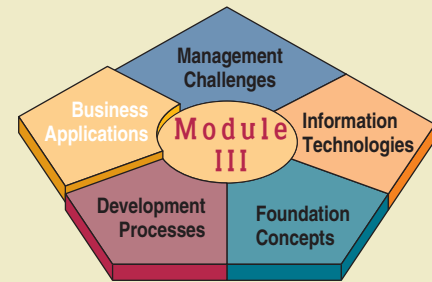


CHAPTER 9



e-COMMERCE SYSTEMS

Chapter Highlights

Section I e-Commerce Fundamentals

Introduction to e-Commerce

The Scope of e-Commerce

Real World Case: Sony, 1-800-Flowers, Starbucks, and Others: Social Networks, Mobile Phones, and the Future of Shopping

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Real World Case: Entellium, Digg, Peerflix, Zappos, and Jigsaw: Success for Second Movers in e-Commerce

Real World Case: KitchenAid and the Royal Bank of Canada: Do You Let Your Brand Go Online All by Itself?

Learning Objectives

1. Identify the major categories and trends of e-commerce applications.
2. Identify the essential processes of an e-commerce system, and give examples of how it is implemented in e-commerce applications.
3. Identify and give examples of several key factors and Web store requirements needed to succeed in e-commerce.
4. Identify and explain the business value of several types of e-commerce marketplaces.
5. Discuss the benefits and trade-offs of several e-commerce clicks-and-bricks alternatives.

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SECTION I

e-Commerce Fundamentals

Introduction to e-Commerce

E-commerce is changing the shape of competition, the speed of action, and the streamlining of interactions, products, and payments from customers to companies and from companies to suppliers.

For most companies today, **electronic commerce** is more than just buying and selling products online. Instead, it encompasses the entire online process of developing, marketing, selling, delivering, servicing, and paying for products and services transacted on inter-networked, global marketplaces of customers, with the support of a worldwide network of business partners. In fact, many consider the term “e-commerce” to be somewhat antiquated. Given that many young businesspeople have grown up in a world in which online commerce has always been available, it may soon be time to eliminate the distinction between e-commerce and e-business and accept that it is all just “business as usual.” Until then, we will retain the term “e-commerce” because it allows for a clearer picture of the differences between online and more traditional business transactions.

As we will see in this chapter, e-commerce systems rely on the resources of the Internet and many other information technologies to support every step of this process. We will also see that most companies, large and small, are engaged in some form of e-commerce activities. Therefore, developing an e-commerce capability has become a competitive necessity for most businesses in today’s marketplace.

Read the Real World Case on the next page. We can learn a lot about new ways to reach customers using technology from this case. See Figure 9.1.

The Scope of e-Commerce

Figure 9.2 illustrates the range of business processes involved in the marketing, buying, selling, and servicing of products and services in companies that engage in e-commerce. Companies involved in e-commerce as either buyers or sellers rely on Internet-based technologies and e-commerce applications and services to accomplish marketing, discovery, transaction processing, and product and customer service processes. For example, e-commerce can include interactive marketing, ordering, payment, and customer support processes at e-commerce catalog and auction sites on the World Wide Web. However, e-commerce also includes e-business processes such as extranet access of inventory databases by customers and suppliers (transaction processing), intranet access of customer relationship management systems by sales and customer service reps (service and support), and customer collaboration in product development via e-mail exchanges and Internet newsgroups (marketing/discovery).

The advantages of e-commerce allow a business of virtually any size that is located virtually anywhere on the planet to conduct business with just about anyone, anywhere. Imagine a small olive oil manufacturer in a remote village in Italy selling its wares to major department stores and specialty food shops in New York, London, Tokyo, and other large metropolitan markets. The power of e-commerce allows geographical barriers to disappear, making all consumers and businesses on earth potential customers and suppliers.

e-Commerce Technologies

Which technologies are necessary for e-commerce? The short answer is that most information technologies and Internet technologies that we discuss in this text are, in some form, involved in e-commerce systems. A more specific answer is illustrated in Figure 9.3, which gives an example of the technology resources required by many e-commerce systems. The figure illustrates some of the hardware, software, data, and network components used by FreeMarkets Inc. to provide business-to-business (B2B) online auction e-commerce services.

REAL WORLD

CASE

1

Sony, 1-800-Flowers, Starbucks, and Others: Social Networks, Mobile Phones, and the Future of Shopping

A number of major retailers have been driven into bankruptcy protection during this recession, including RedEnvelope and Eddie Bauer, or gone out of business altogether, like Circuit City. Blockbuster, Virgin Megastores, and many more have closed stores. Survivors, suffering deflated profits and slow sales, warn of a bleak future.

But smart retailers are going where it's warm: the hot little hands of cellphone- and laptop-toting consumers who want to shop right now, wherever they happen to be sipping their lattes or watching their kids' soccer games. Technology-backed projects to increase revenue include mobile e-commerce, coupons by text message, and even storefronts on social networks. As enablers of these projects, CIOs are moving ever closer to the customer.

"Out of recession develops one picture—finally—of what true business-IT alignment looks like," says Drew Martin, CIO of Sony Electronics. "IT is becoming part of the product offerings." Whether that's hotel kiosks, mobile banking, hospital patient portals, or retail, CIOs are getting their IT groups to the front line in the competition for consumer dollars. When a customer logs on to his new Sony e-book reader, for example, the device automatically connects him to his existing customer profile, from which he can start buying e-books. This feature is available thanks to Martin's efforts to connect product development with Sony's internal customer relationship management system.

As exciting as it is to live on the progressive edge of the CIO profession, though, it's a new world to navigate at a time when wrong moves can severely hurt a company. "The challenge is that now you're entering into the revenue space,"

FIGURE 9.1



Companies are expanding from Web sites and email into new ways of reaching consumers through innovative uses of technology.

Source: © Alex Segre/Alamy.

Martin says. "You need to commit to delivering your part of what needs to be delivered."

"Web sites and e-mail—that's just too many steps now," says Brett Michalak, CIO with Tickets.com, which sells tickets to games, concerts, and other events, as well as having its own ticketing technology.

Social media such as Twitter, Facebook, and YouTube take e-mail out of the equation, putting offers in front of customers on sites they already visit. Dell, JetBlue, Whole Foods, and other big brands have pounced on Twitter as a marketing and promotion tool, tweeting special deals to followers. Dell, for example, attributes more than \$2 million in sales to its 14 Twitter accounts that promote offers to 1.4 million followers. ("15 percent off any Dell Outlet Inspiron laptop. Enter code at checkout . . .")

Sony is using Twitter, among other social networking sites, to hype the SonyReader. A recent tweet included a link to a page at Sony's site comparing the product favorably to Amazon's Kindle. "You can't build a site and expect people to come. We are on YouTube, Facebook, and Twitter to go out and get them," Martin says.

1-800-Flowers intends to find out whether social networkers are also social shoppers. In July 2009, the \$714-million flower delivery company launched the first Facebook storefront. Collectively, Facebook's 300 million active members spend eight billion minutes per day on the site, according to the company. An Experian survey found that dwell time for an adult visiting a social network is 19 minutes and 32 seconds. Meanwhile, 35 percent of adults who had been on a social network in the past month had also bought something online in that time period, the survey found—a ripe demographic.

"Still, there's a lot to do on Facebook, so any shopping has to be fast," says Vibhav Prasad, vice president of Web marketing and merchandising at 1-800-Flowers.

The company's Facebook store, therefore, offers only 10 percent to 15 percent of the several hundred bouquets available from the main 1-800-Flowers Web site, and the checkout process has been pared down. No suggestions to buy related products pop up, for example, and four special-occasion tabs span the top of the page, instead of the eight on the main site.

"It's a fairly impulsive purchase in this channel," Prasad says. "As simple and as quick as we can make it, the more effective we'll be." Impulsiveness is key. Every time Facebook members log in, they see updates about who among their friends is having a birthday. Prasad wants those regular reminders to spark flower buys. Going social was "a logical extension" for 1-800-Flowers, which was one of the first retailers to put up an e-commerce site in the early 1990s, notes Kevin Ranford, director of Web marketing. "It comes from listening to customers and responding to the channels in which they're interacting," Ranford says.

Facebook users spend most of their time looking at their own home pages. They read their news feed—a display of their friends' status updates, quizzes taken, notes posted, and

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games played. So, 1-800-Flowers is planning a way into the news feed. When a fan fills out a wish list to indicate which flowers she'd like to receive, notification goes into the feeds of her friends. Carol logs on to Facebook, sees that Alice has a birthday on Thursday and wishes for the "Pleasantly Pink" bouquet. Ding! Carol clicks over to the 1-800-Flowers store and \$29.99-plus-shipping later, takes care of that gift without ever leaving Facebook. "We think people will do it because social networking is all about you expressing your interests and your friends responding," says Wade Gerten, CEO of Alvenda, the Minneapolis software developer that built the Facebook store for 1-800-Flowers. "Shopping online can be social again, as it was in person."

People lose their credit cards and forget their wallets. But cell phones? There is perhaps no combination of vices so bursting with commercial promise than that of cell phone-plus-coffee. Starbucks is there. In September 2009, the \$9.8 billion coffee chain began testing a system to let customers pay using their iPhones or iPod touch devices. They download the Starbucks Card Mobile App and type in the number of their Starbucks loyalty card, preloaded with spending money. A 2-D bar code appears that cashiers can scan.

Royal Oak Music Theatre, a Michigan music and comedy venue that has featured such acts as Train and Bob Saget, started mobile ticketing three years ago and has adjusted its marketing to cover for finicky technology.

Anyone who's done self-checkout at the supermarket knows that scanning takes a special, knowing touch. Still, scanning bar codes on the screens of mobile devices often requires extra wiggling of the phone and slanting it at different angles. It's slower than scanning paper tickets. To avoid ticking off patrons lined up to run in and grab general-admission floor spots, Royal Oak created a separate VIP entrance for the mobile customers. There, staff use the newer model scanners required for reading mobile bar codes, and it's not so apparent that the scanning takes longer, says Diana Williams, box office manager.

Mobile customers are also allowed to get into the theater a few minutes before traditional customers, which encourages more people to buy their tickets by cell phone, she says. That's cheaper for the theater than handling paper tickets;

saving money and hassle time is Williams' goal. But it also positions the theater well for collecting future revenue.

"Mobile ticketing skews young," Williams observes. The theater does shows for all ages, and for a typical adult event, 16 percent of tickets sold are through the mobile channel. But for a recent show by the boy-band Hansen, popular with tween girls, mobile accounted for nearly 40 percent of tickets. "There's an age—around 22 or younger—where it would never occur to patrons that you couldn't buy a ticket from your phone," Williams says.

Mobile and social commerce projects will change the business of any company that invests in it, says Russ Stanley, managing vice president of ticket services and client relations for the San Francisco Giants. For example, instead of being a long-planned activity, a Major League Baseball game can become an impulse buy, Stanley says, bringing in more sales for the organization.

Every game day, the Giants have 40,000 seats to sell. If they've sold only 30,000, 10,000 spoil every bit as badly as old pears. Last year, the team changed prices daily on about 2,000 seats. Stanley imagines the day when he'll have a database of fans who, say, live within a mile of the ballpark to whom he can text last-minute offers. "Hey, the Giants have \$5 tickets left for tonight. For \$5, I'll walk down there," he says. "As they're walking up to the entrance, they're buying on the mobile."

The Giants started to offer mobile tickets midway through the 2008 season, when they sold about 100 tickets that way per game. In 2009, it was about 200 and Stanley expects to do about 400 per game in the coming years. "Fans who use it love it. It's getting the people to use it," he says.

Like hot dogs and cold beer, holding a ticket is part of the rite of baseball, he says. Plus, there's the souvenir value. When pitcher Jonathan Sanchez threw a no-hitter against the San Diego Padres in July 2009, about 50 mobile fans, as well as people who had bought tickets online and printed them on plain paper at home, later requested the team print "real" tickets for them to commemorate the event. "We did that for them. It's good relations," says Stanley. And, he adds, it could turn into a money-making service in the future.

Source: Adapted from Kim S. Nash, "Facebook, Mobile Phones, and the Future of Shopping," *CIO.com*, November 24, 2009.

CASE STUDY QUESTIONS

1. How do the companies involved benefit from the innovations discussed in the case? Is it about more efficient transaction processing, better reaching out to customers, or both?
2. Use examples from the case to illustrate your answer.
3. "Shopping online can be social again, as it was in person," says Wade Gerten, CEO of Alvenda. Do you think this is a stretch, or are we in the midst of a turning point in online shopping? Explain your answer.
4. Many of the applications discussed in the case are mostly used by the younger demographic, who grew up around technology. How do online behavior patterns change as they become older, with more responsibilities, and more challenging jobs? Do applications like those discussed in the case become less important? More important?

REAL WORLD ACTIVITIES

1. Consider the examples discussed in the case. Go online and research what other companies or industries are doing in terms of the use of social networking sites and mobile commerce. What other examples can you find? Prepare a report that compares those in your research with the ones described here, highlighting similarities and differences. Can you spot any new trends?
2. How often, if ever, do you shop with your mobile phone? What do you think are some of the roadblocks that prevent the widespread adoption of mobile shopping?
3. What would you suggest companies do to overcome those? Break into small groups with your classmates to develop a few recommendations.

FIGURE 9.2 E-commerce involves accomplishing a range of business processes to support the electronic buying and selling of goods and services.

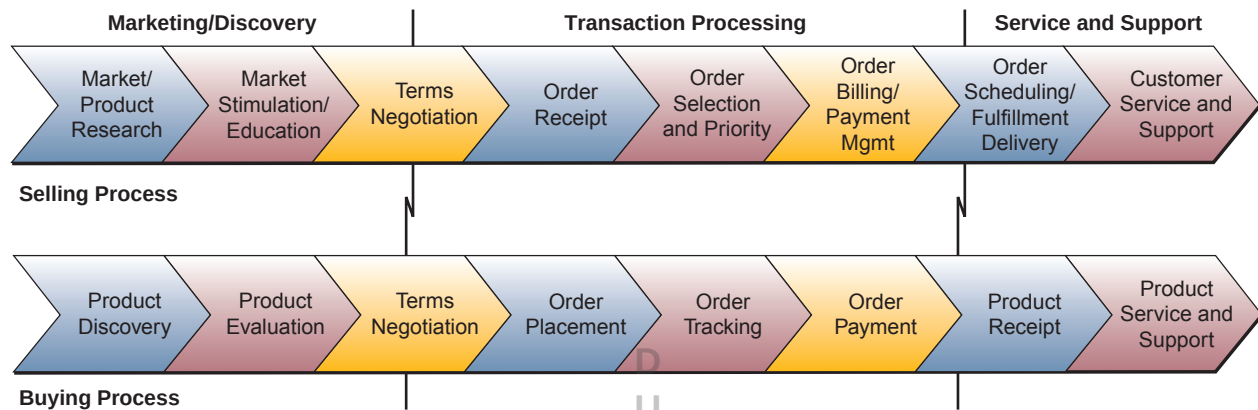
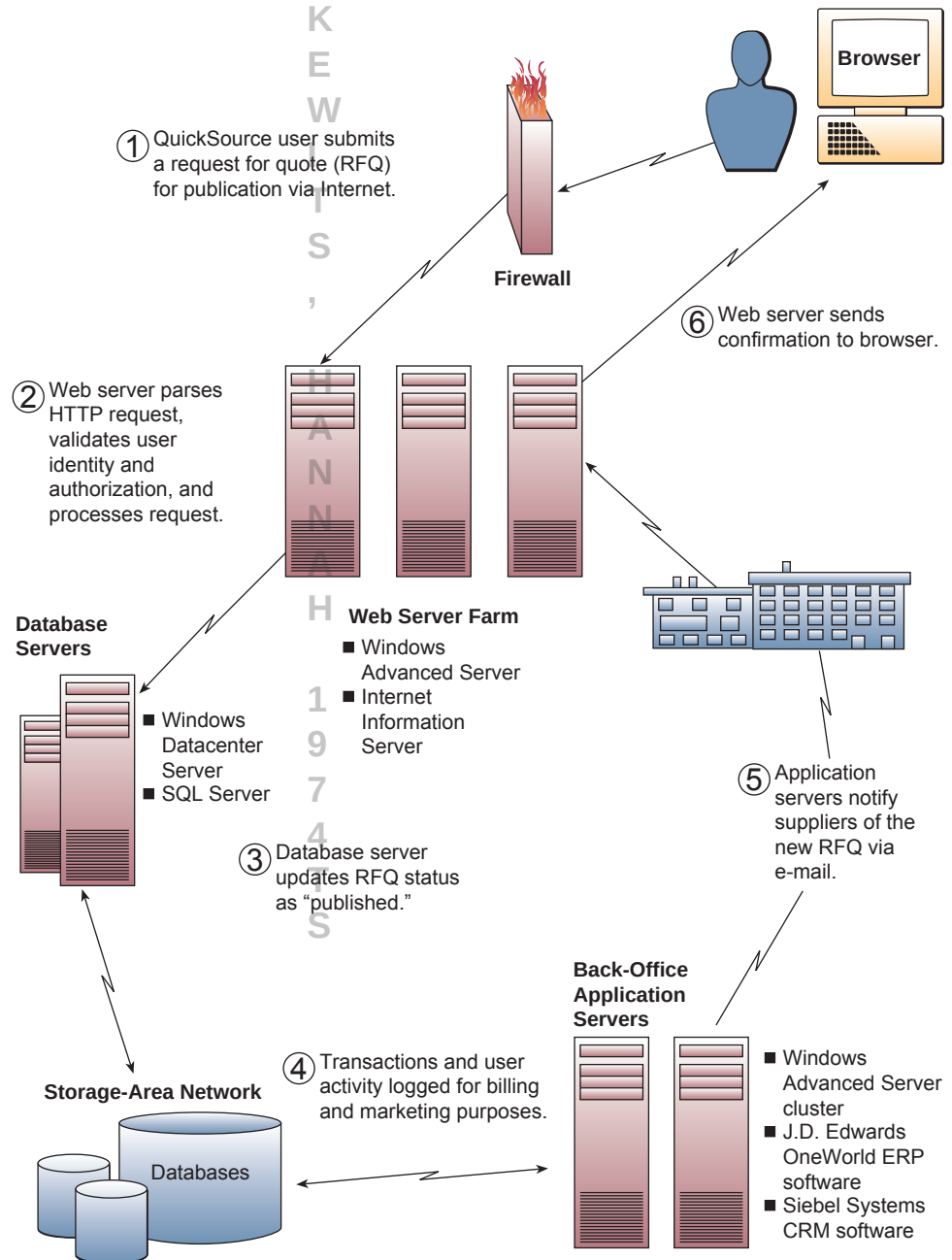


FIGURE 9.3

The hardware, software, network, and database components and IT architecture of B2B online auctions provider FreeMarkets Inc. are illustrated in this example of its Internet-based QuickSource auction service.



