.

FIGURE 10.7 A PRIVATE INDUSTRIAL NETWORK



A private industrial network, also known as a private exchange, links a firm to its suppliers, distributors, and other key business partners for efficient supply chain management and other collaborative commerce activities.

Net marketplaces, which are sometimes called e-hubs, provide a single, digital marketplace based on Internet technology for many different buyers and sellers (see Figure 10.8). They are industry-owned or operate as independent intermediaries between buyers and sellers. Net marketplaces generate revenue from purchase and sale transactions and other services provided to clients. Participants in Net marketplaces can establish prices through online negotiations, auctions, or requests for quotations, or they can use fixed prices.

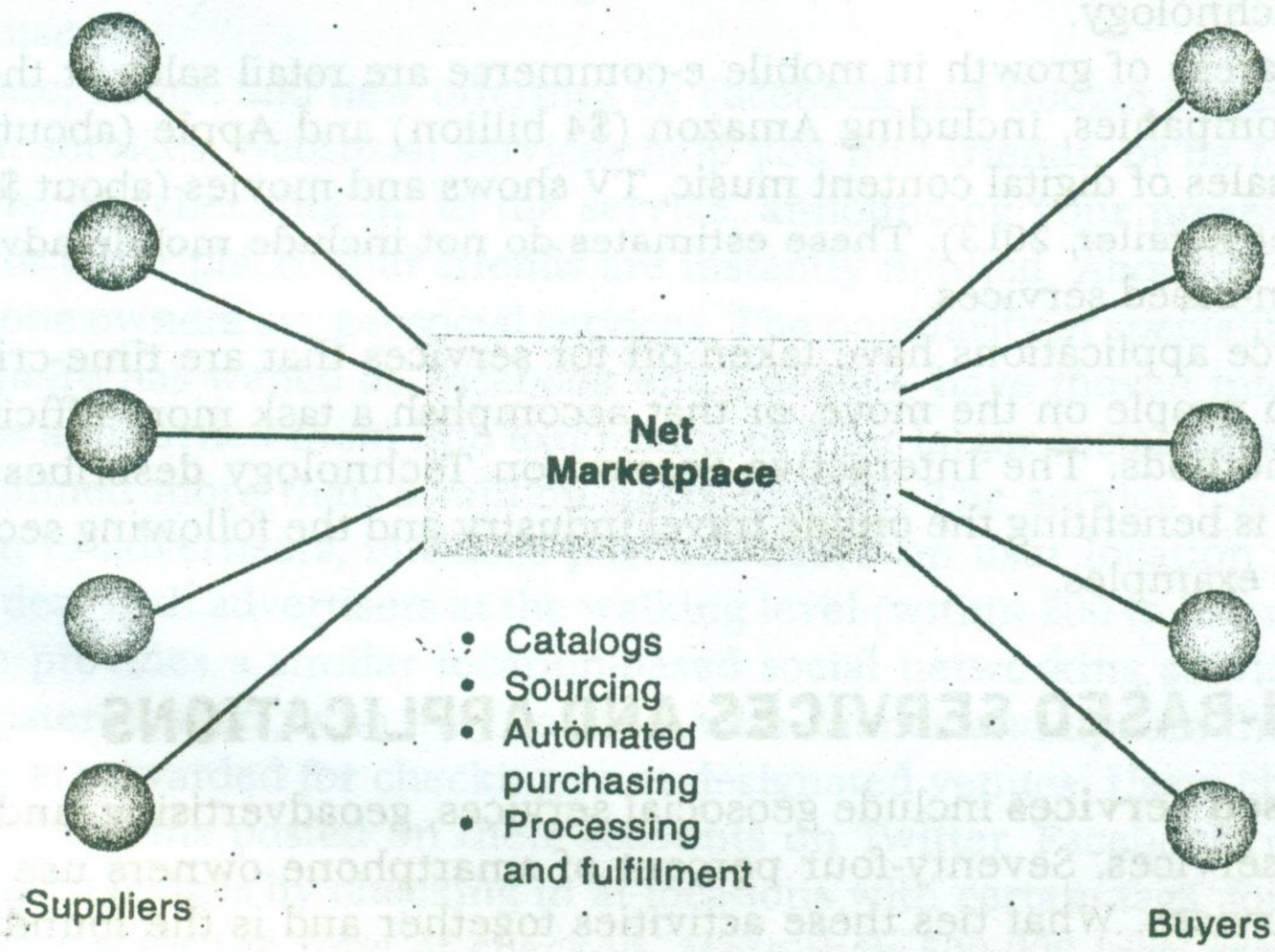
There are many different types of Net marketplaces and ways of classifying them. Some Net marketplaces sell direct goods and some sell indirect goods. **Direct goods** are goods used in a production process, such as sheet steel for auto body production. **Indirect goods** are all other goods not directly involved in the production process, such as office supplies or products for maintenance and repair. Some Net marketplaces support contractual purchasing based on long-term relationships with designated suppliers, and others support short-term spot purchasing, where goods are purchased based on immediate needs, often from many different suppliers.

Some Net marketplaces serve vertical markets for specific industries, such as automobiles, telecommunications, or machine tools, whereas others serve horizontal markets for goods and services that can be found in many different industries, such as office equipment or transportation.

Exostar is an example of an industry-owned Net marketplace, focusing on long-term contract purchasing relationships and on providing common networks and computing platforms for reducing supply chain inefficiencies. This aerospace and defense industry-sponsored Net marketplace was founded jointly by BAE Systems, Boeing, Lockheed Martin, Raytheon, and Rolls-Royce PLC to connect these companies to their suppliers and facilitate collaboration. More than 70,000 trading partners in the commercial, military, and government sectors use Exostar's sourcing, e-procurement, and collaboration tools for both direct and indirect goods.

Exchanges are independently owned third-party Net marketplaces that connect thousands of suppliers and buyers for spot purchasing. Many exchanges

FIGURE 10.8 A NET MARKETPLACE



Net marketplaces are online marketplaces where multiple buyers can purchase from multiple sellers.

provide vertical markets for a single industry, such as food, electronics, or industrial equipment, and they primarily deal with direct inputs. For example, Go2Paper enables a spot market for paper, board, and craft among buyers and sellers in the paper industries from over 75 countries.

Exchanges proliferated during the early years of e-commerce but many have failed. Suppliers were reluctant to participate because the exchanges encouraged competitive bidding that drove prices down and did not offer any long-term relationships with buyers or services to make lowering prices worthwhile. Many essential direct purchases are not conducted on a spot basis because they require contracts and consideration of issues such as delivery timing, customization, and quality of products.

10.5 WHAT IS THE ROLE OF M-COMMERCE IN BUSINESS AND WHAT ARE THE MOST IMPORTANT M-COMMERCE APPLICATIONS?

Walk down the street in any major metropolitan area and count how many people are pecking away at their iPhones, Samsungs or BlackBerrys. Ride the trains, fly the planes, and you'll see your fellow travelers reading an online newspaper, watching a video on their phone, or reading a novel on their Kindle. In five years, the majority of Internet users in the United States will rely on mobile devices as their primary device for accessing the Internet. As the mobile audience expands in leaps and bounds, mobile advertising and m-commerce have taken off.

In 2014, m-commerce constitute about 19 percent of all e-commerce, with about $57 billion in annual revenues generated by retail goods and services, apps, advertising, music, videos, ring tones, applications, movies, television, and location-based services like local restaurant locators and traffic updates. However, m-commerce is the fastest growing form of e-commerce, with some areas expanding at a rate of 50 percent or more per year, and is estimated to grow to $132 billion in 2018 (see Figure 10.9) (eMarketer, 2014d). It is becoming especially popular in the online travel industry, as discussed in the Interactive Session on Technology.

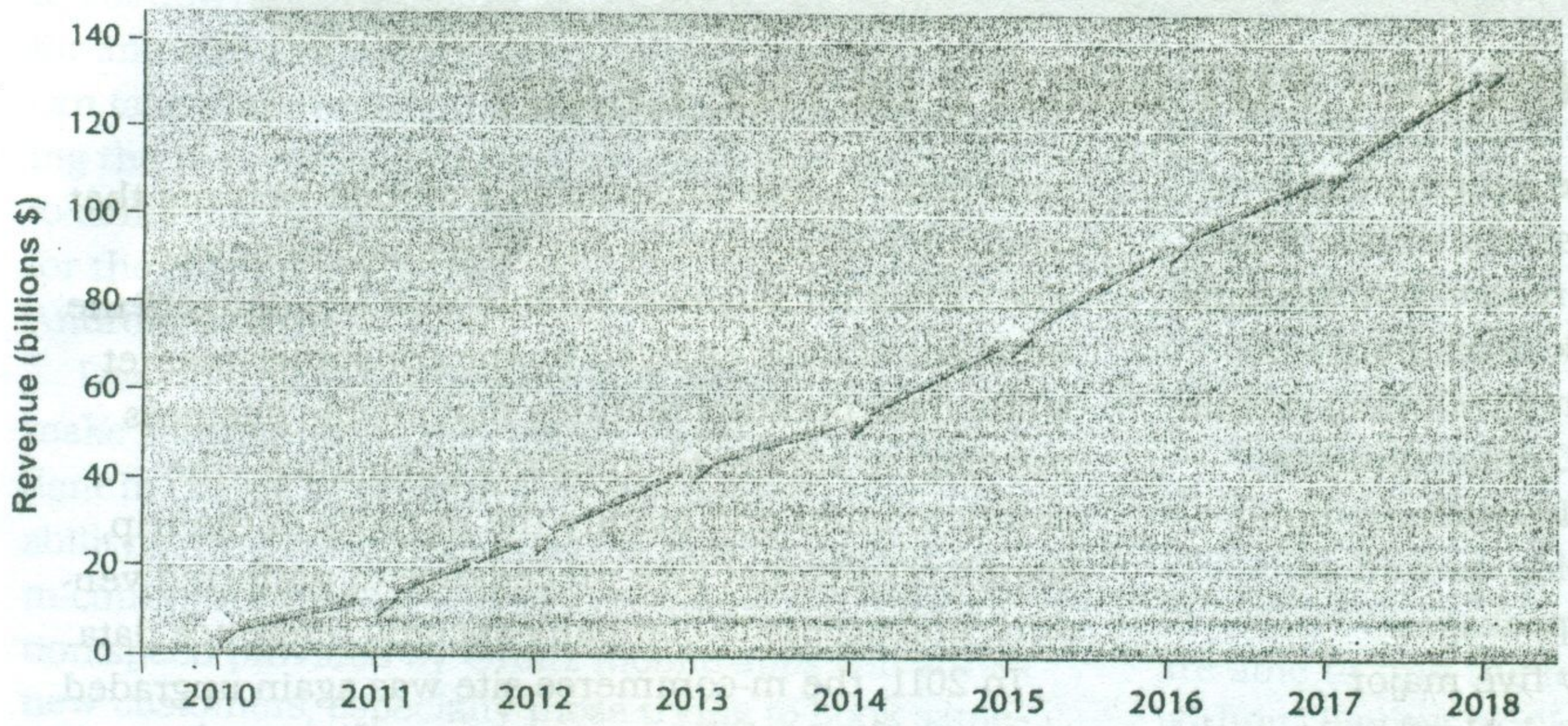
The main areas of growth in mobile e-commerce are retail sales at the top Mobile 400 companies, including Amazon ($4 billion) and Apple (about $1.1 billion); and sales of digital content music, TV shows and movies (about $4 billion) (Internet Retailer, 2013). These estimates do not include mobile advertising or location-based services.

M-commerce applications have taken off for services that are time-critical, that appeal to people on the move, or that accomplish a task more efficiently than other methods. The Interactive Session on Technology describes how m-commerce is benefiting the online travel industry and the following sections provide other examples.

LOCATION-BASED SERVICES AND APPLICATIONS

Location-based services include geosocial services, geoadvertising, and geoinformation services. Seventy-four percent of smartphone owners use location-based services. What ties these activities together and is the foundation for mobile commerce is the global positioning system (GPS) enabled map services available on smartphones. A **geosocial service** can tell you where

FIGURE 10.9 CONSOLIDATED MOBILE COMMERCE REVENUES



Mobile e-commerce is the fastest growing type of B2C e-commerce and represents about 19 percent of all e-commerce in 2014.

your friends are meeting. **Geoadvertising services** can tell you where to find the nearest Italian restaurant, and **geoinformation services** can tell you the price of a house you are looking at, or about special exhibits at a museum you are passing.

Wikitude.me is an example of a geoinformation service. Wikitude.me provides a special kind of browser for smartphones equipped with a built-in GPS and compass that can identify your precise location and where the phone is pointed. Using information from over 800,000 points of interest available on Wikipedia, plus thousands of other local sites, the browser overlays information about points of interest you are viewing, and displays that information on your smartphone screen, superimposed on a map or photograph that you just snapped. For example, users can point their smartphone cameras towards mountains from a tour bus and see the names and heights of the mountains displayed on the screen. Wikitude.me also allows users to geo-tag the world around them, and then submit the tags to Wikitude in order to share content with other users.

Foursquare, Loopt, and new offerings by Facebook and Google are examples of geosocial services. Geosocial services help you find friends, or be found by your friends, by "checking in" to the service, announcing your presence in a restaurant or other place. Your friends are instantly notified. About 20 percent of smartphone owners use geosocial services. The popularity of specialized sites like Foursquare has waned as Facebook and Google+ have moved into geosocial services and turned them into extensions of their larger social networks.

Loopt claimed more than 5 million users in 2014. The service doesn't sell information to advertisers, but does post ads based on user location. Loopt's target is to deal with advertisers at the walking level (within 200 to 250 meters). Foursquare provides a similar location-based social networking service to 22 million registered users, who may connect with friends and update their location. Points are awarded for checking in at designated venues. Users choose to have their check-ins posted on their accounts on Twitter, Facebook, or both. Users also earn badges by checking in at locations with certain tags, for check-in frequency, or for the time of check-in. More than 500,000 local merchants worldwide use the merchant platform for marketing.

INTERACTIVE SESSION: TECHNOLOGY

WILL MOBILE TECHNOLOGY PUT ORBITZ IN THE LEAD?

When it comes to mobile apps and gauging their impact on consumers and business, the online travel industry and its airline and hotel reservation systems are probably the best place to look. And there's no better company in this industry in developing mobile apps than Orbitz Worldwide Inc. Orbitz connects consumers to plane tickets from 400 airlines, hotel rooms from 80,000 hotels worldwide, as well as rental cars, cruises, and vacation packages.

Orbitz was launched in 2001 by five major airlines—Delta, United, Continental, Northwest, and American, to compete with Internet travel companies such as Priceline, Travelocity, and Expedia, which were upending the travel industry. These companies have remained formidable competitors.

From its very beginning, Orbitz distinguished itself as a leader in mobile technology. In 2006, it became the first Internet travel company to offer a mobile Web site where users could check flight status for 27 airlines, search for hotels in the United States and Cancun, Mexico, and access a personal page with itineraries for Orbitz-booked trips.

During the years that followed, Orbiz made many enhancements to its mobile services. It enabled mobile users to view average wait times for airport security lines, locate available Wi-Fi services at airports, compute check-in delays and taxi line wait times, and view weather and traffic conditions. In 2010, Orbitz redesigned its mobile Web site so that users of any Web-enabled device could access capabilities similar to any full-screen e-commerce site, including the ability to purchase flight tickets, book car rentals, and obtain hotel reservations. Like the standard Orbitz Web site, the redesigned mobile site offers a Price Assurance service, which guarantees customers an automatic refund if another Orbitz customer books the same service for less. Orbitz also developed apps that ran on iPhones, iPads and later Android devices that could perform the same functions.

Orbitz was first-to-market with an m-commerce site designed specifically for business users. The opportunity was huge, since most business travelers carry smartphones or tablets. Corporate travelers typically must adhere to company rules specifying preferred vendors, cost limits, mandatory services, and expense documentation. Since each company has its own business "rules" for travel, the Orbitz m-commerce platform needed to be customized for each firm. Orbitz constructed a mobile Web site that could be accessed from any Web-enabled device. The Orbitz for Business mobile Web site delivers the same set of tools enjoyed by the consumer market while incorporating features that enable business travelers to adhere to company guidelines—the ability to enter and modify the purpose of the trip, search results that give precedence to preferred vendors, and access to company-specific reference data.

In 2011, the m-commerce site was again upgraded to respond to swiping gestures, expedite touch screen transactions, and accommodate the small screen size of any Web-enabled mobile device. Orbitz's new proprietary global online travel agency platform creates mobile HTML5 Web pages on the fly from standard e-commerce Web pages. Mobile users can book vacation packages, view the savings from simultaneously booking a flight and hotel room, and create an online profile linked to their credit card to expedite the checkout process. GPS and improved search capabilities enable consumers to locate nearby hotels and conduct price, distance, and rating comparisons; to compare flights and car rentals based on various criteria, including traveler type; and to access customer reviews. Orbitz also instituted mobile exclusive same-day deals, called Mobile Steals, available both on the m-commerce site and through the Hotels by Orbitz app available for iPhone and Android devices. Proprietors are able to fill rooms that might otherwise remain vacant, and consumers save up to 50 percent of the standard rate. While only 12–14 percent of traditional e-commerce Web site shoppers want to reserve a room for the day on which they are searching, smartphone and other mobile users book for the same night between 50 to 60 percent of the time because they are more likely to be traveling and need a room at the last minute.

Orbitz touts the ability to book a hotel room in just three taps. The new mobile Web site has produced a 110 percent increase in visits, a 145 percent increase in the conversion rate, and four times the number of transactions compared to the original Orbitz m-commerce site. Orbitz has been focusing on lodging because hotel bookings are more profitable than airline reservations. Priceline.com, the largest and most profitable online travel agency, generates approximately 90 percent of its sales from hotels. Orbitz receives only 27 percent of revenue from hotels.

Orbitz further enhanced its iOS and Android apps to cut down the number of steps required to search for and make reservations so that the entire process can take place on the mobile device without redirecting the user to hotel, airline, or car rental Web sites to complete the transaction. Orbitz now has apps for the iPhone, iPad, iPod Touch, Kindle Fire, and Android devices.

Does all this investment in mobile technology make a difference? Chris Brown, Orbitz vice president in charge of product strategy, believes that the ability to be a major player in the rapidly escalating m-commerce market will pay off. Increased transaction speed provided by Orbitz mobile apps will attract new customers, especially those trying to book same-day reservations, which account for about 50 percent of Orbitz's mobile car rental purchases. Consumers who book with mobile devices tend to book closer to when they travel and are more certain to buy than just shop. By the end of 2013, mobile apps accounted for about 30 percent of Orbitz hotel transactions.

But the other online travel players also believe consumers will increasingly move to mobile to make their travel plans, and they also have been making large investments in mobile Web sites, search tools, and apps. Priceline and TripAdvisor have rated highest in providing an engaging, enjoyable experience on their sites, and both continue to enjoy much stronger growth in unique visitors and visits than Expedia and Orbitz. Travelers are increasingly planning trips on sites such as TripAdvisor, which aggregate offerings from a number of different online sources in one place. TripAdvisor offers more than 100 million traveler reviews and obtains most of its revenue from ads and referrals to other travel sites. TripAdvisor recently redesigned its Web site to show customers all the rates offered by online agents like Expedia, Priceline, and Travelocity in a single list on its site. By using this "metasearch" capability, customers are able to find the lowest prices on a single screen without having to click on several links.

Sources: Scott McCartney, "Free Travel Free-for-All Among Online Booking Sites," *Wall Street Journal*, April 23, 2014; "Orbitz Worldwide, Inc. (OWW), SEC Filing 10-K Annual Report for the Fiscal Year Ending Tuesday, December 31, 2013," March 18, 2014; Karen Jacobs, "Orbitz Profit Tops Forecasts, Hotel Booking Revenues Up," Reuters, August 8, 2013; Drew Fitzgerald, "Out of Nest, TripAdvisor Soars Past Expedia," *Wall Street Journal*, August 8, 2013; Karl Baker, "Orbitz Falls as CIO Exit Rekindles Hotel Growth Concerns," *Bloomberg Businessweek*, January 10, 2013; Ryan Peckyno, "How Mobile Will Impact Online Travel Companies, Motley Fool, July 29, 2013; Bill Siwicki, "Orbitz Spreads Its 'Mobile Magic' Throughout a Resdesigned M-commerce Site," Internet Retailer, October 10, 2012; Kenneth C. Laudon and Carol Guercio Traver, *E-Commerce* 2013, Pearson Education (2013).

CASE STUDY QUESTIONS

1. How important is mobile technology in Orbitz's business strategy? Why?
2. What managment, organization, and technology issues did Orbitz need to address in its mobile strategy?
3. Why are mobile phone users much more likely to book same-day hotel room or airline reservations?
4. What role does Orbitz for Business play in the company's business strategy?
5. How successful is Orbitz's mobile strategy? Explain your answer.

Connecting people to local merchants in the form of geoadvertising is the economic foundation for mobile commerce. Mobile advertising will reach $17.7 billion in 2014, up 83 percent from 2013. Geoadvertising sends ads to users based on their GPS locations. Smartphones report their locations back to Google and Apple. Merchants buy access to these consumers when they come within range of a merchant. For instance, Kiehl Stores, a cosmetics retailer, sent special offers and announcements to customers who came within 100 yards of their store.

OTHER MOBILE COMMERCE SERVICES

Banks and credit card companies are rolling out services that let customers manage their accounts from their mobile devices. JPMorgan Chase and Bank of America customers can use their cell phones to check account balances,

transfer funds, and pay bills. Apple Pay for the iPhone 6 and Apple Watch, along with other Android and Windows smartphone models, allows users to charge items to their credit card accounts with a swipe of their phone. (See our Learning Track on mobile payment systems.)

Although the mobile advertising market is currently small, it is rapidly growing (up 75 percent from last year and expected to grow to over $47 billion by 2017), as more and more companies seek ways to exploit new databases of location-specific information. The largest providers of mobile display advertising are Apple's iAd platform and Google's AdMob platform (both with a 21 percent market share) followed by Millenial Media. Facebook is a distant fourth but moving rapidly to catch up. Alcatel-Lucent offers a new service to be managed by Placecast that will identify cell phone users within a specified distance of an advertiser's nearest outlet and notify them about the outlet's address and phone number, perhaps including a link to a coupon or other promotion. Placecast's clients include Hyatt, FedEx, and Avis Rent-A-Car.

Yahoo displays ads on its mobile home page for companies such as Pepsi, Procter & Gamble, Hilton, Nissan, and Intel. Google is displaying ads linked to cell phone searches by users of the mobile version of its search engine, while Microsoft offers banner and text advertising on its MSN Mobile portal in the United States. Ads are embedded in games, videos, and other mobile applications.

Shopkick is a mobile application that enables retailers such as Best Buy, Sports Authority, and Macy's to offer coupons to people when they walk into their stores. The Shopkick app automatically recognizes when the user has entered a partner retail store and offers a new virtual currency called "kickbucks," which can be redeemed for Facebook credits, iTunes Gift Cards, travel vouchers, DVDs, or immediate cash-back rewards at any of the partner stores.

Fifty-five percent of online retailers now have m-commerce Web sites—simplified versions of their Web sites that make it possible for shoppers to use cell phones to place orders. Clothing retailers Lilly Pulitzer and Armani Exchange, Home Depot, Amazon, Walmart, and 1–800-Flowers are among those companies with apps for m-commerce sales.

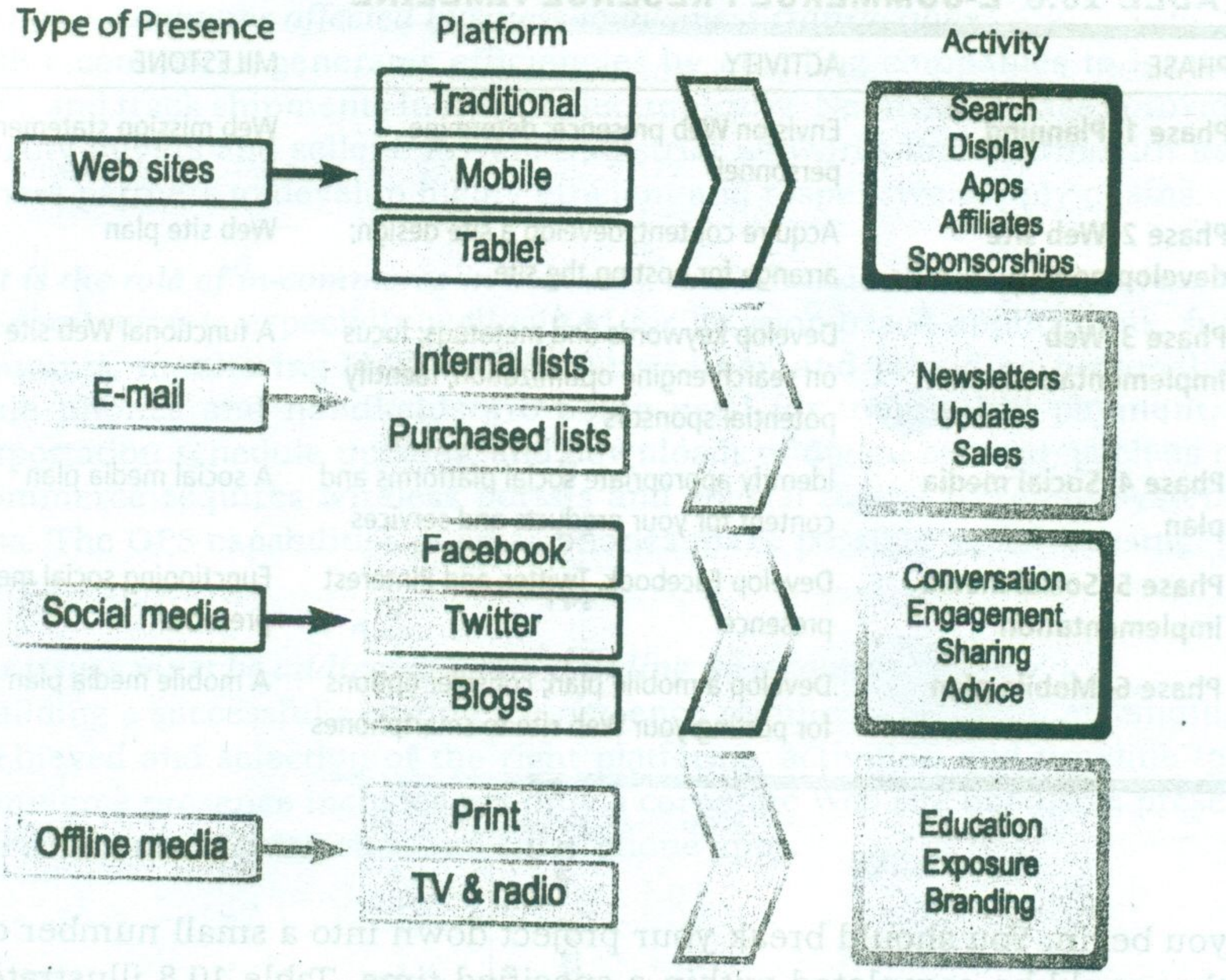
10.6 WHAT ISSUES MUST BE ADDRESSED WHEN BUILDING AN E-COMMERCE PRESENCE?

Building a successful e-commerce presence requires a keen understanding of business, technology, and social issues, as well as a systematic approach. Today, an e-commerce presence is not just a corporate Web site, but may also include a social network site on Facebook, a Twitter feed, and smartphone apps where customers can access your services. Developing and coordinating all these different customer venues can be difficult. A complete treatment of the topic is beyond the scope of this text, and students should consult books devoted to just this topic (Laudon and Traver, 2015). The two most important management challenges in building a successful e-commerce presence are (1) developing a clear understanding of your business objectives and (2) knowing how to choose the right technology to achieve those objectives.

DEVELOP AN E-COMMERCE PRESENCE MAP

E-commerce has moved from being a PC-centric activity on the Web to a mobile and tablet-based activity. While 80 percent or more of e-commerce today is

FIGURE 10.10 E-COMMERCE PRESENCE MAP



An e-commerce presence requires firms to consider the four different types of presence, with specific platforms and activities associated with each.

conducted using PCs, increasingly smartphones and tablets will be used for purchasing. Currently, smartphones and tablets are used by a majority of Internet users in the United States to shop for goods and services, look up prices, enjoy entertainment, and access social sites, less so to make purchases. Your potential customers use these various devices at different times during the day, and involve themselves in different conversations depending what they are doing—touching base with friends, tweeting, or reading a blog. Each of these are "touch points" where you can meet the customer, and you have to think about how you develop a presence in these different virtual places. Figure 10.10 provides a roadmap to the platforms and related activities you will need to think about when developing your e-commerce presence.

Figure 10.10 illustrates four different kinds of e-commerce presence: Web sites, e-mail, social media, and offline media. For each of these types there are different platforms that you will need to address. For instance, in the case of Web site presence, there are three different platforms: traditional desktop, tablets, and smartphones, each with different capabilities. And for each type of e-commerce presence there are related activities you will need to consider. For instance, in the case of Web sites, you will want to engage in search engine marketing, display ads, affiliate programs, and sponsorships. Offline media, the fourth type of e-commerce presence, is included here because many firms use multiplatform or integrated marketing where print ads refer customers to Web sites.

DEVELOP A TIMELINE: MILESTONES

Where would you like to be a year from now? It's a good idea for you to have a rough idea of the time frame for developing your e-commerce presence when

TABLE 10.8 E-COMMERCE PRESENCE TIMELINE

PHASE	ACTIVITY	MILESTONE
Phase 1: Planning	Envision Web presence; determine personnel	Web mission statement
Phase 2: Web site development	Acquire content; develop a site design; arrange for hosting the site	Web site plan
Phase 3: Web Implementation	Develop keywords and metatags; focus on search engine optimization; identify potential sponsors	A functional Web site
Phase 4: Social media plan	Identify appropriate social platforms and content for your products and services	A social media plan
Phase 5: Social media implementation	Develop Facebook, Twitter, and Pinterest presence	Functioning social media presence
Phase 6: Mobile plan	Develop a mobile plan; consider options for porting your Web site to smartphones	A mobile media plan

you begin. You should break your project down into a small number of phases that could be completed within a specified time. Table 10.8 illustrates a one-year timeline for the development of an e-commerce presence for a start-up company devoted to teenage fashions. You can also find more detail about developing an e-commerce Web site in the Learning Tracks for this chapter.

Review Summary

1. *What are the unique features of e-commerce, digital markets, and digital goods?*

E-commerce involves digitally enabled commercial transactions between and among organizations and individuals. Unique features of e-commerce technology include ubiquity, global reach, universal technology standards, richness, interactivity, information density, capabilities for personalization and customization, and social technology. E-commerce is becoming increasingly social, mobile, and local.

Digital markets are said to be more "transparent" than traditional markets, with reduced information asymmetry, search costs, transaction costs, and menu costs, along with the ability to change prices dynamically based on market conditions. Digital goods, such as music, video, software, and books, can be delivered over a digital network. Once a digital product has been produced, the cost of delivering that product digitally is extremely low.

2. *What are the principal e-commerce business and revenue models?*

E-commerce business models are e-tailers, transaction brokers, market creators, content providers, community providers, service providers, and portals. The principal e-commerce revenue models are advertising, sales, subscription, free/freemium, transaction fee, and affiliate.

3. *How has e-commerce transformed marketing?*

The Internet provides marketers with new ways of identifying and communicating with millions of potential customers at costs far lower than traditional media. Crowdsourcing utilizing the "wisdom of crowds" helps companies learn from customers in order to improve product offerings and increase customer value. Behavioral targeting techniques increase the effectiveness of banner, rich media, and video ads. Social commerce uses social networks and social network sites to improve targeting of products and services.

4. *How has e-commerce affected business-to-business transactions?*

B2B e-commerce generates efficiencies by enabling companies to locate suppliers, solicit bids, place orders, and track shipments in transit electronically. Net marketplaces provide a single, digital marketplace for many buyers and sellers. Private industrial networks link a firm with its suppliers and other strategic business partners to develop highly efficient and responsive supply chains.

5. *What is the role of m-commerce in business, and what are the most important m-commerce applications?*

M-commerce is especially well suited for location-based applications, such as finding local hotels and restaurants, monitoring local traffic and weather, and providing personalized location-based marketing. Mobile phones and handhelds are being used for mobile bill payment, banking, securities trading, transportation schedule updates, and downloads of digital content, such as music, games, and video clips. M-commerce requires wireless portals and special digital payment systems that can handle micropayments. The GPS capabilities of smartphones make possible geoadvertising, geosocial, and geoinformation services.

6. *What issues must be addressed when building an e-commerce presence?*

Building a successful e-commerce presence requires a clear understanding of the business objectives to be achieved and selection of the right platforms, activities, and timeline to achieve those objectives. An e-commerce presence includes not only a corporate Web site but also a presence on Facebook, Twitter, and other social networking sites and smartphone apps.

Key Terms

Advertising revenue model, 429
Affiliate revenue model, 431
Behavioral targeting, 434
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Business-to-consumer (B2C), 426
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MyMISLab

Go to **mymislab.com** to complete the problems marked with this icon ✪.

Review Questions

10-1 What are the unique features of e-commerce, digital markets, and digital goods?

- Name and describe four business trends and three technology trends shaping e-commerce today.
- List and describe the eight unique features of e-commerce.
- Explain how e-commerce has become more social, mobile, and local.

10-2 What are the principal e-commerce business and revenue models?

- Summarize the three main types of e-commerce.
- Name and describe the principal e-commerce business models.
- Name and describe the e-commerce revenue models.

10-3 How has e-commerce transformed marketing?

- Explain how social networking and the "wisdom of crowds" help companies improve their marketing.
- Define behavioral targeting and explain how it works at individual Web sites and on advertising networks.
- Define the social graph and explain how it is used in e-commerce marketing.

10-4 How has e-commerce affected business-to-business transactions?

- Explain how Internet technology supports business-to-business electronic commerce.
- Define and describe Net marketplaces and explain how they differ from private industrial networks (private exchanges).

10-5 What is the role of m-commerce in business, and what are the most important m-commerce applications?