Forrester: Web 2.0 Has a Bright Future

As a standard enterprise tool, Web 2.0 has a bright future, one for which companies are expected to spend \$4.6 billion by 2013 to integrate into their corporate computing environments, according to a Forrester Research report. Though still considered an upstart technology, Forrester believes that conventional Web 2.0 elements—social networking, RSS, blogs, wikis, mashups, podcasting, and widgets—are fast becoming the norm for communicating with employees and customers. The report highlights megacompanies such as General Motors, McDonald's, Northwestern Mutual Life Insurance, and Wells Fargo among those who have already jumped into the Web 2.0 pool with both feet. In addition, some 56 percent of North American and European enterprises consider Web 2.0 to be a priority.

"If I wanted to be anywhere in the Web 2.0 economy, I'd want to be on the enterprise side," says report author and Forrester Research analyst Oliver Young. "We're seeing enterprise-class software coming from startups, but we're seeing them through very low price points . . . so it [Web 2.0] will never be a mega market," says Young. "It will eventually disappear into the fabric of the enterprise, despite the major effects the technology will have on how businesses market their products and optimize their workforces."

The consumer-facing ad-funded Web 2.0 sites like Facebook, MySpace, and Delicious will also have difficulty as similar technologies are incorporated into the enterprise. "Even Google is having a hard time selling the advertising," Young said. Still, start-ups have much to gain in pursuing the Web 2.0 world, such as understanding how companies are adopting their technology. Small groups within a company are more likely to adopt blogs, wikis, mashups, and widgets. The key to adoption, he adds, is to show how there is a business value in using the Web 2.0 tools. "Web 2.0 is not a critical 'must have' for any company at this point, but it's more than likely that your competition is using it and is showing faster results because of it."

Source: Adapted from Michael Singer, "Web 2.0: Companies Will Spend \$4.6 Billion by 2013, Forrester Predicts," *InformationWeek*, April 21, 2008.

Categories of e-Commerce

Many companies today are participating in or sponsoring four basic categories of e-commerce applications: **business-to-consumer**, **business-to-business**, **consumer-to-consumer** and business-to-government e-commerce. Note: We do not explicitly cover business-to-government (B2G) and *e-government* applications because they are beyond the scope of this text, but many e-commerce concepts apply to such applications.

Business-to-Consumer (B2C) e-Commerce. In this form of e-commerce, businesses must develop attractive electronic marketplaces to sell products and services to consumers. For example, many companies offer e-commerce Web sites that provide virtual storefronts and multimedia catalogs, interactive order processing, secure electronic payment systems, and online customer support. The B2C marketplace is growing like a wildfire but still remains the tip of the iceberg when compared with all online commerce.

Consumer-to-Consumer (C2C) e-Commerce. The huge success of online auctions like eBay, where consumers (as well as businesses) can buy from and sell to one another in an auction process at an auction Web site, makes this e-commerce model an important e-commerce business strategy. Thus, participating in or sponsoring consumer or business auctions is an important e-commerce alternative for B2C, C2B (consumer-to-business), or B2B e-commerce. Electronic personal advertising of

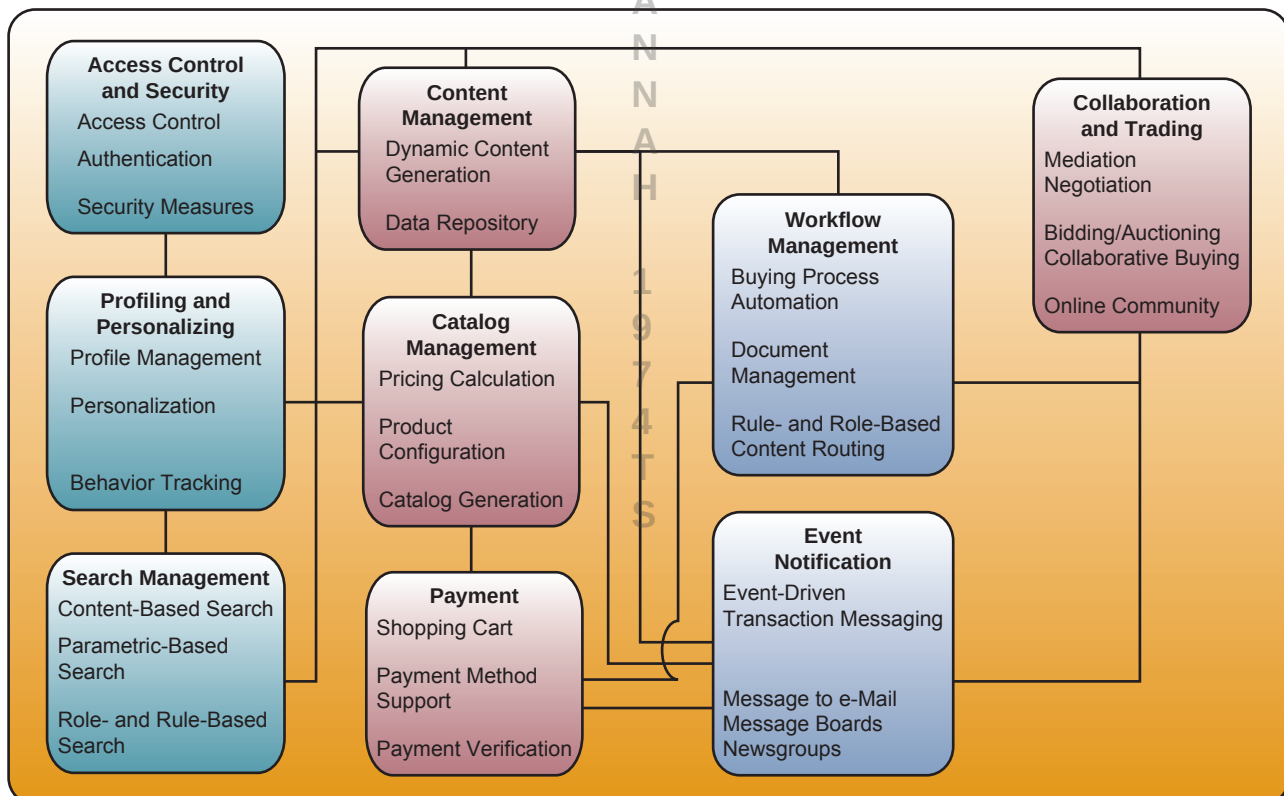
products or services to buy or sell by consumers at electronic newspaper sites, consumer e-commerce portals, or personal Web sites is also an important form of C2C e-commerce.

Business-to-Business (B2B) e-Commerce. If B2C activities are the tip of the iceberg, B2B represents the part of the iceberg that is under the water—the biggest part. This category of e-commerce involves both e-business marketplaces and direct market links between businesses. For example, many companies offer secure Internet or extranet e-commerce catalog Web sites for their business customers and suppliers. Also very important are B2B e-commerce portals that provide auction and exchange marketplaces for businesses. Others may rely on electronic data interchange (EDI) via the Internet or extranets for computer-to-computer exchange of e-commerce documents with their larger business customers and suppliers.

Essential e-Commerce Processes

The essential **e-commerce processes** required for the successful operation and management of e-commerce activities are illustrated in Figure 9.4. This figure outlines the nine key components of an *e-commerce process architecture* that is the foundation of the e-commerce initiatives of many companies today. We concentrate on the role these processes play in e-commerce systems, but you should recognize that many of these components may also be used in internal, noncommerce e-business applications. An example would be an intranet-based human resource system used by a company's employees, which might use all but the catalog management and product payment processes shown in Figure 9.4. Let's take a brief look at each essential process category.

FIGURE 9.4 This e-commerce process architecture highlights nine essential categories of e-commerce processes.



Access Control and Security

E-commerce processes must establish mutual trust and secure access between the parties in an e-commerce transaction by authenticating users, authorizing access, and enforcing security features. For example, these processes establish that a customer and e-commerce site are who they say they are through user names and passwords, encryption keys, or digital certificates and signatures. The e-commerce site must then authorize access to only those parts of the site that an individual user needs to accomplish his or her particular transactions. Thus, you usually will be given access to all resources of an e-commerce site except for other people's accounts, restricted company data, and Web master administration areas. Companies engaged in B2B e-commerce may rely on secure industry exchanges for procuring goods and services or Web trading portals that allow only registered customers to access trading information and applications. Other security processes protect the resources of e-commerce sites from threats such as hacker attacks, theft of passwords or credit card numbers, and system failures. We discuss many of these security threats and features in Chapter 13.

Profiling and Personalizing

Once you have gained access to an e-commerce site, profiling processes can occur that gather data on you and your Web site behavior and choices, as well as build electronic profiles of your characteristics and preferences. User profiles are developed using profiling tools such as user registration, cookie files, Web site behavior tracking software, and user feedback. These profiles are then used to recognize you as an individual user and provide you with a personalized view of the contents of the site, as well as product recommendations and personalized Web advertising as part of a *one-to-one marketing* strategy. Profiling processes are also used to help authenticate your identity for account management and payment purposes and gather data for customer relationship management, marketing planning, and Web site management. Some of the ethical issues in user profiling are discussed in Chapter 13.

Search Management

Efficient and effective search processes provide a top e-commerce Web site capability that helps customers find the specific product or service they want to evaluate or buy. E-commerce software packages can include a Web site search engine component, or a company may acquire a customized e-commerce search engine from search technology companies like Google and Requisite Technology. Search engines may use a combination of search techniques, including searches based on content (e.g., a product description) or parameters (e.g., above, below, or between a range of values for multiple properties of a product).

Content and Catalog Management

Content management software helps e-commerce companies develop, generate, deliver, update, and archive text data and multimedia information at e-commerce Web sites. For example, German media giant Bertelsmann, part owner of BarnesandNoble.com, uses StoryServer content manager software to generate Web page templates that enable online editors from six international offices to easily publish and update book reviews and other product information, which are sold (syndicated) to other e-commerce sites.

E-commerce content frequently takes the form of multimedia catalogs of product information. As such, generating and managing catalog content is a major subset of content management, or catalog management. For example, W.W. Grainger & Co., a multibillion-dollar industrial parts distributor, uses the CenterStage catalog management software suite to retrieve data from more than 2,000 supplier databases, standardize the data, translate it into HTML or XML for Web use, and organize and enhance the data for speedy delivery as multimedia Web pages at its www.grainger.com Web site.

Content and catalog management software works with the profiling tools we mentioned previously to personalize the content of Web pages seen by individual users. For example, Travelocity.com uses OnDisplay content manager software to push

personalized promotional information about other travel opportunities to users while they are involved in an online travel-related transaction.

Finally, content and catalog management may be expanded to include *product configuration* processes that support Web-based customer self-service and the *mass customization* of a company's products. Configuration software helps online customers select the optimum feasible set of product features that can be included in a finished product. For example, both Dell Computer and Cisco Systems use configuration software to sell built-to-order computers and network processors to their online customers.

e-Commerce Tools to Close the Deal

Nothing is as heart-wrenching to an e-tailer as watching a customer abandon a full cart just seconds before consummating the deal. To be so close yet so cashless is more than frustrating; it's harmful to an e-tailer's health. A virtual armory of tools are in use to woo, cajole, prompt, and push consumers to make the buy—but are they working, or are they turning even more customers away?

"Most fall woefully short," says Matthew Brown, senior director of e-commerce and interactive marketing at MarketNet. "Instead of focusing on using tools and technologies to help the customer, much more thought and time needs to go into Web site architecture in the first place."

Many theories are being tossed about as to why consumers turn fickle a hair short of the finish line. For each theory, there are a multitude of technological solutions. "Retailers continue to launch and test technologies and features aimed at reducing abandonment or increasing online conversion," says Jessica Ried, a director of retail strategy at Resource Interactive. "In our experience, it is difficult to know for sure if any particular one is going to be effective for a given retailer without testing it with that retailer's customer base, or at least having a solid understanding of existing customer behaviors on the site through site analytics and surveys."

Once an e-tailer understands the true obstacles to closing the deal, there are a range of tools available to clear the way to bigger profits. The most commonly deployed are live chat, pop-up discounts, and follow-up email programs; some are achieved through the standard use of cookies, others via pixel-based triggers. Third-person endorsements are also frequently used. "Hosting consumer-generated content such as ratings and reviews has typically allowed retailers to improve conversions," explains Ried, "as customers are more confident with their selections. That's because they have access to an 'unbiased' opinion, building trust rather than having to rely solely on the marketing copy on the retailer's site."

"We use Liveperson chat extensively. It has been an incredible tool for answering any last-minute doubts during the last few states of the transaction," notes Adrian Salamunovic, cofounder of DNA 11, a multimillion-dollar e-commerce art retailer. "Our average transaction is over US\$500, so this is very important to us."

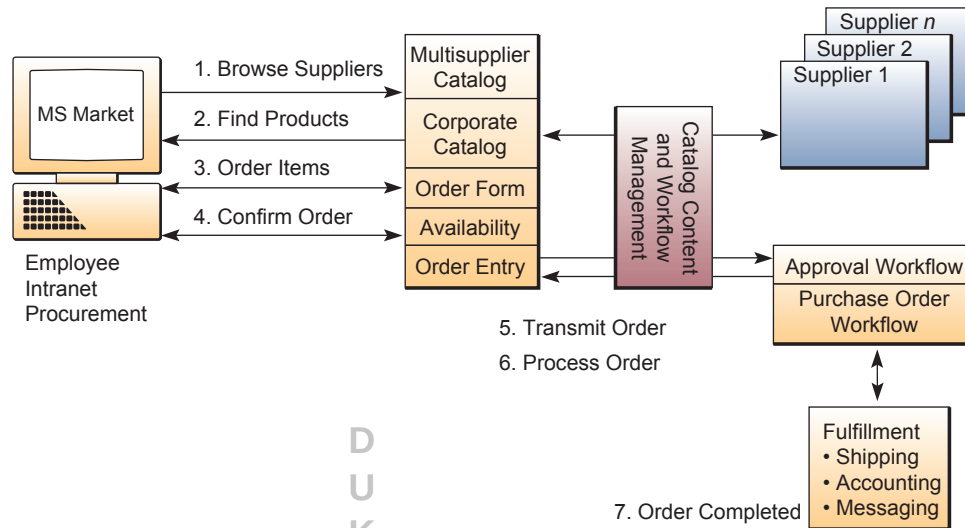
"It pays for itself many times over each month," he adds. "For us, interrupting the client with pop-ups or invitations to chat really doesn't work—in fact, it does the opposite. We've watched customers bounce (exit) quite quickly after being interrupted with pop-ups."

Therein lies the conundrum. No two customers are identical. At least some personalized customization is essential. There is a point, however, at which actions considered helpful by the retailer are perceived as intrusive by the consumer. "Some customers welcome the help; others are unnerved by the Big Brother effect it can suggest," says Resource Interactive's Ried. "Start by considering what is known about consumer behavior in evaluating which technologies, features, and functionalities to explore first."

Source: Adapted from Pam Baker, "Rescuing the e-Commerce Deal When the Customer's Walking Away," *E-Commerce Times*, April 24, 2009.

FIGURE 9.5

The role of catalog/content management and workflow management in a Web-based procurement process: the MS Market system used by Microsoft Corp.



Workflow Management

Many of the business processes in e-commerce applications can be managed and partially automated with the help of workflow management software. E-business workflow systems for enterprise collaboration help employees electronically collaborate to accomplish structured work tasks within knowledge-based business processes. Workflow management in both e-business and e-commerce depends on a *workflow software engine* containing software models of the business processes to be accomplished. The workflow models express the predefined sets of business rules, roles of stakeholders, authorization requirements, routing alternatives, databases used, and sequence of tasks required for each e-commerce process. Thus, workflow systems ensure that the proper transactions, decisions, and work activities are performed, and the correct data and documents are routed to the right employees, customers, suppliers, and other business stakeholders.

As many of you begin your business careers, you will be charged with the responsibility of driving cost out of existing business processes while maintaining or improving the effectiveness of those processes. As you continue to acquire a greater appreciation for, and understanding of, how technology can benefit business, you will explore workflow management as the key to this optimization of cost and effectiveness throughout the business.

For example, Figure 9.5 illustrates the e-commerce procurement processes of the MS Market system of Microsoft Corp. Microsoft employees use its global intranet and the catalog/content management and workflow management software engines built into MS Market to purchase electronically more than \$3 billion annually of business supplies and materials from approved suppliers connected to the MS Market system by their corporate extranets.

Microsoft Corporation: e-Commerce Purchasing Processes

MS Market is an internal e-commerce purchasing system that works on Microsoft's intranet. MS Market has drastically reduced the personnel required to manage low-cost requisitions and gives employees a quick, easy way to order materials without being burdened with paperwork and bureaucratic processes. These high-volume, low-dollar transactions represent about 70 percent of total volume but only 3 percent of Microsoft's accounts payable. Employees were wasting time turning requisitions into purchase orders (POs) and trying to follow business rules and processes. Managers wanted to streamline this process, so the decision was made to create a requisitioning tool that would take all the controls and validations used by requisitioning personnel and push them onto the Web. Employees wanted an easy-to-use online form for ordering supplies that included extranet interfaces to procurement partners, such as Boise Cascade and Marriott.

How does this system work? Let's say a Microsoft employee wants a technical book. He goes to the MS Market site on Microsoft's intranet, and MS Market immediately identifies his preferences and approval code through his log-on ID. The employee selects the Barnes & Noble link, which brings up a catalog, order form, and a list of hundreds of books with titles and prices that have been negotiated between Microsoft buyers and Barnes & Noble. He selects a book, puts it in the order form, and completes the order by verifying his group's cost center number and manager's name.

The order is transmitted immediately to the supplier, cutting down on delivery time, as well as accounting for the payment of the supplies. Upon submission of the order, MS Market generates an order tracking number for reference, sends notification via e-mail to the employee's manager, and transmits the order over the Internet to Barnes & Noble for fulfillment. In this case, since the purchase total is only \$40, the manager's specific approval is not required. Two days later, the book arrives at the employee's office. Thus, MS Market lets employees easily order low-cost items in a controlled fashion at a low cost, without going through a complicated PO approval process.

Source: Adapted from Microsoft IT Showcase, "MS Market: Business Case Study," 2002.

Event Notification

Most e-commerce applications are *event-driven* systems that respond to a multitude of events—from a new customer's first Web site access, to payment and delivery processes, to innumerable customer relationship and supply chain management activities. That is why event notification processes play an important role in e-commerce systems; customers, suppliers, employees, and other stakeholders must be notified of all events that might affect their status in a transaction. **Event notification** software works with workflow management software to monitor all e-commerce processes and record all relevant events, including unexpected changes or problem situations. Then it works with user-profiling software to notify all involved stakeholders automatically of important transaction events using appropriate user-preferred methods of electronic messaging, such as e-mail, newsgroup, pager, and fax communications. This notification includes a company's management, who then can monitor their employees' responsiveness to e-commerce events and customer and supplier feedback.

For example, when you purchase a product at a retail e-commerce Web site like Amazon.com, you automatically receive an e-mail record of your order. Then you may receive e-mail notifications of any change in product availability or shipment status and, finally, an e-mail message notifying you that your order has been shipped and is complete.

Collaboration and Trading

This major category of e-commerce processes consists of those that support the vital collaboration arrangements and trading services needed by customers, suppliers, and other stakeholders to accomplish e-commerce transactions. Thus, in Chapter 2, we discussed how a customer-focused e-business uses tools such as e-mail, chat systems, and discussion groups to nurture online *communities of interest* among employees and customers to enhance customer service and build customer loyalty in e-commerce. The essential collaboration among business trading partners in e-commerce may also be provided by Internet-based trading services. For example, B2B e-commerce Web portals provided by companies like Ariba and Commerce One support matchmaking, negotiation, and mediation processes among business buyers and sellers. In addition, B2B e-commerce is heavily dependent on Internet-based trading platforms and portals that provide online exchange and auctions for e-business enterprises. Therefore, the online auctions and exchanges developed by companies like FreeMarkets are revolutionizing the procurement processes of many major corporations. We will discuss these and other e-commerce applications in Section II.

Electronic Payment Processes

Web Payment Processes

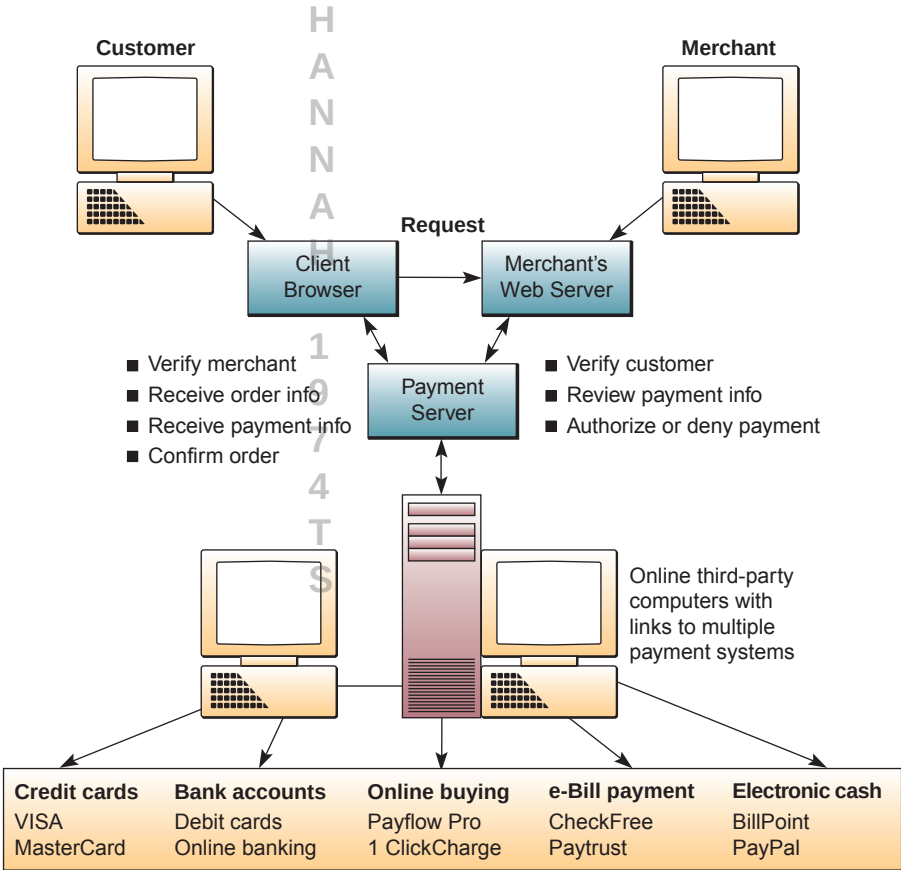
Electronic Funds Transfer

Payment for the products and services purchased is an obvious and vital set of processes in e-commerce transactions. Payment processes, however, are not simple because of the nearly anonymous electronic nature of transactions taking place between the networked computer systems of buyers and sellers and the many security issues involved. E-commerce payment processes are also complex because of the wide variety of debit and credit alternatives, as well as the financial institutions and intermediaries that may be part of the process. Therefore, a variety of **electronic payment systems** have evolved over time. In addition, new payment systems are being developed and tested to meet the security and technical challenges of e-commerce over the Internet.

Most e-commerce systems on the Web involving businesses and consumers (B2C) depend on credit card payment processes, but many B2B e-commerce systems rely on more complex payment processes based on the use of purchase orders, as was illustrated in Figure 9.5. However, both types of e-commerce typically use an electronic *shopping cart* process, which enables customers to select products from Web site catalog displays and put them temporarily in a virtual shopping basket for later checkout and processing. Figure 9.6 illustrates and summarizes a B2C electronic payment system with several payment alternatives.

Electronic funds transfer (EFT) systems are a major form of electronic payment systems in banking and retailing industries. EFT systems use a variety of information technologies to capture and process money and credit transfers between banks and businesses and their customers. For example, banking networks support teller terminals at all bank offices and automated teller machines (ATMs) at locations throughout the world. Banks, credit card companies, and other businesses may support pay-by-phone services. Very popular also are Web-based payment services, such as PayPal and BillPoint for cash transfers, and CheckFree and Paytrust for automatic bill payment,

FIGURE 9.6
An example of a secure electronic payment system with many payment alternatives.



Secure Electronic Payments

that enable the customers of banks and other bill payment services to use the Internet to pay bills electronically. In addition, most point-of-sale terminals in retail stores are networked to bank EFT systems, which makes it possible for you to use a credit card or debit card to pay instantly for gas, groceries, or other purchases at participating retail outlets.

When you make an online purchase on the Internet, your credit card information is vulnerable to interception by *network sniffers*, software that easily recognizes credit card number formats. Several basic security measures are being used to solve this security problem: (1) encrypt (code and scramble) the data passing between the customer and merchant, (2) encrypt the data passing between the customer and the company authorizing the credit card transaction, or (3) take sensitive information off-line. Note: Because encryption and other security issues are discussed in Chapter 13, we will not explain how they work in this section.

For example, many companies use the Secure Socket Layer (SSL) security method developed by Netscape Communications that automatically encrypts data passing between your Web browser and a merchant's server. However, sensitive information is still vulnerable to misuse once it's decrypted (decoded and unscrambled) and stored on a merchant's server, so a digital wallet payment system was developed. In this method, you add security software add-on modules to your Web browser. That enables your browser to encrypt your credit card data in such a way that only the bank that authorizes credit card transactions for the merchant gets to see it. All the merchant is told is whether your credit card transaction is approved or not.

The Secure Electronic Transaction (SET) standard for electronic payment security extends this digital wallet approach. In this method, software encrypts a digital envelope of digital certificates specifying the payment details for each transaction. VISA, MasterCard, IBM, Microsoft, Netscape, and most other industry players have agreed to SET. Therefore, a system like SET may become the standard for secure electronic payments on the Internet. See Figure 9.7.

FIGURE 9.7

VeriSign provides electronic payment, security, and many other e-commerce services.



Source: Courtesy of VeriSign Inc.

SECTION II

e-Commerce Applications and Issues

E-commerce is here to stay. The Web and e-commerce are key industry drivers. It's changed how many companies do business. It's created new channels for our customers. Companies are at the e-commerce crossroads, and there are many ways to go.

Thus, e-commerce is changing how companies do business both internally and externally with their customers, suppliers, and other business partners. As managers confront a variety of e-commerce alternatives, the way companies apply e-commerce to their businesses is also subject to change. The applications of e-commerce by many companies have gone through several major stages as e-commerce matures in the world of business. For example, e-commerce between businesses and consumers (B2C) moved from merely offering multimedia company information at corporate Web sites (*brochureware*) to offering products and services at Web storefront sites via electronic catalogs and online sales transactions. B2B e-commerce, in contrast, started with Web site support to help business customers serve themselves, and then moved toward automating intranet and extranet procurement systems. One of the most important things to understand about e-commerce is that by converting a business model from bricks and mortar to an e-commerce approach, the transaction costs (i.e., the costs of doing business with a customer or supplier) drop dramatically. Thus, anything that can be digital will be digital.

Read the Real World Case on the next page. We can learn a lot from this example about the challenges and opportunities faced by companies attempting to conduct online marketing campaigns. See Figure 9.8.

e-Commerce Trends

Figure 9.9 illustrates some of the trends taking place in the e-commerce applications that we introduced at the beginning of this section. Notice how B2C e-commerce moves from simple Web storefronts to interactive marketing capabilities that provide a personalized shopping experience for customers, and then toward a totally integrated Web store that supports a variety of customer shopping experiences. B2C e-commerce is also moving toward a self-service model in which customers configure and customize the products and services they wish to buy, aided by configuration software and online customer support as needed.

B2B e-commerce participants moved quickly from self-service on the Web to configuration and customization capabilities and extranets connecting trading partners. As B2C e-commerce moves toward full-service and wide-selection retail Web portals, B2B is also trending toward the use of e-commerce portals that provide catalog, exchange, and auction markets for business customers within or across industries. Of course, both of these trends are enabled by e-business capabilities like customer relationship management and supply chain management, which are the hallmarks of the customer-focused and inter-networked supply chains of a fully e-business-enabled company.

Business-to-Consumer e-Commerce

E-commerce applications that focus on the consumer share an important goal: to attract potential buyers, transact goods and services, and build customer loyalty through individual courteous treatment and engaging community features.

What does it take to create a successful B2C e-commerce business venture? That's the question that many are asking in the wake of the failures of many pure B2C *dot-com* companies. One obvious answer would be to create a Web business initiative that offers attractive products or services of great customer value, with a business plan based on realistic forecasts of profitability within the first year or two of operation—a condition that was lacking in many failed dot-coms. Such failures, however, have not stemmed the tide of millions of businesses, both large and small, that are moving at least part of

REAL WORLD

CASE

2

LinkedIn, Umbria, Mattel, and Others: Driving the “Buzz” on the Web

David Hahn has spotted a trend. As director of advertising for the popular online business networking site LinkedIn, he’s being asked pointed questions by large advertisers about his ability to help them find “influentials”—those people within the LinkedIn community who are the most likely to go out and spread the word about a particular product or experience. “Some of them are requesting it specifically, while others are more implying it, but it comes down to the same thing,” Hahn says. “Marketers are very interested in the value of online social networks, and how leaders in those networks can be used to drive proactive behaviors in the population.”

Hahn isn’t alone in his observations.

“The notion of the online influencer is quite the thing today in the marketing world,” says Janet Edan-Harris, CEO of Umbria, which monitors chatter in cyberspace communities for corporations wanting to know what’s being discussed online about their brands and products. “Companies are incredibly eager to get to those people. Do that—or so the conventional wisdom says—and you’ll be in marketing heaven.”

But new research, as well as growing business experience, suggests that such thinking may be overly simplistic. The effectiveness of using online word-of-mouth campaigns—or using individuals rather than traditional media advertising to spread the word about products—is increasingly viewed as an effective way to reach consumers.

But the popular notion that frequently accompanies this—that there are special individuals who hold the key to the hearts of entire online communities—is coming under fire.

Dave Balter certainly thinks so. Three years ago, Balter, CEO of BzzAgent, a word-of-mouth marketing firm, had a

revelation: The so-called “influentials,” or opinion leaders, in online communities can’t be influenced in a way that accelerates the success of a word-of-mouth campaign. “We actually believed in the idea that influentials drove market trends at that point,” says Balter. “But upon closer look, we found out it didn’t add up. The sales data of our campaigns didn’t match the profiles of the opinion leaders we had targeted, and it really caused us to re-evaluate some of our core assumptions.” Today, when a client comes in with the goal of influencing the influentials, “we tell them that’s fools’ gold,” says Balter. “It sounds really great, it sounds really sexy, but the results simply don’t fly.”

This indeed is what Edan-Harris has concluded from her experiences working with online communities. “We say, ‘Wait a minute, is this really a correct assumption, that there are individuals on the Internet that have that much influence?’” she says.

Her conclusion: “Not nearly as much as everyone seems to think.”

Despite this, companies are putting significant dollars into efforts to find these online opinion leaders, whether they’re bloggers, contributors to discussion boards, or members of online social networks. Indeed, a whole cottage industry has sprung up based upon the notion that all marketers need to kick off a successful marketing strategy with a list of Internet opinion leaders. And with the expanding universe of blogs, online communities, and social networks such as MySpace, FaceBook, and LinkedIn, the appeal of this idea has become even more entrenched. There’s a growing perception that the increasingly ubiquitous availability of broadband, coupled with the rise in popularity of blogs and online communities, makes influentials even more influential.