- List and describe important types of m-commerce services and applications.
- Describe common location-based services and applications.

10-6 What issues must be addressed when building an e-commerce presence?

- List and describe the four types of e-commerce presence.

Discussion Questions

✪ **10-7** How does the Internet change consumer and supplier relationships?

✪ **10-8** The mobile platform may not make desktop PCs obsolete, but corporations will have to change their business models to adjust to this shift. Do you agree? Why or why not?

✪ **10-9** How have social technologies changed e-commerce?

Hands-On MIS Projects

The projects in this section give you hands-on experience developing e-commerce strategies for businesses, using spreadsheet software to research the profitability of an e-commerce company, and using Web tools to research and evaluate e-commerce hosting services.

Management Decision Problems

10-10 Columbiana is a small, independent island in the Caribbean that has many historical buildings, forts, and other sites, along with rain forests and striking mountains. A few first-class hotels and several dozen less expensive accommodations can be found along its beautiful white sand beaches. The major airlines have regular flights to Columbiana, as do several small airlines. Columbiana's government wants to increase

tourism and develop new markets for the country's tropical agricultural products. How can a Web presence help? What Internet business model would be appropriate? What functions should the Web site perform?

10-11 Explore the Web sites of the following companies: Eurosparkle, Promod, Kingfisher plc, and ebookers.com. Determine which of these Web sites would benefit most from adding a company-sponsored blog to the Web site. List the business benefits of the blog. Specify the intended audience for the blog. Decide who in the company should author the blog, and select some topics for the blog.

Improving Decision Making: Using Spreadsheet Software to Analyze a Dot-Com Business

Software skills: Spreadsheet downloading, formatting, and formulas
Business skills: Financial statement analysis

10-12 Pick one e-commerce company on the Internet—for example, Ashford, Buy.com, Yahoo, or Priceline. Study the Web pages that describe the company and explain its purpose and structure. Use the Web to find articles that comment on the company. Then visit the Securities and Exchange Commission's Web site at www.sec.gov to access the company's 10-K (annual report) form showing income statements and balance sheets. Select only the sections of the 10-K form containing the desired portions of financial statements that you need to examine, and download them into your spreadsheet. (MyMISLab provides more detailed instructions on how to download this 10-K data into a spreadsheet.) Create simplified spreadsheets of the company's balance sheets and income statements for the past three years.

- Is the company a dot-com success, borderline business, or failure? What information provides the basis of your decision? Why? When answering these questions, pay special attention to the company's three-year trends in revenues, costs of sales, gross margins, operating expenses, and net margins.
- Prepare an overhead presentation (with a minimum of five slides), including appropriate spreadsheets or charts, and present your work to your professor and classmates.

Achieving Operational Excellence: Evaluating E-Commerce Hosting Services

Software skills: Web browser software
Business skills: Evaluating e-commerce hosting services

10-13 This project will help develop your Internet skills in commercial services for hosting an e-commerce site for a small start-up company.

You would like to set up a Web site to sell towels, linens, pottery, and tableware from Portugal and are examining services for hosting small business Internet storefronts. Your Web site should be able to take secure credit card payments and to calculate shipping costs and taxes. Initially, you would like to display photos and descriptions of 40 different products. Visit Verio Europe, Host Europe, and iPage and compare the range of e-commerce hosting services they offer to small businesses, their capabilities, and costs. Also examine the tools they provide for creating an e-commerce site. Compare these services and decide which you would use if you were actually establishing a Web store. Write a brief report indicating your choice and explaining the strengths and weaknesses of each.

Collaboration and Teamwork Project

10-14 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Docs, Google Sites, Google+, or other open source collaboration tools to complete the assignment.

To Pay or Not to Pay: Zagat's Dilemma

CASE STUDY

Founded by Tim and Nina Zagat, the Zagat Survey has collected and published ratings of restaurants by diners since 1979. Zagat publishes surveys for restaurants, hotels, and nightlife in 70 major cities. Zagat has come a long way from its roots in the early 1980s, when the food-loving Zagats started compiling lists of their favorite restaurants for personal use and to share with their closest friends. But with the rise of the Internet, e-commerce, and mobile technology, Zagat has struggled to find a business model that stayed true to the company's origins.

To generate their first survey, the Zagats polled 200 people, and increased that number over time. Executives, tourists, and New York foodies alike found the list to be indispensable. Spurred by this success, the Zagats decided to publish their survey themselves. The few booksellers that took a risk in stocking the book were rewarded with sales so robust that the Zagat Surveys became best sellers.

The pair also published similar lists for other major cities, including Chicago, San Francisco, and Washington, D.C. In addition to print books, Zagat opened a unit that creates custom guides for corporate clients, like the ones at Citibank. For a long time, this business model was sufficient to ensure that Zagat Survey was successful and profitable.

When the dot-com bubble came along, venture capitalists were attracted to Zagat for its brand recognition—the Zagat name is instantly recognizable to food-lovers, travelers, and restaurateurs alike. Zagat was one of the first companies to popularize user-generated content, collecting restaurant reviews from its readers, aggregating those reviews, and computing ratings. In addition to numeric rating scores, the survey also includes a short descriptive paragraph that incorporates selected quotations from several reviewers' comments about each restaurant or service. Venture capitalists saw that Zagat had a golden opportunity to migrate its content from offline to online, Web, and mobile.

Of the many decisions the Zagats faced in bringing their content to the Web, perhaps the most important was how much to charge for various types of content. They ultimately decided to place all of their content behind a pay wall, relying on the Zagat brand to entice customers to purchase full online access. One of the most prominent members of the Zagat investment group was Nathan Myhrvold, formerly the chief technology officer at Microsoft. Myhrvold supported the Zagats' decision to use a pay wall for their content and maintained that putting all of their content online for free would have undermined their book sales.

Although Myhrvold and the Zagats themselves favored the pay wall, other Zagat investors argued that placing content online for free allowed companies like Yelp to get its results on the first page of Google search results, which is critical for maintaining the strength of a brand in today's advertising environment. By not taking this approach, Zagat left itself open to be surpassed by Yelp, Groupon, Google Places, and other similar services offering free content supported by advertising from local businesses. Sure enough, these companies soon began attracting numbers of online visitors that dwarfed Zagat's.

In 2008, the Zagats tried to sell their company. They failed to do so, partially due to Yelp's growing popularity. Prospective buyers were more intrigued by Yelp's much larger online audience and growth potential. The Zagats' failure to sell the company in 2008 highlighted their failure to effectively go digital. Food blogs and similar sites abound on the Web nowadays, but Zagat was in a unique position to get there first and establish itself as a market leader, and it failed to do so.

For much of 2011, Zagat continued to lag behind Yelp and other free review sites in the battle for eyeballs. Yelp drew much greater traffic than Zagat.com. From January to April 2012, Zagat.com had only 310,000 visitors, while Yelp had 31 million. The Zagat Web site claimed it has more users, but the disparity was still significant.

Zagat saw its fortunes change in September 2011, when Google paid $151 million to buy the company. Although the Zagats had sought $200 million in 2008, the deal was considered by analysts to be generous. Google was seeking to establish itself in the local search marketspace, and after failing to purchase Yelp for $500 million in 2009, Zagat was next on their shopping list. In fact, after the Yelp deal fell through, Google and Yelp have become heated rivals, and Yelp has alleged that Google is rigging its search results to favor its own services over those of its competitors.

In the year following the acquisition, Google and Zagat worked together to allow Zagat reviews

to appear alongside Google searches on various platforms. Google wanted to use Zagat's customer generated guide format and apply it to any place that can be searched for: restaurants, retail outlets, nightlife, hotels, resorts, spas, golf courses, and more. A growing percentage of Google searches are for information on nearby locations—20 percent of all searches, and 40 percent of that subset are made using mobile phones.

In May 2012, Google formally announced the inclusion of Zagat guides and online reviews in its new service, Google+ Local. With this service, Google hopes to more effectively compete with Yelp in local search. Because Google values eyeballs over all else, the company opted to remove the pay wall from Zagat content for the first time. Zagat had been charging $25 per year or $5 per month for access to its online reviews. Zagat will still charge $10 a year to use its iPhone app, and after a free six-month trial, it will charge $25 annually to see reviews on devices running Android. Still, normal Google searches on the Web will feature Zagat content for free, and Google is considering dropping the other subscription fees for mobile devices.

Google hopes to combine Zagat reviews with its mapping technology to better compete with Yelp. Trying out both services highlights some of the differences between them. Zagat.com's home page is streamlined, with a minimal number of search boxes and links immediately available. Restaurant reviews are organized by several major "hub" cities as well as popular lists of the top restaurants of a certain type. Clicking on a restaurant shows visitors a portion of the data Zagat maintains on that restaurant. For example, the site now shows the percentage of users that "like" the restaurant, and several featured reviews. Many more reviews of the restaurant are available if the user wants to keep scrolling.

Yelp's front page is much busier and less streamlined than Zagat's, but has a great deal more content available immediately. The front page has lists of the most popular restaurants, retail outlets, bars and clubs, and many other categories, all free to the user. Looking for a dentist in New York City? Yelp has reviews of doctors and dentists that include videos put together by the practices to give visitors more information. Like Zagat.com, Yelp's reviews are organized into a similar list of larger cities, but reviews exist for almost any location you can think of, including less prominent cities and towns. Google is also working towards the goal of ubiquity.

Yelp's strategy is to sell local advertisements wherever businesses exist and to provide free content funded by these sales. Yelp has also relied more on individual reviewers. Instead of distilling reviews into one coherent whole, as Zagat's does, Yelp allows its reviewers to post full, unaltered reviews, which allows top reviewers to gain followings and even receive invitations to special events. The drawback of this approach is that many reviews are far longer than necessary and individual reviews may contain distortions or false claims designed to damage reputations. Zagat reviews give a clearer and more concise impression of a restaurant than most Yelp reviews, and they are aggregated and given a score.

Investors believe that Yelp is on "a different trajectory" because of its unique business model. Zagat sold content to consumers and corporations; Yelp sells advertising to local businesses. Many analysts believe there is much more potential for growth with Yelp's business model than with Zagat's old model because it is a useful advertising vehicle for small businesses everywhere, not just major cities. Zagat may also have hurt itself with its slow response to the emergence of the mobile digital platform.

Most analysts agree that Zagat could have avoided this state of affairs by making a more aggressive effort to go digital. The choice to use a pay wall may be the biggest culprit. But did it necessarily hurt Zagat's bottom line? The company has always been profitable, according to Tim and Nina Zagat. Other successful Web sites have used a pay wall. Zagat book revenue is still strong—the New York survey is still on the New York nonfiction best-seller list, and its corporate custom guide unit is very profitable. Despite their acquisition by Google, the Zagats plan to continue to publish their physical books. Nevertheless, it's also possible that going with a pay wall before establishing a loyal online audience may not be the right time to make the move towards a paid model.

So far, the pairing of Google and Zagat has been successful, and will allow the two companies to better compete with Yelp in local search. But Google also hopes that incorporating Zagat's user-generated content model into Google+ will help its fledgling social network to better compete with Facebook by providing uniquely valuable services to its users. Google envisions Google+ users searching for "pizza" and being given a map with the closest pizzerias marked with Zagat reviews, some of which may be written by their friends on the network. In 2014, Google made big changes to Zagat's app, introducing a host of new features and a completely updated design, as well as limiting the number of cities where the app would work. New filtering options allow

users to perform more granular searches for specific types of restaurants, sorting by style, cost, location, or rating. For Google, acquiring Zagat was just one of a myriad of acquisitions they made in 2011; but from Zagat's perspective, its acquisition represents another phase in a long e-commerce journey, and illustrates the difficulty of developing just the right business model for your company.

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CASE STUDY QUESTIONS

10-15 Evaluate Zagat using the competitive forces and value chain models.

10-16 Compare Zagat's and Yelp's e-commerce business models. How have those models affected each company's Web strategy?

10-17 Why was Zagat's content well suited for the Web and for the mobile digital platform?

10-18 Do you think Zagat's decision to use a pay wall for its Web site was a mistake? Why or why not?

10-19 Will Zagat's acquisition by Google make it more competitive? Explain your answer.

MyMISLab

Go to **mymislab.com** for the following Assisted-graded writing questions:

10-20 Describe the six features of social commerce. Provide an example for each feature describing how a business could use that feature for selling to consumers on line.

10-21 What are the main factors that mediate the relationship between information technology and organizations, and that managers need to take into account when developing new information systems? Give a business example of how each factor would influence the development of new information systems.

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CHAPTER 11

Managing Knowledge

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. What is the role of knowledge management systems in business?
2. What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?
3. What are the major types of knowledge work systems and how do they provide value for firms?
4. What are the business benefits of using intelligent techniques for knowledge management?

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CHAPTER CASES

Fiat: Real Time Management with Business Intelligence
Firewire Surfboards Light Up with CAD
Big Data Makes Cities Smarter
Knowledge Management and Collaboration at Tata Consulting Services

VIDEO CASES

How IBM's Watson Became a Jeopardy Champion
Alfresco: Open Source Document Management and Collaboration
Instructional Videos:
Analyzing Big Data: IBM Watson
Teamwork and Collaboration: John Chambers on Collaboration vs. Command and Control

FIAT: REAL TIME MANAGEMENT WITH BUSINESS INTELLIGENCE

Few industries have experienced as much disruption due to the financial meltdown of 2007–2009 as the auto industry. Global production peaked in 2007 when 53 million cars were produced, but fell to 47 million two years later at the height of the global financial recession. Two large American firms, General Motors and Chrysler, required a financial bail out of €5.6 billion from the United States government. After filing for bankruptcy in 2009, Chrysler found a buyer in Fiat Automobiles S.p.A., who eventually purchased majority control by 2011, and has since attempted to purchase all the shares from the Canadian government, and employee unions in 2013.

Fiat was one of the global automotive companies to weather the financial storm of 2008–2011 without significant government intervention. The 114-year-old automaker is based in Turin, Italy, and is Italy's largest auto manufacturer, with 9 percent of the European market. Its second largest market is Brazil, where it has been the market leader for a decade. The combined Chrysler Fiat company has nearly 215,000 employees, 158 plants, and 77 R&D centers. Fiat's 2012 revenue approached €84 billion. In 2014, Fiat Chrysler shifted to incorporation under Dutch Law, moved its headquarters to the United Kingdom, and was listed on the New York Stock Exchange, indicating a strong move towards becoming a more global company.

Fiat faced several information system challenges resulting from its global expansion, and in particular its purchase of Chrysler. In the past, Fiat global production centers adopted their own database systems to manage their business, and these legacy systems evolved independently over many years.



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Even enterprise systems from a single vendor differed by country and market, making compatibility and reporting a challenge for executives. This meant that executives in Turin could not receive timely and complete information on the firm's key business processes and financial performance. A good deal of management decision making relied on manual spreadsheets using data from different systems, and this led to errors in the data. With Chrysler, Fiat inherited another set of enterprise systems. All business functions were impacted, from supply management and production to marketing and finance. Financial managers required a detailed planning capability. Selling Fiat 500s in the United States and Jeeps throughout Europe made it very difficult to identify the potential cost savings of sharing parts and products across these brands.

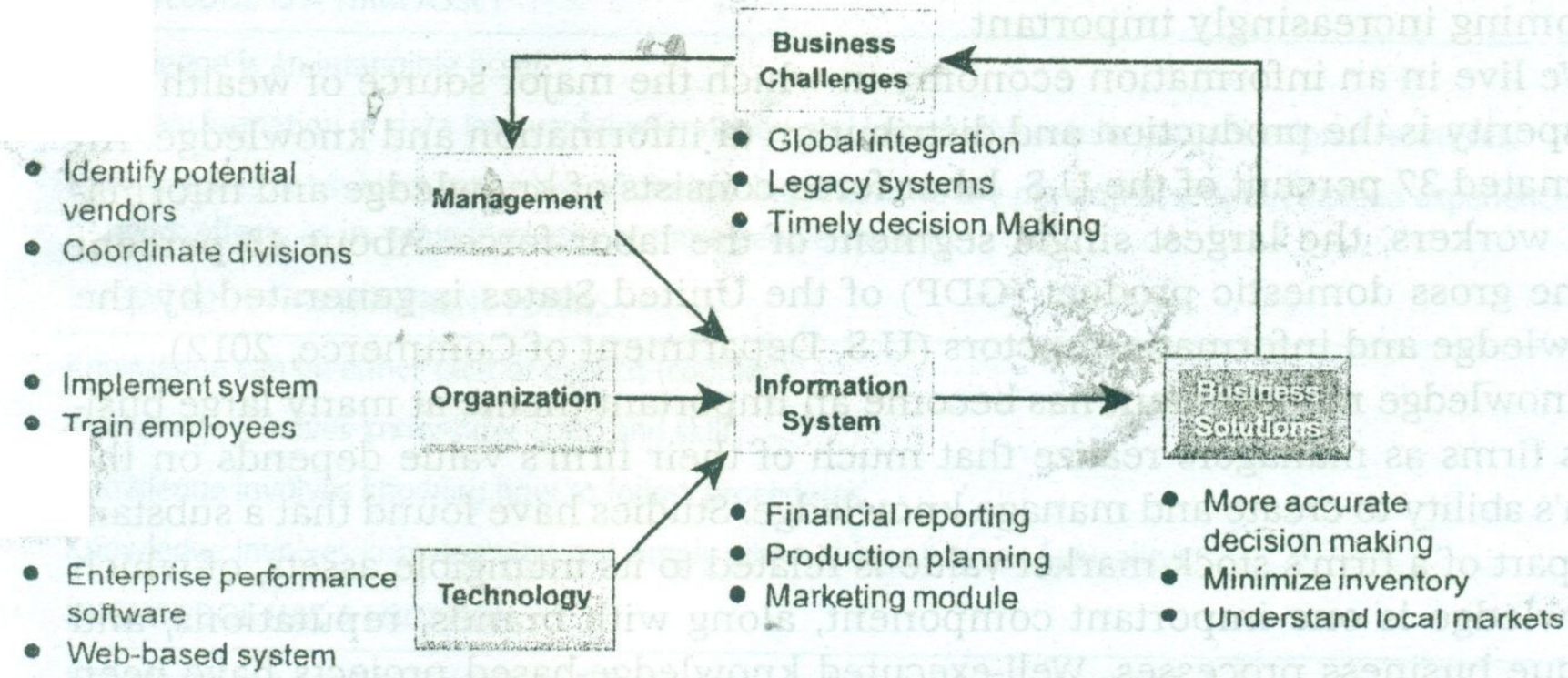
Fiat decided it needed a new system that could provide near real-time information on its operations across the globe to integrate control and reporting, data definitions, pricing, and marketing campaigns for new vehicles. Working with Oracle's Hyperion database and reporting software, and the consulting firm TechEdge SpA, Fiat set out to build an enterprise performance management system with significant business intelligence capabilities based on current data from the divisions.

The new system allows Fiat managers to analyze automobile production across divisions, including the motors used, and vehicle options. In turn this enables executives to define the costs and budgets of production worldwide. Manual work with spreadsheets has been greatly reduced. Using Oracle's Hyperion Planning system, Fiat managers are able to develop a detailed understanding of local market conditions and initiate marketing campaigns and incentive programs to ensure that excess inventories of completed cars do not pile up.

Oracle's Hyperion Financial Management provided an integrated platform for managing government reporting requirements, and the ability to trace and audit assembly and sales by providing a detailed view of dealer sales to final customers. For marketing, the new system enabled Fiat managers to simulate sales volumes and costs, and compared marketing expenditures in each market to sales results. In contrast to previous legacy systems, the enterprise performance system is Web-enabled and reduces reliance on individual PCs. An important element of the new system is making data and information more understandable by creating performance dashboards for managers that reflect their needs as decision makers. These new user interfaces are essential elements for using the data effectively in a competitive environment.

Sources: Tommaso Ebhardt and Daniele Lepido, "Fiat Says Ciao to Italy as Merger with Chrysler Ends Era," Bloomberg.com, August 1, 2014; Worldometer, "Cars Produced in the World," December 15, 2013; Technology Reply, "Competitive Analysis: Second Generation Business Intelligence for Competitive Advantage," October 2013; "Fiat Group Automobiles Aligns Operational Decisions with Strategy by Using End-to-End Enterprise Performance Management System," *Oracle Magazine*, September 2013; David Baum, "Dashboard View: As Fiat Maneuvers Beyond Italy, New Analytics Help Steer Managers in the Right Direction, *Oracle Magazine*, May 2013.

The experiences of Fiat provide an excellent of example of the challenges that businesses face when increasing their scope of operations and moving towards a truly global business. The existing legacy systems at Fiat made it very difficult to coordinate supply chain, production, financial, and marketing decisions on a global basis. Existing systems could not provide real-time data to central management in Turin, and did not have the analytical power to analyze the data from these legacy systems. In this traditional climate, management



had a difficult time responding to changes in local conditions, and discovering potential synergies among their divisions.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. To operate efficiently on a global scale, firms need more timely and accurate data to make intelligent decisions. They also need sophisticated analytic packages that can make sense of the data, provide capsule summaries to management, and provide interfaces that managers can easily use. With these systems, managers are able to see where production bottlenecks occur, understand how their various divisions can cooperate by sharing parts and designs, and respond to changes in demand and avoid excess inventories. Better decision making using business intelligence makes companies like Fiat more profitable.

Here are some questions to think about: Why is it important that global performance management be delivered using Web-based technologies rather than traditional software running on corporate servers and PCs? What people and organizational difficulties do you think firms will face when implementing these global systems? Do firms become too dependent on database firms like Oracle?

11.1 WHAT IS THE ROLE OF KNOWLEDGE MANAGEMENT SYSTEMS IN BUSINESS?

Knowledge management and collaboration systems are among the fastest growing areas of corporate and government software investment. The past decade has shown an explosive growth in research on knowledge and knowledge management in the economics, management, and information systems fields.

Knowledge management and collaboration are closely related. Knowledge that cannot be communicated and shared with others is nearly useless. Knowledge becomes useful and actionable when shared throughout the firm.

We have already described the major tools for collaboration and social business in Chapter 2. In this chapter, we will focus on knowledge management systems, and be mindful that communicating and sharing knowledge are becoming increasingly important.

We live in an information economy in which the major source of wealth and prosperity is the production and distribution of information and knowledge. An estimated 37 percent of the U.S. labor force consists of knowledge and information workers, the largest single segment of the labor force. About 45 percent of the gross domestic product (GDP) of the United States is generated by the knowledge and information sectors (U.S. Department of Commerce, 2012).

Knowledge management has become an important theme at many large business firms as managers realize that much of their firm's value depends on the firm's ability to create and manage knowledge. Studies have found that a substantial part of a firm's stock market value is related to its intangible assets, of which knowledge is one important component, along with brands, reputations, and unique business processes. Well-executed knowledge-based projects have been known to produce extraordinary returns on investment, although the impacts of knowledge-based investments are difficult to measure (Gu and Lev, 2001).

IMPORTANT DIMENSIONS OF KNOWLEDGE

There is an important distinction between data, information, knowledge, and wisdom. Chapter 1 defines **data** as a flow of events or transactions captured by an organization's systems that, by itself, is useful for transacting but little else. To turn data into useful *information*, a firm must expend resources to organize data into categories of understanding, such as monthly, daily, regional, or store-based reports of total sales. To transform information into **knowledge**, a firm must expend additional resources to discover patterns, rules, and contexts where the knowledge works. Finally, **wisdom** is thought to be the collective and individual experience of applying knowledge to the solution of problems. Wisdom involves where, when, and how to apply knowledge.

Knowledge is both an individual attribute and a collective attribute of the firm. Knowledge is a cognitive, even a physiological, event that takes place inside people's heads. It is also stored in libraries and records, shared in lectures, and stored by firms in the form of business processes and employee know-how. Knowledge residing in the minds of employees that has not been documented is called **tacit knowledge**, whereas knowledge that has been documented is called **explicit knowledge**. Knowledge can reside in e-mail, voice mail, graphics, and unstructured documents as well as structured documents. Knowledge is generally believed to have a location, either in the minds of humans or in specific business processes. Knowledge is "sticky" and not universally applicable or easily moved. Finally, knowledge is thought to be situational and contextual. For example, you must know when to perform a procedure as well as how to perform it. Table 11.1 reviews these dimensions of knowledge.

We can see that knowledge is a different kind of firm asset from, say, buildings and financial assets; that knowledge is a complex phenomenon; and that there are many aspects to the process of managing knowledge. We can also recognize that knowledge-based core competencies of firms—the two or three things that an organization does best—are key organizational assets. Knowing how to do things effectively and efficiently in ways that other organizations cannot duplicate is a primary source of profit and competitive advantage that cannot be purchased easily by competitors in the marketplace.

TABLE 11.1 IMPORTANT DIMENSIONS OF KNOWLEDGE

KNOWLEDGE IS A FIRM ASSET
Knowledge is an intangible asset.
The transformation of data into useful information and knowledge requires organizational resources.
Knowledge is not subject to the law of diminishing returns as are physical assets, but instead experiences network effects as its value increases as more people share it.
KNOWLEDGE HAS DIFFERENT FORMS
Knowledge can be either tacit or explicit (codified).
Knowledge involves know-how, craft, and skill.
Knowledge involves knowing how to follow procedures.
Knowledge involves knowing why, not simply when, things happen (causality).
KNOWLEDGE HAS A LOCATION
Knowledge is a cognitive event involving mental models and maps of individuals.
There is both a social and an individual basis of knowledge.
Knowledge is "sticky" (hard to move), situated (enmeshed in a firm's culture), and contextual (works only in certain situations).
KNOWLEDGE IS SITUATIONAL
Knowledge is conditional; knowing when to apply a procedure is just as important as knowing the procedure (conditional).
Knowledge is related to context; you must know how to use a certain tool and under what circumstances.

For instance, having a unique build-to-order production system constitutes a form of knowledge and perhaps a unique asset that other firms cannot copy easily. With knowledge, firms become more efficient and effective in their use of scarce resources. Without knowledge, firms become less efficient and less effective in their use of resources and ultimately fail.

Organizational Learning and Knowledge Management

Like humans, organizations create and gather knowledge using a variety of organizational learning mechanisms. Through collection of data, careful measurement of planned activities, trial and error (experiment), and feedback from customers and the environment in general, organizations gain experience. Organizations that learn adjust their behavior to reflect that learning by creating new business processes and by changing patterns of management decision making. This process of change is called **organizational learning**. Arguably, organizations that can sense and respond to their environments rapidly will survive longer than organizations that have poor learning mechanisms.

THE KNOWLEDGE MANAGEMENT VALUE CHAIN

Knowledge management refers to the set of business processes developed in an organization to create, store, transfer, and apply knowledge. Knowledge management increases the ability of the organization to learn from its environment and to incorporate knowledge into its business processes. Figure 11.1 illustrates the five value-adding steps in the knowledge management value chain. Each stage in the value chain adds value to raw data and information as they are transformed into usable knowledge.

In Figure 11.1, information systems activities are separated from related management and organizational activities, with information systems activities on the top of the graphic and organizational and management activities below. One apt slogan of the knowledge management field is, "Effective knowledge management is 80 percent managerial and organizational, and 20 percent technology."

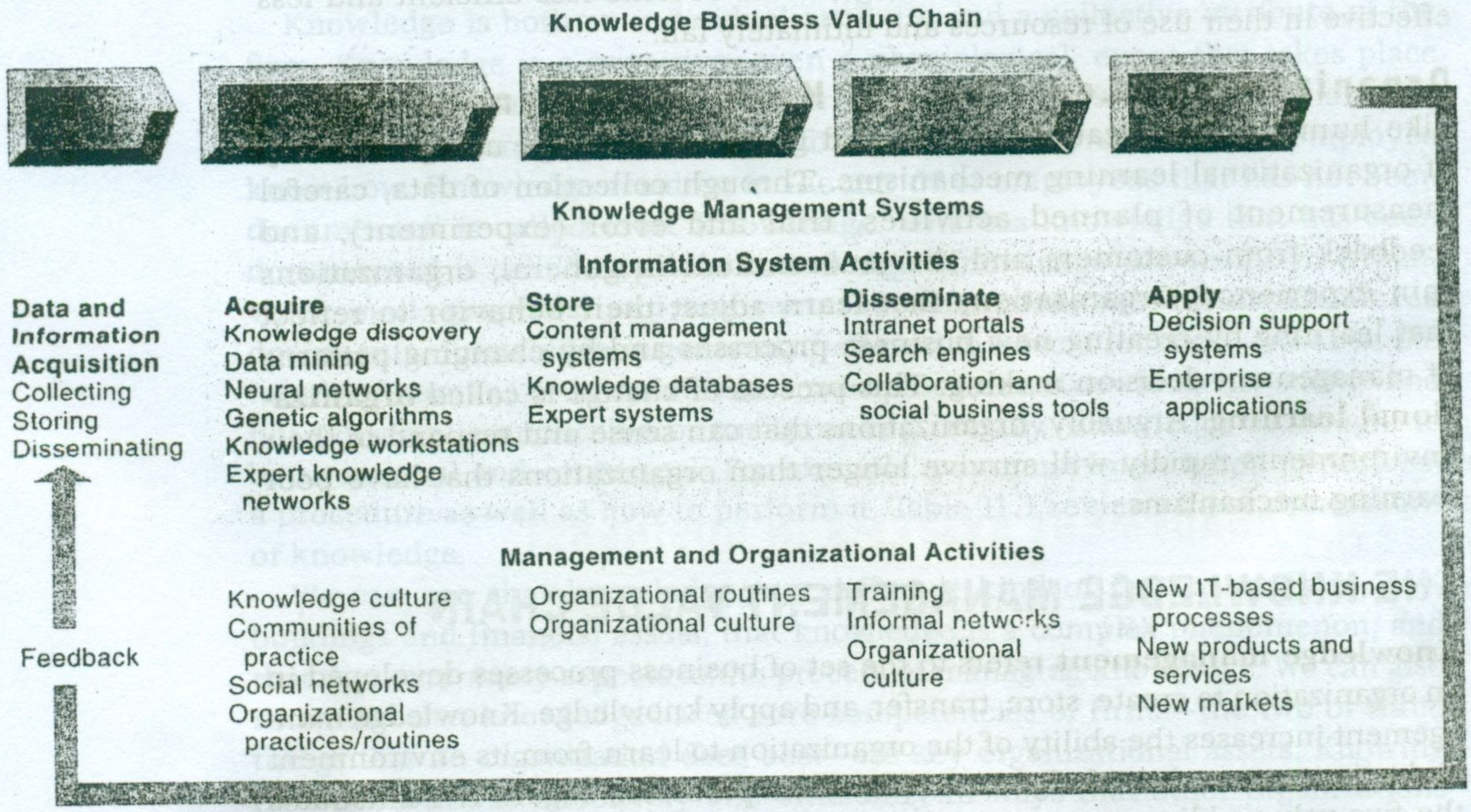
In Chapter 1, we define *organizational and management capital* as the set of business processes, culture, and behavior required to obtain value from investments in information systems. In the case of knowledge management, as with other information systems investments, supportive values, structures, and behavior patterns must be built to maximize the return on investment in knowledge management projects. In Figure 11.1, the management and organizational activities in the lower half of the diagram represent the investment in organizational capital required to obtain substantial returns on the information technology (IT) investments and systems shown in the top half of the diagram.

Knowledge Acquisition

Organizations acquire knowledge in a number of ways, depending on the type of knowledge they seek. The first knowledge management systems sought to build corporate repositories of documents, reports, presentations, and best practices. These efforts have been extended to include unstructured documents (such as e-mail). In other cases, organizations acquire knowledge by developing online expert networks so that employees can "find the expert" in the company who is personally knowledgeable.

In still other cases, firms must create new knowledge by discovering patterns in corporate data or by using knowledge workstations where engineers can discover new knowledge. These various efforts are described throughout this

FIGURE 11.1 **THE KNOWLEDGE MANAGEMENT VALUE CHAIN**



Knowledge management today involves both information systems activities and a host of enabling management and organizational activities.

chapter. A coherent and organized knowledge system also requires systematic data from the firm's transaction processing systems that track sales, payments, inventory, customers, and other vital data, as well as data from external sources such as news feeds, industry reports, legal opinions, scientific research, and government statistics.

Knowledge Storage

Once they are discovered, documents, patterns, and expert rules must be stored so they can be retrieved and used by employees. Knowledge storage generally involves the creation of a database. Document management systems that digitize, index, and tag documents according to a coherent framework are large databases adept at storing collections of documents. Expert systems also help corporations preserve the knowledge that is acquired by incorporating that knowledge into organizational processes and culture. Each of these is discussed later in this chapter and in the following chapter.

Management must support the development of planned knowledge storage systems, encourage the development of corporate-wide schemas for indexing documents, and reward employees for taking the time to update and store documents properly. For instance, it would reward the sales force for submitting names of prospects to a shared corporate database of prospects where all sales personnel can identify each prospect and review the stored knowledge.

Knowledge Dissemination

Portals, e-mail, instant messaging, wikis, social business tools, and search engines technology have added to an existing array of collaboration tools for sharing calendars, documents, data, and graphics (see Chapter 2). Contemporary technology seems to have created a deluge of information and knowledge. How can managers and employees discover, in a sea of information and knowledge, that which is really important for their decisions and their work? Here, training programs, informal networks, and shared management experience communicated through a supportive culture help managers focus their attention on the important knowledge and information.

Knowledge Application

Regardless of what type of knowledge management system is involved, knowledge that is not shared and applied to the practical problems facing firms and managers does not add business value. To provide a return on investment, organizational knowledge must become a systematic part of management decision making and become situated in systems for decision support (described in Chapter 12). Ultimately, new knowledge must be built into a firm's business processes and key application systems, including enterprise applications for managing key internal business processes and relationships with customers and suppliers. Management supports this process by creating—based on new knowledge—new business practices, new products and services, and new markets for the firm.

Building Organizational and Management Capital: Collaboration, Communities of Practice, and Office Environments

In addition to the activities we have just described, managers can help by developing new organizational roles and responsibilities for the acquisition of knowledge, including the creation of chief knowledge officer executive positions, dedicated staff positions (knowledge managers), and communities

of practice. **Communities of practice (COPs)** are informal social networks of professionals and employees within and outside the firm who have similar work-related activities and interests. The activities of these communities include self-education and group education, conferences, online newsletters, and day-to-day sharing of experiences and techniques to solve specific work problems. Many organizations, such as IBM, the U.S. Federal Highway Administration, and the World Bank have encouraged the development of thousands of online communities of practice. These communities of practice depend greatly on software environments that enable collaboration and communication.

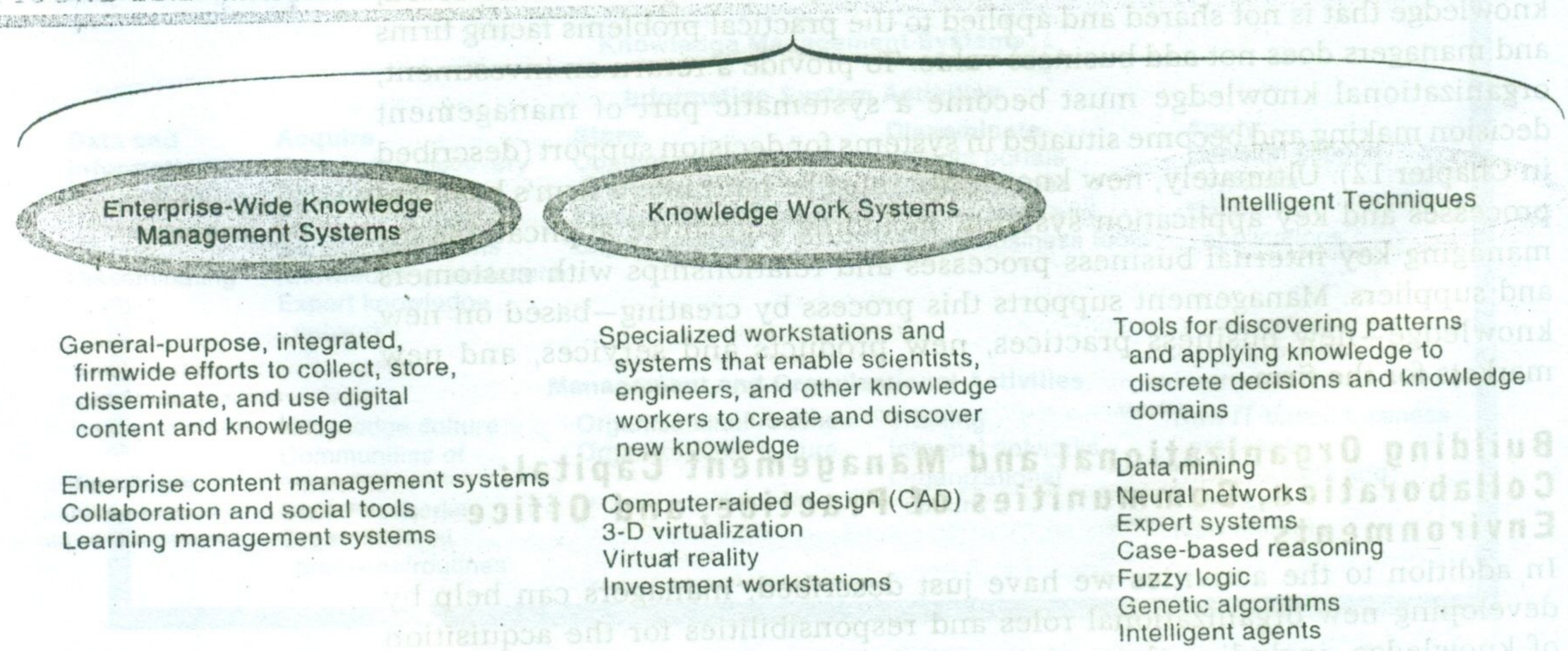
COPs can make it easier for people to reuse knowledge by pointing community members to useful documents, creating document repositories, and filtering information for newcomers. COPs members act as facilitators, encouraging contributions and discussion. COPs can also reduce the learning curve for new employees by providing contacts with subject matter experts and access to a community's established methods and tools. Finally, COPs can act as a spawning ground for new ideas, techniques, and decision-making behavior.

TYPES OF KNOWLEDGE MANAGEMENT SYSTEMS

There are essentially three major types of knowledge management systems: enterprise-wide knowledge management systems, knowledge work systems, and intelligent techniques. Figure 11.2 shows the knowledge management system applications for each of these major categories.

Enterprise-wide knowledge management systems are general-purpose firmwide efforts to collect, store, distribute, and apply digital content and knowledge. These systems include capabilities for searching for information, storing both structured and unstructured data, and locating employee expertise within the firm. They also include supporting technologies such as portals, search engines, collaboration and social business tools, and learning management systems.

FIGURE 11.2 **MAJOR TYPES OF KNOWLEDGE MANAGEMENT SYSTEMS**



There are three major categories of knowledge management systems, and each can be broken down further into more specialized types of knowledge management systems.

The development of powerful networked workstations and software for assisting engineers and scientists in the discovery of new knowledge has led to the creation of knowledge work systems such as computer-aided design (CAD), visualization, simulation, and virtual reality systems. **Knowledge work systems (KWS)** are specialized systems built for engineers, scientists, and other knowledge workers charged with discovering and creating new knowledge for a company. We discuss knowledge work applications in detail in Section 11.3.

Knowledge management also includes a diverse group of **intelligent techniques**, such as data mining, expert systems, neural networks, fuzzy logic, genetic algorithms, and intelligent agents. These techniques have different objectives, from a focus on discovering knowledge (data mining and neural networks), to distilling knowledge in the form of rules for a computer program (expert systems and fuzzy logic), to discovering optimal solutions for problems (genetic algorithms). Section 11.4 provides more detail about these intelligent techniques.

11.2 WHAT TYPES OF SYSTEMS ARE USED FOR ENTERPRISE-WIDE KNOWLEDGE MANAGEMENT AND HOW DO THEY PROVIDE VALUE FOR BUSINESSES?

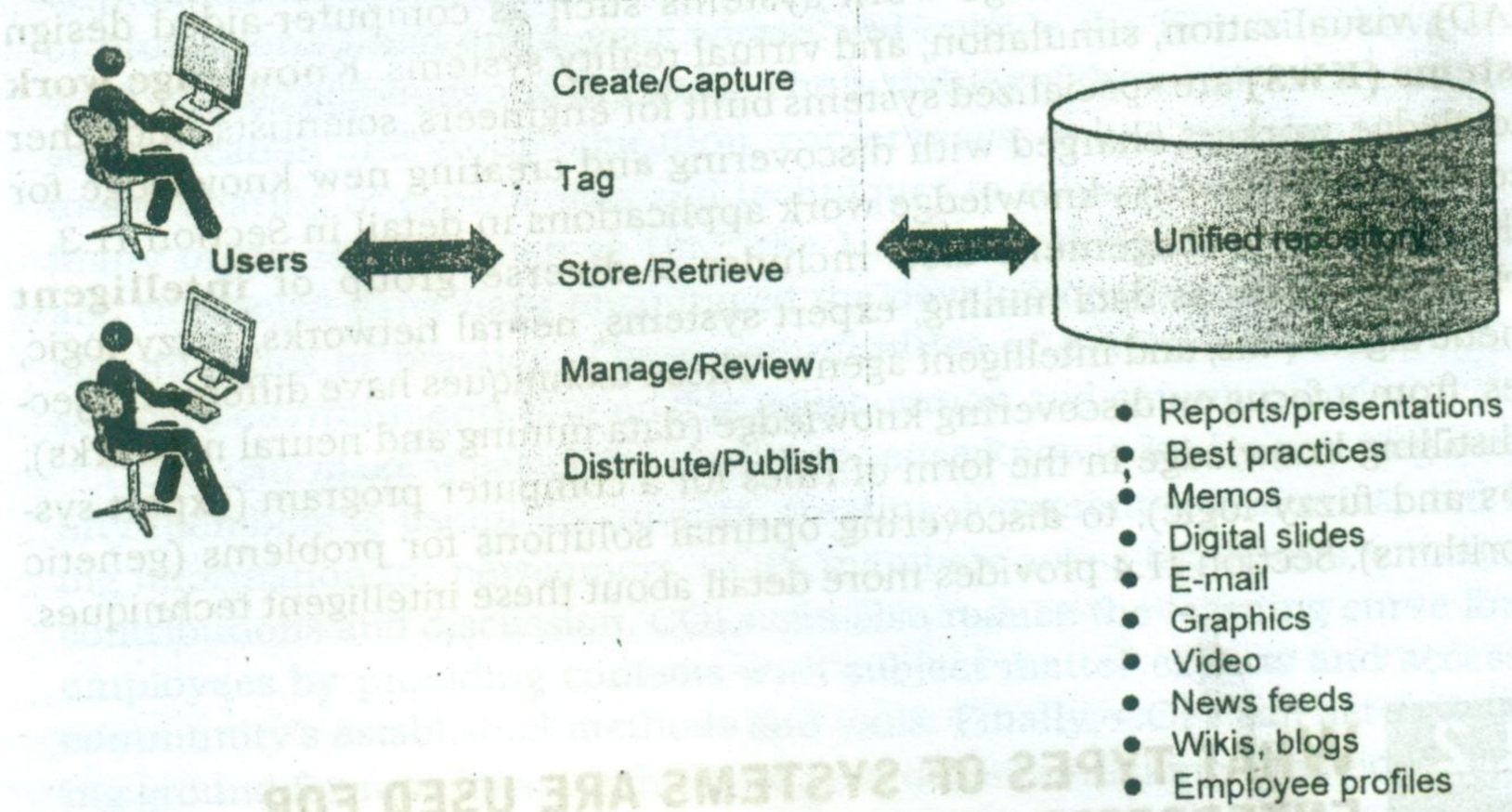
Firms must deal with at least three kinds of knowledge. Some knowledge exists within the firm in the form of structured text documents (reports and presentations). Decision makers also need knowledge that is semistructured, such as e-mail, voice mail, chat room exchanges, videos, digital pictures, brochures, or bulletin board postings. In still other cases, there is no formal or digital information of any kind, and the knowledge resides in the heads of employees. Much of this knowledge is tacit knowledge that is rarely written down. Enterprise-wide knowledge management systems deal with all three types of knowledge.

ENTERPRISE CONTENT MANAGEMENT SYSTEMS

Businesses today need to organize and manage both structured and semistructured knowledge assets. **Structured knowledge** is explicit knowledge that exists in formal documents, as well as in formal rules that organizations derive by observing experts and their decision-making behaviors. But, according to experts, at least 80 percent of an organization's business content is semistructured or unstructured—information in folders, messages, memos, proposals, e-mails, graphics, electronic slide presentations, and even videos created in different formats and stored in many locations.

Enterprise content management systems help organizations manage both types of information. They have capabilities for knowledge capture, storage, retrieval, distribution, and preservation to help firms improve their business processes and decisions. Such systems include corporate repositories of documents, reports, presentations, and best practices, as well as capabilities for collecting and organizing semistructured knowledge such as e-mail (see Figure 11.3). Major enterprise content management systems also enable users to access external sources of information, such as news feeds and research, and to communicate via e-mail, chat/instant messaging, discussion groups, and videoconferencing. They are starting to incorporate blogs, wikis, and other enterprise social networking tools. Open Text Corporation, EMC

FIGURE 11.3 AN ENTERPRISE CONTENT MANAGEMENT SYSTEM



An enterprise content management system has capabilities for classifying, organizing, and managing structured and semistructured knowledge and making it available throughout the enterprise.

(Documentum), IBM, and Oracle Corporation are leading vendors of enterprise content management software.

Calgary is the largest city in Alberta and the third largest municipality in Canada, with a population exceeding 1.1 million. Its 15,000 employees use OpenText Content Suite Platform to manage and share many different kinds of documents to provide essential services to citizens. Content Suite helps the city capture content it can actually track. Once a workspace is established in Content Server, the system automatically classifies documents, including graphic content, according to record type, retention requirements, and who in the organization is responsible for the document. Content created by one workgroup is easily accessible by other workgroups. Content Suite helped the city establish a strong records management program that supports groups with different needs. For example, Calgary's legal department and Freedom of Information Group places top priority on control and governance. Its Security team and City Council are more concerned with the separation between public documents and maintenance of confidential content. Business units with users in the field need an easy way to access the information they need while they are on the go. Content Suite is able to manage Calgary's content to meet each group's most important information requirements (OpenText 2013–2014).

A key problem in managing knowledge is the creation of an appropriate classification scheme, or **taxonomy**, to organize information into meaningful categories so that it can be easily accessed. Once the categories for classifying knowledge have been created, each knowledge object needs to be "tagged," or classified, so that it can be easily retrieved. Enterprise content management systems have capabilities for tagging, interfacing with corporate databases and content repositories, and creating enterprise knowledge portals that provide a single point of access to information resources.

Firms in publishing, advertising, broadcasting, and entertainment have special needs for storing and managing unstructured digital data such as photographs, graphic images, video, and audio content. For example, Coca-Cola must

keep track of all the images of the Coca-Cola brand that have been created in the past at all of the company's worldwide offices, to prevent both redundant work and variation from a standard brand image. **Digital asset management systems** help companies classify, store, and distribute these digital objects.

LOCATING AND SHARING EXPERTISE

Some of the knowledge businesses need is not in the form of a digital document but instead resides in the memory of individual experts in the firm. Contemporary enterprise content management systems, along with the systems for collaboration and social business introduced in Chapter 2, have capabilities for locating experts and tapping their knowledge. These include online directories of corporate experts and their profiles, with details about their job experience, projects, publications, and educational degrees, and repositories of expert-generated content. Specialized search tools make it easier for employees to find the appropriate expert in a company.

For knowledge resources outside the firm, social networking and social business tools enable users to bookmark Web pages of interest, tag these bookmarks with keywords, and share the tags and Web page links with other people. These bookmarks are often public on sites such as Delicious and Reddit, but some can be saved privately and shared only with specified people or groups.

LEARNING MANAGEMENT SYSTEMS

Companies need ways to keep track of and manage employee learning and to integrate it more fully into their knowledge management and other corporate systems. A **learning management system (LMS)** provides tools for the management, delivery, tracking, and assessment of various types of employee learning and training.

Contemporary LMS support multiple modes of learning, including CD-ROM, downloadable videos, Web-based classes, live instruction in classes or online, and group learning in online forums and chat sessions. The LMS consolidates mixed-media training, automates the selection and administration of courses, assembles and delivers learning content, and measures learning effectiveness.

CVM Solutions, LLC (CVM) uses Digitec's Knowledge Direct learning management system to provide training about how to manage suppliers for clients such as Procter & Gamble, Colgate-Palmolive, and Delta Airlines. Knowledge Direct provides a portal for accessing course content online, along with hands-free administration features such as student registration and assessment tools, built-in Help and Contact Support, automatic e-mail triggers to remind users of courses or deadlines, automatic e-mail acknowledgement of course completions, and Web-based reporting for courses accessed.

Businesses run their own learning management systems, but they are also turning to publicly-available **massive open online courses (MOOCs)** to educate their employees. A MOOC is an online course made available via the Web to very large numbers of participants. For example, in March 2013 employees from General Electric, Johnson & Johnson, Samsung, and Walmart were among over 90,000 learners from 143 countries enrolled in Foundations for Business Strategy, a MOOC offered through the Coursera online learning platform by the University of Virginia's Darden School of Business (Nurmohamed, Gillani, and Lenox, 2013).

11.3 WHAT ARE THE MAJOR TYPES OF KNOWLEDGE WORK SYSTEMS AND HOW DO THEY PROVIDE VALUE FOR FIRMS?

The enterprise-wide knowledge systems we have just described provide a wide range of capabilities that can be used by many if not all the workers and groups in an organization. Firms also have specialized systems for knowledge workers to help them create new knowledge and to ensure that this knowledge is properly integrated into the business.

KNOWLEDGE WORKERS AND KNOWLEDGE WORK

Knowledge workers, which we introduced in Chapter 1, include researchers, designers, architects, scientists, and engineers who primarily create knowledge and information for the organization. Knowledge workers usually have high levels of education and memberships in professional organizations and are often asked to exercise independent judgment as a routine aspect of their work. For example, knowledge workers create new products or find ways of improving existing ones. Knowledge workers perform three key roles that are critical to the organization and to the managers who work within the organization:

- Keeping the organization current in knowledge as it develops in the external world—in technology, science, social thought, and the arts
- Serving as internal consultants regarding the areas of their knowledge, the changes taking place, and opportunities
- Acting as change agents, evaluating, initiating, and promoting change projects

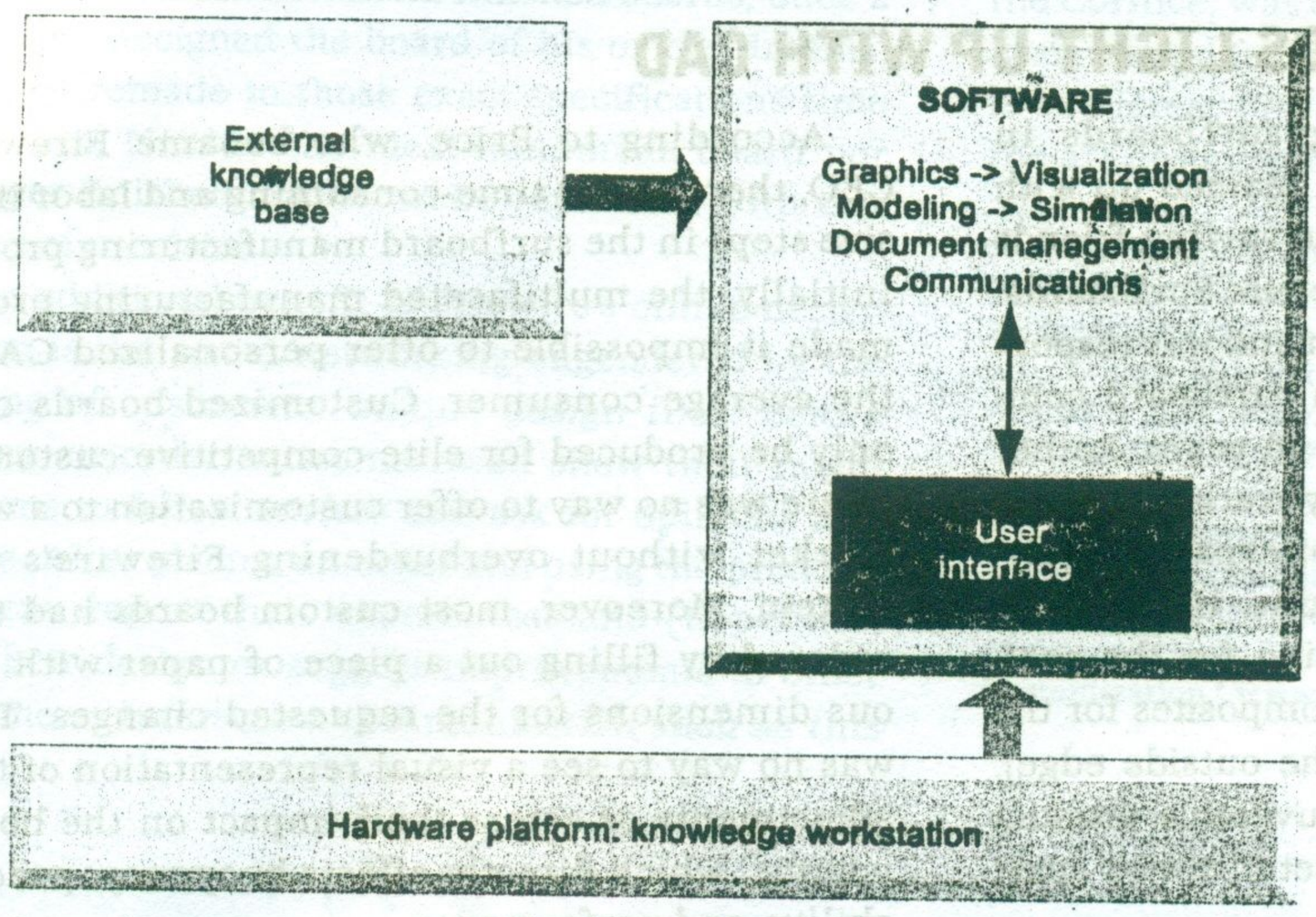
REQUIREMENTS OF KNOWLEDGE WORK SYSTEMS

Most knowledge workers rely on office systems, such as word processors, voice mail, e-mail, videoconferencing, and scheduling systems, which are designed to increase worker productivity in the office. However, knowledge workers also require highly specialized knowledge work systems with powerful graphics, analytical tools, and communications and document management capabilities.

These systems require sufficient computing power to handle the sophisticated graphics or complex calculations necessary for such knowledge workers as scientific researchers, product designers, and financial analysts. Because knowledge workers are so focused on knowledge in the external world, these systems also must give the worker quick and easy access to external databases. They typically feature user-friendly interfaces that enable users to perform needed tasks without having to spend a great deal of time learning how to use the system. Knowledge workers are highly paid—wasting a knowledge worker's time is simply too expensive. Figure 11.4 summarizes the requirements of knowledge work systems.

Knowledge workstations often are designed and optimized for the specific tasks to be performed; so, for example, a design engineer requires a different workstation setup than a financial analyst. Design engineers need graphics with enough power to handle three-dimensional (3-D) CAD systems. However, financial analysts are more interested in access to a myriad number of external databases and large databases for efficiently storing and accessing massive amounts of financial data.

FIGURE 11.4 REQUIREMENTS OF KNOWLEDGE WORK SYSTEMS



Knowledge work systems require strong links to external knowledge bases in addition to specialized hardware and software.

EXAMPLES OF KNOWLEDGE WORK SYSTEMS

Major knowledge work applications include CAD systems, virtual reality systems for simulation and modeling, and financial workstations. **Computer-aided design (CAD)** automates the creation and revision of designs, using computers and sophisticated graphics software. Using a more traditional physical design methodology, each design modification requires a mold to be made and a prototype to be tested physically. That process must be repeated many times, which is a very expensive and time-consuming process. Using a CAD workstation, the designer need only make a physical prototype toward the end of the design process because the design can be easily tested and changed on the computer. The ability of CAD software to provide design specifications for the tooling and manufacturing processes also saves a great deal of time and money while producing a manufacturing process with far fewer problems.

For example, Ford Motor Company used a computer simulation to create an engine cylinder that came up with the most efficient design possible. Engineers altered that design to account for manufacturing constraints and tested the revised design virtually in models that used decades of data on material properties and engine performance. Ford then created the mold to make a real part that could be bolted onto an engine for further testing. The entire process took days instead of months and cost thousands of dollars instead of millions.

CAD systems are able to supply data for **3-D printing**, also known as additive manufacturing, which uses machines to make solid objects, layer by layer, from specifications in a digital file. 3-D printing is currently being used for producing prototypes and customized manufacturing work (see the Interactive Session on Technology).

Virtual reality systems have visualization, rendering, and simulation capabilities that go far beyond those of conventional CAD systems. They

ACTIVE SESSION: TECHNOLOGY

FIREWIRE SURFBOARDS LIGHT UP WITH CAD

Nev Hyman had been building surfboards in Australia for 35 years. In 2005, he teamed up with Mark Price and a group of longtime surfing friends in Carlsbad, California, to form Firewire Surfboards. This company thrives on innovation and was responsible for the first major change in surfboard composition and assembly methods in 40 years. Rather than polyurethane resin and polyurethane foam, Firewire's boards were composed of expanded polystyrene (EPS) foam and epoxy resins. Hyman and Price believed that this composition for the surfboard core, along with aerospace composites for the deck skin and balsa wood rails (the outside edge), created a more flexible and maneuverable product that would attract top surfers and set Firewire apart from its competitors.

FireWire is competing in a crowded field that includes Isle Surfboards, Surftech, Aviso Surf, Boardworks Surf, Channel Island, and Lost Enterprises. FireWire is alone in the reintroduction of balsa wood to the board rails for added flex response time and the ability to maintain speed during precarious maneuvers. Firewire believes it can compete successfully because its surf boards are far lighter, stronger, and more flexible than those of competitors. An additional selling point is the reduced environmental impact: Firewire's materials emit only 2 percent of the harmful compounds of traditional boards and recycling excess EPS foam has earned Firewire international awards and acclaim.

But that isn't enough. To make sure it stays ahead of the competition, Firewire decided to start making custom surfboards instead of just the usual off-the-rack sizes. For the everyday surfer, the durability and flexbility of Firewire's materials was a key selling point. However, custom boards made to surfer specifications are critical in the elite surfboard market, and the ability to claim top-level competitive surfers as customers drives the broader surfboard market as well.

Traditionally, skilled craftsmen called shapers designed and built surfboards by hand, but Firewire started doing some of this work using computer-aided designs (CAD) sent to cutting facilities. The company's computer-aided manufacturing process returned to the shaper a board that was 85–90 percent complete, leaving the artisan to complete the customization and the lamination process.

According to Price, who became Firewire's CEO, there are 29 time-consuming and labor intensive steps in the surfboard manufacturing process. Initially, the multifaceted manufacturing process made it impossible to offer personalized CAD to the average consumer. Customized boards could only be produced for elite competitive customers. There was no way to offer customization to a wider market without overburdening Firewire's CAD system. Moreover, most custom boards had to be ordered by filling out a piece of paper with various dimensions for the requested changes. There was no way to see a visual representation of these adjustments or assess their impact on the board's volume, which directly affects buoyancy, paddling ability, and performance.

Firewire needed a system that would allow customers to experiment with established designs, feed the CAD process, and integrate it with its computer numerical control (CNC) manufacturing process. Enter ShapeLogic Design-to-Order Live! For NX, which provides an online customization system with a Web-based user interface and advanced 3D CAD tools.

Firewire started working with the ShapeLogicNX software in 2009 to develop its own Firewire Surfboards' Custom Board Design (CBD) system, which allows users to easily manipulate board dimensions of established models within design parameters. Any registered customer can choose a standard Firewire model and use drag-and-drop tools to adjust the board's length, midpoint width, nose width, tail width, and thickness, as long as these changes don't degrade the board's design integrity. CBD generates a precise 3D model of the stock model used as the base design along with a 3D portable document format (PDF) file of the customized board. The PDF file documents the board's dimensions and volume. A customer can manipulate the model from all angles and compare the customized board to the standard board to fully understand the design before placing an order. When the customer uses the system to order a custom board, CBD generates a precise solid CAD model of the board that is transmitted directly to the Firewire factory for driving the CNC machines that manufacture the board.

This combination of technologies results in a board that is 97 percent complete, minimizing the

manufacturing time, finishing process, and thus, costs to the consumer. In contrast to the earlier CAD assisted, 10–15 percent hand-finished boards, once a surfer has designed the board of his or her dreams, it can be remade to those exact specifications time and again. Neither the ideal handmade board nor a shaper-finished board can be replicated with this degree of precision.

An additional benefit of Firewire's online design system is the social networking engendered by the sharing of customers' unique design files. Before placing an order, customers can show their modifications to fellow surfers and ask for opinions and advice. After placing an order and using the product, they can report their experiences and (hopefully) tout their design or suggest improvements to other customers. Interactive communication such as this drives customers to the Firewire site, creating a marketing buzz that boosts sales. Firewire's latest board, the Cornice, was designed by a firm that uses CAD to design wind turbines. Launched in 2015, the Cornice is the latest Firewire offering to combine state-of-the-art design with top notch functionality.

Sources: Kailee Bradstreet, "Firewire Launches the Cornice Surfboard," *Transworld Business*, January 12, 2015; "Case Study: NX CAD Technology Drives Custom Surfboard Design," http://www.plm.automation.siemens.com/en_us, accessed August 9, 2013; www.firewiresurfboards.com, accessed August 9, 2013; "Firewire Partners with NanoTune 'Board Tuning Technology,'" www.surfnewsdaily.com, February 22, 2012; "Firewire Surfboards Custom Board Design Blends Replicability of Machine Made Boards with Uniqueness of Custom Boards," http://surfingnewsdaily.com, October 12, 2011; and William Atkinson, "How Firewire Surfboards Refined Its 3D Order Customization," www.cioinsight.com, November 21, 2011.

1. Analyze Firewire using the value chain and competitive forces models.
2. What strategies is Firewire using to differentiate its product, reach its customers, and persuade them to buy its products?
3. What is the role of CAD in Firewire's business model?
4. How did the integration of online custom board design software (CBD), CAD, and computer numerical control (CNC) improve Firewire's operations?

use interactive graphics software to create computer-generated simulations that are so close to reality that users almost believe they are participating in a real-world situation. In many virtual reality systems, the user dons special clothing, headgear, and equipment, depending on the application. The clothing contains sensors that record the user's movements and immediately transmit that information back to the computer. For instance, to walk through a virtual reality simulation of a house, you would need garb that monitors the movement of your feet, hands, and head. You also would need goggles containing video screens and sometimes audio attachments and feeling gloves so that you can be immersed in the computer feedback.

At NYU Langone Medical Center in New York City, students wearing 3-D glasses are able to "dissect" a virtual cadaver projected on a screen. With the help of a computer, they can move through the virtual body, scrutinizing layers of muscles or watching a close-up of a pumping heart along with bright red arteries and deep blue veins. The virtual human body was created by BioDigital Systems, a New York City medical visualization firm. The virtual cadaver being used at Langone is a beta version that BioDigital plans to develop into a searchable, customizable map of the human body for medical educators and physicians. NYU medical school has no current plans to phase out dissection, but the 3-D virtual cadaver is a valuable complementary teaching tool (Singer, 2012).

Ford Motor Company has been using virtual reality to help design its vehicles. In one example of Ford's Immersive Virtual Environment, a designer

was presented with a car seat, steering wheel, and blank dashboard. Wearing virtual reality glasses and gloves with sensors, the designer was able to "sit" in the seat surrounded by the vehicle's 3-D design to experience how a proposed interior would look and feel. The designer would be able to identify blind spots or see if knobs were in an awkward place. Ford's designers could also use this technology to see the impact of a design on manufacturing. For example, is a bolt that assembly line workers need to tighten too hard to reach?

Augmented reality (AR) is a related technology for enhancing visualization. AR provides a live direct or indirect view of a physical real-world environment whose elements are augmented by virtual computer-generated imagery. The user is grounded in the real physical world, and the virtual images are merged with the real view to create the augmented display. The digital technology provides additional information to enhance the perception of reality, making the surrounding real world of the user more interactive and meaningful. The yellow first-down markers shown on televised football games are examples of augmented reality as are medical procedures like image-guided surgery, where data acquired from computerized tomography (CT) and magnetic resonance imaging (MRI) scans or from ultrasound imaging are superimposed on the patient in the operating room. Other industries where AR has caught on include military training, engineering design, robotics, and consumer design.

Virtual reality applications developed for the Web use a standard called **Virtual Reality Modeling Language (VRML)**. VRML is a set of specifications for interactive, 3-D modeling on the World Wide Web that can organize multiple media types, including animation, images, and audio to put users in a simulated real-world environment. VRML is platform independent, operates over a desktop computer, and requires little bandwidth.

DuPont, the Wilmington, Delaware, chemical company, created a VRML application called HyperPlant, which enables users to access 3-D data over the Internet using Web browser software. Engineers can go through 3-D models as if they were physically walking through a plant, viewing objects at eye level. This level of detail reduces the number of mistakes they make during construction of oil rigs, oil plants, and other structures.

The financial industry is using specialized **investment workstations** such as Bloomberg Terminals to leverage the knowledge and time of its brokers, traders, and portfolio managers. Firms such as Merrill Lynch and UBS Financial Services have installed investment workstations that integrate a wide range of data from both internal and external sources, including contact management data, real-time and historical market data, and research reports. Previously, financial professionals had to spend considerable time accessing data from separate systems and piecing together the information they needed. By providing one-stop information faster and with fewer errors, the workstations streamline the entire investment process from stock selection to updating client records. Table 11.2 summarizes the major types of knowledge work systems.

11.4 WHAT ARE THE BUSINESS BENEFITS OF USING INTELLIGENT TECHNIQUES FOR KNOWLEDGE MANAGEMENT?

Artificial intelligence and database technology provide a number of intelligent techniques that organizations can use to capture individual and collective knowledge and to extend their knowledge base. Expert systems, case-based

TABLE 11.2 EXAMPLES OF KNOWLEDGE WORK SYSTEMS

KNOWLEDGE WORK SYSTEM	FUNCTION IN ORGANIZATION
CAD/CAM (computer-aided manufacturing)	Provides engineers, designers, and factory managers with precise control over industrial design and manufacturing
Virtual reality systems	Provide drug designers, architects, engineers, and medical workers with precise, photorealistic simulations of objects
Investment workstations	High-end PCs and workstations used in the financial sector to analyze trading situations instantaneously and facilitate portfolio management

reasoning, and fuzzy logic are used for capturing tacit knowledge. Neural networks and data mining are used for **knowledge discovery**. They can discover underlying patterns, categories, and behaviors in large data sets that could not be discovered by managers alone or simply through experience. Genetic algorithms are used for generating solutions to problems that are too large and complex for human beings to analyze on their own. Intelligent agents can automate routine tasks to help firms search for and filter information for use in electronic commerce, supply chain management, and other activities.

Data mining, which we introduced in Chapter 6, helps organizations capture undiscovered knowledge residing in large databases, providing managers with new insight for improving business performance. It has become an important tool for management decision making, and we provide a detailed discussion of data mining for management decision support in Chapter 12.

The other intelligent techniques discussed in this section are based on **artificial intelligence (AI)** technology, which consists of computer-based systems (both hardware and software) that attempt to emulate human behavior. Such systems would be able to learn languages, accomplish physical tasks, use a perceptual apparatus, and emulate human expertise and decision making. Although AI applications do not exhibit the breadth, complexity, originality, and generality of human intelligence, they play an important role in contemporary knowledge management.

CAPTURING KNOWLEDGE: EXPERT SYSTEMS

Expert systems are an intelligent technique for capturing tacit knowledge in a very specific and limited domain of human expertise. These systems capture the knowledge of skilled employees in the form of a set of rules in a software system that can be used by others in the organization. The set of rules in the expert system adds to the memory, or stored learning, of the firm.