It’s critical to understand, however, that all of these proponents of opinion leaders as drivers of social and commercial trends aren’t talking about media stars or personalities, but about otherwise seemingly ordinary members of a community who, through accumulation of knowledge or number of connections with others, act as catalysts for change. Not surprisingly, marketers of all stripes almost at once began trying to take advantage of this—at first off-line, and now increasingly within the online social networks rising in popularity.

“The largest companies had already established influence-based programs and are now extending that model into the online social networking space,” says Matthew Hurst, a scientist at Microsoft LiveLabs who follows online marketing trends. “It’s not the notion of influence that’s new, it’s the technology that is now enabling it to a greater degree.” Not surprisingly, a rapidly increasing number of companies have leaped into the fray to help firms identify the influentials in cyberspace.

Buzzlogic is one of them. Launched in 2007, Buzzlogic is dedicated to the idea that opinion leaders in online social networks can be identified, and their influence can be measured.

An early Buzzlogic beta customer is Protuo.com, a Web-based career management portfolio service that provides

FIGURE 9.8



Online opinion leaders may be tapping into underlying trends that are critical to marketers.

matchmaking between employers and potential employees. Not having the funds to buy expensive marketing spots in TV, radio, or mainstream print media, Jennifer Gerlach, vice president of marketing, hired Buzzlogic to find the people who are the most influential in the human resource/employee professional space, contact them, and get them to buzz about the product. “We noticed that once one blogger wrote about our service, then suddenly a bunch of other people were writing about it. All at once, there were reviewers everywhere,” says Gerlach, who just snagged a major feature in Inc. that she attributes to the online influentials campaign. She says she can map increases in site traffic precisely to blog mentions, and she views the campaign as a huge success.

But despite this apparent triumph, a steadily growing number of online marketing experts would argue that rather than being responsible for the deluge of publicity that Protuo.com is experiencing, the bloggers targeted by Buzzlogic were simply tapping into a sort of zeitgeist waiting to happen—in this case, intense interest in how the Internet could be used to bring employers and candidates together more efficiently than traditional job boards are capable of doing.

Indeed, a growing school of thought is that influentials aren’t so much leading trends as acting as mouthpieces for underlying social movements that are either already in progress or lying fallow waiting to be triggered. Thus, successful marketing doesn’t depend so much on finding influential people and seeding them with ideas as much as doing the kind of research that exposes embryo trends, and then helping influentials discover them.

This in fact is what Umbria does by focusing on tracking online conversations taking place in discussion boards and social networks as well as blogs. “It’s much more important to identify those themes that are gaining momentum than try to find opinion leaders,” says Edan-Harris. “You want to ride the wave rather than trying to start one on your own.” By listening first to the conversations and being nimble enough to use the Internet to craft campaigns that jump on an existing trend, “you get much better results than attempting to generate your own little epicenter,” she says.

Protuo.com’s Gerlach agreed with some aspects of that. “There has to be a story around your product, and that story

has to resonate in the world for the opinion leader strategy to work,” she says.

Herein lies the problem with swallowing the influentials theory whole cloth. Much of the so-called evidence of how the process works is a matter of reverse engineering. Once something happens—if there’s a best-selling book coming out of nowhere, or a surprise political upset—you can always go back to the beginning and find the event or person that seems to have triggered it. You can always tell a causal story in retrospect.

Michael Shore, vice president of worldwide consumer insights for Mattel, directs an organization that increasingly monitors blogs, social networks, discussion boards, and forums to figure out what the market might want from toys in general and Mattel products in particular. But unlike many other global consumer-brands companies, Mattel isn’t interested in simply smoking out those individuals who are inordinately influential in their online communities and pushing top-down marketing messages onto them.

Despite the fact that this has become the strategy du jour in the online world, Shore’s philosophy is a more holistic one.

“We’re not just interested in opinion leaders. We’d consider that too narrow a focus,” says Shore, who hired MarketTools.com to help him develop and get involved with online communities. Instead, he uses the online universe to do what he calls “cultural assessments” that involve analyzing language, behavioral patterns, and values. Armed with that information, Shore says, Mattel gets valuable information from the Internet that it uses to shape future product development as well as marketing campaigns.

If there’s one thing that everyone agrees on, it’s that marketers need to invest a great deal more effort into how online social networks and Internet communities actually work with respect to selling products and services at the grassroots level.

“It’s an emerging medium, and the rules haven’t yet been established,” says Umbria’s Edan-Harris. “We’re still learning what does and doesn’t work.”

Source: Adapted from Alice LaPlante, “Online Influencers: How the New Opinion Leaders Drive Buzz on the Web,” *InformationWeek*, May 5, 2007.

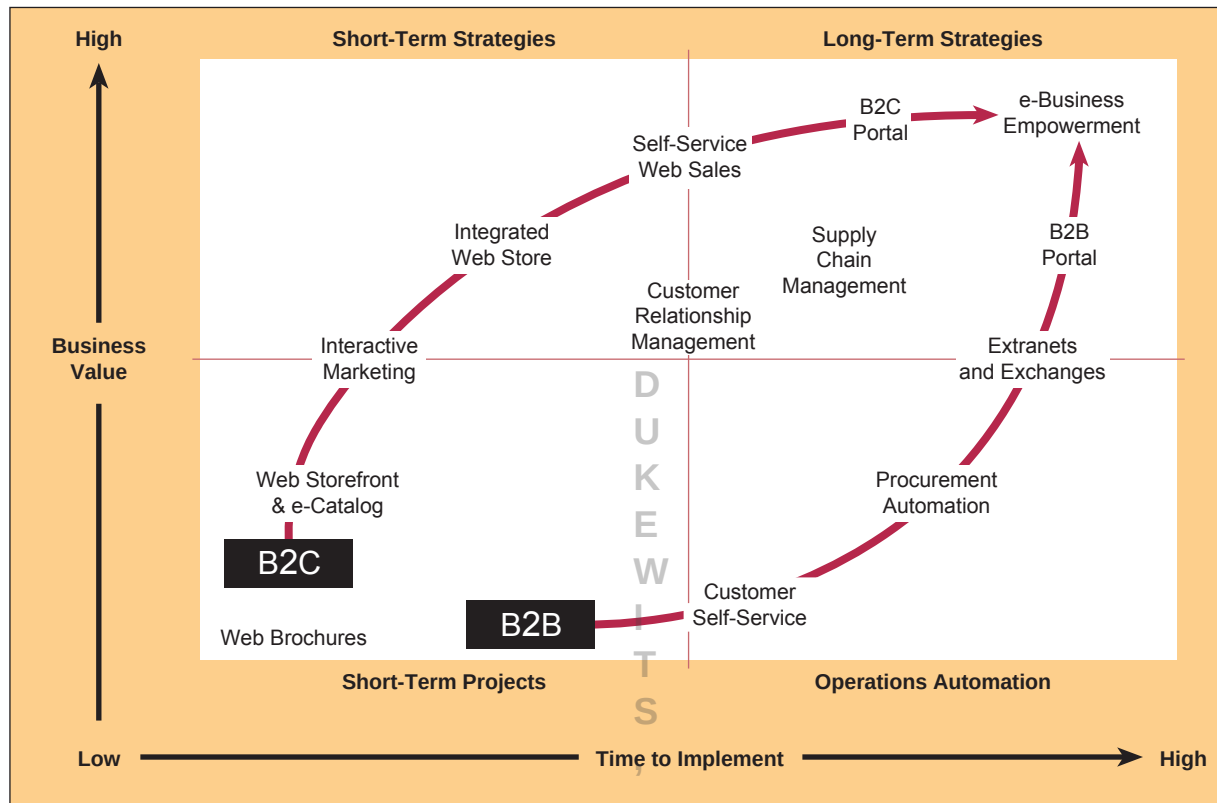
CASE STUDY QUESTIONS

1. How can companies benefit from the “cultural assessments” regularly performed by Mattel? How could the information obtained be used to create business value for those organizations? Provide multiple examples.
2. The case notes that, in spite of disconfirming evidence as to the effectiveness of targeting online opinion leaders, companies are nonetheless increasing their efforts to identify and contact them. Why do you think this is the case?
3. One of the participants in the case states that “you want to ride the wave rather than trying to start one of your own.” What does she mean by that? If companies are not starting these “waves,” where are they coming from?

REAL WORLD ACTIVITIES

1. A number of technological and cultural developments in recent years has resulted in the emergence of extensive social networks and a large number of avidly followed blogs. Go online to research how companies are tapping into these trends and what new marketing practices have arisen as a result. Prepare a report to summarize your findings.
2. Reflect on your own purchasing behavior. How much do you rely on blogs, feedbacks, and recommendations from past customers to make your own purchase decisions? Why do you (or don’t you) rely on these sources of information? Do you believe they are largely unbiased? Break into small groups to discuss these issues with your classmates and compare perspectives on them.

FIGURE 9.9 Trends in B2C and B2B e-commerce, and the business strategies and value driving these trends.



Source: Adapted from Jonathan Rosenoer, Douglas Armstrong, and J. Russell Gates, *The Clickable Corporation: Successful Strategies for Capturing the Internet Advantage* (New York: The Free Press, 1999), p. 24.

their business to the Web. So let's take a look at some essential success factors and Web site capabilities for companies engaged in either B2C or B2B e-commerce. Figure 9.10 provides examples of a few top-rated retail Web companies.

e-Commerce Success Factors

On the Internet, the barriers of time, distance, and form are broken down, and businesses are able to transact the sale of goods and services 24 hours a day, 7 days a week, 365 days a year with consumers all over the world. In certain cases, it is even possible to convert a physical good (CDs, packaged software, a newspaper) to a virtual good (MP3 audio, downloadable software, information in HTML format).

A basic fact of Internet retailing is that all retail Web sites are created equal as far as the “location, location, location” imperative of success in retailing is concerned. No site is any closer to its Web customers, and competitors offering similar goods and services may be only a mouse click away. This scenario makes it vital that businesses find ways to build customer satisfaction, loyalty, and relationships so that customers keep coming back to their Web stores. Thus, the key to e-tail (retail business conducted online) success is to optimize several key factors, such as selection and value, performance and service efficiency, the look and feel of the site, advertising and incentives to purchase, personal attention, community relationships, and security and reliability. Let's briefly examine each of these factors that are essential to the success of a B2C Web business. See Figure 9.11.

Selection and Value. Obviously, a business must offer Web shoppers a good selection of attractive products and services at competitive prices, or the shoppers will

FIGURE 9.10
Examples of a few top-rated retail Web sites.

Top Retail Web Sites		
•	Amazon.com \$19.2B Web sales volume www.amazon.com Amazon.com is the exception to the rule that consumers prefer to shop “real world” retailers online. The mother of all shopping sites, Amazon features a vast selection of books, videos, DVDs, CDs, toys, kitchen items, electronics, and even home and garden goods sold to millions of loyal customers.	
•	Staples, Inc. \$7.7B Web sales volume www.staples.com Staples tops the “Big 3” office supply giants in terms of Internet sales, although Office Depot and OfficeMax are also members of the top 10 retail Web sites list. Consumers can access the entire catalog online and can have their purchases delivered to their home or office within 24 hours and often within the same business day.	
•	Dell, Inc. \$4.8B Web sales volume www.dell.com Dell has created an online shopping experience for their customers that makes buying and configuring a computer system to meet a specific need almost effortless.	
•	Office Depot \$4.8B Web sales volume www.officedepot.com The Internet has become a transforming force for Office Depot and their Web sales have increased every year since they first launched their Web site. Today, customers can order any product online and can have their purchase delivered directly to their home or business with applicable freight charges or can pick up their purchase at their local Office Depot store with no additional shipping charges.	

quickly click away from a Web store. However, a company’s prices don’t have to be the lowest on the Web if it builds a reputation for high quality, guaranteed satisfaction, and top customer support while shopping and after the sale. For example, top-rated e-tailer REI.com helps you select quality outdoor gear for hiking and other activities with a “How to Choose” section and gives a money-back guarantee on your purchases.

Performance and Service. People don’t want to be kept waiting when browsing, selecting, or paying in a Web store. A site must be efficiently designed for ease of

FIGURE 9.11
Some of the key factors for success in e-commerce.

e-Commerce Success Factors
• Selection and Value. Attractive product selections, competitive prices, satisfaction guarantees, and customer support after the sale.
• Performance and Service. Fast and easy navigation, shopping, and purchasing, and prompt shipping and delivery.
• Look and Feel. Attractive Web storefront, Web site shopping areas, multimedia product catalog pages, and shopping features.
• Advertising and Incentives. Targeted Web page advertising and e-mail promotions, discounts, and special offers, including advertising at affiliate sites.
• Personal Attention. Personal Web pages, personalized product recommendations, Web advertising and e-mail notices, and interactive support for all customers.
• Community Relationships. Virtual communities of customers, suppliers, company representatives, and others via newsgroups, chat rooms, and links to related sites.
• Security and Reliability. Security of customer information and Web site transactions, trustworthy product information, and reliable order fulfillment.
• Great Customer Communication. Easy-to-find contact information, online order status, product support specialists.

access, shopping, and buying, with sufficient server power and network capacity to support Web site traffic. Web shopping and customer service must also be friendly and helpful, as well as quick and easy. In addition, products offered should be available in inventory for prompt shipment to the customer.

Look and Feel. B2C sites can offer customers an attractive Web storefront, shopping areas, and multimedia product catalogs. These could range from an exciting shopping experience with audio, video, and moving graphics to a more simple and comfortable look and feel. Thus, most retail e-commerce sites let customers browse product sections, select products, drop them into a virtual shopping cart, and go to a virtual checkout station when they are ready to pay for their order.

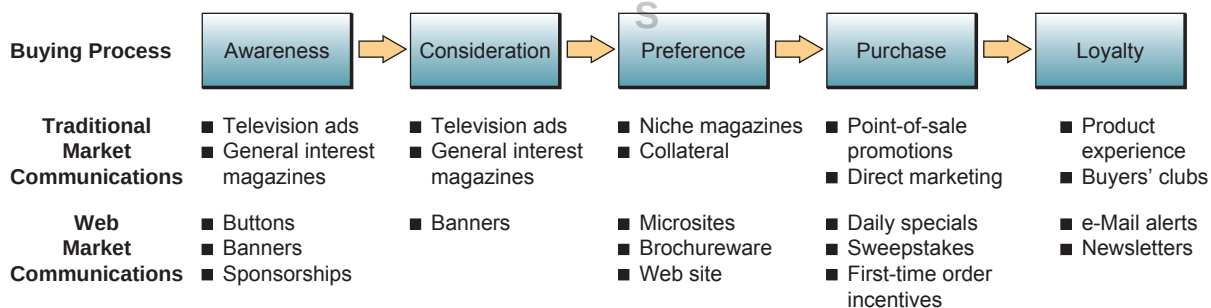
Advertising and Incentives. Some Web stores may advertise in traditional media, but most advertise on the Web with targeted and personalized banner ads and other Web page and e-mail promotions. Most B2C sites also offer shoppers incentives to buy and return. Typically, these incentives mean coupons, discounts, special offers, and vouchers for other Web services, sometimes with other e-tailers at cross-linked Web sites. Many Web stores also increase their market reach by being part of Web banner advertising exchange programs with thousands of other Web retailers. Figure 9.12 compares major marketing communications choices in traditional and e-commerce marketing to support each step of the buying process.

Personal Attention. Personalizing your shopping experience encourages you to buy and make return visits. Thus, e-commerce software can automatically record details of your visits and build user profiles of you and other Web shoppers. Many sites also encourage you to register with them and fill out a personal interest profile. Then, whenever you return, you are welcomed by name or with a personal Web page, greeted with special offers, and guided to those parts of the site in which you are most interested. This *one-to-one marketing* and relationship building power is one of the major advantages of personalized Web retailing.

Community Relationships. Giving online customers with special interests a feeling of belonging to a unique group of like-minded individuals helps build customer loyalty and value. Thus, Web site relationship and affinity marketing programs build and promote virtual communities of customers, suppliers, company representatives, and others via a variety of Web-based collaboration tools. Examples include discussion forums or newsgroups, chat rooms, message board systems, and cross-links to related Web site communities.

Security and Reliability. As a customer of a successful Web store, you must feel confident that your credit card, personal information, and details of your transactions

FIGURE 9.12 How traditional and Web marketing communications differ in supporting each step of the buying process.



are secure from unauthorized use. You must also feel that you are dealing with a trustworthy business whose products and other Web site information you can trust to be as advertised. Having your orders filled and shipped as you requested, in the time frame promised, and with good customer support are other measures of an e-tailer's reliability.

Great Customer Communications. As more consumers shift their habits from the traditional brick-and-mortar approach to an online shopping experience, one thing becomes even more important than ever: the need for constant and informative communication channels with the customer. Despite the conveniences associated with online shopping, consumers still have questions that need to be answered by a human being. Issues ranging from product information to order status or modification are often still handled the “old fashioned way.” Land's End, the famous outdoor clothing retailer, provides telephone and chat space access to customer representatives that will even help you pick out your purchases in real time.