Expert systems lack the breadth of knowledge and the understanding of fundamental principles of a human expert. They typically perform very limited tasks that can be performed by professionals in a few minutes or hours, such as diagnosing a malfunctioning machine or determining whether to grant credit for a loan. Problems that cannot be solved by human experts in the same short period of time are far too difficult for an expert system. However, by capturing human expertise in limited areas, expert systems can provide benefits, helping organizations make high-quality decisions with fewer people. Today, expert systems are widely used in business in discrete, highly structured decision-making situations.

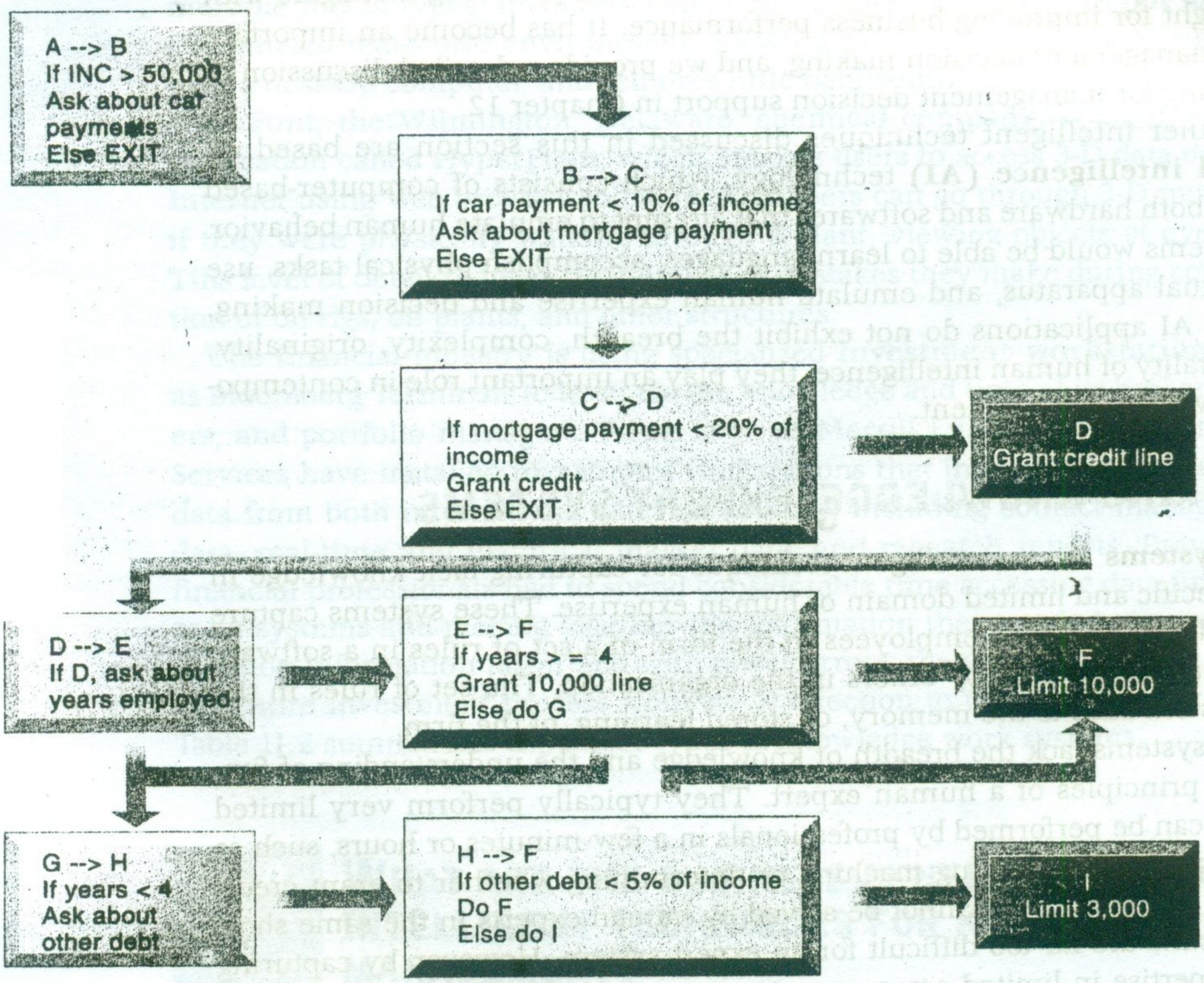
How Expert Systems Work

Human knowledge must be modeled or represented in a way that a computer can process. Expert systems model human knowledge as a set of rules that collectively are called the **knowledge base**. The rules are obtained by carefully interviewing one or several "experts" who have a thorough command of the knowledge base for the system or by documenting business rules found in manuals, books, or reports. Expert systems have from 200 to many thousands of these rules, depending on the complexity of the problem. These rules are much more interconnected and nested than in a traditional software program (see Figure 11.5).

The strategy used to search through the knowledge base is called the **inference engine**. Two strategies are commonly used: forward chaining and backward chaining (see Figure 11.6).

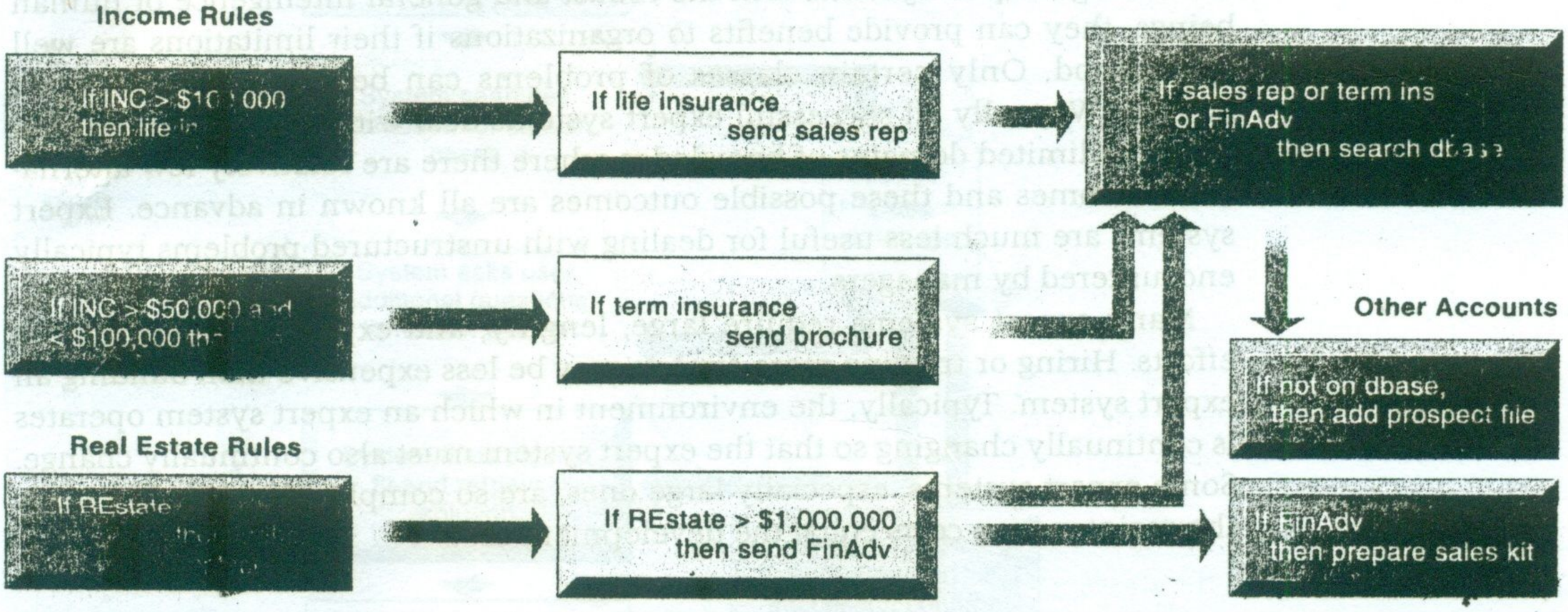
In **forward chaining,** the inference engine begins with the information entered by the user and searches the rule base to arrive at a conclusion. The strategy is to fire, or carry out, the action of the rule when a condition is true. In Figure 11.6, beginning on the left, if the user enters a client's name with income greater than $100,000, the engine will fire all rules in sequence from left to right. If the user then enters information indicating that the same client

FIGURE 11.5 RULES IN AN EXPERT SYSTEM



An expert system contains a number of rules to be followed. The rules are interconnected; the number of outcomes is known in advance and is limited; there are multiple paths to the same outcome; and the system can consider multiple rules at a single time. The rules illustrated are for simple credit-granting expert systems.

FIGURE 11.6 INFERENCE ENGINES IN EXPERT SYSTEMS



An inference engine works by searching through the rules and "firing" those rules that are triggered by facts gathered and entered by the user. Basically, a collection of rules is similar to a series of nested IF statements in a traditional software program; however, the magnitude of the statements and degree of nesting are much greater in an expert system.

owns real estate, another pass of the rule base will occur and more rules will fire. Processing continues until no more rules can be fired.

In **backward chaining,** the strategy for searching the rule base starts with a hypothesis and proceeds by asking the user questions about selected facts until the hypothesis is either confirmed or disproved. In our example, in Figure 11.6, ask the question, "Should we add this person to the prospect database?" Begin on the right of the diagram and work toward the left. You can see that the person should be added to the database if a sales representative is sent, term insurance is granted, or a financial adviser visits the client.

Examples of Successful Expert Systems

Expert systems provide businesses with an array of benefits including improved decisions, reduced errors, reduced costs, reduced training time, and higher levels of quality and service. Con-Way Transportation built an expert system called Line-haul to automate and optimize planning of overnight shipment routes for its nationwide freight-trucking business. The expert system captures the business rules that dispatchers follow when assigning drivers, trucks, and trailers to transport 50,000 shipments of heavy freight each night across 25 states and Canada and then plots their routes. Line-haul runs on a Sun computer platform and uses data on daily customer shipment requests, available drivers, trucks, trailer space, and weight stored in an Oracle database. The expert system uses thousands of rules and 100,000 lines of program code written in C++ to crunch the numbers and create optimum routing plans for 95 percent of daily freight shipments. Con-Way dispatchers tweak the routing plan provided by the expert system and relay final routing specifications to field personnel responsible for packing the trailers for their nighttime runs. Con-Way recouped its $3 million investment in the system within two years by reducing the number of drivers, packing more freight per trailer, and reducing damage from rehandling. The system also reduces dispatchers' arduous nightly tasks.

Although expert systems lack the robust and general intelligence of human beings, they can provide benefits to organizations if their limitations are well understood. Only certain classes of problems can be solved using expert systems. Virtually all successful expert systems deal with problems of classification in limited domains of knowledge where there are relatively few alternative outcomes and these possible outcomes are all known in advance. Expert systems are much less useful for dealing with unstructured problems typically encountered by managers.

Many expert systems require large, lengthy, and expensive development efforts. Hiring or training more experts may be less expensive than building an expert system. Typically, the environment in which an expert system operates is continually changing so that the expert system must also continually change. Some expert systems, especially large ones, are so complex that in a few years the maintenance costs equal the development costs.

ORGANIZATIONAL INTELLIGENCE: CASE-BASED REASONING

Expert systems primarily capture the tacit knowledge of individual experts, but organizations also have collective knowledge and expertise that they have built up over the years. This organizational knowledge can be captured and stored using case-based reasoning. In **case-based reasoning (CBR)**, descriptions of past experiences of human specialists, represented as cases, are documented and stored in a database for later retrieval when the user encounters a new case with similar parameters. The system searches for stored cases with problem characteristics similar to the new one, finds the closest fit, and applies the solutions of the old case to the new case. Successful solutions are tagged to the new case and both are stored together with the other cases in the knowledge base. Unsuccessful solutions also are appended to the case database along with explanations as to why the solutions did not work (see Figure 11.7).

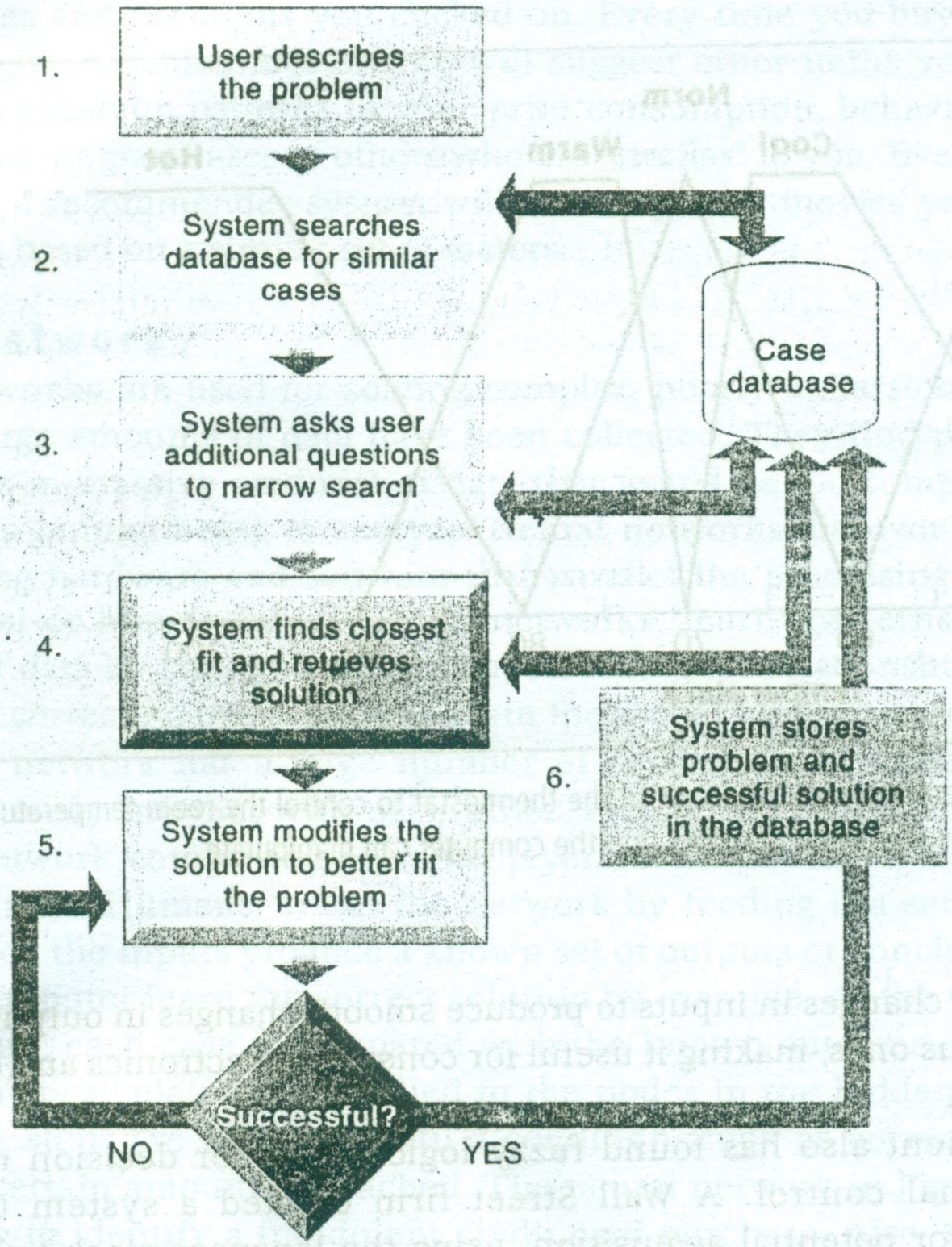
Expert systems work by applying a set of IF-THEN-ELSE rules extracted from human experts. Case-based reasoning, in contrast, represents knowledge as a series of cases, and this knowledge base is continuously expanded and refined by users. You'll find case-based reasoning in diagnostic systems in medicine or customer support where users can retrieve past cases whose characteristics are similar to the new case. The system suggests a solution or diagnosis based on the best-matching retrieved case.

FUZZY LOGIC SYSTEMS

Most people do not think in terms of traditional IF-THEN rules or precise numbers. Humans tend to categorize things imprecisely using rules for making decisions that may have many shades of meaning. For example, a man or a woman can be *strong* or *intelligent*. A company can be *large*, *medium*, or *small* in size. Temperature can be *hot*, *cold*, *cool*, or *warm*. These categories represent a range of values.

Fuzzy logic is a rule-based technology that can represent such imprecision by creating rules that use approximate or subjective values. It can describe a particular phenomenon or process linguistically and then represent that description in a small number of flexible rules. Organizations can use fuzzy logic to create software systems that capture tacit knowledge where there is linguistic ambiguity.

FIGURE 11.7 **HOW CASE-BASED REASONING WORKS**

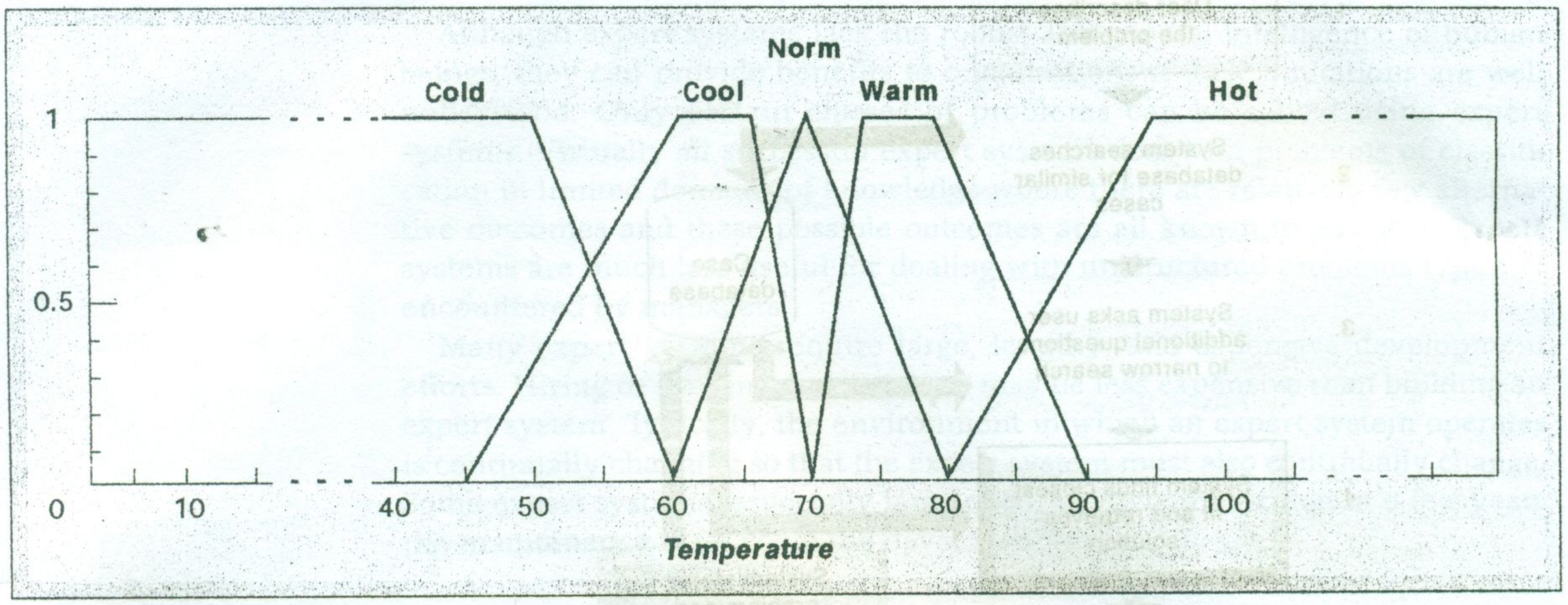


Case-based reasoning represents knowledge as a database of past cases and their solutions. The system uses a six-step process to generate solutions to new problems encountered by the user.

Let's look at the way fuzzy logic would represent various temperatures in a computer application to control room temperature automatically. The terms (known as *membership functions*) are imprecisely defined so that, for example, in Figure 11.8, cool is between 45 degrees and 70 degrees, although the temperature is most clearly cool between about 60 degrees and 67 degrees. Note that *cool* is overlapped by *cold* or *norm*. To control the room environment using this logic, the programmer would develop similarly imprecise definitions for humidity and other factors, such as outdoor wind and temperature. The rules might include one that says: "If the temperature is *cool* or *cold* and the humidity is low while the outdoor wind is high and the outdoor temperature is low, raise the heat and humidity in the room." The computer would combine the membership function readings in a weighted manner and, using all the rules, raise and lower the temperature and humidity.

Fuzzy logic provides solutions to problems requiring expertise that is difficult to represent in the form of crisp IF-THEN rules. In Japan, Sendai's subway system uses fuzzy logic controls to accelerate so smoothly that standing passengers need not hold on. Mitsubishi Heavy Industries in Tokyo has been able to reduce the power consumption of its air conditioners by 20 percent by implementing control programs in fuzzy logic. The autofocus device in cameras is only possible because of fuzzy logic. In these instances, fuzzy logic allows

FIGURE 11.8 FUZZY LOGIC FOR TEMPERATURE CONTROL



The membership functions for the input called temperature are in the logic of the thermostat to control the room temperature. Membership functions help translate linguistic expressions such as *warm* into numbers that the computer can manipulate.

incremental changes in inputs to produce smooth changes in outputs instead of discontinuous ones, making it useful for consumer electronics and engineering applications.

Management also has found fuzzy logic useful for decision making and organizational control. A Wall Street firm created a system that selects companies for potential acquisition, using the language stock traders understand. A fuzzy logic system has been developed to detect possible fraud in medical claims submitted by health care providers anywhere in the United States.

MACHINE LEARNING

Machine learning is the study of how computer programs can improve their performance without explicit programming. Why does this constitute learning? A machine that learns is a machine that, like a human being, can recognize patterns in data, and change its behavior based on its recognition of patterns, experience, or prior learnings (a database). For instance, a car-driving robot should be able to recognize the presence of other cars and objects (people), and change its behavior accordingly (stop, go, slow down, speed up, or turn). The idea of a self-taught, self-correcting, computer program is not new, and has been a part of the artificial intelligence field at least since the 1970s. Up until the 1990s, however, machine learning was not very capable of producing useful devices or solving interesting, business problems.

Machine learning has expanded greatly in the last ten years because of the growth in computing power available to scientists and firms and its falling cost, along with advances in the design of algorithms, databases, and robots (see the chapter-ending case on IBM's Watson). The Internet and the big data (see Chapter 6) made available on the Internet have proved to be very useful testing and proving grounds for machine learning.

We use machine learning every day but don't recognize it. Every Google search is resolved using algorithms that rank the billions of Web pages based on your query, and change the results based on any changes you make in your

search, all in a few milliseconds. Search results also vary according to your prior searches and the items you clicked on. Every time you buy something on Amazon, its recommender engine will suggest other items you might be interested in based on patterns in your prior consumption, behavior on other Web sites, and the purchases of others who are "similar" to you. Every time you visit Netflix, a recommender system will come up with movies you might be interested in based on a similar set of factors.

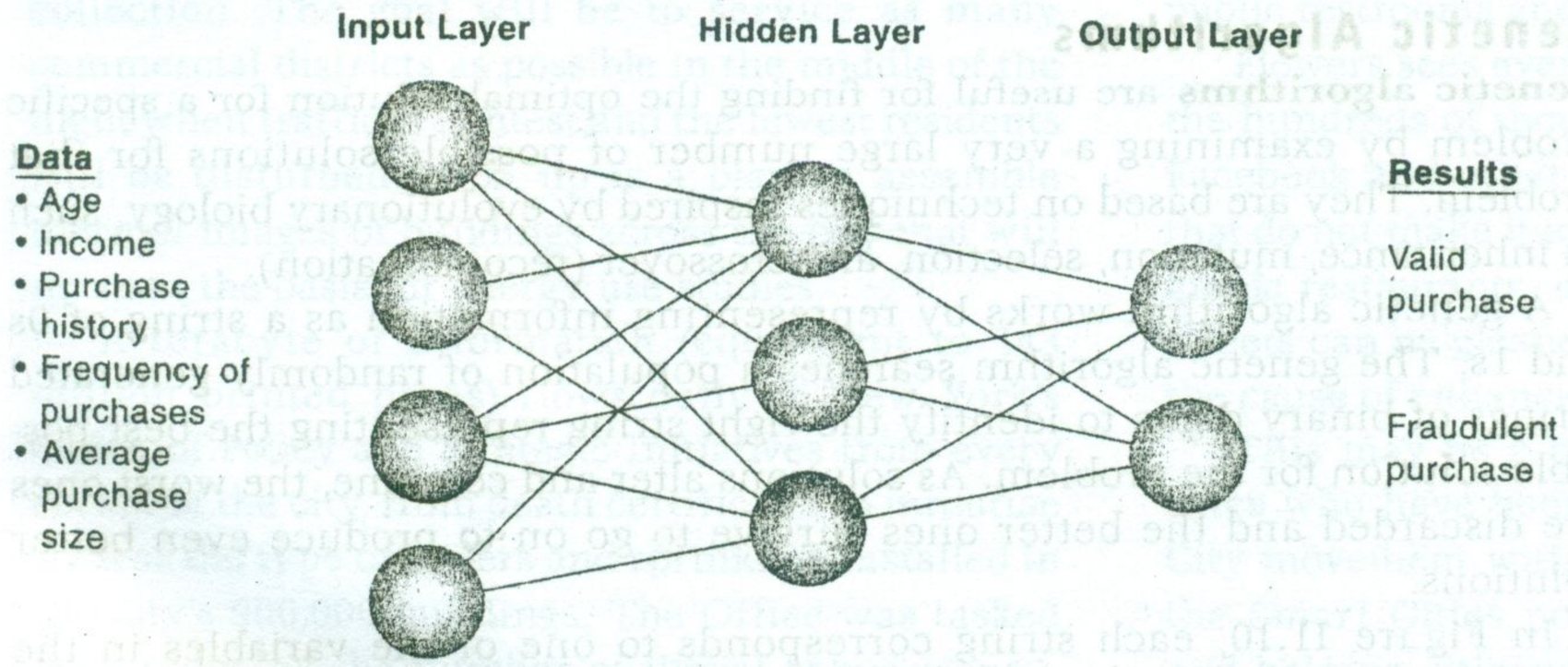
Neural Networks

Neural networks are used for solving complex, poorly understood problems for which large amounts of data have been collected. They find patterns and relationships in massive amounts of data that would be too complicated and difficult for a human being to analyze. Neural networks discover this knowledge by using hardware and software that parallel the processing patterns of the biological or human brain. Neural networks "learn" patterns from large quantities of data by sifting through data, searching for relationships, building models, and correcting over and over again the model's own mistakes.

A neural network has a large number of sensing and processing nodes that continuously interact with each other. Figure 11.9 represents one type of neural network comprising an input layer, an output layer, and a hidden processing layer. Humans "train" the network by feeding it a set of training data for which the inputs produce a known set of outputs or conclusions. This helps the computer learn the correct solution by example. As the computer is fed more data, each case is compared with the known outcome. If it differs, a correction is calculated and applied to the nodes in the hidden processing layer. These steps are repeated until a condition, such as corrections being less than a certain amount, is reached. The neural network in Figure 11.9 has learned how to identify a fraudulent credit card purchase. Also, self-organizing neural networks can be trained by exposing them to large amounts of data and allowing them to discover the patterns and relationships in the data.

A Google research team headed by Stanford University computer scientist Andrew Y. Ng and Google fellow Jeff Dean recently created a neural network

FIGURE 11.9 HOW A NEURAL NETWORK WORKS



A neural network uses rules it "learns" from patterns in data to construct a hidden layer of logic. The hidden layer then processes inputs, classifying them based on the experience of the model. In this example, the neural network has been trained to distinguish between valid and fraudulent credit card purchases.

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with more than one billion connections that could identify cats. The network used an array of 16,000 processors and was fed random thumbnails of images, each extracted from a collection of 10 million YouTube videos. The neural network taught itself to recognize cats, without human help in identifying specific features during the learning process. Google believes this neural network has promising applications in image search, speech recognition, and machine language translation (Markoff, 2013). IBM has developed an energy-efficient processor chip that relies on a dense web of transistors similar to the brain's neural network. It is still in experimental mode, with great promise for pattern recognition (Markoff, 2014). The Interactive Session on Organizations describes neural network applications for facial recognition and their potential impact on individual privacy.

Whereas expert systems seek to emulate or model a human expert's way of solving problems, neural network builders claim that they do not program solutions and do not aim to solve specific problems. Instead, neural network designers seek to put intelligence into the hardware in the form of a generalized capability to learn. In contrast, the expert system is highly specific to a given problem and cannot be retrained easily.

Neural network applications in medicine, science, and business address problems in pattern classification, prediction, financial analysis, and control and optimization. In medicine, neural network applications are used for screening patients for coronary artery disease, for diagnosing patients with epilepsy and Alzheimer's disease, and for performing pattern recognition of pathology images. The financial industry uses neural networks to discern patterns in vast pools of data that might help predict the performance of equities, corporate bond ratings, or corporate bankruptcies. Visa International uses a neural network to help detect credit card fraud by monitoring all Visa transactions for sudden changes in the buying patterns of cardholders.

There are many puzzling aspects of neural networks. Unlike expert systems, which typically provide explanations for their solutions, neural networks cannot always explain why they arrived at a particular solution. Moreover, they cannot always guarantee a completely certain solution, arrive at the same solution again with the same input data, or always guarantee the best solution. They are very sensitive and may not perform well if their training covers too little or too much data. In most current applications, neural networks are best used as aids to human decision makers instead of substitutes for them.

Genetic Algorithms

Genetic algorithms are useful for finding the optimal solution for a specific problem by examining a very large number of possible solutions for that problem. They are based on techniques inspired by evolutionary biology, such as inheritance, mutation, selection, and crossover (recombination).

A genetic algorithm works by representing information as a string of 0s and 1s. The genetic algorithm searches a population of randomly generated strings of binary digits to identify the right string representing the best possible solution for the problem. As solutions alter and combine, the worst ones are discarded and the better ones survive to go on to produce even better solutions.

In Figure 11.10, each string corresponds to one of the variables in the problem. One applies a test for fitness, ranking the strings in the population according to their level of desirability as possible solutions. After the initial population is evaluated for fitness, the algorithm then produces the next generation of strings, consisting of strings that survived the fitness test plus offspring

INTERACTIVE SESSION: ORGANIZATIONS

BIG DATA MAKES CITIES SMARTER

New York City wants very much to be a "smart city." In the fall of 2013, New York University, with support from city government, opened the Center for Urban Science and Progress under the direction of Steven E. Koonin, a former Obama administration undersecretary for science in the Department of Energy. Koonin foresees work on a broad range of quality of life and urban efficiency projects ranging from traffic management to reducing water and electricity consumption by 30 to 50 percent in ten years' time.

The first target for a ten-member team of graduate students, music professors, and computer scientists is noise pollution. Starting with data from 311 (the non-emergency line for citizen complaints on a range of issues including noise disturbances), the researchers will gather additional data from wireless sensors on windows and buildings and noise meters on traffic lights and street corners. A smartphone app may also be employed in a crowd-sourcing effort to encourage citizen participation and gather even more comprehensive statistics. One possible outcome foreseen by Koonin is a noise limit ordinance for vehicles. Using a combination of incentives and violation fees, citizens will be persuaded to replace or repair malfunctioning mufflers. Computer simulations will inform decision-makers about the optimum combination of enforcement mechanisms and sequence of steps to maximize compliance.

Zoning, building classification, and traffic flow data along with Department of Sanitation routes and pickup times will be used to optimize garbage collection. The goal will be to service as many commercial districts as possible in the middle of the night when traffic is lightest and the fewest residents will be disturbed. Next up is a plan to assemble thermal images of buildings across the city that will serve as the basis for energy use studies.

A terabyte of information (equivalent to 143 million printed pages) flows daily to New York's Office of Policy and Strategic Initiatives from every corner of the city, from death certificates to minutiae such as the type of boilers and sprinklers installed in the city's 900,000 buildings. The Office was tasked with reducing the number of illegal conversions—the creation of additional dwelling units in buildings that lack legally required infrastructure such as adequate means of egress and electrical wiring. The team combined data from 19 agencies and created a model to optimize building inspections. Building age, repair permits, foreclosure notices, late tax payments, and other similar data fed a program that fueled an increase from 13 percent to 70 percent of building inspections identifying a hazardous dwelling. Previously, the city's 200 building inspectors had futilely attempted to respond to the more than 20,000 annual complaints based solely on sketchy grievance descriptions.

Michael Flowers is the Analytics Director for the Office. When the Department of Environmental Protection wanted to improve its efficiency in locating restaurants that illegally dump cooking oil into sewers—the primary cause of clogged city pipes—it turned to Flowers's team. Using the restaurant location, geospatial sewer location, and certificates on file with the Business Integrity Commission, a data sifting program easily pinpointed restaurants that had not contracted with a grease-hauling service and their nearest storm drain. Health department inspectors sent to these locations registered a stunning 95% success rate in catching culprits.

Participants in a Big Apps competition, begun in 2009, use the more than 1,000 data sets now publicly available on the NYC Open Data Portal as their primary resource. In the 2013 Best Jobs and Economic Mobility category, the ChildCareDesk app garnered first place. Maps, Yelp reviews, and detailed reports from various city accreditation agencies assist parental decision-making, and an alert system notifies them when a vacancy has arisen. Other winning apps in previous years provide the locations of public restrooms and the safest routes for bicyclists.

Flowers sees even more data that can be mined—the hundreds of thousands of daily posts to Twitter, Facebook and other social media sites. Complaints that do not make it to city agencies concerning unhygienic restaurants, uncollected garbage, and unsafe streets can be gleaned from these sources to further the cause of enhancing a New Yorker's quality of life.

This may be a bridge too far for privacy advocates who have been watching the Big Data/Smart City movement with a wary eye. While recognizing the Smart Cities potential for improving services and helping citizens, groups such as the New York Civil Liberties Union worry about possible abuses. Safeguards, including removing names and tax identification numbers and installing employee keystroke logs, have proven vulnerable to reverse identification and tampering. Undoubtedly, the release

of public data, even absent any surveillance intent, must include safeguards.

Ford is working on safety systems that will inform drivers of both internal (V2I: vehicle-to-infrastructure) and external (V2V: vehicle-to-vehicle) threats. The V2V system warns you if a car is speeding up to run a red light, for example. Ford has also developed an upgrade for stoplights to create "smart intersections" that monitor digital maps, GPS data, and traffic signal status and transmit that data to onboard computers. Drivers are then both visually and aurally alerted to potential hazards.

Intel research scientists foresee smart cities with drivers who not only know the velocity of the car in front of them, but can simultaneously see three cars to the right, left, and behind. What's more, cameras can detect if surrounding drivers are looking up, down, or forward, and if one of them is balancing a cup along with the steering wheel. These "driver states" will feed predictive modeling programs to calculate the odds of an accident occurring and which vehicles are best-positioned to avert calamity. Decreased collision rates and their attendant injuries and fatalities are no doubt a societal good, but many questions arise with this level of data-sharing. Will law enforcement have access to velocity information that could result in automatic speeding tickets? If you turn around to give a pacifier to the baby in the car seat, will the increase in accident probability garner you an automatic moving violation? While we might all want the information about the careless drivers around us, are we willing to share our own driving foibles?

Sources: Jeff Bertolucci, "Big Data: When Cars Can Talk," *Information Week*, June 11, 2013; Alan Feuer, "The Mayor's Geek Squad" *New York Times*, March 23, 2013; John Foley, "New York City Builds on Its Technology Base," *Information Week*, April 23, 2013; Steve Lohr, "SimCity, for Real: Measuring an Untidy Metropolis," *New York Times*, February 23, 2013; "Smarter, More Competitive Cities: Forward-thinking Cities Are Investing in Insight Today," IBM, January 2012.

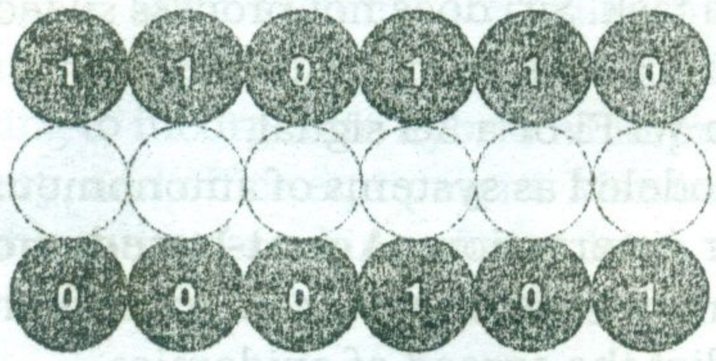
CASE STUDY QUESTIONS

1. What technologies is New York employing to improve the quality of life of its citizens?
2. What are the people, organization, and technology issues that should be addressed by "smart city" initiatives?
3. What problems are solved by "smart cities?" What are the drawbacks?
4. Give examples of four decisions that would be improved in a "smart city."

strings produced from mating pairs of strings, and tests their fitness. The process continues until a solution is reached.

Genetic algorithms are used to solve problems that are very dynamic and complex, involving hundreds or thousands of variables or formulas. The problem must be one where the range of possible solutions can be represented genetically and criteria can be established for evaluating fitness. Genetic algorithms expedite the solution because they are able to evaluate many solution alternatives quickly to find the best one. For example, General Electric engineers used genetic algorithms to help optimize the design for jet turbine aircraft engines, where each design change required changes in up to 100 variables. The supply

FIGURE 11.10 THE COMPONENTS OF A GENETIC ALGORITHM



	Length	Width	Weight	Fitness
1	Long	Wide	Light	55
2	Short	Narrow	Heavy	49
3	Long	Narrow	Heavy	36
4	Short	Medium	Light	61
5	Long	Medium	Very light	74

This example illustrates an initial population of "chromosomes," each representing a different solution. The genetic algorithm uses an iterative process to refine the initial solutions so that the better ones, those with the higher fitness, are more likely to emerge as the best solution.

chain management software from i2 Technologies uses genetic algorithms to optimize production-scheduling models incorporating hundreds of thousands of details about customer orders, material and resource availability, manufacturing and distribution capability, and delivery dates.

INTELLIGENT AGENTS

Intelligent agent technology helps businesses navigate through large amounts of data to locate and act on information that is considered important. **Intelligent agents** are software programs that work without direct human intervention to carry out specific tasks for an individual user, business process, or software application. The agent uses a built-in or learned knowledge base to accomplish tasks or make decisions on the user's behalf, such as deleting junk e-mail, scheduling appointments, or traveling over interconnected networks to find the cheapest airfare to California.

There are many intelligent agent applications today in operating systems, application software, e-mail systems, mobile computing software, and network tools. For example, the wizards found in Microsoft Office software tools have built-in capabilities to show users how to accomplish various tasks, such as formatting documents or creating graphs, and to anticipate when users need assistance. Chapter 10 describes how intelligent agent shopping bots can help consumers find products they want and assist them in comparing prices and other features.

Although some intelligent agents are programmed to follow a simple set of rules, others are capable of learning from experience and adjusting their behavior. Siri, an application on Apple's iOS operating system for the iPhone and iPad, is an example. Siri is an intelligent personal assistant that uses voice recognition technology to answer questions, make recommendations, and perform actions. The software adapts to the user's individual preferences over time and

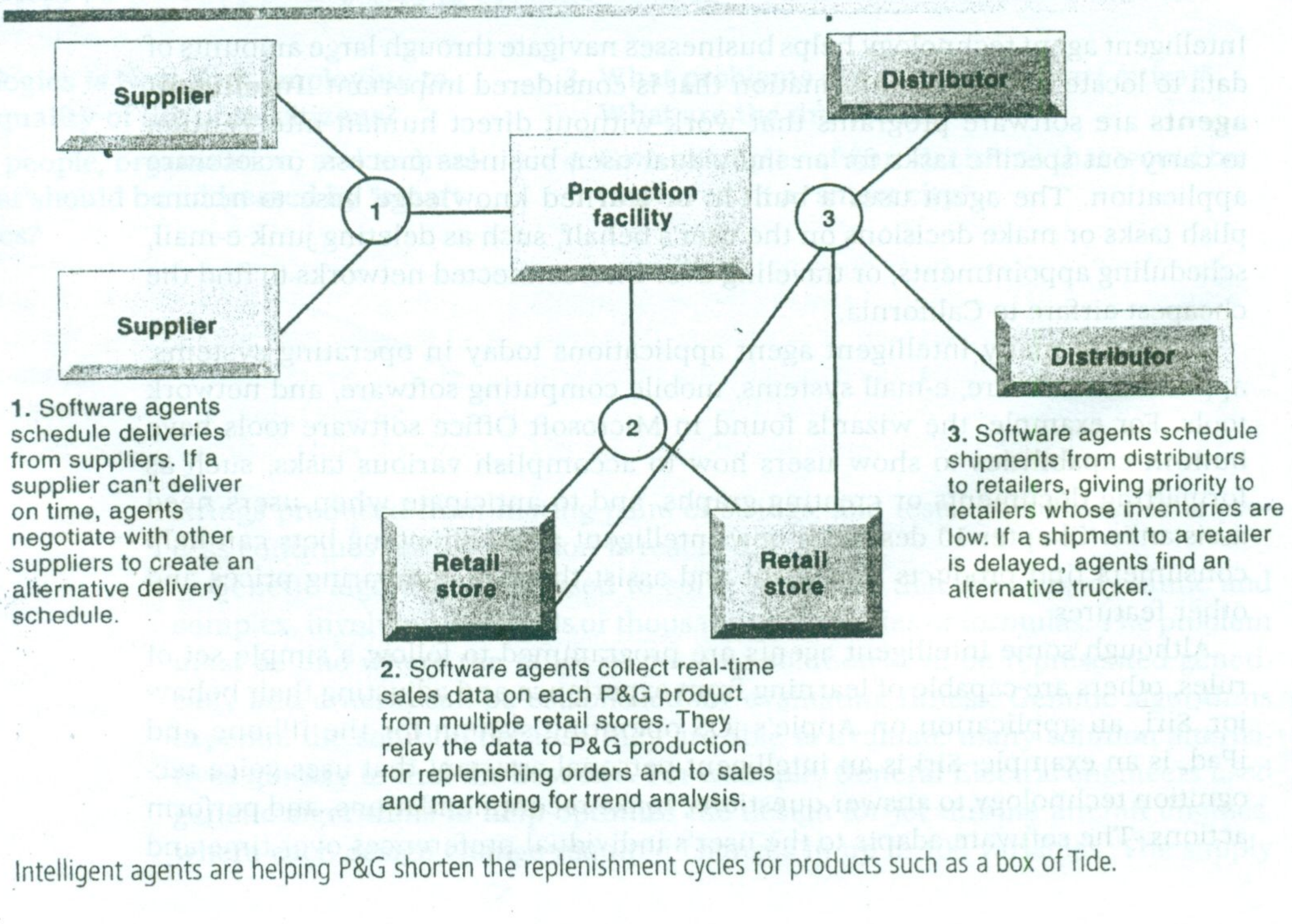
personalizes results, performing tasks such as finding nearby restaurants, purchasing movie tickets, getting directions, scheduling appointments, and sending messages. Siri understands natural speech, and it asks the user questions if it needs more information to complete a task. Siri does not process speech input locally on the users's device. Instead, it sends commands through a remote server, so users have to be connected to Wi-Fi or a 3G signal.

Many complex phenomena can be modeled as systems of autonomous agents that follow relatively simple rules for interaction. **Agent-based modeling** applications have been developed to model the behavior of consumers, stock markets, and supply chains and to predict the spread of epidemics.

Procter & Gamble (P&G) used agent-based modeling to improve coordination among different members of its supply chain in response to changing business conditions (see Figure 11.11). It modeled a complex supply chain as a group of semiautonomous "agents" representing individual supply chain components, such as trucks, production facilities, distributors, and retail stores. The behavior of each agent is programmed to follow rules that mimic actual behavior, such as "order an item when it is out of stock." Simulations using the agents enable the company to perform what-if analyses on inventory levels, in-store stockouts, and transportation costs.

Using intelligent agent models, P&G discovered that trucks should often be dispatched before being fully loaded. Although transportation costs would be higher using partially loaded trucks, the simulation showed that retail store stockouts would occur less often, thus reducing the amount of lost sales, which would more than make up for the higher distribution costs. Agent-based modeling has saved P&G $300 million annually on an investment of less than 1 percent of that amount.

FIGURE 11.11 INTELLIGENT AGENTS IN P&G'S SUPPLY CHAIN NETWORK



Intelligent agents are helping P&G shorten the replenishment cycles for products such as a box of Tide.

HYBRID AI SYSTEMS

Genetic algorithms, fuzzy logic, neural networks, and expert systems can be integrated into a single application to take advantage of the best features of these technologies. Such systems are called **hybrid AI systems**. Hybrid applications in business are growing. In Japan, Hitachi, Mitsubishi, Ricoh, Sanyo, and others are starting to incorporate hybrid AI in products such as home appliances, factory machinery, and office equipment. Matsushita has developed a "neurofuzzy" washing machine that combines fuzzy logic with neural networks. Nikko Securities has been working on a neurofuzzy system to forecast convertible-bond ratings.

Review Summary

1. *What is the role of knowledge management systems in business?*

   Knowledge management is a set of processes to create, store, transfer, and apply knowledge in the organization. Much of a firm's value depends on its ability to create and manage knowledge. Knowledge management promotes organizational learning by increasing the ability of the organization to learn from its environment and to incorporate knowledge into its business processes. There are three major types of knowledge management systems: enterprise-wide knowledge management systems, knowledge work systems, and intelligent techniques.

2. *What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?*

   Enterprise-wide knowledge management systems are firmwide efforts to collect, store, distribute, and apply digital content and knowledge. Enterprise content management systems provide databases and tools for organizing and storing structured documents and tools for organizing and storing semistructured knowledge, such as e-mail or rich media. Knowledge network systems provide directories and tools for locating firm employees with special expertise who are important sources of tacit knowledge. Often these systems include group collaboration tools (including wikis and social bookmarking), portals to simplify information access, search tools, and tools for classifying information based on a taxonomy that is appropriate for the organization. Enterprise-wide knowledge management systems can provide considerable value if they are well designed and enable employees to locate, share, and use knowledge more efficiently.

3. *What are the major types of knowledge work systems and how do they provide value for firms?*

   Knowledge work systems (KWS) support the creation of new knowledge and its integration into the organization. KWS require easy access to an external knowledge base; powerful computer hardware that can support software with intensive graphics, analysis, document management, and communications capabilities; and a user-friendly interface. Computer-aided design (CAD) systems, augmented reality applications, and virtual reality systems, which create interactive simulations that behave like the real world, require graphics and powerful modeling capabilities. KWS for financial professionals provide access to external databases and the ability to analyze massive amounts of financial data very quickly.

4. *What are the business benefits of using intelligent techniques for knowledge management?*

   Artificial intelligence lacks the flexibility, breadth, and generality of human intelligence, but it can be used to capture, codify, and extend organizational knowledge. Expert systems capture tacit knowledge from a limited domain of human expertise and express that knowledge in the form of rules. Expert systems are most useful for problems of classification or diagnosis. Case-based reasoning represents organizational knowledge as a database of cases that can be continually expanded and refined.

   Fuzzy logic is a software technology for expressing knowledge in the form of rules that use approximate or subjective values. Fuzzy logic has been used for controlling physical devices and is starting to be used for limited decision-making applications.

Machine learning refers to the ability of computer programs to automatically learn and improve with experience. Neural networks consist of hardware and software that attempt to mimic the thought processes of the human brain. Neural networks are notable for their ability to learn without programming and to recognize patterns that cannot be easily described by humans. They are being used in science, medicine, and business to discriminate patterns in massive amounts of data.

Genetic algorithms develop solutions to particular problems using genetically based processes such as fitness, crossover, and mutation. Genetic algorithms are beginning to be applied to problems involving optimization, product design, and monitoring industrial systems where many alternatives or variables must be evaluated to generate an optimal solution.

Intelligent agents are software programs with built-in or learned knowledge bases that carry out specific tasks for an individual user, business process, or software application. Intelligent agents can be programmed to navigate through large amounts of data to locate useful information and in some cases act on that information on behalf of the user.

Key Terms

3-D printing, 471
Agent-based modeling, 486
Artificial intelligence (AI), 475
Augmented reality (AR), 474
Backward chaining, 477
Case-based reasoning (CBR), 478
Communities of practice (COPs), 466
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Go to **mymislab.com** to complete the problems marked with this icon .

Review Questions

11-1 What is the role of knowledge management systems in business?

- Define knowledge management and explain its value to businesses.
- Describe the important dimensions of knowledge.
- Distinguish between data, knowledge, and wisdom and between tacit knowledge and explicit knowledge.
- Describe the stages in the knowledge management value chain.

11-2 What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?

- Define and describe the various types of enterprise-wide knowledge management systems and explain how they provide value for businesses.

- Describe the role of the following in facilitating knowledge management: taxonomies, MOOCs, and learning management systems.

11-3 What are the major types of knowledge work systems and how do they provide value for firms?

- Define knowledge work systems and describe the generic requirements of knowledge work systems.
- Describe how the following systems support knowledge work: CAD, virtual reality, augmented reality, and investment workstations.

11-4 What are the business benefits of using intelligent techniques for knowledge management?

- Define an expert system, describe how it works, and explain its value to business.
- Define case-based reasoning and explain how it differs from an expert system.
- Define machine learning and give some examples.
- Define a neural network, and describe how it works and how it benefits businesses.
- Define and describe fuzzy logic, genetic algorithms, and intelligent agents. Explain how each works and the kinds of problems for which each is suited.

Discussion Questions

11-5 Knowledge management is a business process, not a technology. Discuss.

11-6 Describe various ways that knowledge management systems could help firms with sales and marketing or with manufacturing and production.

11-7 Your company wants to do more with knowledge management. Describe the steps it should take to develop a knowledge management program and select knowledge management applications.

Hands-On MIS Projects

The projects in this section give you hands-on experience designing a knowledge portal, identifying opportunities for knowledge management, creating a simple expert system, and using intelligent agents to research products for sale on the Web.

Management Decision Problems

11-8 U.S. Pharma Corporation is headquartered in New Jersey but has research sites in Germany, France, the United Kingdom, Switzerland, and Australia. Research and development of new pharmaceuticals is key to ongoing profits, and U.S. Pharma researches and tests thousands of possible drugs. The company's researchers need to share information with others within and outside the company, including the U.S. Food and Drug Administration, the World Health Organization, and the International Federation of Pharmaceutical Manufacturers & Associations. Also critical is access to health information sites, such as the U.S. National Library of Medicine, and to industry conferences and professional journals. Design a knowledge portal for U.S. Pharma's researchers. Include in your design specifications relevant internal systems and databases, external sources of information, and internal and external communication and collaboration tools. Design a home page for your portal.

11-9 Canadian Tire is one of Canada's largest companies, with 57,000 employees and 1,200 stores and gas bars (gas stations) across Canada selling sports, leisure, home products, apparel, and financial services as well as automotive and petroleum products. The retail outlets are independently owned and operated. Canadian Tire has been using daily mailings and thick product catalogs to inform its dealers about new products, merchandise setups, best practices, product ordering, and problem resolution and it is looking for a better way to provide employees with human resources and administrative documents. Describe the problems created by this way of doing business and how knowledge management systems might help.

Improving Decision Making: Building a Simple Expert System for Retirement Planning

Software skills: Spreadsheet formulas and IF function or expert system tool
Business skills: Benefits eligibility determination

11-10 Expert systems typically use a large number of rules. This project has been simplified to reduce the number of rules, but it will give you experience working with a series of rules to develop an application.

When employees at your company retire, they are given cash bonuses. These cash bonuses are based on the length of employment and the retiree's age. To receive a bonus, an employee must be at least 50 years of age and have worked for the company for more than five years. The following table summarizes the criteria for determining bonuses.

LENGTH OF EMPLOYMENT	BONUS
<5 years	No bonus
5–10 years	20 percent of current annual salary
11–15 years	30 percent of current annual salary
16–20 years	40 percent of current annual salary
20–25 years	50 percent of current annual salary
26 or more years	100 percent of current annual salary

Using the information provided, build a simple expert system. Find a demonstration copy of an expert system software tool on the Web that you can download. Alternatively, use your spreadsheet software to build the expert system. (If you are using spreadsheet software, we suggest using the IF function so you can see how rules are created.)

Improving Decision Making: Using Intelligent Agents for Comparison Shopping

Software skills: Web browser and shopping bot software
Business skills: Product evaluation and selection

11-11 This project will give you experience using shopping bots to search online for products, find product information, and find the best prices and vendors. Select a digital camera you might want to purchase, such as the Canon PowerShot S110 or the Olympus Tough TG-3. Visit MySimon (www.mysimon.com), BizRate.com (www.bizrate.com), and Google Shopping to do price comparisons for you. Evaluate these shopping sites in terms of their ease of use, number of offerings, speed in obtaining information, thoroughness of information offered about the product and seller, and price selection. Which site or sites would you use and why? Which camera would you select and why? How helpful were these sites for making your decision?

Collaboration and Teamwork Project

11-12 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Docs, Google Sites, Google+, or other open source collaboration tools to complete the assignment.

Knowledge Management and Collaboration at Tata Consulting Services

CASE STUDY

Tata Consultancy Services (TCS) is an IT-services, business-solutions and outsourcing organization that offers a portfolio of IT and IT-enabled services to clients all over the globe in horizontal, vertical, and geographical domains. A part of the Tata Group, India's largest industrial conglomerate, TCS has over 108,000 IT consultants in 47 countries.

The concept of knowledge management (KM) was introduced in TCS in 1995 and a dedicated KM team called "Corporate GroupWare" was formed in 1998. This group launched the KM-pilot in mid-1999, which was implemented subsequently by a team comprising the steering committee, corporate GroupWare implanters, branch champions, application owners and the infrastructure group.

At that time, KM in TCS covered nearly every function, from quality assurance to HR management. While its 50 offices in India were linked through dedicated communication lines, overseas offices were connected through the Net and the Lotus Notes Domino Servers. The employees could access the knowledge repository that resided on the corporate and branch servers through the intranet with a browser front-end or a Notes client. The knowledge repository, also called KBases, contained a wide range of information about processes, line of business, line of technology, and projects.

Though the formal KM efforts started in TCS in the late 1990s, the informal, closely knit communities of practices (CoPs) had existed at TCS since the 1980s, when it had around a thousand employees. The earliest "group" was based on the migration of technologies. Later, teams were formed for mainframe, Unix, and databases. The groups, consisting of one or two experts in their respective fields, began formal documentation practices with the members writing down the best practices. Recollecting the group practices in the initial days, K. Ananth Krishnan, a technology consultant at that time, recounted that in the mid-1980s, problems and solutions were documented and there were over 1,500 case studies dealing with mainframes. Similarly, 40 case studies dealing with overall system quality were reviewed as early as 1993.

The next step was to create process asset libraries (PALs), which contained information related to technology, processes, and case studies for project leaders, which were made available to all development centers through the intranet.

Then Ultimatix, a Web-based electronic knowledge management (EKM) portal, which made the knowledge globally available, was developed. The PAL library and KBases, which were hosted on the intranet, were merged with Ultimatix, which had sub-portals for a quality management system, software productivity improvement, training materials, and tools information. There were EKM administrators for each practice and subject group with defined responsibilities, such as editing the documents and approving them for publication. Commenting on the success of CoP, Krishnan maintained that between January 2003 and June 2003, CoP members had exchanged around 10,000 document transactions relating to the industry practices and 21,000 service practices via Ultimatix. The telecom CoP alone had 6,000 transactions, excluding the intranet-based community activities.

To encourage employee conversations, TCS took considerable care in the architecture of its development centers located across the country. Reflecting on the new design of one of its development centers in Sholinganallur, Chennai, CFO S. Mahalingam commented that the center is made up of modules, each dedicated to one particular technology or a client or an industry practice. These structures lead to garden terraces where employees gather during their break for informal conversations and to brainstorm the solutions to many problems.

TCS also launched a number of training programs such as the Initial Learning Program, targeted at new employees, the Continuous Learning Program for experienced employees, and the Leadership Development Program for employees with more than five years' experience. The integrated competency and learning management systems (iCALMS) that was deployed globally across all TCS offices promoted a culture of learning and growth in the organization. Equipped with data about competency definitions, role definitions, and online/classroom learning objectives, it helped the consultants to enhance their skills in a customized manner. To gain cross-industry experience, TCS regularly rotated people across various functions and within other Tata Group companies. Employees were also encouraged to join outside bodies like the IEEE, and to go in for certifications.

Knowmax, a knowledge management system, developed using Microsoft sharepoint portal server in 2007, gave TCS consultants access to nearly 40 years of experience and best practices, arranged by type of engagement, the technology in use, and customer requirements. It supported more than 60 knowledge assets and was accessible via Ultimatix to all TCS associates. Any associate could contribute to the K-Bank and knowledge officers were made responsible for maintaining the quality of content.

To maintain the work–life balance of its employees, TCS initiated Propel sessions, which brought together employees with similar interests to conduct various activities such as reading books. Later, held every quarter through conferences and camps, this initiative also spurred knowledge transfer among the employees. The knowledge sharing at the project level was done through the LiveMeeting application, where all the project meetings were recorded and stored in the project repository. Team members who missed the meeting or any new members in the team could listen to the recorded sessions, and this enabled them to catch up with the rest of the team. Furthermore, Knowledge Transition sessions conducted weekly by a subject matter expert helped the team to learn from the experience of the experts. A "Tip of the Day" mail, comprising either technical, or conceptual, or human skills tips was also shared within the organization almost daily.

Though Ultimatix, launched in 2002, digitized the entire organization from end to end and improved the business processes' efficiency, it still couldn't tap the knowledge of employees effectively. To improve collaboration among employees, Project Infinity was launched in 2007; this involved a number of technologies including IBM's Sametime, QuickPlace, Lotus Domino Collaboration tools, Avaya VOIP telephony, and Polycom IP videoconferencing.

As a result of adopting Infinity, collaboration of overseas and local offices improved as instant messaging (IM) got rid of cultural and pronunciation differences that could occur on the phone. Furthermore, corporate communications were able to run a 24-hour internal news broadcast to all TCS offices in the world. In addition, travel and telecommunications costs were reduced by 40 percent and 6 percent respectively.

Other than these channels, the company also used the JustAsk system (embedded into the KM), Blog platform, IdeaStorm, TIP, and My Site. Blogging has caught on rapidly since 2006 when it was first introduced. Almost 40,000–50,000 TCS staff blogged on the intranet. While the JustAsk system allowed employees to post questions that others could answer, Idea Storm was a once-a-year event where two to three topics were posted by the corporate team on which ideas were invited by everyone. TIP, an open portal for product innovation and potential new ideas was launched to promote the sharing of ideas. MySite, embedded into the KM portal, allowed each associate to have a personal page like Facebook or Orkut.

In 2014, TCS remained India's largest software exporter, and became the first company to surpass $90 billion in market capitalization. TCS used economic downturns in the late 2000s to become even more efficient, and has since continued to add more staff as economic conditions improved. CEO Natarajan Chandrasekaran continues to emphasize collaboration among members of individual business units as well as across the whole of TCS. In 2015, TCS continued to report solid financial figures, including strong gains in operating profit, recording a 3.9 percent increase over the previous year. Although the company's overall profits remained steady at approximately $3.93 billion, analysts suggest that the company is still positioned well going into 2015. Although many divisions of TCS are seasonal, the company as a whole has diversified to such a degree that they can avoid excessive swings from quarter to quarter. The future for TCS continues to look bright going forward.

Sources: "TCS Slips Over 2% Post Q3 Results; Goldman Sachs Retains Buy," EconomicTimes.com, January 16, 2015; Aimee Chanthadavong, "Tata Consultancy Services Profit Up 4 Percent Amid Soft Q3," Zdnet.com, January 16, 2015; "Dhanya Thoppil, "Tata Consultancy Services Manages Its Size to Stay Agile," *Wall Street Journal*, July 27, 2014; Sankaranarayanan G., "Building Communities, the TCS way," expressitpeople.com, September 2003; Kavita Kaur, "Give and Take," india-today.com, January 2000; Sunil Shah, "Network Wonder: Collaborative Tools Help TCS

Grow," cio.com, July 2007; Shivani Shinde, "TCS Sees Synergy in Gen X Tools," rediff.com, July 2008.

CASE STUDY QUESTIONS

11-13 Analyze the knowledge management efforts at TCS using the knowledge management value chain model. Which tools or activities were used for managing tacit knowledge and which ones are used for explicit knowledge?

11-14 Describe the growth of knowledge management systems at TCS. How have these systems helped TCS in its business?

11-15 Describe the collaboration tools used at TCS. What benefits did TCS reap from these tools?

11-16 How did Web 2.0 tools help TCS to manage knowledge and collaboration among its employees?

11-17 How do you think KM tools have changed some key operational processes at TCS, such as bidding for new projects, project development and implementation, and customer service?

Case contributed by Neerja Sethi and Vijay Sethi, Nanyang Technological University

MyMISLab

Go to **mymislab.com** for the following Assisted-graded writing questions:

11-18 How do each of the following types of systems acquire and represent knowledge: Expert system, case-based reasoning, neural network?

11-19 How do enterprise content management systems help organizations manage structured and semistructured knowledge? What are two examples of each type of knowledge handled by these systems?

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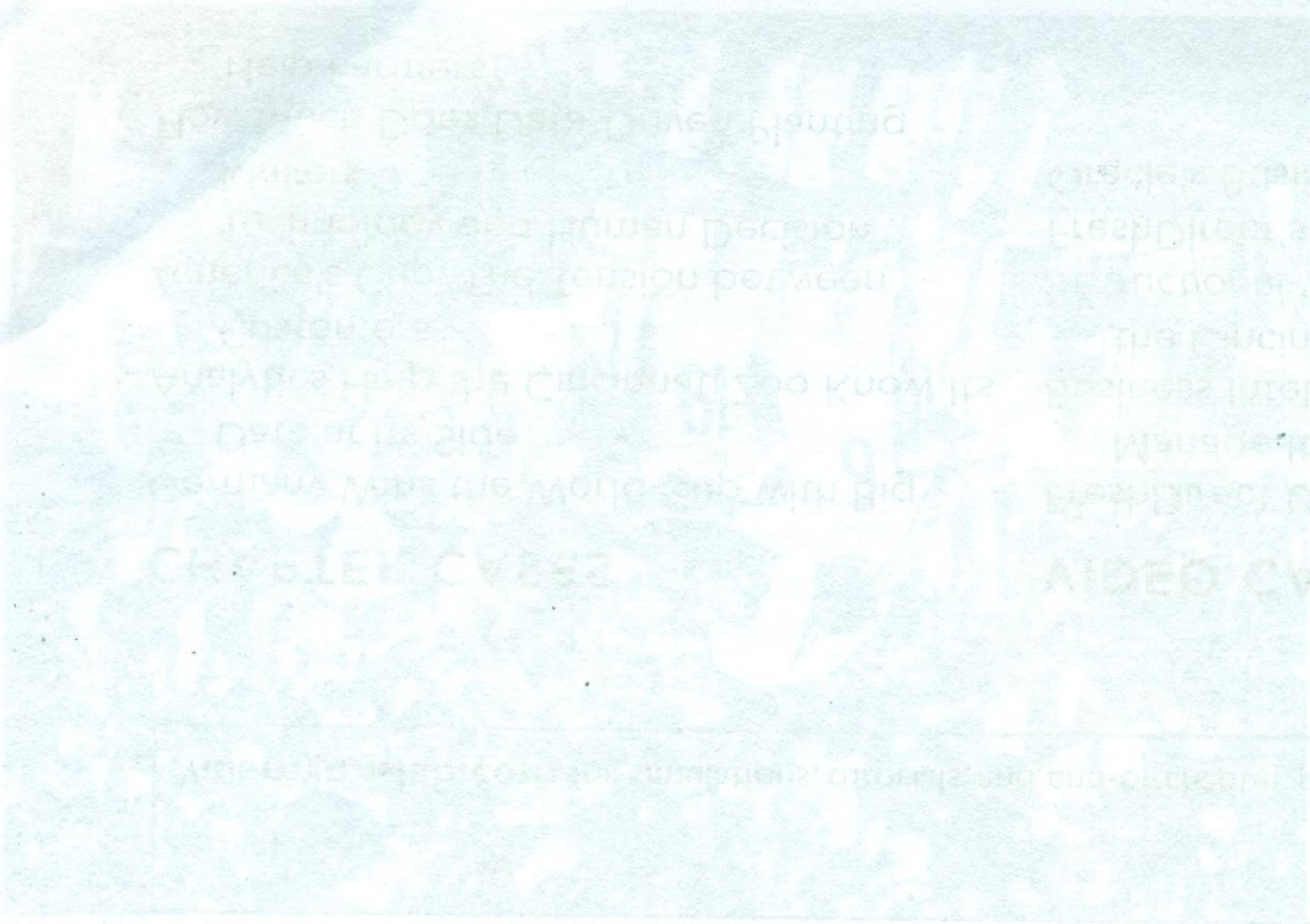
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Enhancing Decision Making

CHAPTER 12

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. What are the different types of decisions and how does the decision-making process work? How do information systems support the activities of managers and management decision making?
2. How do business intelligence and business analytics support decision making?
3. How do different decision-making constituencies in an organization use business intelligence? What is the role of information systems in helping people working in a group make decisions more efficiently?

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CHAPTER CASES

Germany Wins the World Cup with Big Data at Its Side

Analytics Help the Cincinnati Zoo Know Its Customers

America's Cup: The Tension between Technology and Human Decision Makers

How Much Does Data-Driven Planting Help Farmers?

VIDEO CASES

FreshDirect Uses Business Intelligence to Manage Its Online Grocery

Business Intelligence: Intelligence Helps the Cincinnati Zoo

Instructional Video:

FreshDirect's Secret Sauce

Oracle's Business Intelligence App

GERMANY WINS THE WORLD CUP WITH BIG DATA AT ITS SIDE

In a stunning display of talent, resilience, and teamwork, Germany won the 2014 World Cup, defeating Argentina 1–0. Argentina had Lionel Messi, the 2014 World Cup's best player. Brazil, whom the Germans defeated 7–1 in the semi-finals, was considered the overwhelming favorite. Exactly how did Germany pull this off?

The German team sparkled with individual talent in every position, and was praised for playing brilliantly as a team. But the winners had another behind-the-scenes advantage: Big data was at their side. The German team was able to use information technology to analyze massive amounts of data about teams' performance and then use what it had learned to improve how it played. Each of the 32 competing 2014 World Cup teams had a dedicated video and performance analyst, but Germany appears to have been the only one that employed a special database and software to measure and analyze individual and team performance and strategies.

In 2012, the German Football Association partnered with German software giant SAP AG to create a custom match analysis tool called Match Insights that collects and analyzes massive amounts of player performance data. Match Insights analyzes video data from on-field cameras that capture thousands of data points per second, including player speed and position. These data are organized and stored in an SAP database. Match Insights uses SAP HANA in-memory computing and analytic software to analyze vast quantities of data in real time (see Chapter 6). Match Insights allows coaches to target performance metrics for specific players and give them feedback via their mobile devices.



© Ralf Falbe/Alamy

About 50 students at Deutsche Sporthochschule Köln (a sports university in Cologne) started compiling data about the teams and players that would be competing for the next World Cup, including every play they had run, and input the data into the Match Insights database. These data included video from eight on-field cameras that surround the area where the match is played, which the database views as a grid. The system assigns each German and opposing soccer player a unique identifier, so that their movements can be tracked digitally. Match Insights analyzes these data to measure key performance indicators, such as possession time (the percentage of time a team has the ball in a match), the number of touches controlling the ball, and movement speeds.

Improving speed was a major objective for the German team in 2014. Match Insights enabled the team to analyze statistics about average possession time and reduce it from 3.4 seconds to about 1.1 seconds. Better possession time enabled the German team to improve on their aggressive, fast-paced style of playing that brought them to World Cup victory.