Amazon.com: Partnering and Leveraging Infrastructure

Amazon.com has just launched an application on Facebook that enables members of the social network to buy gifts for each other based on wish lists registered with the online retailer. *Amazon Giver* also provides Facebook members with the option of viewing suggested items for friends based on interests listed on their profile pages. A second Facebook application, *Amazon Grapevine*, provides a news feed of friends' activity on Amazon, such as when they update their wish lists, write reviews, or tag products. Both applications only share information between Facebook members who have opted in to the service.

“By combining Amazon's vast selection of products with Facebook's millions of users, we are able to make activities like giftgiving more efficient and rewarding for Facebook users,” says Eva Manolis, vice president of Amazon.

By adding the *Amazon Giver* application to their profile, Facebook members get the option of clicking directly to a secure Amazon checkout page. If the recipient has a wish list, then Amazon can ship the item without the buyer entering a shipping address, which would already be on file. In order for people to view a wish list, it would have to be set as “public.” With *Amazon Grapevine*, people have the option to choose what type of activity they would be willing to share with friends through the news feed. Activity updates are entirely opt-in.

Amazon.com has also introduced a new way for online merchants to leverage Amazon's infrastructure to ship physical products. “The *Amazon Fulfillment Web Service* (Amazon FWS) allows merchants to tap in to Amazon's network of fulfillment centers and our expertise in logistics,” says Amazon Web Services evangelist Jeff Barr. “Merchants can store their own products to our fulfillment centers and then, using a simple Web service interface, fulfill orders for the products.”

Amazon FWS is designed to complement *Fulfillment By Amazon* (FBA), the fulfillment service Amazon has offered since 2006, by making the fulfillment process accessible programmatically. Amazon also maintains a separate fulfillment program called *Amazon Advantage*, which allows content publishers to send Amazon music, books, and videos for sale on consignment, with a 55 percent fee.

The idea, Barr explains, is to be able to ship a product with a simple Web service call. By making it possible for merchants to further automate their e-commerce and fulfillment efforts, Amazon is demonstrating its commitment to selling “muck,” as CEO Jeff Bezos has referred to his company's e-commerce infrastructure.

Source: Adapted from Antone Gonsalves, “Amazon.com Launches Shopping Apps on Facebook,” *InformationWeek*, March 13, 2008; and Thomas Claburn, “Amazon Introduces Fulfillment Web Service,” *InformationWeek*, March 20, 2008.

Web Store Requirements

Most business-to-consumer e-commerce ventures take the form of retail business sites on the World Wide Web. Whether a huge retail Web portal like Amazon.com or a small specialty Web retailer, the primary focus of such e-tailers is to develop, operate, and manage their Web sites so they become high-priority destinations for consumers who will repeatedly choose to go there to buy products and services. Thus, these Web sites must be able to demonstrate the key factors for e-commerce success that we have just covered. In this section, let's discuss the essential Web store requirements that you would have to implement to support a successful retail business on the Web, as summarized and illustrated in Figure 9.13.

Developing a Web Store

Before you can launch your own retail store on the Internet, you must build an e-commerce Web site. Many companies use simple Web site design software tools and predesigned templates provided by their Web site hosting service to construct their Web retail store. That includes building your Web storefront and product catalog Web pages, as well as tools to provide shopping cart features, process orders, handle credit card payments, and so forth. Of course, larger companies can use their own software developers or hire an outside Web site development contractor to build a custom-designed e-commerce site. Also, like most companies, you can contract with your ISP (Internet service provider) or a specialized Web hosting company to operate and maintain your B2C Web site.

Once you build your Web site, it must be developed as a retail Web business by marketing it in a variety of ways that attract visitors to your site and transform them into loyal Web customers. So, your Web site should include Web page and e-mail advertising and promotions for Web visitors and customers, as well as Web advertising

FIGURE 9.13 To develop a successful e-commerce business, these Web store requirements must be implemented by a company or its Web site hosting service.

Developing a Web Store		
• Build - Web site design tools - Site design templates - Custom design services - Web site hosting	• Market - Web page advertising - E-mail promotions - Web advertising exchanges with affiliate sites - Search engine registrations and optimization	
Serving Your Customers		
• Serve - Personalized Web pages - Dynamic multimedia catalog - Catalog search engine - Integrated shopping cart	• Transact - Flexible order process - Credit card processing - Shipping and tax calculations - E-mail order notifications	• Support - Web site online help - Customer service e-mail - Discussion groups and chat rooms - Links to related sites
Managing a Web Store		
• Manage - Web site usage statistics - Sales and inventory reports - Customer account management - Links to accounting system	• Operate 24×7 Web site hosting - Online tech support - Scalable network capacity - Redundant servers and power	• Protect - User password protection - Encrypted order processing - Encrypted Web site administration - Network firewalls and security monitors

exchange programs with other Web stores. Also, you can register your Web business with its own domain name (e.g., yourstore.com), as well as registering your Web site with the major Web search engines and directories to help Web surfers find your site more easily. In addition, you might consider affiliating as a small business partner with large Web portals like Yahoo! and Netscape, large e-tailers and auction sites like Amazon and eBay, and small business e-commerce portals like Microsoft's Small Business Center.

Spamming Web Searches



A new market for writing has arisen online, and it's targeted at search engines. Content optimized for successful search results ranges from informative articles to incoherent copy stuffed with keywords, a plague that's been labeled search-engine spam. Popular keywords generate significant traffic for Web sites with related content, giving Web site owners a financial incentive to host content that ranks near the top of search results. As traffic rises, ad revenue tends to follow, often through ad-delivery services for Web sites like Google's AdSense.

A cottage industry has formed to help people tailor content for search engines, such as rewriting copy by substituting synonyms for certain words so that text can be repurposed to score well on search engines. The rephrased text looks different to a search engine, contributing to the host site's rank and traffic. Google's Webmaster Guidelines warns against the practice of crafting copy for its search engine: "Make pages for users, not for search engines." But that hasn't stopped many from trying.

Creating content for search engines is one aspect of what's called search-engine optimization or SEO, part of a broader business known as search-engine marketing, or SEM. In sufficient quantity, and absent sufficient quality, SEO content is a form of spam that's aimed at search engines rather than people. And like product-oriented spam, it's controversial.

Chris Winfield, president and cofounder of SEM company 10e20 LLC, says one of the biggest problems for Google, MSN, and Yahoo is search-engine spam. "That spam consists of pages that are created for the search engines or pages that otherwise trick the end user," he says. Ani Kortikar, CEO of SEM company Netramind Technologies Pvt. Ltd., says that while search engines may require businesses to employ certain tactics to show up in search results, the tactics should be used to support good content rather than simply to drive traffic.

But just as legitimate e-mail marketers have felt the backlash against spammers, well-intentioned search-engine marketers—and search engines as well—may suffer if the tricksters continue to thrive. Says Winfield of 10e20, "One of the most important things for any search engine is people having confidence and becoming repeat users."

Source: Adapted from Thomas Claburn, "The Spamming of Web Search," *InformationWeek*, April 1, 2005.

Getting Customers to Find You

Just because your Web store has been launched does not mean customers will come flocking to your cyber front door. Your Web store needs to be discovered by your customers, and this means getting listed in the popular search engines.

You can submit your Web site to search engines such as Yahoo, Google, Live, and others, and each will begin looking at your Web pages and listing you when appropriate search terms are entered. Waiting for your site to show up competitively ranked with all the other similar sites could take weeks and even months. There is a science to search engine ranking and it is an essential element in Web store success.

Search engine optimization (SEO) is considered a subset of search engine marketing, and it focuses on improving the number and/or quality of visitors to a Web site over "natural" (also called "organic" or "algorithmic" search engine) listings. The term SEO can also refer to search engine optimizers, an industry of consultants who carry out optimization projects on behalf of clients.

Search engines display different kinds of listings on a results page, including paid advertising in the form of pay-per-click (PPC) advertisements and paid inclusion listings, as well as unpaid organic search results and keywords specific listings, such as news stories, definitions, map locations, and images. As an Internet marketing strategy, SEO considers how search engines work and what people search for.

Optimizing a Web site primarily involves editing its content and HTML coding to both increase its relevance to specific keywords and to remove barriers to the indexing activities of search engines. Because SEO requires making changes to the source code of a site, it is often most effective when incorporated into the initial development and design of a site, leading to the use of the term “search engine friendly” to describe designs, menus, content management systems, and shopping carts that can be optimized easily and effectively.

A range of strategies and techniques are employed in SEO, including changes to a site’s code (referred to as on-page factors) and getting links from other sites (referred to as off-page factors). These techniques include two broad categories: techniques that search engines recommend as part of good design, and those techniques that search engines do not approve of and attempt to minimize the effect of, referred to as spamdexing. Methods such as *link farms*, where a group of Web sites is set up so that all hyperlink to every other Web site in the group, and *keyword stuffing*, where a Web page is loaded with keywords in the meta tags or in content, are examples of techniques considered “black hat” SEO. Such techniques serve only to degrade both the relevance of search results and the user experience of search engines.

SEO, as a marketing strategy, can often generate a good return. However, as the search engines are not paid for the traffic they send from **organic search**, the algorithms used can and do change, and there are many factors that can cause search engine problems when crawling or ranking a site’s pages. There are no guarantees of success, either in the short or long term. Because of the lack of guarantees and certainty, SEO is often compared to traditional public relations (PR), with PPC advertising closer to traditional advertising.

Serving Your Customers

Once your retail store is on the Web and receiving visitors, the Web site must help you welcome and serve them personally and efficiently so that they become loyal customers. So most e-tailers use several Web site tools to create user profiles, customer files, and personal Web pages and promotions that help them develop a one-to-one relationship with their customers. This effort includes creating incentives to encourage visitors to register, developing *Web cookie files* to identify returning visitors automatically, or contracting with Web site tracking companies like DoubleClick and others for software to record and analyze the details of the Web site behavior and preferences of Web shoppers automatically.

Of course, your Web site should have the look and feel of an attractive, friendly, and efficient Web store. That means having e-commerce features like a dynamically changing and updated multimedia catalog, a fast catalog search engine, and a convenient shopping cart system that is integrated with Web shopping, promotions, payment, shipping, and customer account information. Your e-commerce order processing software should be fast and able to adjust to personalized promotions and customer options like gift handling, special discounts, credit card or other payments, and shipping and tax alternatives. Also, automatically sending your customers e-mail notices to document when orders are processed and shipped is a top customer service feature of e-tail transaction processing.

Providing customer support for your Web store is an essential Web site capability. Thus, many e-tail sites offer help menus, tutorials, and lists of FAQs (frequently asked questions) to provide self-help features for Web shoppers. Of course, e-mail correspondence with customer service representatives of your Web store offers more personal assistance to customers. Establishing Web site discussion groups and chat rooms

for your customers and store personnel to interact helps create a more personal community that can provide invaluable support to customers, as well as build customer loyalty. Providing links to related Web sites from your Web store can help customers find additional information and resources, as well as earning commission income from the affiliate marketing programs of other Web retailers. For example, the Amazon.com affiliate program pays commissions of up to 15 percent for purchases made by Web shoppers clicking to its Web store from your site.

Managing a Web Store

A Web retail store must be managed as both a business and a Web site, and most e-commerce hosting companies offer software and services to help you do just that. For example, companies like FreeMerchant, Prodigy Biz, and Verio provide their hosting clients with a variety of management reports that record and analyze Web store traffic, inventory, and sales results. Other services build customer lists for e-mail and Web page promotions or provide customer relationship management features to help retain Web customers. Also, some e-commerce software includes links to download inventory and sales data into accounting packages like QuickBooks for bookkeeping and preparation of financial statements and reports.

Of course, Web-hosting companies must enable their Web store clients to be available online 24 hours a day and seven days a week all year. This availability requires them to build or contract for sufficient network capacity to handle peak Web traffic loads and redundant network servers and power sources to respond to system or power failures. Most hosting companies provide e-commerce software that uses passwords and encryption to protect Web store transactions and customer records, as well as to employ network firewalls and security monitors to repel hacker attacks and other security threats. Many hosting services also offer their clients 24-hour tech support to help them with any technical problems that arise. We will discuss these and other e-commerce security management issues in Chapter 13.

Luxury Goes Digital: Fashion House Embraces Online Shopping

Historically, luxury brands have been slow to embrace e-commerce. But in recent years, high-end retail sites like Net-a-Porter and Yoox and discount luxury flash sales like those on Gilt Groupe and Rue La La are forcing executives to rethink the benefits of online sales. Bain & Co. estimates that the \$4.9 billion online luxury market grew by 20 percent in 2009.

Richemont, which owns luxury names like Cartier, Van Cleef & Arpels, Montblanc, and Jaeger-LeCoultre, has a 33 percent stake in Net-a-Porter and will buy the remaining 66 percent of the company, with founder Natalie Massenet remaining as the executive chairman. Richemont made the offer, valuing Net-a-Porter at \$534 million.

Net-a-Porter, founded in 2000 by former fashion journalist Natalie Massenet, has been a forerunner in selling expensive designer women's clothes and accessories online. That is a space that was long overlooked by big luxury goods houses like Richemont, Burberry PLC, and LVMH Moët Hennessy Louis Vuitton SA, which jumped on the online sales bandwagon far later than their lower-priced counterparts did.

With the acquisition of a successful luxury e-tailer—Net-a-Porter saw sales of \$183 million last year—Richemont is clearly making a commitment to boosting its presence in the online luxury space. Just one month earlier, Cartier had launched its U.S. transactional site.

At the time, Cartier North America CEO Emmanuel Perrin acknowledged the importance of selling on the Web. "The Internet has been a medium taking an increasing part in our client's lifestyle and means of interaction," he says.

Being available online is no longer a stigma to luxury brands, and things like holograms allow them to help consumers identify authorized resellers online. High-end designers like Narciso Rodriguez and Norma Kamali have even created exclusive collections for EBay.

The big luxury brands have made digital retailing a higher priority, having recognized that shoppers are increasingly willing to buy very expensive products on the Web. But selling \$1,000 dresses online is different from hawking groceries or second-hand books: Customers want an editorial element, a guiding hand to replace the in-store salesperson and signal what's in style, which is where Net-a-Porter has carved out its niche.

"It's just as much a magazine as it is a store," says Massenet. "That really has served us well, because when you're online you lose the offline experience of walking into a store."

Says Massenet, "Richemont has completely embraced our vision and strategy since they came on board as a shareholder and together we are going to continue to build the 21st century model for luxury fashion retailing."

That model would be online shopping.

Source: Adapted from Anne C. Lee, "Luxury Goes Digital: Fashion House Richemont Embraces E-Commerce," *Fast Company*, April 1, 2010; and Paul Sonne, "Richemont to Buy Net-a-Porter," *The Wall Street Journal*, April 2, 2010.

Business-to-Business e-Commerce

Business-to-business e-commerce is the wholesale and supply side of the commercial process, where businesses buy, sell, or trade with other businesses. B2B e-commerce relies on many different information technologies, most of which are implemented at e-commerce Web sites on the World Wide Web and corporate intranets and extranets. B2B applications include electronic catalog systems, electronic trading systems such as exchange and auction portals, electronic data interchange, electronic funds transfers, and so on. All of the factors for building a successful retail Web site that we discussed previously also apply to wholesale Web sites for business-to-business e-commerce.

In addition, many businesses are integrating their Web-based e-commerce systems with their e-business systems for supply chain management, customer relationship management, and online transaction processing, as well as with their traditional, or legacy, computer-based accounting and business information systems. This integration ensures that all e-commerce activities are integrated with e-business processes and supported by up-to-date corporate inventory and other databases, which in turn are automatically updated by Web sales activities.

Avnet Tears Up the B2B E-Commerce Playbook

When does a global distributor of electronic components need to start operating more like Amazon.com and other consumer-focused companies? When the market demands that it move in that direction.

At Avnet Inc., they came to just that realization a few years ago as they saw a shift taking place within their electronic components market. While large manufacturers continued to buy large quantities of components for their designs, a growing segment of engineers and smaller companies wanted to buy low volumes (including product samples) online, instead of by phone or face to face. Many of their customers had to either be really patient or simply stubborn to make a successful purchase on the e-commerce site they offered at the time.

Avnet realized the need to shift their B2B e-commerce approach to incorporate a B2C perspective. While they were dealing with business customers, their online purchasing expectations were shaped by their experiences on consumer-friendly Web sites such as Amazon.com and HomeDepot.com. The problem was that the experience and functionality that those kinds of sites provide users isn't easily replicated in a B2B environment, especially within the components industry. For example, Avnet deals with millions of parts, and each part has dozens of technical attributes that must be precisely specified for engineers to determine whether it's the part they need. Additionally, legal and country-specific regulations determine which companies and individuals Avnet can ship certain parts to around the world.