Match Insights can show the team virtual "defensive shadows" that indicate how much area a player can protect with his own body. This information helps the team visualize and exploit weak links in an opponent's setup.

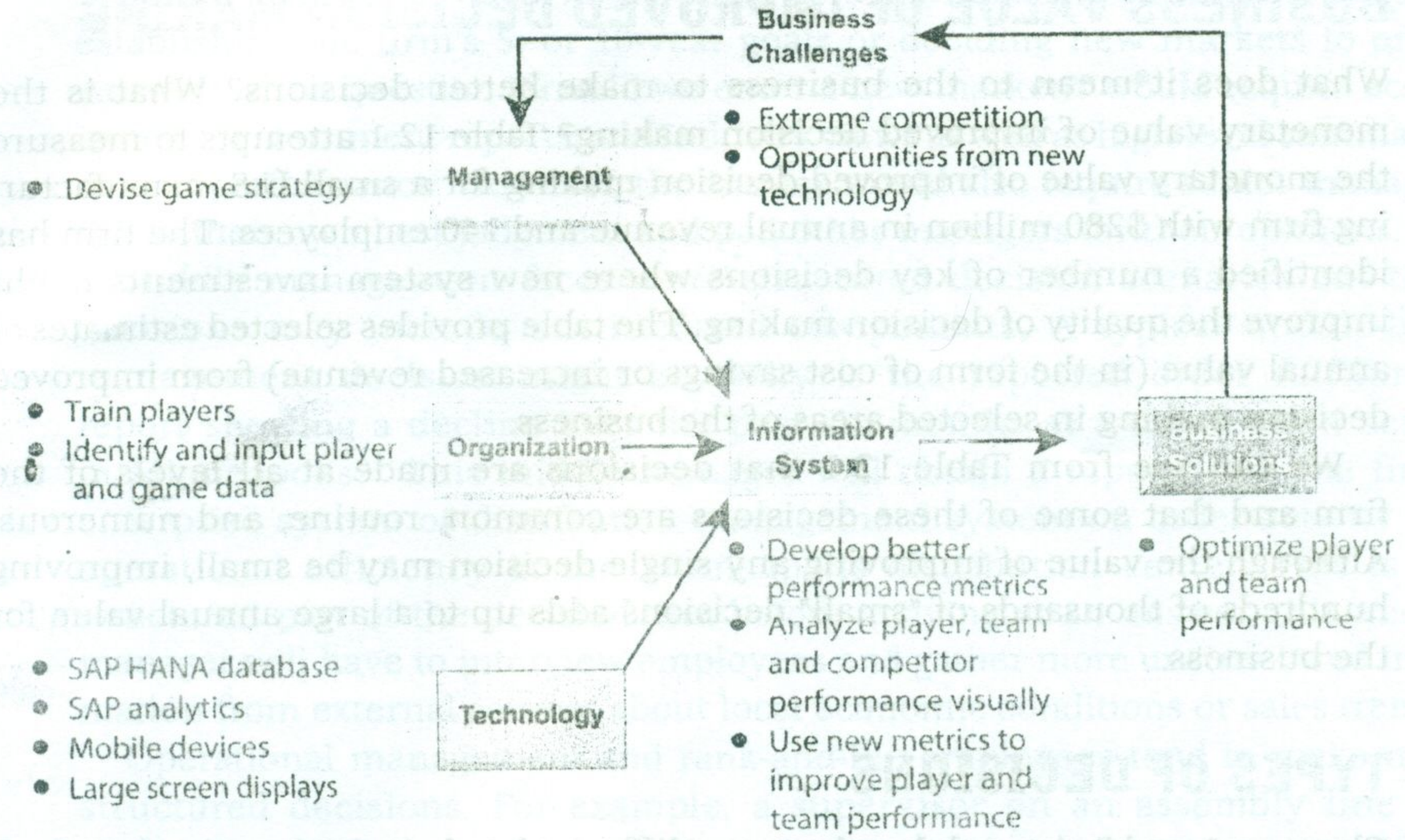
The German team also used Match Insights to evaluate the performance of its competitors. For example, the Germans were able to see before playing against the French that this team was very concentrated in the middle but left spaces on the flanks because their full-backs did not push up properly. The German team also reviewed extensive data about how Brazil's players reacted in pressure situations, their preferred routes, and how they responded when fouled.

Match Insights was able to make its vast trove of performance data available to team members' mobile phones or tablets. With help from SAP, the team developed a mobile app that sends short clips of analysis to individual players or groups of players. Right after a game, every player receives several visual examples of him doing things well and poorly and may also receive visual data about the opposition. Players can also view their performance data in the players' lounge.

Some commentators have described Match Insights as Germany's 12th man.SAP plans to offering Match Insights to other clubs and soccer federations.

Sources: Jack Rosenberger, "Germany's Secret World Cup Weapon: Big Data," *CIO Insight*, July 18, 2014; Steven Norton, "Germany's 12th Man at the World Cup: Big Data," *Wall Street Journal*, July 10, 2014; and SAP News, "SAP and the German Football Association Turn Big Data into Smart Decisions to Improve Player Performance at the World Cup in Brazil," June 11, 2014.

Soccer is one of a growing number of sports being transformed by big data.Others include baseball (think Moneyball), basketball, and tennis. Data analytics are just starting to be used in soccer, and the German team appears to have been in the forefront for the 2014 World Cup soccer competition. The chapter-opening case shows how advanced analytics helped this team come out on top by providing very detailed information about individual player and team performance that could help the team make better decisions about how to improve its game. The opening case has important lessons for other organizations and businesses as well: You can be more efficient and competitive if, like the German World Cup team, you know how to use data to drive your decisions.



The chapter-opening diagram calls attention to important points raised by this case and this chapter. World Cup Soccer is one of the globe's most competitive and highly-charged sports, and the German team was not favored to win the 2014 competition. However, it appears to be the first World Cup team to take advantage of new opportunities from information technology, including tools for capturing, storing, and analyzing big data regarding player and team performance. Other teams were hamstrung by earlier models of decision making that didn't take advantage of available technology. The German World Cup team collected vast quantities of detailed statistical and visual data and was able to devise a better set of metrics for analyzing player and team performance. Match Insights helped World Cup managers, coaches, and players make more precise, fine-grained decisions on how to best play the game.

Here are some questions to think about: How did using Match Insights change the way the German World Cup team made decisions? Give examples of two decisions that were improved by using Match Insights. What can businesses learn from the German 2014 World Cup victory?

12.1 What are the different types of decisions and how does the decision-making process work? How do information systems support the activities of managers and management decision making?

Decision making in businesses used to be limited to management. Today, lower-level employees are responsible for some of these decisions, as information systems make information available to lower levels of the business. But what do we mean by better decision making? How does decision making take place in businesses and other organizations? Let's take a closer look.

BUSINESS VALUE OF IMPROVED DECISION MAKING

What does it mean to the business to make better decisions? What is the monetary value of improved decision making? Table 12.1 attempts to measure the monetary value of improved decision making for a small U.S. manufacturing firm with $280 million in annual revenue and 140 employees. The firm has identified a number of key decisions where new system investments might improve the quality of decision making. The table provides selected estimates of annual value (in the form of cost savings or increased revenue) from improved decision making in selected areas of the business.

We can see from Table 12.1 that decisions are made at all levels of the firm and that some of these decisions are common, routine, and numerous. Although the value of improving any single decision may be small, improving hundreds of thousands of "small" decisions adds up to a large annual value for the business.

TYPES OF DECISIONS

Chapters 1 and 2 showed that there are different levels in an organization. Each of these levels has different information requirements for decision support and responsibility for different types of decisions (see Figure 12.1). Decisions are classified as structured, semistructured, and unstructured.

Unstructured decisions are those in which the decision maker must provide judgment, evaluation, and insight to solve the problem. Each of these decisions is novel, important, and nonroutine, and there is no well-understood or agreed-on procedure for making them.

Structured decisions, by contrast, are repetitive and routine, and they involve a definite procedure for handling them so that they do not have to be treated each time as if they were new. Many decisions have elements of both types of decisions and are **semistructured**, where only part of the problem has a clear-cut answer provided by an accepted procedure. In general, structured decisions are more prevalent at lower organizational levels, whereas unstructured problems are more common at higher levels of the firm.

TABLE 12.1 BUSINESS VALUE OF ENHANCED DECISION MAKING

EXAMPLE DECISION	DECISION MAKER	NUMBER OF ANNUAL DECISIONS	ESTIMATED VALUE TO FIRM OF A SINGLE IMPROVED DECISION	ANNUAL VALUE
Allocate support to most valuable customers	Accounts manager	12	$100,000	$1,200,000
Predict call center daily demand	Call center management	4	$150,000	$600,000
Decide parts inventory levels daily	Inventory manager	365	$5,000	$1,825,000
Identify competitive bids from major suppliers	Senior management	1	$2,000,000	$2,000,000
Schedule production to fill orders	Manufacturing manager	150	$10,000	$1,500,000
Allocate labor to complete a job	Production floor manager	100	$4,000	$400,000

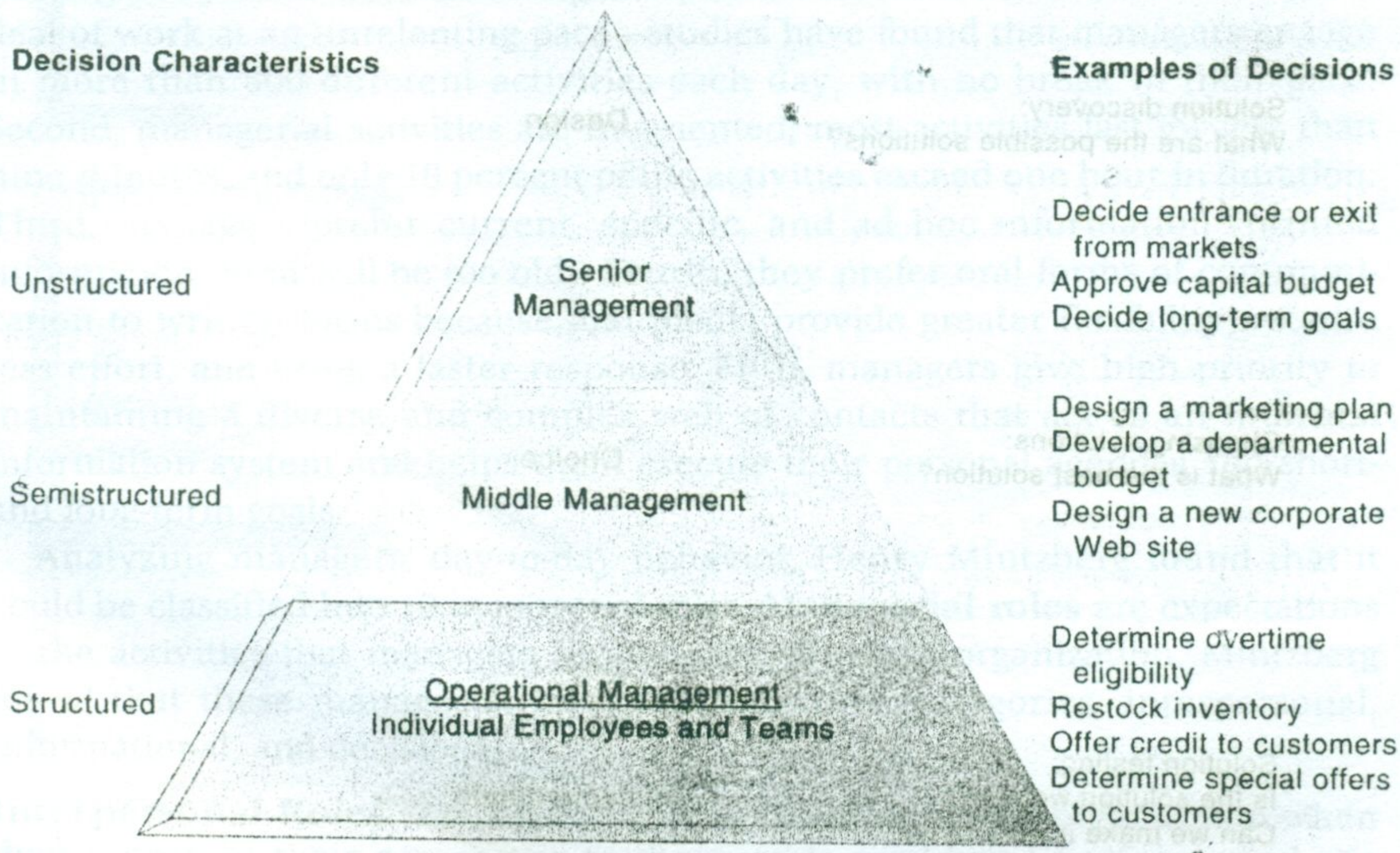
Senior executives face many unstructured decision situations, such as establishing the firm's 5- or 10-year goals or deciding new markets to enter. Answering the question "Should we enter a new market?" would require access to news, government reports, and industry views as well as high-level summaries of firm performance. However, the answer would also require senior managers to use their own best judgment and poll other managers for their opinions.

Middle management faces more structured decision scenarios but their decisions may include unstructured components. A typical middle-level management decision might be "Why is the reported order fulfillment report showing a decline over the past six months at a distribution center in Minneapolis?" This middle manager will obtain a report from the firm's enterprise system or distribution management system on order activity and operational efficiency at the Minneapolis distribution center. This is the structured part of the decision. But before arriving at an answer, this middle manager will have to interview employees and gather more unstructured information from external sources about local economic conditions or sales trends.

Operational management and rank-and-file employees tend to make more structured decisions. For example, a supervisor on an assembly line has to decide whether an hourly paid worker is entitled to overtime pay. If the employee worked more than eight hours on a particular day, the supervisor would routinely grant overtime pay for any time beyond eight hours that was clocked on that day.

A sales account representative often has to make decisions about extending credit to customers by consulting the firm's customer database that contains credit information. If the customer met the firm's prespecified criteria for granting credit, the account representative would grant that customer credit to make a purchase. In both instances, the decisions are highly structured and are

FIGURE 12.1 INFORMATION REQUIREMENTS OF KEY DECISION-MAKING GROUPS IN A FIRM



Senior managers, middle managers, operational managers, and employees have different types of decisions and information requirements.

routinely made thousands of times each day in most large firms. The answer has been preprogrammed into the firm's payroll and accounts receivable systems.

THE DECISION-MAKING PROCESS

Making a decision is a multistep process. Simon (1960) described four different stages in decision making: intelligence, design, choice, and implementation (see Figure 12.2).

Intelligence consists of discovering, identifying, and understanding the problems occurring in the organization—why a problem exists, where, and what effects it is having on the firm.

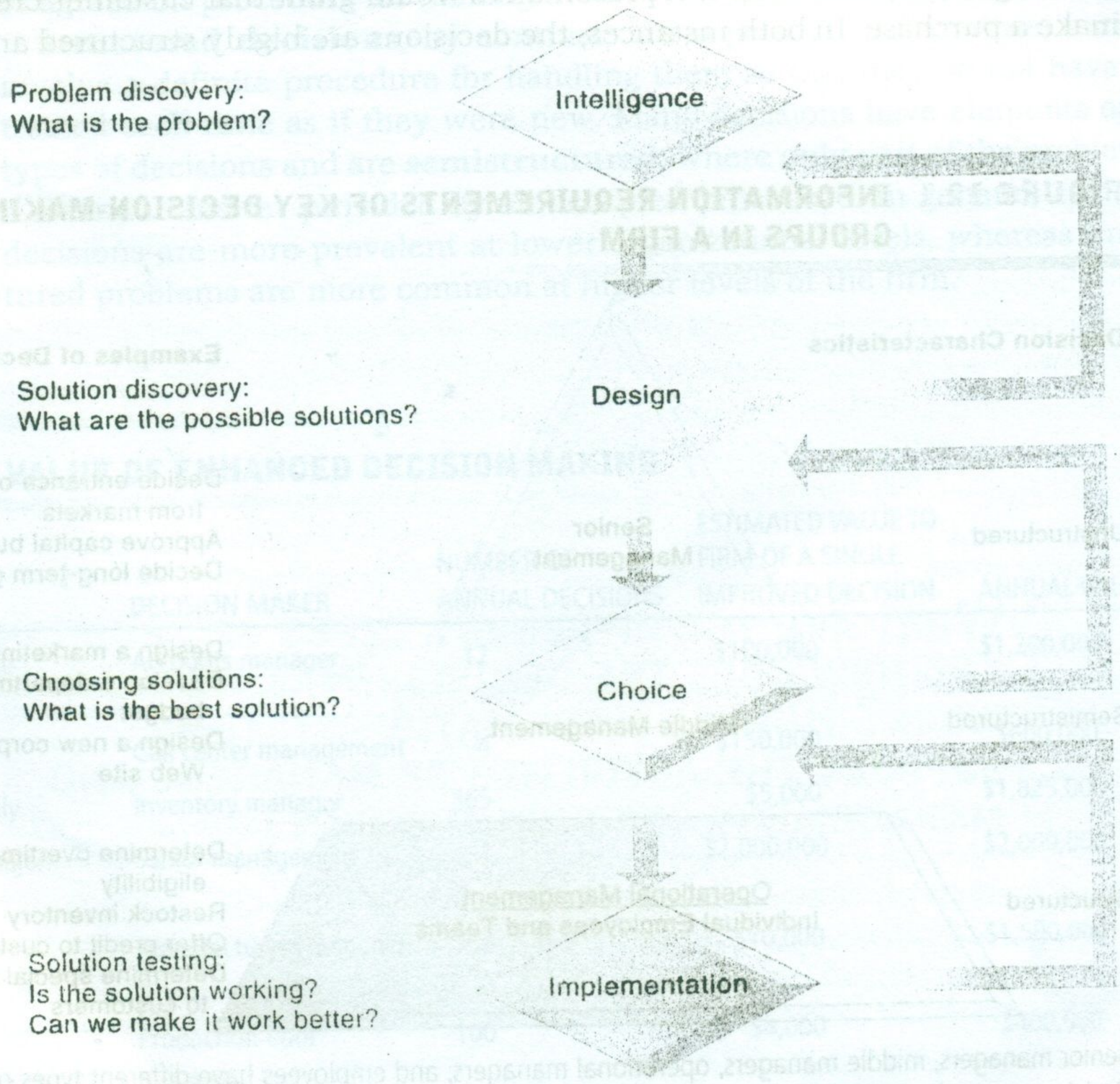
Design involves identifying and exploring various solutions to the problem.

Choice consists of choosing among solution alternatives.

Implementation involves making the chosen alternative work and continuing to monitor how well the solution is working.

What happens if the solution you have chosen doesn't work? Figure 12.2 shows that you can return to an earlier stage in the decision-making process and repeat it if necessary. For instance, in the face of declining sales, a sales management team may decide to pay the sales force a higher commission for making more sales to spur on the sales effort. If this does not produce sales increases, managers would need to investigate whether the problem stems from

FIGURE 12.2 STAGES IN DECISION MAKING



The decision-making process is broken down into four stages.

poor product design, inadequate customer support, or a host of other causes that call for a different solution.

MANAGERS AND DECISION MAKING IN THE REAL WORLD

The premise of this book and this chapter is that systems to support decision making produce better decision making by managers and employees, above average returns on investment for the firm, and ultimately higher profitability. However, information systems cannot improve all the different kinds of decisions taking place in an organization. Let's examine the role of managers and decision making in organizations to see why this is so.

Managerial Roles

Managers play key roles in organizations. Their responsibilities range from making decisions, to writing reports, to attending meetings, to arranging birthday parties. We are able to better understand managerial functions and roles by examining classical and contemporary models of managerial behavior.

The **classical model of management**, which describes what managers do, was largely unquestioned for the more than 70 years since the 1920s. Henri Fayol and other early writers first described the five classical functions of managers as planning, organizing, coordinating, deciding, and controlling. This description of management activities dominated management thought for a long time, and it is still popular today.

The classical model describes formal managerial functions but does not address exactly what managers do when they plan, decide things, and control the work of others. For this, we must turn to the work of contemporary behavioral scientists who have studied managers in daily action. **Behavioral models** state that the actual behavior of managers appears to be less systematic, more informal, less reflective, more reactive, and less well organized than the classical model would have us believe.

Observers find that managerial behavior actually has five attributes that differ greatly from the classical description. First, managers perform a great deal of work at an unrelenting pace—studies have found that managers engage in more than 600 different activities each day, with no break in their pace. Second, managerial activities are fragmented; most activities last for less than nine minutes, and only 10 percent of the activities exceed one hour in duration. Third, managers prefer current, specific, and ad hoc information (printed information often will be too old). Fourth, they prefer oral forms of communication to written forms because oral media provide greater flexibility, require less effort, and bring a faster response. Fifth, managers give high priority to maintaining a diverse and complex web of contacts that act as an informal information system and helps them execute their personal agendas and short- and long-term goals.

Analyzing managers' day-to-day behavior, Henry Mintzberg found that it could be classified into 10 managerial roles. **Managerial roles** are expectations of the activities that managers should perform in an organization. Mintzberg found that these managerial roles fell into three categories: interpersonal, informational, and decisional.

Interpersonal Roles. Managers act as figureheads for the organization when they represent their companies to the outside world and perform symbolic duties, such as giving out employee awards, in their **interpersonal role**.

Managers act as leaders, attempting to motivate, counsel, and support subordinates. Managers also act as liaisons between various organizational levels; within each of these levels, they serve as liaisons among the members of the management team. Managers provide time and favors, which they expect to be returned.

Informational Roles. In their **informational role,** managers act as the nerve centers of their organizations, receiving the most concrete, up-to-date information and redistributing it to those who need to be aware of it. Managers are therefore information disseminators and spokespersons for their organizations.

Decisional Roles. Managers make decisions. In their **decisional role**, they act as entrepreneurs by initiating new kinds of activities; they handle disturbances arising in the organization; they allocate resources to staff members who need them; and they negotiate conflicts and mediate between conflicting groups.

Table 12.2, based on Mintzberg's role classifications, is one look at where systems can and cannot help managers. The table shows that information systems are now capable of supporting most, but not all, areas of managerial life.

Real-World Decision Making

We now see that information systems are not helpful for all managerial roles. And in those managerial roles where information systems might improve decisions, investments in information technology do not always produce positive results. There are three main reasons: information quality, management filters, and organizational culture (see Chapter 3).

Information Quality. High-quality decisions require high-quality information. Table 12.3 describes information quality dimensions that affect the quality of decisions.

TABLE 12.2 MANAGERIAL ROLES AND SUPPORTING INFORMATION SYSTEMS

ROLE	BEHAVIOR	SUPPORT SYSTEMS
Interpersonal Roles		
Figurehead	→	Telepresence systems
Leader	Interpersonal →	Telepresence, social networks, Twitter
Liaison	→	Smartphones, social networks
Informational Roles		
Nerve center	→	Management information systems, executive support system
Disseminator	Information →	E-mail, social networks
Spokesperson	processing →	Webinars, telepresence
Decisional Roles		
Entrepreneur	Decision →	None exist
Disturbance handler	making →	None exist
Resource allocator	→	Business intelligence, decision-support system
Negotiator	→	None exist

Sources: Kenneth C. Laudon and Jane P. Laudon; and Mintzberg, 1971.

TABLE 12.3 INFORMATION QUALITY DIMENSIONS

QUALITY DIMENSION	DESCRIPTION
Accuracy	Do the data represent reality?
Integrity	Are the structure of data and relationships among the entities and attributes consistent?
Consistency	Are data elements consistently defined?
Completeness	Are all the necessary data present?
Validity	Do data values fall within defined ranges?
Timeliness	Are data available when needed?
Accessibility	Are the data accessible, comprehensible, and usable?

If the output of information systems does not meet these quality criteria, decision making will suffer. Chapter 6 has shown that corporate databases and files have varying levels of inaccuracy and incompleteness, which in turn will degrade the quality of decision making.

Management Filters. Even with timely, accurate information, some managers make bad decisions. Managers (like all human beings) absorb information through a series of filters to make sense of the world around them. Managers have selective attention, focus on certain kinds of problems and solutions, and have a variety of biases that reject information that does not conform to their prior conceptions.

For instance, Wall Street firms such as Bear Stearns and Lehman Brothers imploded in 2008 because they underestimated the risk of their investments in complex mortgage securities, many of which were based on subprime loans that were more likely to default. The computer models they and other financial institutions used to manage risk were based on overly optimistic assumptions and overly simplistic data about what might go wrong. Management wanted to make sure that their firms' capital was not all tied up as a cushion against defaults from risky investments, preventing them from investing it to generate profits. So the designers of these risk management systems were encouraged to measure risks in a way that minimzed their importance. Some trading desks also oversimplified the information maintained about the mortgage securities to make them appear as simple bonds with higher ratings than were warranted by their underlying components.

Organizational Inertia and Politics. Organizations are bureaucracies with limited capabilities and competencies for acting decisively. When environments change and businesses need to adopt new business models to survive, strong forces within organizations resist making decisions calling for major change. Decisions taken by a firm often represent a balancing of the firm's various interest groups rather than the best solution to the problem.

Studies of business restructuring find that firms tend to ignore poor performance until threatened by outside takeovers, and they systematically blame poor performance on external forces beyond their control—such as economic conditions (the economy), foreign competition, and rising prices—rather than blaming senior or middle management for poor business judgment.

Today, many decisions made by organizations are not made by managers, or any humans. For instance, when you enter a query into Google's search engine, Google has to decide which URLs to display in about half a second on average (500 milliseconds). The New York Stock Exchange spent over $450 million in 2010–2011 to build a trading platform that executes incoming orders in less than 50 milliseconds. High frequency traders at electronic stock exchanges execute their trades in under 30 milliseconds.

The class of decisions that are highly structured and automated is growing rapidly. What makes this kind of automated high-speed decision making possible are computer algorithms that precisely define the steps to be followed to produce a decision, very large databases, very high-speed processors, and software optimized to the task. In these situations, humans (including managers) are eliminated from the decision chain because they are too slow.

This also means organizations in these areas are making decisions faster than what managers can monitor or control. Inability to control automated decisions was a major factor in the "Flash Crash" experienced by U.S. stock markets on May 6, 2010, when the Dow Jones Industrial Average fell over 600 points in a matter of minutes before rebounding later that day. The stock market was overwhelmed by a huge wave of sell orders triggered primarily by high-speed computerized trading programs within a few seconds, causing shares of some companies like Procter & Gamble to sell for pennies. The past few years have seen a series of similar breakdowns in computerized trading systems, including one on August 1, 2012 when a software error caused Knight Capital to enter millions of faulty trades in less than an hour. The trading glitch created wild surges and plunges in nearly 150 stocks and left Knight with $440 million in losses.

How does the Simon framework of intelligence-design-choice-implementation work in high-velocity decision environments? Essentially, the intelligence, design, choice, and implementation parts of the decision-making process are captured by the software's algorithms. The humans who wrote the software have already identified the problem, designed a method for finding a solution, defined a range of acceptable solutions, and implemented the solution. Obviously, with humans out of the loop, great care needs to be taken to ensure the proper operation of these systems lest they do significant harm to organizations and humans.

12.2 How do business intelligence and business analytics support decision making?

Chapter 2 introduced you to the different types of systems used for supporting management decision making. At the foundation of all of these decision support systems are a business intelligence and business analytics infrastructure that supplies the data and the analytic tools for supporting decision making. In this section, we want to answer the following questions:

- What are business intelligence (BI) and business analytics (BA)
- Who makes business intelligence and business analytics hardware and software?
- Who are the users of business intelligence?

- What kinds of analytical tools come with a BI/BA suite?
- How do managers use these tools?
- What are some examples of firms who have used these tools?
- What management strategies are used for developing BI/BA capabilities?

WHAT IS BUSINESS INTELLIGENCE?

"Business intelligence (BI)" is a term used by hardware and software vendors and information technology consultants to describe the infrastructure for warehousing, integrating, reporting, and analyzing data that come from the business environment, including big data. The foundation infrastructure collects, stores, cleans, and makes relevant information available to managers. Think databases, data warehouses, data marts, Hadoop, and analytic platforms, which we described in Chapter 6. "Business analytics (BA)" is also a vendor-defined term that focuses more on tools and techniques for analyzing and understanding data. Think online analytical processing (OLAP), statistics, models, and data mining, which we also introduced in Chapter 6.

Business intelligence and analytics are essentially about integrating all the information streams produced by a firm into a single, coherent enterprise-wide set of data, and then, using modeling, statistical analysis tools (like normal distributions, correlation and regression analysis, Chi square analysis, forecasting, and cluster analysis), and data mining tools to make sense out of all these data so managers can make better decisions and plans. The German World Cup soccer team described in the chapter-opening case is using business intelligence and analytics to make some very fine-grained decisions about how to improve team and player performance.

Business Intelligence Vendors

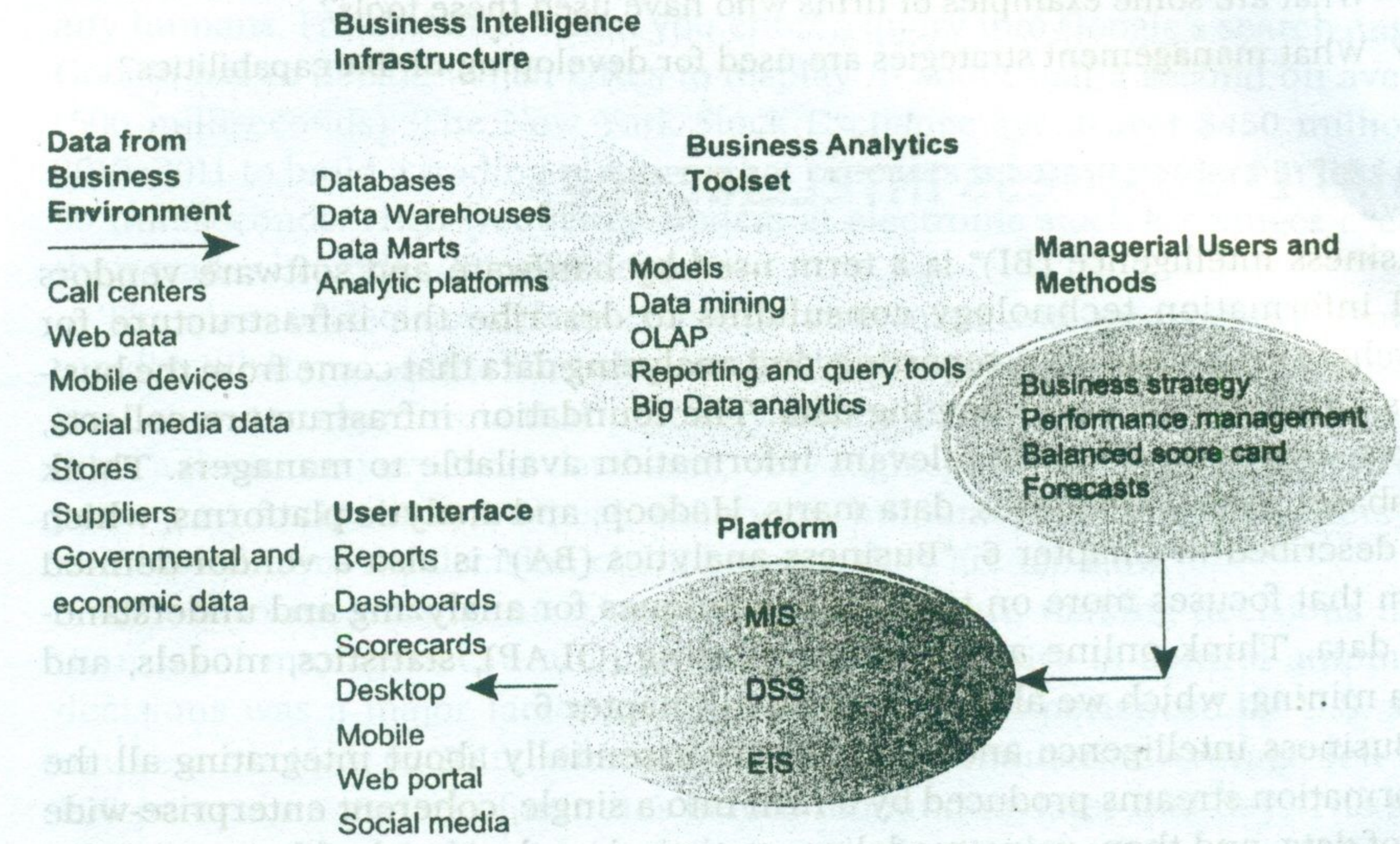
It is important to remember that business intelligence and analytics are products defined by technology vendors and consulting firms. They consist of hardware and software suites sold primarily by large system vendors to very large Fortune 500 firms. The largest five providers of these products are Oracle, SAP, IBM, Microsoft, and SAS. Microsoft's products are aimed at small to medium-sized firms, and they are based on desktop tools familiar to employees (such as Excel spreadsheet software), Microsoft SharePoint collaboration tools, and Microsoft SQL Server database software. According to Gartner Inc., the global business intelligence and analytics market was $14.4 billion in 2013 (Gartner, 2014). This makes business intelligence and business analytics one of the fastest growing and largest segments in the U.S. software market.

THE BUSINESS INTELLIGENCE ENVIRONMENT

Figure 12.3 gives an overview of a business intelligence environment, highlighting the kinds of hardware, software, and management capabilities that the major vendors offer and that firms develop over time. There are six elements in this business intelligence environment:

- **Data from the business environment:** Businesses must deal with both structured and unstructured data from many different sources, including big data. The data need to be integrated and organized so that they can be analyzed and used by human decision makers.
- **Business intelligence infrastructure:** The underlying foundation of business intelligence is a powerful database system that captures all the

FIGURE 12.3 BUSINESS INTELLIGENCE AND ANALYTICS FOR DECISION SUPPORT



Business intelligence and analytics requires a strong database foundation, a set of analytic tools, and an involved management team that can ask intelligent questions and analyze data.

relevant data to operate the business. The data may be stored in transactional databases or combined and integrated into an enterprise-data warehouse or series of interrelated data marts.

- **Business analytics toolset:** A set of software tools are used to analyze data and produce reports, respond to questions posed by managers, and track the progress of the business using key indicators of performance.
- **Managerial users and methods:** Business intelligence hardware and software are only as intelligent as the human beings who use them. Managers impose order on the analysis of data using a variety of managerial methods that define strategic business goals and specify how progress will be measured. These include business performance management and balanced scorecard approaches focusing on key performance indicators and industry strategic analyses focusing on changes in the general business environment, with special attention to competitors. Without strong senior management oversight, business analytics can produce a great deal of information, reports, and online screens that focus on the wrong matters and divert attention from the real issues. You need to remember that, so far, only humans can ask intelligent questions.
- **Delivery platform—MIS, DSS, ESS:** The results from business intelligence and analytics are delivered to managers and employees in a variety of ways, depending on what they need to know to perform their jobs. MIS, DSS, and ESS, which we introduced in Chapter 2, deliver information and knowledge to different people and levels in the firm—operational employees, middle managers, and senior executives. In the past, these systems could not share data and operated as independent systems. Today, one suite of hardware and software tools in the form of a business intelligence and analytics package is able to integrate all this information and bring it to managers' desktop or mobile platforms.

- **User interface:** Business people are no longer tied to their desks and desktops. They often learn quicker from a visual representation of data than from a dry report with columns and rows of information. Today's business analytics software suites feature **data visualization** tools, such as rich graphs, charts, dashboards, and maps. They also are able to deliver reports on BlackBerrys, iPhones, iPads, and other mobile handhelds as well as on the firm's Web portal. BA software is adding capabilities to post information on Twitter, Facebook, or internal social media to support decision making in an online group setting rather than in a face-to-face meeting.

BUSINESS INTELLIGENCE AND ANALYTICS CAPABILITIES

Business intelligence and analytics promise to deliver correct, nearly real-time information to decision makers, and the analytic tools help them quickly understand the information and take action. There are six analytic functionalities that BI systems deliver to achieve these ends:

- **Production reports:** These are predefined reports based on industry-specific requirements (see Table 12.4).
- **Parameterized reports:** Users enter several parameters as in a pivot table to filter data and isolate impacts of parameters. For instance, you might want to enter region and time of day to understand how sales of a product vary by region and time. If you were Starbucks, you might find that customers in the East buy most of their coffee in the morning, whereas in the Northwest customers buy coffee throughout the day. This finding might lead to different marketing and ad campaigns in each region. (See the discussion of pivot tables in Section 12.3.)
- **Dashboards/scorecards:** These are visual tools for presenting performance data defined by users.
- **Ad hoc query/search/report creation:** These allow users to create their own reports based on queries and searches.
- **Drill down:** This is the ability to move from a high-level summary to a more detailed view.

TABLE 12.4 EXAMPLES OF BUSINESS INTELLIGENCE PREDEFINED PRODUCTION REPORTS

BUSINESS FUNCTIONAL AREA	PRODUCTION REPORTS
Sales	Forecast sales; sales team performance; cross-selling; sales cycle times
Service/Call Center	Customer satisfaction; service cost; resolution rates; churn rates
Marketing	Campaign effectiveness; loyalty and attrition; market basket analysis
Procurement and Support	Direct and indirect spending; off-contract purchases; supplier performance
Supply Chain	Backlog; fulfillment status; order cycle time; bill of materials analysis
Financials	General ledger; accounts receivable and payable; cash flow; profitability
Human Resources	Employee productivity; compensation; workforce demographics; retention

- **Forecasts, scenarios, models:** These include the ability to perform linear forecasting, what-if scenario analysis, and analyze data using standard statistical tools.

Who Uses Business Intelligence and Business Analytics?

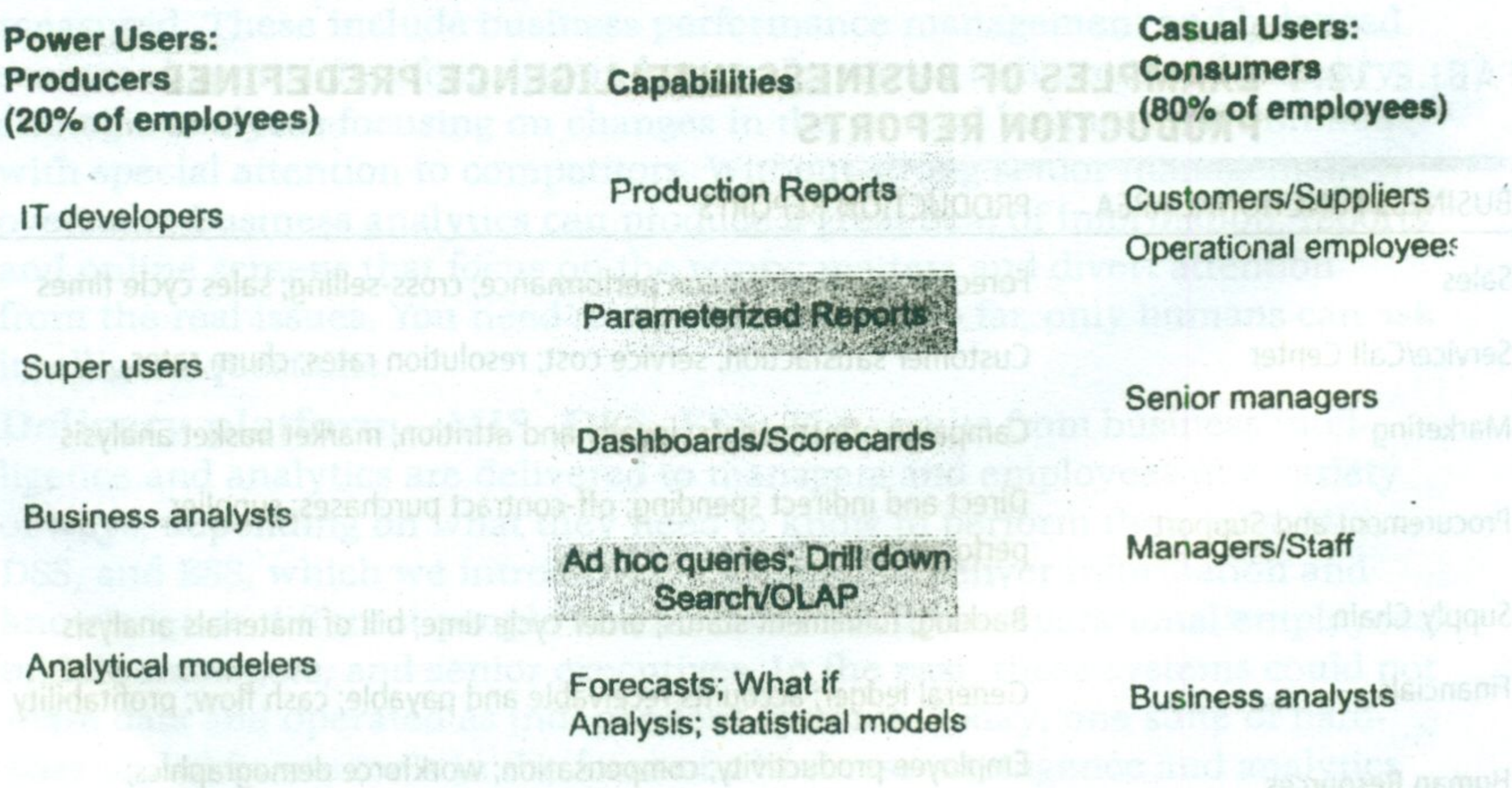
In previous chapters, we have described the different information constituencies in business firms—from senior managers to middle managers, analysts, and operational employees. This also holds true for BI and BA systems (see Figure 12.4). Over 80 percent of the audience for BI consists of casual users who rely largely on production reports. Senior executives tend to use BI to monitor firm activities using visual interfaces like dashboards and scorecards. Middle managers and analysts are much more likely to be immersed in the data and software, entering queries and slicing and dicing the data along different dimensions. Operational employees will, along with customers and suppliers, be looking mostly at prepackaged reports.

Predictive Analytics

An important capability of business intelligence analytics is the ability to model future events and behaviors, such as the probability that a customer will respond to an offer to purchase a product. **Predictive analytics** use statistical analysis, data mining techniques, historical data, and assumptions about future conditions to predict future trends and behavior patterns. Variables that can be measured to predict future behavior are identified. For example, an insurance company might use variables such as age, gender, and driving record as predictors of driving safety when issuing auto insurance policies. A collection of such predictors is combined into a predictive model for forecasting future probabilities with an acceptable level of reliability.

FedEx has been using predictive analytics to develop models that predict how customers will respond to price changes and new services, which customers are most at risk of switching to competitors, and how much revenue will be

FIGURE 12.4 BUSINESS INTELLIGENCE USERS



Casual users are consumers of BI output, while intense power users are the producers of reports, new analyses, models, and forecasts.

generated by new storefront or drop-box locations. The accuracy rate of FedEx's predictive analytics system ranges from 65 to 90 percent.

Predictive analytics are being incorporated into numerous business intelligence applications for sales, marketing, finance, fraud detection, and health care. One of the most well-known applications is credit scoring, which is used throughout the financial services industry. When you apply for a new credit card, scoring models process your credit history, loan application, and purchase data to determine your likelihood of making future credit payments on time. Telecommunications companies use predictive analytics to identify which customers are most profitable, which are most likely to leave, and which new services and plans will be most likely to retain customers. Health care insurers have been analyzing data for years to identify which patients are most likely to generate high costs.

Many companies employ predictive analytics to predict response to direct marketing campaigns. By identifying customers less likely to respond, companies are able to lower their marketing and sales costs by bypassing this group and focusing their resources on customers who have been identified as more promising. For instance, the U.S. division of The Body Shop PLC used predictive analytics and its database of catalog, Web, and retail store customers to identify customers who were more likely to make catalog purchases. That information helped the company build a more precise and targeted mailing list for its catalogs, improving the response rate for catalog mailings and catalog revenues.

Big Data Analytics

Predictive analytics are starting to use big data from both private and public sectors, including data from social media, customer transactions, and output from sensors and machines. In e-commerce, many online retailers have capabilities for making personalized online product recommendations to their Web site visitors to help stimulate purchases and guide their decisions about what merchandise to stock. However, most of these product recommendations have been based on the behaviors of similar groups of customers, such as those with incomes under $50,000 or whose ages are between 18–25 years. Now some retailers are starting to analyze the tremendous quantities of online and in-store customer data they collect along with social media data to make these recommendations more individualized.These efforts are translating into higher customer spending and customer retention rates. Table 12.5 provides examples of companies using big data analytics.

In the public sector, big-data analytics has been driving the movement toward "smart cities," which make intensive use of digital technology to make better decisions about running cities and serving their residents. Public recordkeeping has produced warehouses full of property transfers, tax records, corporate filings, environmental compliance audits, restaurant inspections, building maintenance reports, mass transit appraisals, crime data, health department stats, public education records, utility reviews, and more. Municipalities are adding more data captured through sensors, location data from mobile phones, and targeted smartphone apps. Predictive modeling programs now inform public policy decisions on utility management, transportation operation, healthcare delivery, and public safety. What's more, the ability to evaluate how changes in one service impact the operation and delivery of other services enables holistic problem-solving that could only be dreamed of a generation ago. The Interactive Session on Technology describes how big-data analytics are helping New York City and Barcelona become "smarter."

INTERACTIVE SESSION: TECHNOLOGY

ANALYTICS HELP THE CINCINNATI ZOO KNOW ITS CUSTOMERS

Founded in 1873, the Cincinnati Zoo & Botanical Garden is one of the world's top-rated zoological institutions, and the second oldest zoo in the United States. It is also one of the nation's most popular attractions, a Top 10 Zagat-rated Zoo, and a *Parents Magazine* Top Zoo for Children. The Zoo's 71-acre site is home to more than 500 animal and 3,000 plant species. About 1.3 million people visit this zoo each year.

Although the Zoo is a nonprofit organization partially subsidized by Hamilton County, more than two-thirds of its $26 million annual budget is paid from fundraising efforts, and the remainder comes from admission fees, food, and gifts. To increase revenue and improve performance, the Zoo's senior management team embarked on a comprehensive review of its operations. The review found that management had limited knowledge and understanding of what was actually happening in the Zoo on a day-to-day basis, other than how many people visited every day and the Zoo's total revenue.

Who is coming to the Zoo? How often do they come? What do they do and what do they buy? Management had no idea. Each of the Zoo's four income streams—admissions, membership, retail, and food service—had different point-of-sale platforms, and the food service business, which brings in $4 million a year, still relied on manual cash registers. Management had to sift through paper receipts just to understand daily sales totals.

The Zoo had compiled a spreadsheet that collected visitors' zip codes, hoping to use the data for geographic and demographic analysis. If the data could be combined with insight into visitor activity at the Zoo—what attractions they visited, what they ate and drank, and what they bought at the gift shops—the information would be extremely valuable for marketing.

To achieve this, however, the Zoo needed to change its information systems to focus more on analytics and data management. The Zoo replaced its four legacy point-of-sale systems with a single platform—Galaxy POS from Gateway Ticketing Systems. It then enlisted IBM and BrightStar Partners (a consulting firm partnering with IBM) to build a centralized data warehouse and implement IBM Cognos Business Intelligence to provide real-time analytics and reporting.

Like all outdoor attractions, the Zoo's business is highly weather-dependent. On rainy days, attendance falls off sharply, often leaving the Zoo overstaffed and overstocked. If the weather is unusually hot, sales of certain items such as ice cream and bottled water are likely to rise, and the Zoo may run out of these items.

The Zoo now feeds weather forecast data from the U.S. National Oceanic and Atmospheric Administration (NOAA) Web site into its business intelligence system. By comparing current forecasts to historic attendance and sales data during similar weather conditions, the Zoo is able to make more accurate decisions about labor scheduling and inventory planning.

As visitors scan their membership cards at the Zoo's entrance, exit, attractions, restaurants, and stores, or use the Zoo's Loyalty Rewards card, the Zoo's system captures these data and analyzes them to determine usage and spending patterns down to the individual customer level. This information helps the Zoo segment visitors based on their spending and visitation behaviors and use this information to target marketing and promotions specifically for each customer segment.

One customer segment the Zoo identified consisted of people who spent nothing other than the price of admissions during their visit. If each of these people spent $20 on their next visit to the Zoo, the Zoo would take in an extra $260,000, which is almost 1 percent of its entire budget. The Zoo used its customer information to devise a direct mail marketing campaign in which this type of visitor would be offered a discount for some of the Zoo's restaurants and gift shops. Loyal customers are also rewarded with targeted marketing and recognition programs.

Instead of sending a special offer to its entire mailing list, the Zoo is able to tailor campaigns more precisely to smaller groups of people, increasing its chances of identifying the people who were most likely to respond to its mailings. More targeted marketing helped the Zoo cut $40,000 from its annual marketing budget.

Management had observed that food sales tend to trail off significantly after 3 p.m. each day, and started closing some of the Zoo's food outlets at that time. But more detailed data analysis showed that a big spike in soft-serve ice cream sales occurs during the last hour

before the Zoo closes. As a result, the Zoo's soft-serve ice cream outlets are open for the entire day.

The Zoo's Beer Hut concession features six different brands, which are typically rotated based on sales volume and the seasons. With IBM analytics, management can now instantly identify which beer is selling best, on what day, and at what time to make sure inventory meets demand. Previously, it took 7 to 14 days to get this information, which required hiring part-time staff to sift through register tapes.

The Zoo's ability to make better decisions about operations has led to dramatic improvements in sales. Six months after deploying its business intelligence solution, the Zoo achieved a 30.7 percent increase in food sales and a 5.9 percent increase in retail sales compared to the same period a year earlier.

Other zoos across the country have taken note of the Cincinnati Zoo's success, including the Point Defiance Zoo in Tacoma, Washington. Point Defiance's online ticket sales increased by 700 percent in 2013, but management had no idea how or why the increase had occurred. After consulting with the Cincinnati Zoo, Point Defiance purchased IBM Cognos 10.2. With more customizability in ticket offers and promotions, and more granular data available on customer demographics, the zoo has been able to sustain its record attendance through 2014.

Sources: Amy Lee, "Tacoma Zoo Taps IBM Cognos for Analytics Push," Cruxialcio.com, June 18, 2014; Justin Kern, "Analytics: Coming to a Zoo, Museum, or Park Near You," *Information Management*, August 28, 2012; IBM Corporation, "Cincinnati Zoo Improves Customer Experience and Enhances Performance," 2011; Nucleus Research, "IBM ROI Case Study: Cincinnati Zoo," July 2011; and www.cincinnatizoo.org, accessed May 26, 2012.

CASE STUDY QUESTIONS

1. What management, organization, and technology factors were behind the Cincinnati Zoo losing opportunities to increase revenue?
2. Why was replacing legacy point-of-sale systems and implementing a data warehouse essential to an information system solution?
3. How did the Cincinnati Zoo benefit from business intelligence? How did it enhance operational performance and decision making? What role was played by predictive analytics?
4. Visit the IBM Cognos Web site and describe the business intelligence tools that would be the most useful for the Cincinnati Zoo.

Operational Intelligence and Analytics

Some of the decisions described in the Interactive Session on smart cities deal with how to run the business of these cities on a day-to-day basis. These are largely operational decisions, and this type of business activity monitoring is called **operational intelligence**. Another example of operational intelligence is the use of data generated by sensors on trucks, trailers, and intermodal containers owned by Schneider National, one of North America's largest truckload, logistics and intermodal services providers. The sensors monitor location, driving behaviors, fuel levels and whether a trailer or container is loaded or empty. Data from fuel tank sensors help Schneider identify the optimal location at which a driver should stop for fuel based on how much is left in the tank, the truck's destination, and fuel prices en route. General Electric Company (GE) is using myriad sensors to collect data about heat, vibrations, and pressure inside a

TABLE 12.5 WHAT BIG DATA ANALYTICS CAN DO

Bank of America	Able to analyze all of its 50 million customers at once to understand each customer across all channels and interactions, and present consistent, finely-customized offers. Can determine which of its customers has a credit card, or a mortgage loan that could benefit from refinancing at a competitor. When the customer visits BofA online, calls a call center, or visits a branch, that information is available for the online app or sales associate to present BofA's competing offer.
Vestas Wind Systems	Improves wind turbine placement for optimal energy output using IBM BigInsights software and an IBM "Firestorm" supercomputer to analyze 2.8 petabytes of structured and unstructured data such as weather reports, tidal phases, geospatial and sensor data, satellite images, deforestation maps, and weather modeling research. The analysis, which used to take weeks, can now be completed in less than one hour.
Hunch.com	Analyzes massive database with data from customer purchases, social networks and signals from around the Web to produce a "taste graph" that maps users with their predicted affinity to products, services, and Web sites. The taste graph includes predictions about 500 million people, 200 million objects (videos, gadgets, books), and 30 billion connections between people and objects. Helps eBay develop more finely customized recommendations on items to offer.
Actian	Provides Fidelity National Information Services and other financial companies with platform to run fraud analytics against 440,000 ATMs, supporting 95 million cards and over 2 million point-of-sale locations.

massive steam-driven GE generator capable of powering 750,000 homes. These sensor data are analyzed along with data on fuel costs, local weather, demand for power, and alternative supplies of electricity to determine the optimal generator performance for the conditions of the moment (Davenport, 2014).

The Internet of Things is creating huge streams of data from Web activities, smartphones, sensors, gauges, and monitoring devices that can be used for operational intelligence about activities inside and outside the organization. Software for operational intelligence and analytics enables organizations to analyze these streams of big data as they are generated in real time. Companies can set trigger alerts on events or have them fed into live dashboards to help managers with their decisions. For example, Schneider's sensors capture hard braking in a moving truck and relay the data to corporate headquarters, where the data are tracked in dashboards monitoring safety metrics. The event initiates a conversation between the driver and that person's supervisor.

Another example of operational intelligence is the use of real-time data in the 34th America's Cup race, as described in the Interactive Session on Management. As you read this case, try to determine the extent to which information technology was able to replace human decision-makers.

Location Analytics and Geographic Information Systems

The Interactive Session on smart cities also describes data and decisions based on location data. BI analytics include **location analytics**, the ability to gain business insight from the location (geographic) component of data, including location data from mobile phones, output from sensors or scanning devices, and data from maps. For example, location analytics might help a marketer determine which people to target with mobile ads about nearby restaurants

INTERACTIVE SESSION: MANAGEMENT

AMERICA'S CUP: THE TENSION BETWEEN TECHNOLOGY AND HUMAN DECISION MAKERS

On September 25, 2013, Oracle Team USA pulled off one of the greatest comebacks in organized sports by winning the last race of the 34th America's Cup Race on breezy San Francisco Bay. Oracle was down 8–1 to its archrival New Zealand in the previous week after losing seven races in a row. Looked like a rout. But then a miracle: Oracle won seven races in a row. And in a winner-take-all finale, Oracle beat Team New Zealand by 44 seconds over the 12-mile race course before thousands of spectators lined up along San Francisco Bay. Both Team USA and Team New Zealand were the highest of high-tech boats ever to leave a designer's computer screen.

In earlier days, America's Cup races were typically among single-hulled sailboats in the 70-foot range that looked like sailboats in the local yacht club, just more so: a single, long, narrow hull, and a really tall mast to hold the sails up. They might get up to 10 miles an hour on the race course.

In 2010, software billionaire Larry Ellison, founder of Oracle, changed all that by spending over $300 million on a new kind of Cup racer: a three-hulled catamaran made of carbon fiber with what looked like an aircraft wing instead of a mast with sails. In two races, the boat, BMW Oracle USA, beat its Swiss contender, Alinghi. Having won the 33rd America's Cup, Ellison could set the boat design and rules for the 34th race in 2013.

The 2013 design was a spectacular jump from traditional sailboats to 21st Century sailing machines. The 2013 boats were 72-foot, twin-hull catamarans dubbed AC72s, capable of over 50 miles per hour—among the fastest sail boats ever built. The AC72 used small hydrofoils underneath the hulls that provided over 12,000 pounds of lift, bringing the boats out of the water completely, and flying like an airplane. In the end, it was unclear to seasoned sailors worldwide whether the AC72 was really a sailboat at all, but rather more aptly called a "sailing machine."

The 34th America's Cup campaign cost Ellison $100 million, including the cost of a single boat pegged at about $8 million. Oracle had two identical boats built. The new boats were also capable of going completely out of control, usually by digging their bows into the water, and then flipping.

Controlling this wickedly sleek sailing machine requires a lightning-fast collection of massive amounts of data, powerful data management, rapid real-time data analysis, quick decision making, and immediate measurement of the results. In short, all the information technologies needed by a modern business firm. When you can perform all these tasks thousands of times in an hour, you can incrementally improve your performance and have an overwhelming advantage over less IT-savvy opponents on race day. For Team USA, this meant using 250 sensors on the wing, hull, and rudder to gather real-time data on pressure, angles, loads, and strains to monitor the effectiveness of each adjustment. The sensors track 4,000 variables, 10 times a second, producing 90 million data points an hour. The sensors are wired to an onboard server that processes the information, and sends it out on a wireless network to crew member wrist displays. Managing all these data is Oracle Database 11g data management software. The data are also wirelessly transferred to a tender ship running Oracle 11g for near real-time analysis using a family of formulas (called velocity prediction formulas) geared to understanding what makes the boat go fast. Oracle's Application Express presentation graphics summarize the millions of data points and present the boat managers with charts that make sense of the information. The data are also sent to Oracle's Austin data center for more in-depth analysis. Using powerful data analysis tools, USA managers were able to find relationships they had never thought about before. Over several months of practice, from day one to the day before the race, the crew of Team USA could chart a steady improvement in performance. For the first time in history, it seemed possible to leave sailing to the computer hardware and software.

Each Team USA crew member wore a small mobile handheld computer on his wrist to display data on the key performance variables customized for that person's responsibilities, such as the load balance on a specific rope or the current aerodynamic performance of the wing sail. The captain and tactician had data displayed on their sunglasses. In this way, each crew member gets the data he needs instantly to perform his job. The crew was trained to sail like pilots looking at instruments, rather than sailors looking at the boat and sea for clues. Professional and amateur sailors across the world wondered if the technology had

transformed sailing into something else, something akin to flying drones from a desk.

So, why did Team USA lose seven races in a row, and how was Oracle able to pull out a victory? After the seventh loss, skipper James Spithill called for a one-day "time-out" allowed by the rules. Team USA was losing the upwind legs of all the races where Team New Zealand had the edge. The sailors and engineers disagreed about the solution. The engineers called for boat modifications, while the sailors called for more attention to be paid to sailing and less attention to monitoring their wrist computers. In training for the races, the sailors were told to listen to the engineers who had the best technology to predict boat speeds. The engineers' software program told them to sail Team USA as close as possible to wind on the upwind legs (about 45 degrees to the wind), but the sailors' observations of the actual races suggested New Zealand was winning because it sailed five degrees off the wind at about 50 degrees, sailing a longer but faster upwind course. The difference was seconds per mile, which, all other things being equal, adds up to victory in a 12-mile race. The sailors claimed the engineers' software was just wrong.

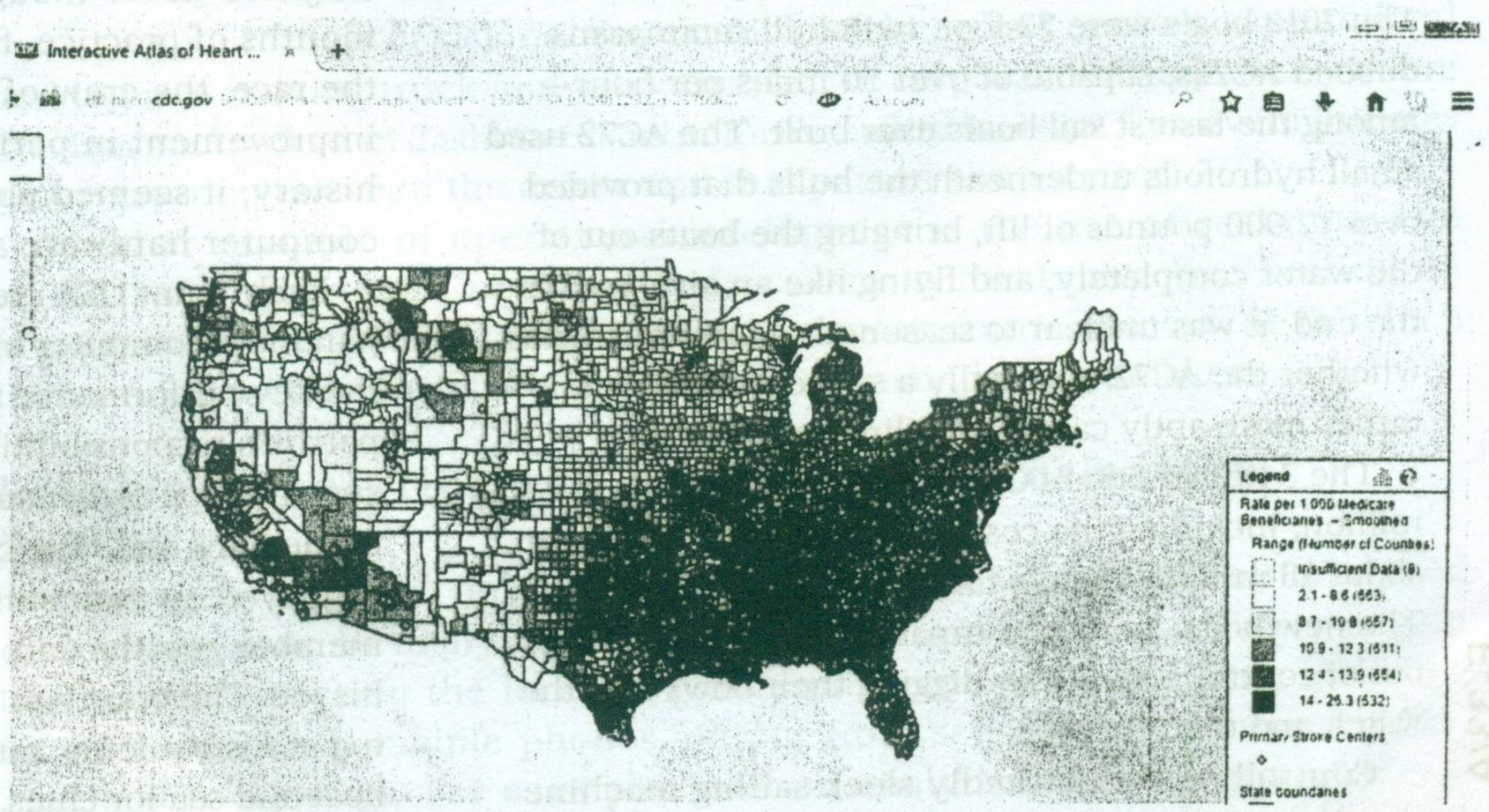
In the end, Team USA pursued both solutions: multiple small changes were made in the boat hull and underwater foils, and on the race course. Spithill and his team stopped looking so much at their wrist computer screens, and started to act like sailors on a race course rather than drone pilots in an office. Team USA won every upwind leg of the last eight races. The engineers admitted their software models were not providing accurate advice.

Sources: Stu Wood, "Against the Wind, One of the Greatest Comebacks in Sports History," *Wall Street Journal*, Feb. 28, 2014 and "America's Cup: Resolving the Tension Between Man and Technology," *Wall Street Journal*, March 3, 2014; Christopher Carey, "Oracle Completes Voyage to History, Winning America's Cup," *New York Times*, September 25, 2013; Christopher Carey, "After Comeback for the Ages, a Last Dash for America's Cup," *New York Times*, September 25, 2013; and Joe Schneider, "Team New Zealand Gets Last Shot at America's Cup as Costs Surge," Bloomberg News, Feb 7, 2013.

CASE STUDY QUESTIONS

1. How did information technology change the way America's Cup boats were managed and sailed?
2. How did information technology impact decision making at Team USA?
3. How much was technology responsible for Team USA's America's Cup victory? Explain your answer.
4. Compare the role of big data in Team USA's America's Cup victory with its role in the German team's 2014 World Cup victory described in the chapter-opening case.

The U.S. Centers for Disease Control and Prevention created a GIS for identifying the stroke hospitalization rate per 1000 Medicare beneficiaries (age 65 and older) in various parts of the United States. The small yellow triangles designate primary stroke care centers.



F-33/B

and stores, or quantify the impact of mobile ads on in-store visits. Location analytics would help a utility company view and measure outages and their associated costs as related to customer location to help prioritize marketing, system upgrades and customer service efforts. UPS's package tracking and delivery-routing systems described in Chapter 1 use location analytics, as does an application used by Starbucks to determine where to open new stores. The Starbucks application identifies geographic locations that will produce a high sales-to-investment ratio and per-store sales volume.

The Starbucks application and some of the New York City systems described earlier are examples of **geographic information systems (GIS)**. GIS provide tools to help decision makers visualize problems that benefit from mapping. GIS software ties location data about the distribution of people or other resources to points, lines, and areas on a map. Some GIS have modeling capabilities for changing the data and automatically revising business scenarios.

GIS might be used to help state and local governments calculate response times to natural disasters and other emergencies or to help banks identify the best location for new branches or ATM terminals. For example, Columbia, South Carolina-based First Citizens Bank uses MapInfo GIS software to determine which markets to focus on for retaining customers and which to focus on for acquiring new customers. The GIS software also lets the bank drill down into details at the individual branch level and individualize goals for each branch. Each branch is able to see whether the greatest revenue opportunities are from mining its database of existing customers or from finding new customers.

MANAGEMENT STRATEGIES FOR DEVELOPING BI AND BA CAPABILITIES

There are two different strategies for adopting BI and BA capabilities for the organization: one-stop integrated solutions versus multiple best-of-breed vendor solutions. The hardware firms (IBM, HP, and now Oracle, which owns Sun Microsystems) want to sell your firm integrated hardware/software solutions that tend to run only on their hardware (the totally integrated solution). It's called "one-stop shopping." The software firms (SAP, SAS, and Microsoft) encourage firms to adopt the "best-of-breed" software that runs on any machine they want. In this strategy, you adopt the best database and data warehouse solution, and select the business intelligence and analytics package from whatever vendor you believe is best.

The first solution carries the risk that a single vendor provides your firm's total hardware and software solution, making your firm dependent on its pricing power. However, it offers the advantage of dealing with a single vendor who can deliver on a global scale. The second solution offers greater flexibility and independence, but with the risk of potential difficulties integrating the software to the hardware platform, as well as to other software. Vendors always claim their software is "compatible" with other software, but the reality is that it can be very difficult to integrate software from different vendors.

Regardless of which strategy your firm adopts, all BI and BA systems lock the firm into a set of vendors and switching is very costly. Once you train thousands of employees across the world on using a particular set of tools, it is extremely difficult to switch. When you adopt these systems, you are in essence taking in a new partner.



HOW DO DIFFERENT DECISION-MAKING CONSTITUENCIES IN AN ORGANIZATION USE BUSINESS INTELLIGENCE? WHAT IS THE ROLE OF INFORMATION SYSTEMS IN HELPING PEOPLE WORKING IN A GROUP MAKE DECISIONS MORE EFFICIENTLY?

There are many different constituencies that make up a modern business firm. Earlier in this text and in this chapter we identified three levels of management: lower supervisory (operational) management, middle management, and senior management (vice president and above, including executive or "C level" management, e.g. chief executive officer, chief financial officers, and chief operational officer.) Each of these management groups has different responsibilities and different needs for information and business intelligence, with decisions becoming less structured among higher levels of management (review Figure 12.1).

DECISION SUPPORT FOR OPERATIONAL AND MIDDLE MANAGEMENT

Operational and middle management are generally charged with monitoring the performance of key aspects of the business, ranging from the down-time of machines on a factory floor, to the daily or even hourly sales at franchise food stores, to the daily traffic at a company's Web site. Most of the decisions they make are fairly structured. Management information systems (MIS) are typically used by middle managers to support this type of decision making, and their primary output is a set of routine production reports based on data extracted and summarized from the firm's underlying transaction processing systems (TPS). Increasingly, middle managers receive these reports online on the company portal, and are able to interactively query the data to find out why events are happening. To save even more analysis time, managers turn to exception reports, which highlight only exceptional conditions, such as when the sales quotas for a specific territory fall below an anticipated level or employees have exceeded their spending limits in a dental care plan. Table 12.6 provides some examples of MIS applications.