So Avnet went ahead and made a few changes. First, they eliminated the need to register. Previously, all customers had to register to get on the commerce site. To make matters even more complicated, all customers had to qualify for credit before they could search for parts, even if they were purchasing with a credit card. Now anyone can search for part information without having to register and share personal details. Only when customers reach a purchase point does the site then ask them for their information. And if the customer is paying with a credit card, credit checks are out the window.

Previously, customers could search for parts only by entering precise supplier part numbers, which may be up to 50 characters—the equivalent of making a reader search for a book by the unique ISBN number. Furthermore, the search result displayed information on only the part corresponding to the number entered, not on alternative parts that may also meet the customer’s requirements. Customers can now search by part number, product name, description, and technical attributes. Returned search results now include similar products that match the engineer’s requirements, so the engineer can make informed decisions about alternative parts based on factors such as availability, cost, and manufacturer.

The new e-commerce site, featuring more than 3.5 million electronic components, took two years to develop and deploy, and Avnet keeps on adding functionality based on customer feedback. So far, however, results tell them that customers already like what they see: There has been a 75 percent annual increase in e-commerce revenue and a 50 percent annual increase in site visitors.

Source: Adapted from Steve Phillips and Beth Ely, “Global CIO : Avnet Tears Up the B2B E-Commerce Playbook,” *InformationWeek*, June 15, 2009.

e-Commerce Marketplaces

The latest e-commerce transaction systems are scaled and customized to allow buyers and sellers to meet in a variety of high-speed trading platforms: auctions, catalogs, and exchanges.

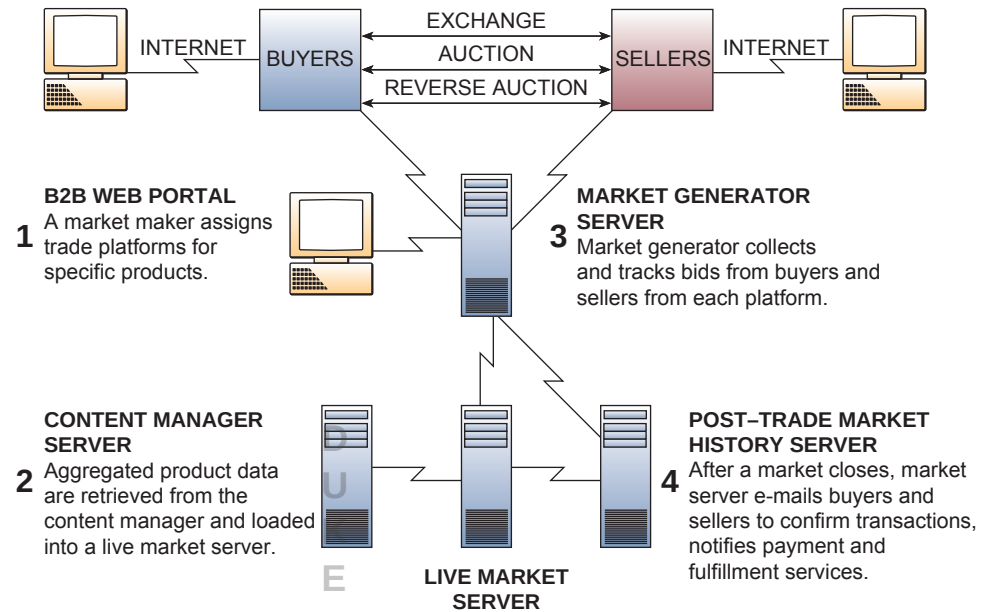
Businesses of any size can now buy everything from chemicals to electronic components, excess electrical energy, construction materials, or paper products at business-to-business **e-commerce marketplaces**. Figure 9.14 outlines five major types of e-commerce marketplaces used by businesses today. However, many B2B **portals** provide several types of marketplaces. Thus, they may offer an electronic **catalog** shopping and ordering site for products from many suppliers in an industry. Or they may serve as an **exchange** for buying and selling via a bid-ask process

FIGURE 9.14
Types of e-commerce marketplaces.

e-Commerce Marketplaces
• One to Many. Sell-side marketplaces. Host one major supplier, who dictates product catalog offerings and prices. Examples: Cisco.com and Dell.com.
• Many to One. Buy-side marketplaces. Attract many suppliers that flock to these exchanges to bid on the business of a major buyer like GE or AT&T.
• Some to Many. Distribution marketplaces. Unite major suppliers who combine their product catalogs to attract a larger audience of buyers. Examples: VerticalNet and Works.com.
• Many to Some. Procurement marketplaces. Unite major buyers who combine their purchasing catalogs to attract more suppliers and thus more competition and lower prices. Examples: the auto industry.
• Many to Many. Auction marketplaces used by many buyers and sellers that can create a variety of buyers. Examples: eBay and FreeMarkets.

FIGURE 9.15

An example of a B2B e-commerce Web portal that offers exchange, auction, and reverse auction electronic markets.



or at negotiated prices. Very popular are electronic **auction** Web sites for B2B auctions of products and services. Figure 9.15 illustrates a B2B trading system that offers exchange, auction, and reverse auction (where sellers bid for the business of a buyer) electronic markets.

Many of these B2B **e-commerce portals** are developed and hosted by third-party *market-maker* companies who serve as **infomediaries** that bring buyers and sellers together in catalog, exchange, and auction markets. Infomediaries are companies that serve as intermediaries in e-business and e-commerce transactions. Examples are Ariba, Commerce One, and VerticalNet, to name a few successful companies. All provide e-commerce marketplace software products and services to power business Web portals for e-commerce transactions.

These B2B e-commerce sites make business purchasing decisions faster, simpler, and more cost effective because companies can use Web systems to research and transact with many vendors. Business buyers get one-stop shopping and accurate purchasing information. They also get impartial advice from infomediaries that they can't get from the sites hosted by suppliers and distributors. Thus, companies can negotiate or bid for better prices from a larger pool of vendors. Of course, suppliers benefit from easy access to customers from all over the globe. Now, let's look at a real-world example.

SpecEx.com: B2B Trading of Wireless Spectrum

Online marketplaces like Craigslist and Freecycle allow consumers to make low-cost sales—or even exchange goods for free—through sophisticated technological systems that make such transactions efficient.

Some companies are attempting to apply a similar model to online business-to-business marketplaces.

The FCC holds auctions to grant licenses for radio spectrums, and most of these are used by cell phone carriers, or for first responders and their communication gear. But some of these spectrums aren't being used for a variety of reasons.

Spectrum Bridge's Web site, SpecEx.com, aims to create a secondary market for these unused spectrum. The company says the site can provide an easy and effective way to connect buyers and sellers. The market could potentially be large, as

public-safety agencies and major wireless carriers like Verizon Wireless and AT&T routinely purchase spectrum on the secondary market. The cable companies could also become potential buyers, especially as some are eyeing the wireless voice space. Spectrum Bridge makes money by taking a percentage of the transaction.

All transfers of spectrum would have to be approved by the FCC, but the agency has been supportive of spectrum trading in the past.

The idea of organizing the secondary spectrum market isn't a new one, but previous attempts have not been successful because they couldn't get enough buyers and sellers. "The spectrum world is almost tribal," says Peter Stanforth, chief technology officer for Spectrum Bridge. "It consists of small groups of people who know each other—and do everything manually." That is not an efficient system for smaller parcels—SpecEx's sweet spot. "By automating a lot of functions and bringing in a wider audience of buyers and sellers, we are making these smaller pieces more liquid and valuable," explains Stanforth.

Rick Rotondo, chief marketing officer of Spectrum Bridge, compares the SpecEx service to Craigslist, a favorite site for consumer bargains. With its launch several years ago, Craigslist made the sale of small consumer items efficient, which is what SpecEx aims to do with respect to the sale of wireless spectrum parcels. "Let's say you had used sunglasses you wanted to sell, for maybe \$25. Before online classifieds were introduced, it would not have been cost-efficient to try to sell them to a huge audience in a paper, because the ad probably would have cost you \$20." Same thing with wireless spectrum, he says. "Transaction costs are eating up most of the value for small buyers and sellers."

E-commerce technology can standardize much of the process, notes Stanforth. "What we are trying to do is be the eBay of the wireless spectrum world—a one-stop shop where companies can go to monetize excess or idle spectrum, and spectrum seekers can go to find reasonably priced unused spectrums."

Source: Adapted from Erika Morphy, "The Corporate Bargain Hunters' Quest for a Business Model," *E-Commerce Times*, January 20, 2009; and Marin Perez, "Spectrum Bridge Launches Online Secondary Market," *InformationWeek*, September 5, 2008.

Clicks and Bricks in e-Commerce

Companies are recognizing that success will go to those who can execute clicks-and-mortar strategies that bridge the physical and virtual worlds. Different companies will need to follow very different paths when deciding how closely—or loosely—to integrate their Internet initiatives with their traditional operations.

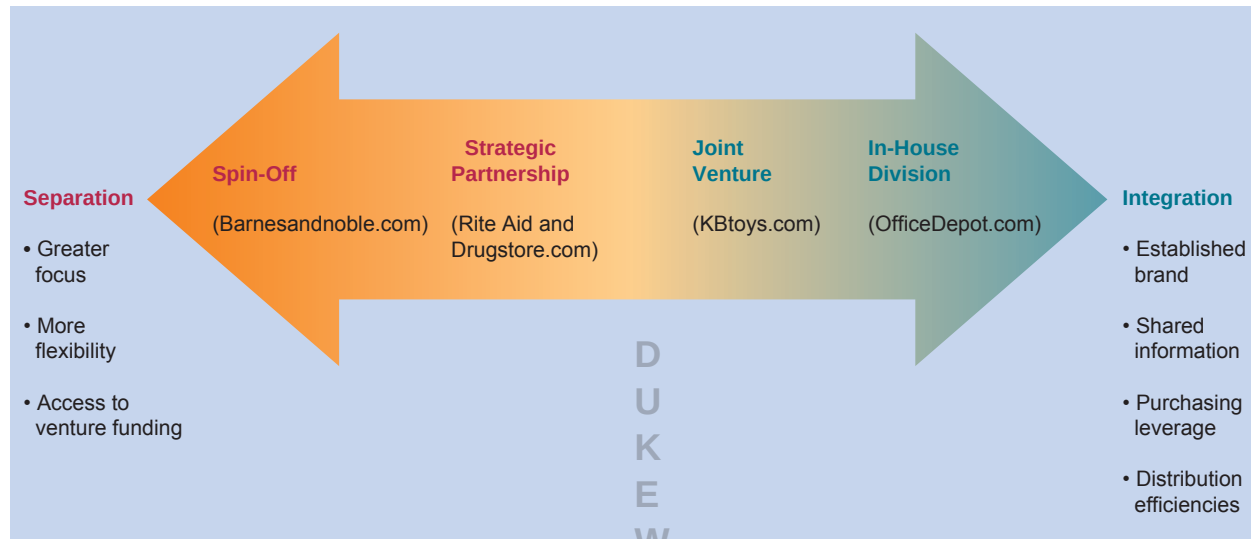
Figure 9.16 illustrates the spectrum of alternatives and benefit trade-offs that e-business enterprises face when choosing an e-commerce **clicks-and-bricks strategy**. E-business managers must answer this question: Should we integrate our e-commerce virtual business operations with our traditional physical business operations or keep them separate? As Figure 9.16 shows, companies have implemented a range of integration/separation strategies and made key benefit trade-offs in answering that question. Let's take a look at several alternatives.

e-Commerce Integration

The Internet is just another channel that gets plugged into the business architecture.

So says CIO Bill Seltzer of the office supply retailer Office Depot, which fully integrates its OfficeDepot.com e-commerce sales channel into its traditional business operations. Thus, Office Depot is a prime example of why many companies have chosen integrated clicks-and-bricks strategies, where their e-commerce business is integrated in some major ways into the traditional business operations of a company. The business case for such strategies rests on:

FIGURE 9.16 Companies have a spectrum of alternatives and benefit trade-offs when deciding on an integrated or separate e-commerce business.



- Capitalizing on any unique strategic capabilities that may exist in a company's traditional business operations that could be used to support an e-commerce business.
- Gaining several strategic benefits of integrating e-commerce into a company's traditional business, such as sharing established brands and key business information, joint buying power, and distribution efficiencies.

For example, Office Depot already had a successful catalog sales business with a professional call center and a fleet of more than 2,000 delivery trucks. Its 1,825 stores and 30 warehouses were networked by a sophisticated information system that provided complete customer, vendor, order, and product inventory data in real time. These business resources made an invaluable foundation for coordinating Office Depot's e-commerce activities and customer services with its catalog business and physical stores. Thus, customers can shop at OfficeDepot.com at their home or business or at in-store kiosks. Then they can choose to pick up their purchases at the stores or have them delivered. In addition, the integration of Web-enabled e-commerce applications within Office Depot's traditional store and catalog operations has helped increase the traffic at their physical stores and improved the catalog operation's productivity and average order size.

Borders and Amazon.com: Splitting Up Is Never Easy

Borders.com has always been run by Amazon.com. It features Amazon's inventory, site content, fulfillment, and customer service capabilities. The sales even belong to Amazon, with a percentage going to Borders. The new Borders site marks a major juncture in Borders's business and e-commerce strategy and the end of what will be a seven-year relationship with Amazon.com at a time when the Ann Arbor, Michigan-based bookseller is in the midst of a turnaround.

In 2001, when the retailing rivals inked this deal to develop a cobranded Web site, it was mutually beneficial. Amazon.com, which had gone public in 1997, was under pressure to turn its first profit. Extending the e-commerce infrastructure into which it had invested millions of dollars to third parties such as Borders injected much-needed cash into Amazon.com's business. Borders, which like many traditional brick-and-mortar stores at the time, was struggling to make the e-commerce game work for

them, got a tried and tested, user-friendly e-commerce site powered by a company that consumers trusted. Never mind the fact that Amazon was a competitor.

“The relationship with Amazon.com allowed us at the time to focus on our brick-and-mortar stores while still having an online channel that was branded Borders,” says Anne Roman, a spokeswoman for Borders. She notes that the company had its own e-commerce site before it partnered with Amazon but that the costs associated with operating and marketing it outweighed the revenue it generated at the time.

Roman says the existing relationship with Amazon doesn’t allow Borders to do all the things it wants to do to move forward to create a more integrated, cross-channel experience for customers, such as give Borders’ customers access to author readings and concerts at the company’s flagship store in Ann Arbor via online video. Borders also wants customers to be able to earn points toward the Borders Rewards loyalty program when they shop online. Currently, customers can’t earn points when they use the cobranded site because it exists as a separate silo of Borders’s business. “Once we launch the proprietary site, that loyalty program will be fully integrated into it,” says Roman.

However, Borders has to give customers a compelling reason to buy books, movies, and music from Borders.com instead of Amazon.com. That’s not going to be easy when Amazon.com has customer loyalty locked up and is so competitive on pricing. Gartner Research analyst Adam Sarner notes that the Web influences 40 percent of commerce in the off-line world. If Borders can take advantage of that dynamic, he adds, they’ll be better able to compete with Amazon. “If their site can become a lead management tool that gets more people to visit the store and pick up more books or visit three times instead of two, that might be a better model for them,” says Sarner. “Borders has the benefit of the physical stores. That’s where they can differentiate themselves from Amazon.”

Source: Adapted from Meridith Levinson, “Borders Tries to Open New Chapter with Web Site Relaunch Separate from Amazon.com,” *CIO Magazine*, October 2, 2007.

Other Clicks-and-Bricks Strategies

As Figure 9.16 illustrates, other clicks-and-bricks strategies range from partial e-commerce integration using joint ventures and strategic partnerships to complete separation via the spin-off of an independent e-commerce company.

For example, KBtoys.com is an e-commerce joint venture of KB Online Holdings LLC, created by toy retailer KB Toys, and BrainPlay.com, formerly an e-tailer of children’s products. The company is 80 percent owned by KB Toys but has independent management teams and separate distribution systems. However, KBtoys.com has successfully capitalized on the shared brand name and buying power of KB Toys, as well as the ability of its customers to return purchases to more than 1,300 KB Toys stores, which also heavily promote the e-commerce site.

The strategic partnership of the Rite Aid retail drugstore chain and Drugstore.com is a good example of a less integrated e-commerce venture. Rite Aid only owns about 25 percent of Drugstore.com, which has an independent management team and a separate business brand. However, both companies share the decreased costs and increased revenue benefits of joint buying power, an integrated distribution center, cobranded pharmacy products, and joint prescription fulfillment at Rite Aid stores.

Finally, let’s look at an example of the benefits and challenges of a completely separate clicks-and-bricks strategy. Barnesandnoble.com was created as an independent e-commerce company that was spun off by the Barnes & Noble book retail chain. This status enabled it to gain several hundred million dollars in venture capital funding, create an entrepreneurial culture, attract quality management, maintain a high degree of business flexibility, and accelerate decision making. However, the book e-retailer has done poorly since its founding and failed to gain market share from Amazon.com,

FIGURE 9.17

Key questions for developing an e-commerce channel strategy.

A Checklist for Channel Development	
1.	What audiences are we attempting to reach?
2.	What action do we want those audiences to take? To learn about us, to give us information about themselves, to make an inquiry, to buy something from our site, to buy something through another channel?
3.	Who owns the e-commerce channel within the organization?
4.	Is the e-commerce channel planned alongside other channels?
5.	Do we have a process for generating, approving, releasing, and withdrawing content?
6.	Will our brands translate to the new channel or will they require modification?
7.	How will we market the channel itself?

its leading competitor. Many business analysts say that the failure of Barnes & Noble to integrate some of the marketing and operations of Barnesandnoble.com within their thousands of bookstores meant it forfeited a key strategic business opportunity.

e-Commerce Channel Choices

Some of the key questions that the management of companies must answer in making a clicks-and-bricks decision and developing the resulting e-commerce channel are outlined in Figure 9.17. An **e-commerce channel** is the marketing or sales channel created by a company to conduct and manage its chosen e-commerce activities. How this e-commerce channel is integrated with a company's traditional sales channels (e.g., retail/wholesale outlets, catalog sales, and direct sales) is a major consideration in developing its e-commerce strategy.

Thus, the examples in this section emphasize that there is no universal clicks-and-bricks e-commerce strategy or e-commerce channel choice for every company, industry, or type of business. Both e-commerce integration and separation have major business benefits and shortcomings. Deciding on a clicks-and-bricks strategy and e-commerce channel depends heavily on whether a company's unique business operations provide strategic capabilities and resources to support a profitable business model successfully for its e-commerce channel. As these examples show, most companies are implementing some measure of clicks-and-bricks integration because "the benefits of integration are almost always too great to abandon entirely."

REI: Scaling e-Commerce Mountain

When outdoor equipment retailer REI wanted to boost in-store sales, the company looked to its Web site. In June 2003, REI.com launched free in-store pickup for customers who ordered online. The logic behind that thinking: People who visit stores to collect their online purchases might be swayed to spend more money upon seeing the colorful displays of clothing, climbing gear, bikes, and camping equipment.

REI's hunch paid off. "One out of every three people who buy something online will spend an additional \$90 in the store when they come to pick something up," says Joan Broughton, REI's vice president of multichannel programs. That tendency translates into a healthy 1 percent increase in store sales.

As Broughton sees it, the mantra for any multichannel retailer should be "a sale is a sale is a sale, whether online, in stores or through catalogs." The Web is simply not an isolated channel with its own operational metrics or exclusive group of customers.

As the Web has matured as a retail channel, consumers have turned to online shopping as an additional place to interact with a retailer rather than a replacement for existing channels such as stores or catalogs.

And to make that strategy as cost-efficient as possible, the company uses the same trucks that restock its stores to fulfill online orders slated for in-store pickup. To

make this work, REI had to integrate order information from the Web site and replenishment orders from stores at its distribution warehouse in Washington state.

In and of itself, integrating the two types of order information wasn't complex, says Brad Brown, REI's vice president of information services. What was difficult, however, was coordinating fulfillment of both online and replenishment orders because "orders placed on the Web by customers are nothing like replenishment orders that stores place," he says. Online orders are picked from the warehouse at the time of the order and then put in a queue until the appropriate truck is loaded, whereas store orders are picked by an automated replenishment system that typically picks orders at one time based on either a weekly or biweekly replenishment schedule.

To make in-store pickup a reality, Brown's group wrote a "promise algorithm" that informs customers of a delivery date when they place an online order. Timing can get tricky when orders are placed the day before a truck is scheduled to depart the warehouse with a store-replenishment delivery. For example, if an online order is placed on a Monday night and a truck is scheduled to depart Tuesday morning, the system promises the customer a pickup date of a week later, as if the order would be placed on the following week's truck. However, REI will shoot for fulfilling the order that night; if it can do it, REI (and, ultimately, the customer) is happy because the order arrives sooner than was promised.

Creating effective business-to-consumer retail Web sites entails more than simply calculating sales figures. It's about delivering the functionality that users expect and using the site to drive sales through other channels. And only IT integration can make this happen.

Source: Adapted from Megan Santosus, "Channel Integration—How REI Scaled e-Commerce Mountain," *CIO Magazine*, May 15, 2004.

Summary

- **e-Commerce.** E-commerce encompasses the entire online process of developing, marketing, selling, delivering, servicing, and paying for products and services. The Internet and related technologies and e-commerce Web sites on the World Wide Web and corporate intranets and extranets serve as the business and technology platforms for e-commerce marketplaces for consumers and businesses in the basic categories of business-to-consumer (B2C), business-to-business (B2B), and consumer-to-consumer (C2C) e-commerce. The essential processes that should be implemented in all e-commerce applications—access control and security, personalizing and profiling, search management, content management, catalog management, payment systems, workflow management, event notification, and collaboration and trading—are summarized in Figure 9.4.
- **e-Commerce Issues.** Many e-business enterprises are moving toward offering full-service B2C and B2B e-commerce portals supported by integrated customer-focused processes and inter-networked supply chains, as illustrated in Figure 9.9. In addition, companies must evaluate a variety of e-commerce integration or separation alternatives and benefit trade-offs when choosing a clicks-and-bricks strategy and e-commerce channel, as summarized in Figures 9.16 and 9.17.
- **B2C e-Commerce.** Businesses typically sell products and services to consumers at e-commerce Web sites that provide attractive Web pages, multimedia catalogs, interactive order processing, secure electronic payment systems, and online customer support. However, successful e-tailers build customer satisfaction and loyalty by optimizing factors outlined in Figure 9.11, such as selection and value, performance and service efficiency, the look and feel of the site, advertising and incentives to purchase, personal attention, community relationships, and security and reliability. In addition, a Web store has several key business requirements, including building and marketing a Web business, serving and supporting customers, and managing a Web store, as summarized in Figure 9.13.
- **B2B e-Commerce.** Business-to-business applications of e-commerce involve electronic catalog, exchange, and auction marketplaces that use Internet, intranet, and extranet Web sites and portals to unite buyers and sellers, as summarized in Figure 9.14 and illustrated in Figure 9.15. Many B2B e-commerce portals are developed and operated for a variety of industries by third-party market-maker companies called infomediaries, which may represent consortiums of major corporations.

Key Terms and Concepts

These are the key terms and concepts of this chapter. The page number of their first explanation is in parentheses.

- | | | |
|---|--|--|
| 1. Clicks-and-bricks strategy (376) | <i>b.</i> Collaboration and trading (359) | 5. Electronic commerce (350) |
| 2. E-commerce channel (379) | <i>c.</i> Content and catalog management (356) | <i>a.</i> Business-to-business (B2B) (354) |
| 3. E-commerce marketplaces (374) | <i>d.</i> Electronic payment systems (360) | <i>b.</i> Business-to-consumer (B2C) (354) |
| <i>a.</i> Auction (375) | <i>e.</i> Event notification (359) | <i>c.</i> Consumer-to-consumer (C2C) (354) |
| <i>b.</i> Catalog (374) | <i>f.</i> Profiling and personalizing (356) | 6. Electronic funds transfer (EFT) (360) |
| <i>c.</i> Exchange (374) | <i>g.</i> Search management (356) | 7. Infomediaries (375) |
| <i>d.</i> Portal (374) | <i>b.</i> Workflow management (358) | 8. Search engine optimization (370) |
| 4. E-commerce processes (355) | | |
| <i>a.</i> Access control and security (356) | | |

Review Quiz

Match one of the key terms and concepts listed previously with each of the brief examples or definitions that follow. Try to find the best fit for the answers that seem to fit more than one term or concept. Defend your choices.

- | | |
|--|--|
| ___ 1. The online process of developing, marketing, selling, delivering, servicing, and paying for products and services. | ___ 12. Companies that serve as intermediaries in e-commerce transactions. |
| ___ 2. Business selling to consumers at retail Web stores is an example. | ___ 13. A process aimed at improving the volume and/or quality of traffic to a Web site. |
| ___ 3. Using an e-commerce portal for auctions by business customers and their suppliers is an example. | ___ 14. An e-commerce marketplace that may provide catalog, exchange, or auction service for businesses or consumers. |
| ___ 4. Using an e-commerce Web site for auctions among consumers is an example. | ___ 15. Buyers bidding for the business of a seller. |
| ___ 5. E-commerce applications must implement several major categories of interrelated processes, such as search and catalog management, in order to be effective. | ___ 16. Marketplace for bid (buy) and ask (sell) transactions. |
| ___ 6. Helps to establish mutual trust between you and an e-tailer at an e-commerce site. | ___ 17. The most widely used type of marketplace in B2C e-commerce. |
| ___ 7. Tracks your Web site behavior to provide you with an individualized Web store experience. | ___ 18. The marketing or sales channel created by a company to conduct and manage its e-commerce activities. |
| ___ 8. Develops, generates, delivers, and updates information to you at a Web site. | ___ 19. The processing of money and credit transfers between businesses and financial institutions. |
| ___ 9. Ensures that proper e-commerce transactions, decisions, and activities are performed to serve you more efficiently. | ___ 20. Ways to provide efficient, convenient, and secure payments in e-commerce. |
| ___ 10. Sends you an e-mail when your e-commerce order has been shipped. | ___ 21. Companies can evaluate and choose from several e-commerce integration alternatives. |
| ___ 11. Includes matchmaking, negotiation, and mediation processes among buyers and sellers. | ___ 22. Web sites and portals hosted by individual companies, consortiums, or intermediaries that bring together buyers and sellers to accomplish e-commerce transactions. |
| | ___ 23. A component of e-commerce sites that helps customers find what they are looking for. |

Discussion Questions

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| 1. Most businesses should engage in e-commerce on the Internet. Do you agree or disagree with this statement? Explain your position. | 2. Are you interested in investing in, owning, managing, or working for a business that is primarily engaged in e-commerce on the Internet? Explain your position. |
|--|--|

REAL WORLD CASE 3

Entellium, Digg, Peerflix, Zappos, and Jigsaw: Success for Second Movers in e-Commerce

Anyone who has watched short-track speed skating during the Winter Olympics knows that skating with the lead is no easy task.

The No. 2 skater gets to conserve precious energy by drafting behind the leader. No. 2 watches the frontrunner's every move, gauging when and where to make a bid for the gold. Now corporate America and speed skating have much in common.

There are no safe leads.

For companies that use the Internet as the home base for their businesses, the second-mover advantage seems even more substantial. That's why Paul Johnston is deeply grateful to Marc Benioff.

Johnston's Seattle-based start-up, Entellium, has won hundreds of contracts against Benioff's Salesforce.com and other competitors since it moved from Malaysia in 2004, and its revenues grew fivefold in 2005. What Johnston really likes, though, is not having to sell companies on the concept of letting an outsider host their customer relationship management software.

What makes fast-following the hot strategy of the moment is the relative ease with which founders can get a start-up out on the track and send it chasing the competition. Cheap open-source tools can help you deploy new business software quickly.

Offshore manufacturers can quickly churn out anything from semiconductors to engine parts. The Web connects marketers to a vast pool of beta testers, while angel investors and venture capitalists, flush with new funds, stand at the ready.

Of course, fast-following isn't as simple as saying "Me too." To battle established leaders, you need the right product and strategy, as well as a big dose of savvy. Here's how to show up after the starting gun and still come out on top.

Number 1: Be better, faster, cheaper, and easier

To steal business from Benioff, Johnston knew that Entellium had to offer something different. "This is true for any follower," he says.

It's what Johnston calls the "awesome, awesome, not totally ****-ed up" approach. The first "awesome" is how Entellium's software works. Johnston, formerly an Apple sales executive, aims to bring to the stodgy world of enterprise software the ease of use of consumer-directed offerings like Google Maps and the role-playing game Everquest. He even hired developers from the gaming industry to borrow interface tricks.

After appealing to customers on usability, Johnston hits them with the price: about 40 percent less than the competition. That's the second "awesome." The last part is making Entellium a less risky decision.

Who wants to put their job on the line for a start-up the boss has never heard of? Johnston offers free 24×7 service to make it easier for new customers to stick their necks out.

Number 2: Trip up incumbents with tactics from other fields

Common wisdom would say that the last thing the world needs is another technology news Web site, but Digg founders Jay Adelson and Kevin Rose are uncommonly wise.

A year ago, inspired by social-networking sites like MySpace—whose users rank everything from people to music—Adelson and Rose decided to use the same approach to build a better version of tech news site Slashdot.

Digg lets readers submit news stories and vote for the ones they think are most important. The top 15 vote-getters make it to the front page. The formula is working. Between May and November, the number of monthly unique visitors to Digg surged 284 percent to 404,000, eclipsing Slashdot's 367,000, according to ComScore Media Metrix. In addition, Adelson and Rose recently landed \$2.8 million from investors, including eBay founder Pierre Omidyar and Netscape cofounder Marc Andreessen.

Moving forward, Adelson and Rose won't be shy about borrowing even more from seemingly unrelated companies. Soon they'll start tracking what members read and offering story recommendations à la Amazon. Digg is also set to branch out into nontechnology stories, which readers will be able to categorize with Delicious-style social bookmarking tags.

"A lot of companies are afraid to touch their original technology, to reconsider the premise on which they started the business," Adelson notes. "But when you stop doing that, that's when you get lapped [overtaken]."

Number 3: Swipe their business models and start your own race

When Billy McNair and Danny Robinson were hatching the idea for a new DVD company, Netflix handed them part of their business plan. Consumers had already learned that renting by mail was easy. McNair and Robinson believed they could do better than rentals. After all, eBay had shown them how.

By mixing together the best of two worlds, the founders came up with Peerflix, a Web site on which people exchange DVDs for a 99-cent transaction fee. Like eBay, Peerflix sits in the middle, linking movie fans and taking a piece of the action. Eager to avoid going head-to-head with eBay, however, McNair and Robinson are starting with lower-ticket items—those that sell for less than \$25—for which auctions may not be worth the hassle.

"We've married the best of online rental services and online secondary markets," McNair claims. Since it launched

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in September, Peerflix has helped trade nearly 200,000 DVDs, and the founders are now talking about extending the idea to video games and other items.

Number 4: Follow the biggest leader you can find

When he hatched Zappos six years ago, Nick Swinnum put other online shoe sellers in his cross-hairs. Web-based competitors typically carried a limited number of brands and catered to small niches—say, women's dress shoes or men's outdoor boots. Zappos would crush them, Swinnum reasoned, with an online store that offered every conceivable make and model.

That was the right idea, but it focused on the wrong competitors. The online shoe market was so tiny that even if Zappos dominated it, there wouldn't be enough business for the company to thrive. To grow, it had to steal customers from bricks-and-mortar stores. Before 2001, Zappos didn't carry inventory; rather, the company asked distributors to drop-ship directly to consumers.

It was an easy, cheap arrangement, but the problem was that Zappos couldn't guarantee service; 8 percent of the time customers tried to buy shoes, the desired pair was out of stock. In other words, the experience was nothing like walking into a shoe store. "We realized then who our real competition was, and that we had to find a way to make an inventory model work," Swinnum says.

So Zappos began to cozy up to suppliers.

Contrary to industry practice, Swinnum shared data with manufacturers on exactly how well their shoes were selling. "Traditionally the vendor–retail relationship was adversarial," he recognizes. "We thought, 'Instead of trying to hide this information from the brands, let's open everything

up. They can help us build the business.'" Did they ever! Grateful shoe reps helped Zappos craft promotions to spur sales.

Since targeting traditional shoe stores, Zappos has thrived. In 2001, the company did \$8.6 million in sales; the next year it did \$32 million. In 2005, Zappos posted more than \$300 million in revenues from an expanding line of shoes, handbags, and other leather goods.

Number 5: Aim for the leader's Achilles' heel

When he was vice president for sales at online marketing shop Digital Impact, Jim Fowler watched his field reps fail with a growing sense of frustration. Their problem? The leading online databases of corporate information, such as Dun & Bradstreet subsidiary Hoover's, didn't offer the deep, up-to-date contact lists that salespeople need to close deals.

Rather than complain about those vendors, Fowler decided to improve on them.

His company, Jigsaw, is a new kind of contact subscription service: All of the names and addresses in Jigsaw's database come from its users. Sales reps pay a minimum of \$25 per month to access contacts at thousands of companies, or they pay nothing if they contribute 25 contacts per month themselves. Users police the listings to ensure they're current.

Since Jigsaw's launch in December 2004, its database has surged from 200,000 contacts to more than 2 million; some 38,000 subscribers are adding 10,000 new contacts a day. Through Jigsaw you can find more than 16,000 contacts at Medtronic, for example; Hoover's, meanwhile, offers extensive research on the company but only about 30 contacts. According to Fowler, "It's never too late if you are smarter and better than everyone else."