TABLE 12.6 **EXAMPLES OF MIS APPLICATIONS**

COMPANY	MIS APPLICATION
California Pizza Kitchen	Inventory Express application "remembers" each restaurant's ordering patterns and compares the amount of ingredients used per menu item to predefined portion measurements established by management. The system identifies restaurants with out-of-line portions and notifies their managers so that corrective actions will be taken.
PharMark	Extranet MIS identifies patients with drug-use patterns that place them at risk for adverse outcomes.
Black & Veatch	Intranet MIS tracks construction costs for various projects across the United States.
Taco Bell	Total Automation of Company Operations (TACO) system provides information on food, labor, and period-to-date costs for each restaurant.

FIGURE 12.5 SENSITIVITY ANALYSIS

Total fixed costs	19000					
Variable cost per unit	3					
Average sales price	17					
Contribution margin	14					
Break-even point	1357					
		Variable Cost per Unit				
Sales	1357	2	3	4	5	6
Price	14	1583	1727	1900	2111	2375
	15	1462	1583	1727	1900	2111
	16	1357	1462	1583	1727	1900
	17	1267	1357	1462	1583	1727
	18	1188	1267	1357	1462	1583

This table displays the results of a sensitivity analysis of the effect of changing the sales price of a necktie and the cost per unit on the product's break-even point. It answers the question, "What happens to the break-even point if the sales price and the cost to make each unit increase or decrease?"

Support for Semistructured Decisions

Some managers are "super users" and keen business analysts who want to create their own reports, and use more sophisticated analytics and models to find patterns in data, to model alternative business scenarios, or to test specific hypotheses. Decision-support systems (DSS) are the BI delivery platform for this category of users, with the ability to support semistructured decision making.

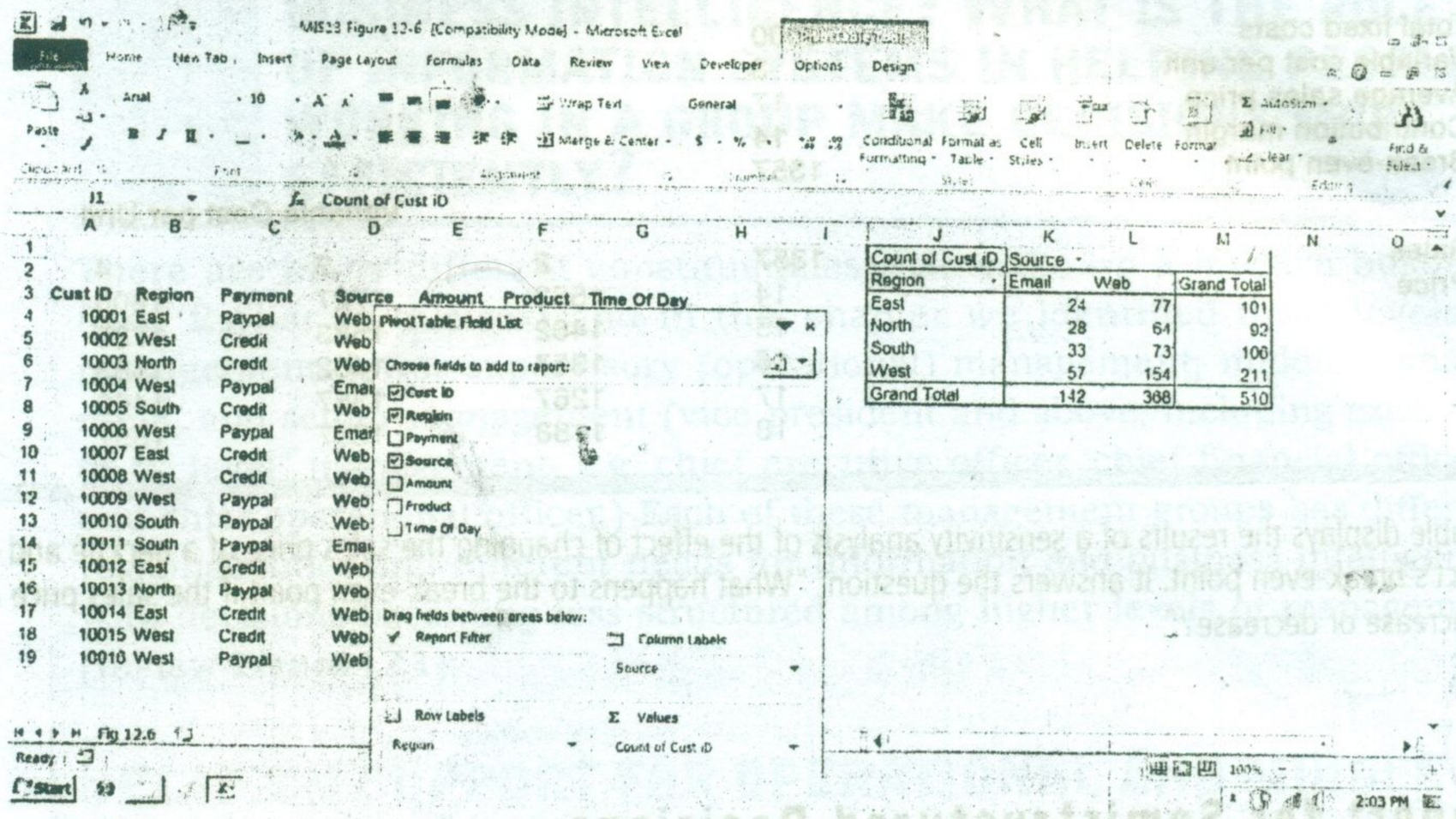
DSS rely more heavily on modeling than MIS, using mathematical or analytical models to perform what-if or other kinds of analysis. "What-if" analysis, working forward from known or assumed conditions, allows the user to vary certain values to test results to predict outcomes if changes occur in those values. What happens if we raise product prices by 5 percent or increase the advertising budget by $1 million? **Sensitivity analysis** models ask what-if questions repeatedly to predict a range of outcomes when one or more variables are changed multiple times (see Figure 12.5). Backward sensitivity analysis helps decision makers with goal seeking: If I want to sell 1 million product units next year, how much must I reduce the price of the product?

Chapter 6 described multidimensional data analysis and OLAP as one of the key business intelligence technologies. Spreadsheets have a similar feature for multidimensional analysis called a **pivot table**, which manager "super users" and analysts employ to identify and understand patterns in business information that may be useful for semistructured decision making.

Figure 12.6 illustrates a Microsoft Excel pivot table that examines a large list of order transactions for a company selling online management training videos and books. It shows the relationship between two dimensions: the sales region and the source of contact (Web banner ad or e-mail) for each customer order. It answers the question: does the source of the customer make a difference in addition to region? The pivot table in this figure shows that most customers come from the West and that banner advertising produces most of the customers in all the regions.

One of the Hands-On MIS projects for this chapter asks you to use a pivot table to find answers to a number of other questions using the same list of transactions for the online training company as we used in this discussion. The complete Excel file for these transactions is available in MyMISLab. We have also added a Learning Track on creating pivot tables using Excel.

FIGURE 12.6 A PIVOT TABLE THAT EXAMINES CUSTOMER REGIONAL DISTRIBUTION AND ADVERTISING SOURCE



In this pivot table, we are able to examine where an online training company's customers come from in terms of region and advertising source.

In the past, much of this modeling was done with spreadsheets and small stand-alone databases. Today these capabilities are incorporated into large enterprise BI systems where they are able to analyze data from large corporate databases. BI analytics include tools for intensive modeling, some of which we described earlier. Such capabilities help Progressive Insurance identify the best customers for its products. Using widely available insurance industry data, Progressive defines small groups of customers, or "cells," such as motorcycle riders aged 30 or above with college educations, credit scores over a certain level, and no accidents. For each "cell," Progressive performs a regression analysis to identify factors most closely correlated with the insurance losses that are typical for this group. It then sets prices for each cell, and uses simulation software to test whether this pricing arrangement will enable the company to make a profit. These analytic techniques, make it possible for Progressive to profitably insure customers in traditionally high-risk categories that other insurers would have rejected.

DECISION SUPPORT FOR SENIOR MANAGEMENT: BALANCED SCORECARD AND ENTERPRISE PERFORMANCE MANAGEMENT METHODS

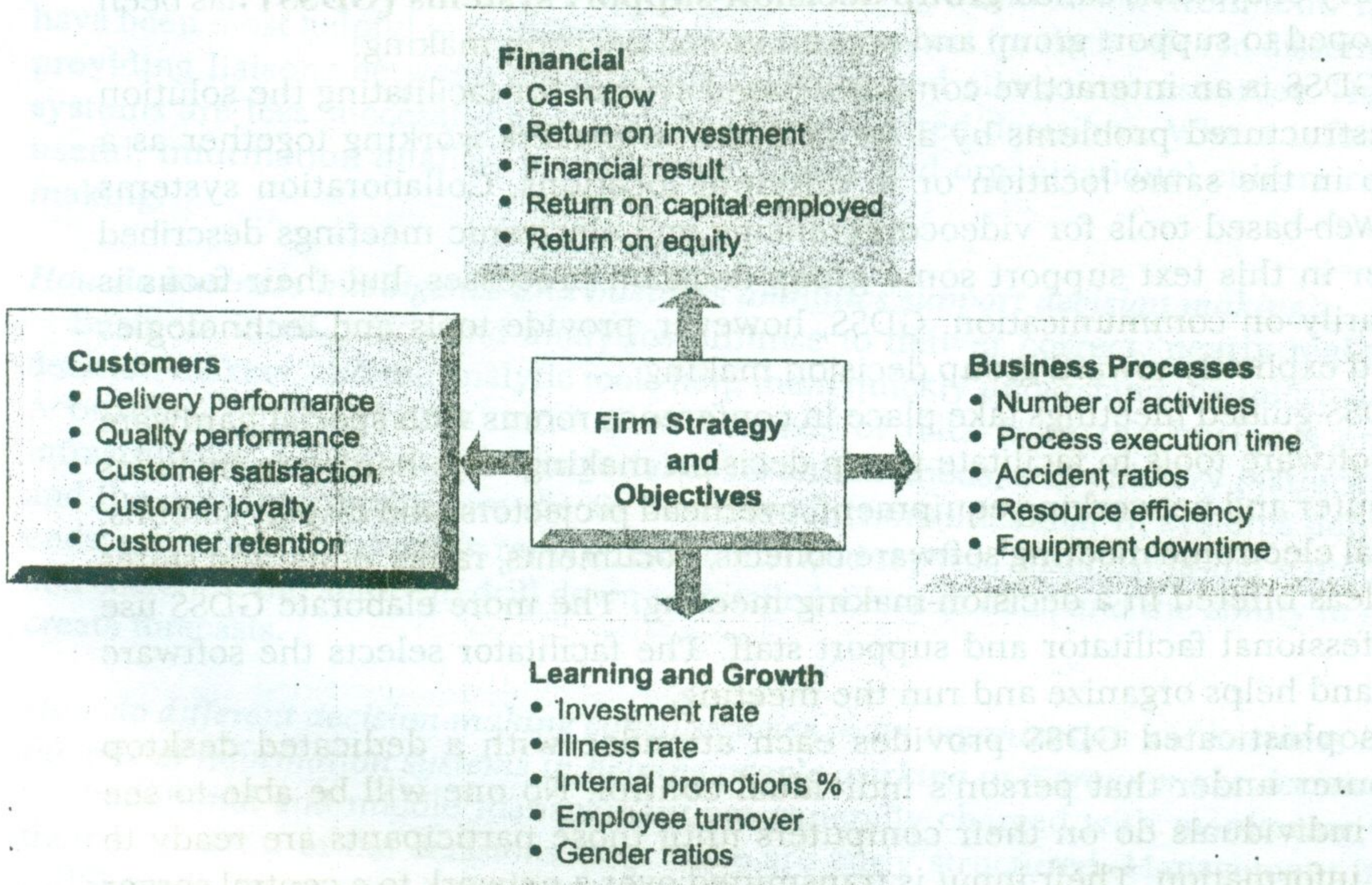
The purpose of executive support systems (ESS), introduced in Chapter 2, is to help C-level executive managers focus on the really important performance information that affect the overall profitability and success of the firm. There are two parts to developing ESS. First, you will need a methodology for understanding exactly what is "the really important performance information" for a specific firm that executives need, and second, you will need to develop systems capable of delivering this information to the right people in a timely fashion.

Currently, the leading methodology for understanding the really important information needed by a firm's executives is called the **balanced scorecard method** (Kaplan and Norton, 2004; Kaplan and Norton, 1992). The balanced score card is a framework for operationalizing a firm's strategic plan by focusing on measurable outcomes on four dimensions of firm performance: financial, business process, customer, and learning and growth (Figure 12.7).

Performance on each dimension is measured using **key performance indicators (KPIs)**, which are the measures proposed by senior management for understanding how well the firm is performing along any given dimension. For instance, one key indicator of how well an online retail firm is meeting its customer performance objectives is the average length of time required to deliver a package to a consumer. If your firm is a bank, one KPI of business process performance is the length of time required to perform a basic function like creating a new customer account.

The balanced scorecard framework is thought to be "balanced" because it causes managers to focus on more than just financial performance. In this view, financial performance is past history—the result of past actions—and managers should focus on the things they are able to influence today, such as business process efficiency, customer satisfaction, and employee training. Once a scorecard is developed by consultants and senior executives, the next step is automating a flow of information to executives and other managers for each of the key performance indicators. There are literally hundreds of consulting and software firms that offer these capabilities, which are described below. Once these systems are implemented, they are often referred to as ESS.

FIGURE 12.7 THE BALANCED SCORECARD FRAMEWORK



In the balanced scorecard framework, the firm's strategic objectives are operationalized along four dimensions: financial, business process, customer, and learning and growth. Each dimension is measured using several KPIs.

Another closely related popular management methodology is **business performance management (BPM)**. Originally defined by an industry group in 2004 (led by the same companies that sell enterprise and database systems like Oracle, SAP, and IBM), BPM attempts to systematically translate a firm's strategies (e.g., differentiation, low-cost producer, market share growth, and scope of operation) into operational targets. Once the strategies and targets are identified, a set of KPIs are developed that measure progress towards the targets. The firm's performance is then measured with information drawn from the firm's enterprise database systems. BPM uses the same ideas as balanced scorecard but with a stronger strategy flavor.

Corporate data for contemporary ESS are supplied by the firm's existing enterprise applications (enterprise resource planning, supply chain management, and customer relationship management). ESS also provide access to news services, financial market databases, economic information, and whatever other external data senior executives require. ESS also have significant **drill-down** capabilities if managers need more detailed views of data.

Well-designed ESS help senior executives monitor organizational performance, track activities of competitors, recognize changing market conditions, and identify problems and opportunities. Employees lower down in the corporate hierarchy also use these systems to monitor and measure business performance in their areas of responsibility. For these and other business intelligence systems to be truly useful, the information must be "actionable"—it must be readily available and also easy to use when making decisions. If users have difficulty identifying critical metrics within the reports they receive, employee productivity and business performance will suffer.

GROUP DECISION-SUPPORT SYSTEMS (GDSS)

The DSS we have just described focus primarily on individual decision making. However, so much work is accomplished in groups within firms that a special category of systems called **group decision-support systems (GDSS)** has been developed to support group and organizational decision making.

A GDSS is an interactive computer-based system for facilitating the solution of unstructured problems by a set of decision makers working together as a group in the same location or in different locations. Collaboration systems and Web-based tools for videoconferencing and electronic meetings described earlier in this text support some group decision processes, but their focus is primarily on communication. GDSS, however, provide tools and technologies geared explicitly toward group decision making.

GDSS-guided meetings take place in conference rooms with special hardware and software tools to facilitate group decision making. The hardware includes computer and networking equipment, overhead projectors, and display screens. Special electronic meeting software collects, documents, ranks, edits, and stores the ideas offered in a decision-making meeting. The more elaborate GDSS use a professional facilitator and support staff. The facilitator selects the software tools and helps organize and run the meeting.

A sophisticated GDSS provides each attendee with a dedicated desktop computer under that person's individual control. No one will be able to see what individuals do on their computers until those participants are ready to share information. Their input is transmitted over a network to a central server that stores information generated by the meeting and makes it available to all on the meeting network. Data can also be projected on a large screen in the meeting room.

GDSS make it possible to increase meeting size while at the same time increasing productivity because individuals contribute simultaneously rather than one at a time. A GDSS promotes a collaborative atmosphere by guaranteeing contributors' anonymity so that attendees focus on evaluating the ideas themselves without fear of personally being criticized or of having their ideas rejected based on the contributor. GDSS software tools follow structured methods for organizing and evaluating ideas and for preserving the results of meetings, enabling nonattendees to locate needed information after the meeting. GDSS effectiveness depends on the nature of the problem and the group and on how well a meeting is planned and conducted.

Review Summary

1. *What are the different types of decisions and how does the decision-making process work? How do information systems support the activities of managers and management decision making?*

The different levels in an organization (strategic, management, operational) have different decision-making requirements. Decisions can be structured, semistructured, or unstructured, with structured decisions clustering at the operational level of the organization and unstructured decisions at the strategic level. Decision making can be performed by individuals or groups and includes employees as well as operational, middle, and senior managers. There are four stages in decision making: intelligence, design, choice, and implementation. Systems to support decision making do not always produce better manager and employee decisions that improve firm performance because of problems with information quality, management filters, and organizational culture.

Early classical models of managerial activities stress the functions of planning, organizing, coordinating, deciding, and controlling. Contemporary research looking at the actual behavior of managers has found that managers' real activities are highly fragmented, variegated, and brief in duration and that managers shy away from making grand, sweeping policy decisions.

Information technology provides new tools for managers to carry out both their traditional and newer roles, enabling them to monitor, plan, and forecast with more precision and speed than ever before and to respond more rapidly to the changing business environment. Information systems have been most helpful to managers by providing support for their roles in disseminating information, providing liaisons between organizational levels, and allocating resources. However, information systems are less successful at supporting unstructured decisions. Where information systems are useful, information quality, management filters, and organizational culture can degrade decision making.

2. *How do business intelligence and business analytics support decision making?*

Business intelligence and analytics promise to deliver correct, nearly real-time information to decision makers, and the analytic tools help them quickly understand the information and take action. A business intelligence environment consists of data from the business environment, the BI infrastructure, a BA toolset, managerial users and methods, a BI delivery platform (MIS, DSS, or ESS), and the user interface. There are six analytic functionalities that BI systems deliver to achieve these ends: predefined production reports, parameterized reports, dashboards and scorecards, ad hoc queries and searches, the ability to drill down to detailed views of data, and the ability to model scenarios and create forecasts.

3. *How do different decision-making constituencies in an organization use business intelligence? What is the role of information systems in helping people working in a group make decisions more efficiently?*

Operational and middle management are generally charged with monitoring the performance of their firm. Most of the decisions they make are fairly structured. Management information systems (MIS) producing routine production reports are typically used to support this type of decision making. For making unstructured decisions, middle managers and analysts will use decision-support systems (DSS) with powerful analytics and modeling tools, including spreadsheets and pivot tables. Senior executives making unstructured decisions use dashboards and visual interfaces displaying key

performance information affecting the overall profitability, success, and strategy of the firm. The balanced scorecard and business performance management are two methodologies used in designing executive support systems (ESS).

Group decision-support systems (GDSS) help people working together in a group arrive at decisions more efficiently. GDSS feature special conference room facilities where participants contribute their ideas using networked computers and software tools for organizing ideas, gathering information, making and setting priorities, and documenting meeting sessions.

Key Terms

Balanced scorecard method, 521
Behavioral models, 503
Business performance management (BPM), 522
Choice, 502
Classical model of management, 503
Data visualization, 509
Decisional role, 504
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Geographic information systems (GIS), 517
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Unstructured decisions, 500

MyMISLab

Go to **mymislab.com** to complete the problems marked with this icon ✪.

Review Questions

12-1 What are the different types of decisions and how does the decision-making process work? How do information systems support the activities of managers and management decision making?

- List and describe the different levels of decision making and decision-making constituencies in organizations. Explain how their decision-making requirements differ.
- Distinguish between an unstructured, semistructured, and structured decision.
- List and describe the stages in decision making.
- Compare the descriptions of managerial behavior in the classical and behavioral models.
- Explain how you can determine the quality of decisions and decision making.

12-2 How do business intelligence and business analytics support decision making?

- Define and describe business intelligence and business analytics.
- List and describe the elements of a business intelligence environment.
- List and describe the analytic functionalities provided by BI systems.
- Describe Big Data analytics and provide two examples.

12-3 How do different decision-making constituencies in an organization use business intelligence? What is the role of information systems in helping people working in a group make decisions more efficiently?

- List each of the major decision-making constituencies in an organization and describe the types of decisions each makes.

- Describe how MIS, DSS, or ESS provide decision support for each of these groups.
- Define and describe the balanced scorecard method and business performance management.
- Define a group decision-support system (GDSS) and explain how it differs from a DSS.
- Explain how a GDSS works and how it provides value for a business.

Discussion Questions

12-4 As a manager or user of information systems, what would you need to know to participate in the design and use of a DSS or an ESS? Why?

12-5 Why is the balanced scorecard method a leading methodology for understanding the most important information needed a firm's executives? How is related to business performance management?

12-6 How much can business intelligence and business analytics help companies refine their business strategy? Explain your answer.

Hands-On MIS Projects

The projects in this section give you hands-on experience identifying opportunities for DSS, using a spreadsheet pivot table to analyze sales data, and online retirement planning tools for financial planning.

Management Decision Problems

12-7 Dealerships for Subaru and other automobile manufacturers keep records of the mileage of cars they sell and service. Mileage data are used to remind customers of when they need to schedule service appointments, but they are used for other purposes as well. What kinds of decisions does this piece of data support at the local level and at the corporate level? What would happen if this piece of data were erroneous, for example, showing mileage of 130,000 instead of 30,000? How would it affect decision making? Assess its business impact.

12-8 Applebee's is the largest casual dining chain in the world, with over 1,800 locations throughout the U.S. and also in 20 other countries. The menu features beef, chicken, and pork items, as well as burgers, pasta, and seafood. Applebee's CEO wants to make the restaurant more profitable by developing menus that are tastier and contain more items that customers want and are willing to pay for despite rising costs for gasoline and agricultural products. How might business intelligence help management implement this strategy? What pieces of data would Applebee's need to collect? What kinds of reports would be useful to help management make decisions on how to improve menus and profitability?

Improving Decision Making: Using Pivot Tables to Analyze Sales Data

Software skills: Pivot tables
Business skills: Analyzing sales data

12-9 This project gives you an opportunity to learn how to use Excel's PivotTable feature to analyze a database or data list. Use the data file for Online Management Training Inc. described earlier in the chapter. This is a list of the sales transactions at OMT for one day. You can find this spreadsheet file at MyMISLab. Use Excel's PivotTable to help you answer the following questions:

- Where are the average purchases higher? The answer might tell managers where to focus marketing and sales resources, or pitch different messages to different regions.

- What form of payment is the most common? The answer could be used to emphasize in advertising the most preferred means of payment.
- Are there any times of day when purchases are most common? Do people buy are products while at work (likely during the day) or at home (likely in the evening)?
- What's the relationship between region, type of product purchased, and average sales price?

We provide instructions on how to use Excel PivotTables in our Learning Tracks.

Improving Decision Making: Using a Web-Based DSS for Retirement Planning

Software skills: Internet-based software
Business skills: Financial planning

12-10 This project will help develop your skills in using Web-based DSS for financial planning.

The Web sites for CNN Money and Kiplinger feature Web-based DSS for financial planning and decision making. Select either site to plan for retirement. Use your chosen site to determine how much you need to save to have enough income for your retirement. Assume that you are 50 years old, single and plan to retire in 16 years. You have $100,000 in savings. Your current annual income is $85,000. Your goal is to be able to generate an annual retirement income of $60,000, including Social Security benefit payments.

Use the Web site you have selected to determine how much money you need to save to help you achieve your retirement goal. If you need to calculate your estimated Social Security benefit, use the Quick Calculator at the Social Security Administration Web site

Critique the site—its ease of use, its clarity, the value of any conclusions reached, and the extent to which the site helps investors understand their financial needs and the financial markets.

Collaboration and Teamwork Project

12-11 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Sites, Google Docs, Google+, or other open source collaboration tools to complete the assignment.

How Much Does Data-Driven Planting Help Farmers?

CASE STUDY

Like many other businesses, farming is being reshaped by information technology. Many tractors and combines today are guided by Global Positioning System (GPS) satellite-based navigation systems. The GPS computer receives signals from earth-orbiting satellites to track each piece of equipment's location and where it has gone. The system issues instructions for hoses to deliver precise amounts of fertilizer right into the grooves cut by the tiller. The system helps steer the equipment, so farmers are able to monitor progress on iPads and other tablet computers in their tractor cabs. Placing seed and fertilizer together with this level of precision means farmers need to use fewer loads of fertilizer, potentially saving an individual farmer tens of thousands of dollars.

Now big agricultural companies like Monsanto and Dupont want to do more. Since adjustments in planting depth or the distance between crop rows can make a big difference in crop yields, these companies want their computers to analyze the data generated during this computerized planting work to show farmers how to further increase their crop output. This practice is also known as predictive planting. Proponents say prescriptive planting will spark an agricultural revolution rivalling the introduction of mechanized tractors in the first half of the 20th century and the rise of genetically modified seeds in the 1990s.

Here's how prescriptive planting works: The farmer provides data on field boundaries, historic crop yields, and soil conditions to an agricultural data analysis company, which analyzes the data along with other data it has collected about seed performance and soil types in different areas. The company then sends a computer file with recommendations back to the farmer, who uploads the data into computerized planting equipment. The farmer's planting equipment follows the recommendations as it plants fields. For example, the recommendations might tell an Iowa corn farmer to lower the number of seeds planted per acre or to plant more seeds per acre in specified portions of the field capable of growing more corn. The farmer might also receive advice on the exact type of seed to plant in different areas. The data analysis company monitors weather and other factors to advise farmers how to manage crops as they grow.

A new software application developed by Monsanto called FieldScripts takes into account variables such as the amount of sunlight and shade, and variations in soil nitrogen and phosphorous content down to an area as small as a 10-meter by 10-meter grid. Monsanto then analyzes the data in conjunction with the genetic properties of their seeds, combines all this information with climate predictions, and delivers precise planting instructions or "scripts" to iPads connected to planting equipment in the field. Tools such as FieldScripts would allow farmers to pinpoint areas that need more or less fertilizer, saving them the cost of spreading fertilizer everywhere, while boosting their yields in areas that have performed more poorly and reducing the amount of excess fertilizer that enters the water table. So, predictive planting could also be good for the environment.

Prescriptive planting could help improve the average corn harvest to more than 200 bushels an acre from the current 160 bushels, some experts say. Such a gain would generate an extra $182 an acre in revenue for farmers, based on recent prices. (Iowa corn farmers received about $759 an acre in 2013.) On a larger scale, according to Monsanto, the world's largest seed company, data-driven planting advice to farmers could increase worldwide crop production by about $20 billion a year. So far, output from predictive planting systems has not achieved those spectacular levels. Farmers who use prescriptive planting report their yields rising by 5 to 10 bushels per acre.

The costs of investing in the new technology and vendor service fees can amount to more than what many small farmers can earn in extra yield from their farms. According to Sara Olson of Lux Research Inc., the problem with precision agriculture is the diminishing returns that come along with costly technologies on smaller farms. That means that only the really big farms are likely to benefit.

Monsanto estimates that FieldScripts will improve yields by 5 to 10 bushels per acre. With corn at around $4 per bushel, that's an increase of $20–$40 per acre. A small farm, of about 500 acres, could get anywhere from $10,000 to $20,000 in extra revenue. Monsanto charges around $10 per acre for the service, so the farm will wind up paying around $5,000—in addition to paying tens of thousands of dollars to either retrofit its existing planting

equipment or buy more modern tractors that include the electronics gear that syncs the "scripts" provided by the Monsanto online service with the planter's onboard navigation systems. Monsanto also charges an extra $15 per acre for its local climate prediction service. A small farm will most likely lose money or break even for the first two years of using a service like FieldScripts, according to Olson.

For large farm of about 5,000 acres, FieldScripts could increase revenues increase by between $100,000 and $200,000. With Monsanto's service costing around $50,000, that farm's total profits will run between $50,000 to $150,000, more than sufficient to offset the cost of updating farm machinery. Whether a farm is big or small the impact of FieldScripts would be minimal in good years because yields would be high regardless. Steve Pitstick, who owns a 2,600-acre corn and soybean farm near DeKalb, Ill., said that the technology is likely to have a bigger impact in years when conditions aren't so good. Since Midwest farming conditionswere good in 2013, Pitstick found that yields from fields that he managed using FieldScripts were only between 1 percent and 2 percent higher than fields where he didn't use the service.

A spokesperson for Monsanto stated that the outcome of predictive planting is less about the size of the farm and more about the farmer's technology know-how. A wide range of farmers are currently using various types of precision agriculture technology. Both small-and large-scale farmers dealing with various crops and production methods are increasingly looking for new technologies and tools that can improve their yields while managing their overall risk. According to Michael Cox, co-director of investment research at securities firm Piper Jaffray Cos., revenue from FieldScripts and other technology-driven products and services could account for 20 percent of Monsanto's projected growth in per-share earnings by 2018.

Although some farmers have embraced predictive planting, others are critical. Many farmers are worried about the intrusion of big data into their once-insular businesses and are especially suspicious of what Monsanto and DuPont might do with the collected data. Others worry about seed prices rising too much, since the companies that developed predictive planting technology are the same ones that sell seeds. Farmers also fear that rivals could use the data to their own advantage. For instance, if nearby farmers saw crop-yield information, they might rush to rent farmland, pushing land and other costs higher. Other farmers worry that Wall Street traders could use the data to make bets on futures contracts. If such bets push futures-contract prices lower early in the growing season, it might squeeze the profits farmers could lock in for their crops by selling futures.

There are not yet any publicly known examples where a farmer's prescriptive-planting information has been misused. Monsanto and DuPont officials say the companies have no plans to sell data gathered from farmers. Deere& Co., which working with DuPont and Dow Chemical Co. to formulate specialized seed-planting recommendations based on data from its tractors, combines and other machinery, says it obtains consent from customers before sharing any of their data.

Kip Tom has been testing Monsanto's system on his 20,000-acre farm near Leesburg, Indiana, for about three years. He claims he would not plant a single acre without it. But he keeps close tabs on how data flow from and to his farm machinery. In 2013, Mr. Tom unplugged a cable inside one of his combine to prevent it from capturing details of his planting algorithm as he harvested corn. The combine's manufacturer didn't develop that information, so Tom didn't believe it should have access to it.

Some farmers have discussed aggregating planting data on their own so they could decide what information to sell and at what price. Other farmers are working with smaller technology companies that are trying to keep agricultural giants from dominating the prescriptive-planting business. Steve Cubbage, owner of Prime Meridian LLC in Nevada, Missouri, one of these small companies, says his company's independence from the seed, machinery and chemical industry adds credibility. About one hundred farmers use Prime Meridian's precision-seeding service, and Cubbage expects the number to increase dramatically. The company is developing a system to store farm-by-farm information on an online Web-based service that could give access to seed dealers, financial advisers and other outsiders approved by farmers.

The American Farm Bureau Federation, a trade group for farmers, has warned members that seed companies touting higher crop yields from prescriptive planting have a vested interest in persuading farmers to plant more. The Federation also says the services might steer farmers to buy certain seeds, sprays and equipment for their land. The Farm Bureau has held internal talks about whether the trade group should set up its own computer servers as a data storehouse, but no decision has been reached.

Brian Dunn, who grows wheat, corn and sorghum on 2,500 acres near St. John, Kansas, believes that big companies can help in the short-term, but is skeptical about the long-term. He uses Prime Meridian's service.

In a move to ease farmers' worries, Monsanto said last month that it supports industrywide standards for managing information collected from fields. The company aims to build a free online data storehouse where farmers could upload information ranging from crop yields to planting dates. Monsanto says it wouldn't access the data without permission from farmers.

One reason that suspicions run deep among some farmers: a surge in seed prices as the biggest companies increased their market share during the past fifteen years, largely through takeovers. Monsanto and DuPont now sell about 70 percent of all corn seed in the U.S. In 2013, farmers paid about $118 an acre for corn seed, up 166 percent from the inflation-adjusted cost of $45 an acre in 2005, according to Purdue University estimates. The seed companies say the higher prices reflect the benefits of using their genetically modified seeds, including bigger crops and resistance to insects and weed-killing sprays that have helped reduce the usage of harmful pesticides.

Sources: Jacob Bunge, "On the Farm Data Harvesting Sows Seeds of Mistrust," *Wall Street Journal*, February 25, 2014; Michael Hickins, "For Small Farmers, Big Data Adds Modern Problems to Ancient Ones," *Wall Street Journal*, February 25, 2014; www.monsanto.com, accessed March 4, 2014; Drake Bennett, "Inside Monsanto, America's Third-Hated Company," Business Week, July 3, 2014; and Christopher Eutaw, "The Biggest Revolution Since Louis XVI Was Beheaded," Capital Hill Daily, February 27, 2014.

CASE STUDY QUESTIONS

12-12 List and describe the technologies used in this case study.

12-13 How do the systems described in this case provide operational intelligence?

12-14 How does predictive planting support decision making? Identify three different decisions that can be supported.

12-15 How helpful is predictive planting to individual farmers and the agricultural industry? Explain your answer.

MyMISLab

Go to **mymislab.com** for the following Assisted-graded writing questions:

12-16 Identify and describe three factors that prevent managers from making good decisions.

12-17 Give three examples of data used in location analytics and explain how each can help businesses.

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