CASE STUDY QUESTIONS

1. Is the second-mover advantage always a good business strategy? Defend your answer with examples of the companies in this case.
2. What can a front-runner business do to foil the assaults of second movers? Defend your answer using the examples of the front-runner companies in the case.
3. Do second movers always have the advantage in Web-based business success? Why or why not? Evaluate the five strategies given in the case and the companies that used them to help defend your answer.

REAL WORLD ACTIVITIES

1. Use the Internet to research the current business status of all of the many companies in this case. Are the second movers still successfully using their strategies, or have the first movers foiled their attempts? Have new strong players entered the markets of the first and second movers, or have business, economic, or societal developments occurred to change the nature of competition in these markets?
2. Assume you will start an Internet-based business similar to one of those mentioned in this case or another one of your choice. Would you be a first, second, or later mover in the market you select? How would you differentiate yourself from other competitors or prospective new entrants? Break into small groups to share your ideas and attempt to agree on the best Web-based business opportunity of the group.

REAL WORLD

CASE

4

KitchenAid and the Royal Bank of Canada: Do You Let Your Brand Go Online All by Itself?

A reputation is a fragile thing—especially on the Internet, where trademarked images are easily borrowed, corporate secrets can be divulged anonymously in chat rooms, and idle speculation and malicious commentary on a blog can affect a company's stock price. Brands are under constant attack, but companies such as BrandProtect, MarkMonitor, and NameProtect (now part of Corporation Services Company) are stepping in to offer companies some artillery in the fight for control of their brands and reputations.

Brian Maynard, director of marketing for KitchenAid, a division of Whirlpool, had a rather unique problem. Like the classic Coke bottle and Disney's Mickey Mouse ears, the silhouette of the KitchenAid mixer, that colorful and distinctively rounded wedding registry staple, is a registered trademark. Although the KitchenAid stand mixer silhouette has been a registered trademark since the mid-1990s, it has been a well-recognized symbol since the current design was introduced in the 1930s. "The KitchenAid mixer is an incredible asset so it is important for us to protect both the name and the image from becoming generic," says Maynard, who reports that the equity of the brand has been estimated to be in the tens of millions of dollars. Any kind of violations that go unnoticed can quickly erode that precious equity.

KitchenAid had experienced some problems on the Web with knockoffs and unauthorized uses of the mixer's image, but getting a handle on the many and varied online trademark infringements seemed daunting. Maynard knew that historically, corporate brands that were not well-protected and policed by their owners had been ruled generic by the courts—*aspirin* and *escalator* are two examples. "Throughout history terms like *escalator* and *aspirin* have become generic simply because people did not do the work to protect them," says Maynard. "To avoid that fate, you have to show the courts that you have put every effort into protecting your brand. If you don't police your brand, courts will typically rule that the mark is no longer meaningful and has become ubiquitous." So when he received a cold-call from BrandProtect, he was intrigued.

Criminals hijacking online corporate brands and masquerading for profit, however, are ramping up their efforts. Dubbed "brandjacking" by MarkMonitor Inc., a San Francisco-based brand protection service provider, the practice is becoming a major threat to household names. "Not only is the volume of these abuses significant, but abusers are becoming alarmingly savvy marketers," says Frederick Felman, MarkMonitor's chief marketing officer. In its first Brandjacking Index report, MarkMonitor tracked 25 of the top 100 brands for three weeks by monitoring illegal or unethical tactics that ranged from cybersquatting to pay-per-click fraud. Media companies made up the greatest percentage of targeted brands.

Cybersquatting, which usually means registering a URL that includes a real brand's name, easily took the prize for

the most threats. MarkMonitor tracked more than 286,000 instances in the three-week span. "When I heard about the solution I didn't even realize there was anything like that out there," says Maynard. "I saw right away that it solved a problem I didn't even realize existed."

BrandProtect uses a technology platform that functions like a giant spider, mapping the Web and identifying what's going on in its darkest recesses. The mapping technology is combined with a filter and human analysis component that identifies and returns to its clients actionable data on illicit activities that may adversely affect their corporate identity. Depending on the client's chosen service level, those activities can include any of 22 categories of infractions—from phishing to counterfeiting, misuse of corporate logos and trademarked product images, domain infractions, and employees blogging about corporate trade secrets. Staying ahead of the many ways that a company's brand can be compromised or diluted online is a challenge that Kevin Joy, vice president of marketing for BrandProtect, compares to a never-ending game of Whack-a-Mole.

The challenge of brand protection, however, has grown exponentially for companies operating in the online world. "With the advent of the Internet a few things happened," explains Maynard. "Everyone in the world could now see the mixer so the potential for misuse of our trademark became greater. Because it is so well known, there was more risk of companies creating knock-off products and marketing them under other names. So it was even more important than ever to prove that we were putting every effort into protecting the brand and our trademarks."

Other types of violations also surfaced as KitchenAid's online policing activities grew. Some, such as sites using the logo without permission, were minor and could be easily fixed with a warning letter. Others were not so innocent, such as using the logo to create links to illegal sites. "We spent a lot of time training people and policing online activities," says Maynard.

The many successes have made the relationship worthwhile. Recently, Maynard was impressed by how quickly he was able to resolve a case of domain infraction. A small vendor that works with KitchenAid was experimenting with registering URLs such as *shopkitchenaid.com* and *buykitchenaid.com* for marketing purposes. That Friday when Maynard received his report, he noticed the new URLs, recognized the name of the owner, and called his contact at the company to explain that any URLs containing the name KitchenAid had to be owned by the company. Maynard says his contact was shocked by how quickly KitchenAid had gotten on top of the issue. "He didn't even know he couldn't have ownership of that URL and was stunned that we knew about it so quickly."

Given the strategic importance of the KitchenAid brand, Maynard says BD-BrandProtect has played a major role in

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bringing him peace of mind. “It is my responsibility to protect this brand and I am not going to allow any loss of equity on my watch. In fact, the value of the stand mixer silhouette continues to increase year after year. Before BD-BrandProtect, however, I thought I was out there doing it on my own. Now I know I can leave the brand in better condition than when I started.”

As Manager of Brand Standards for the Royal Bank of Canada, Lise Buisson knows that the job of protecting the bank’s brand online involves a lot more than finding out when someone has cut and pasted a logo onto their site without permission. “As brands become more valued, any improper use of your brand can become a reputational risk. When someone displays your logo, for example, it becomes a de facto endorsement, whether we have approved it or not. We have to be careful about things like that.” Royal Bank of Canada and its subsidiaries operate under the master brand name of RBC. With 70,000 full- and part-time employees serving 15 million clients through offices in North America and 34 countries around the world, RBC is the largest bank in Canada.

“We didn’t expect to see what we saw. We were inundated. No one realized how easy it was for someone to come to our site, grab a logo, and put it somewhere else. It forced us to sit down as a group and figure out what we could do,” says Buisson. She quickly discovered that a majority of the infractions noted were harmless and did not require a second thought. “In most cases the users were well meaning,” she says. “It could be a charity site or mortgage partner using

our logo. I would say that 90 percent of these incidents were quite harmless.”

“BD-BrandProtect immediately flagged and dealt with a bank in the North Sea region that had used our logo and positioned themselves with another name. When anyone misrepresents themselves as an affiliate of ours, it makes us very nervous,” notes Buisson. Where concerns are raised, RBC will take the appropriate measures, from issuing a polite request to the user to cease using their brand to initiating legal action. “In the vast majority of cases a polite letter is enough.” Once a year, RBC reviews its branding policies to ensure that the reports continue to reflect their top priorities. It has also established a number of policies to ensure that the appropriate follow-up measures are used when required. “If, for example, we find advertising of our logo on a gambling site, we now have a policy about that,” she says.

Buisson says that as Internet activities continue to escalate, she has come to realize that the job of monitoring online brand activities properly would just have been too much for departmental staff to handle. “I’m a big proponent of going to the experts and sitting down and working with them. It’s very reassuring to work with a company that’s looking out for us. It certainly helps some of us sleep at night.”

Source: Adapted from Daintry Duffy, “Brand Aid for a Manufacturer’s Online Property,” *CIO Magazine*, September 17, 2007; *Royal Bank of Canada Case Study and KitchenAid Case Study*, www.bdbrandprotect.com, accessed April 22, 2008; and Gregg Ketzner, “Brandjackers’ Make Millions Feeding Off Internet Brand Names,” *Computerworld*, April 30, 2007.

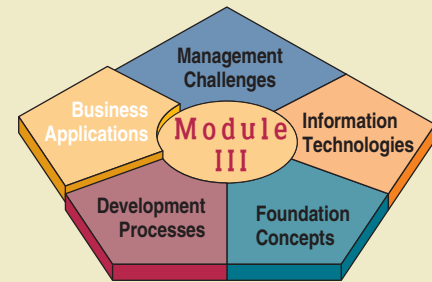
CASE STUDY QUESTIONS

1. Consider your own online shopping patterns. How much weight do you place on the presence of a name or logo or other trademark (such as the KitchenAid silhouette) on a Web site when purchasing goods or services? Do you ever stop to consider whether you may have been misled? How could you tell the difference?
2. Brian Maynard of KitchenAid notes that the development of the Internet changed the problem of brand policing. What are some of these changes? What new challenges can you think of that did not exist in the pre-online world? Provide several examples.
3. The companies mentioned in the case (e.g., KitchenAid, RBC, Disney, and Coke) were well established and enjoyed strong brand recognition well before the advent of the Internet. Do you think online-only companies face the same problems as they do? Why or why not? Justify the rationale for your answer.

REAL WORLD ACTIVITIES

1. Online trust providers such as eTrust (www.etrust.org) and others review privacy policies, including information collection and use, sharing and disclosure, and security, and then certify Web sites as meeting their standards. Companies that achieve this can then display a logo to that effect. Search the Internet to discover how these providers prevent unauthorized lifting and use of their certification logos by Web sites that have not gone through the process. Prepare a report to summarize your findings. Have you ever noticed these logos? Does it make any difference to you as a consumer whether a Web site displays them or not?
2. The case features technology developed by BrandProtect (www.brandprotect.com); competitors include MarkMonitor (www.markmonitor.com) and NameProtect (www.cscprotectbrands.com). Visit their Web sites to compare and contrast their offerings. Then break into small groups to compare your findings and discuss new features that you believe are lacking, as well as why you think these vendors should include these features.

CHAPTER 10



SUPPORTING DECISION MAKING

Chapter Highlights

Section I

Decision Support in Business

Introduction

Real World Case: Valero Energy, Eltek Manufacturing, J&J, and Overstock.com: The Move Toward Fact-Based Decision Making

Decision Support Trends

Decision Support Systems

Management Information Systems

Online Analytical Processing

Using Decision Support Systems

Executive Information Systems

Enterprise Portals and Decision Support

Knowledge Management Systems

Section II

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Business and AI

An Overview of Artificial Intelligence

Real World Case: Kimberly-Clark Corp.: Shopping for Virtual Products in Virtual Stores

Expert Systems

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Virtual Reality

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Real World Case: Goodyear, JEA, OSUMC, and Monsanto: Cool Technologies Driving Competitive Advantage

Real World Case: Hillman Group, Avnet, and Quaker Chemical: Process Transformation through Business Intelligence Deployments

Learning Objectives

1. Identify the changes taking place in the form and use of decision support in business.
2. Identify the role and reporting alternatives of management information systems.
3. Describe how online analytical processing can meet key information needs of managers.
4. Explain the decision support system concept and how it differs from traditional management information systems.
5. Explain how the following information systems can support the information needs of executives, managers, and business professionals:
 - a. Executive information systems
 - b. Enterprise information portals
 - c. Knowledge management systems
6. Identify how neural networks, fuzzy logic, genetic algorithms, virtual reality, and intelligent agents can be used in business.
7. Give examples of several ways expert systems can be used in business decision-making situations.

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SECTION I

Decision Support in Business

Introduction

As companies migrate toward responsive e-business models, they are investing in new data-driven decision support application frameworks that help them respond rapidly to changing market conditions and customer needs.

To succeed in business today, companies need information systems that can support the diverse information and decision-making needs of their managers and business professionals. In this section, we will explore in more detail how this is accomplished by several types of management information, decision support, and other information systems. We concentrate our attention on how the Internet, intranets, and other Web-enabled information technologies have significantly strengthened the role that information systems play in supporting the decision-making activities of every manager and knowledge worker in business.

Read the Real World Case on the next page. We can learn a lot from this case about new trends in decision making within companies. See Figure 10.1.

Information, Decisions, and Management

Figure 10.2 emphasizes that the type of information required by decision makers in a company is directly related to the **level of management decision making** and the amount of structure in the decision situations they face. It is important to understand that the framework of the classic *managerial pyramid* shown in Figure 10.2 applies even in today's *downsized organizations* and *flattened* or nonhierarchical organizational structures. Levels of management decision making still exist, but their size, shape, and participants continue to change as today's fluid organizational structures evolve. Thus, the levels of managerial decision making that must be supported by information technology in a successful organization are:

- **Strategic Management.** Typically, a board of directors and an executive committee of the CEO and top executives develop overall organizational goals, strategies, policies, and objectives as part of a strategic planning process. They also monitor the strategic performance of the organization and its overall direction in the political, economic, and competitive business environment.
- **Tactical Management.** Increasingly, business professionals in self-directed teams as well as business unit managers develop short- and medium-range plans, schedules, and budgets and specify the policies, procedures, and business objectives for their subunits of the company. They also allocate resources and monitor the performance of their organizational subunits, including departments, divisions, process teams, project teams, and other workgroups.
- **Operational Management.** The members of self-directed teams or operating managers develop short-range plans such as weekly production schedules. They direct the use of resources and the performance of tasks according to procedures and within budgets and schedules they establish for the teams and other workgroups of the organization.

Information Quality

What characteristics of information products make them valuable and useful to you? To answer this important question, we must first examine the characteristics or attributes of **information quality**. Information that is outdated, inaccurate, or hard to understand is not very meaningful, useful, or valuable to you or other business professionals. People need information of high quality, that is, information products whose characteristics, attributes, or qualities make the information more valuable to them. It is useful to think of information as having the three dimensions of time, content, and form. Figure 10.3 summarizes the important attributes of information quality and groups them into these three dimensions.

REAL WORLD

CASE

1

Valero Energy, ElKay Manufacturing, J&J, and Overstock.com: The Move Toward Fact-Based Decision Making

It's 7 a.m. in San Antonio, Texas, and Rich Marcogliese, chief operating officer of Valero Energy, is holding his usual morning meeting with the plant managers of 16 major refineries throughout the United States and Canada.

On the walls of the HQ operations center are a series of monitors centered by a giant screen with a live display of the company's Refining Dashboard. Whether the executives are in the room or connected remotely, all eyes are trained on the Web-accessible gauges and charts, which are refreshed with the latest data every five minutes.

"They review how each plant and unit is performing compared to the plan," says Valero CIO Hal Zesch, "and if there is any deviation, the manager explains what's going on at their plant."

For Valero, a surprisingly little-known Fortune 10 (that's right, one zero) company with more than \$118 billion (with a "b") in revenue, just one dashboard needle moving from green to red might signal millions of dollars at stake. The point of the dashboard isn't to call managers out; it's to give executives timely information so they can take corrective action.

Valero's Refining Dashboard is just the sort of cutting-edge decision-support tool that thousands, if not tens of thousands, of companies are now attempting to create. Those companies have embraced the idea that decisions based on fact will consistently beat those based on gut. Business bestsellers including "Competing on Analytics," "Super Crunchers," and "The Numerati" have documented that it's an approach that works. Financial analysts, board members, and even the news media increasingly expect sound, data-backed analyses from top management. And when things go wrong, regulators—and in some cases, even district attorneys—follow the numbers to trace bad decisions.

FIGURE 10.1



Data are replacing gut when it comes to business decisions.

Source: © age fotostock/SuperStock.

Plenty of obstacles stand in the way of better decision support, from backward-looking metrics and ill-advised goals to antiquated budgeting approaches and technophobic executives. For management teams that can make use of the data—and these days there's always plenty of data—there are huge opportunities to improve efficiency, develop innovative products, get closer to customers, and outsell competitors.

Valero rolled out its dashboard in early 2008 at the behest of COO Marcogliese. He had launched a Commitment to Excellence program aimed at improving performance, and he wanted to see real-time data related to plant and equipment reliability, inventory management, safety, and energy consumption.

Real-time performance data are compared against daily and monthly targets, and there are executive-level, refinery-level, and even individual system-operator-level dashboard views. It's rare among business intelligence deployments to get fresh data every five minutes, but Valero has tapped directly into "process historian" systems at each plant in a six-month deployment of SAP's Manufacturing Integration and Intelligence application.

A major focus of Valero's Commitment to Excellence program is reducing energy consumption, so the company is rolling out separate dashboards that show detailed statistics on power consumption by unit and plant. "Based on the data, managers can share best practices and make changes in operations to reduce energy consumption while maintaining production levels," CIO Zesch explains. Estimated savings to date: \$140 million per year for the seven plants where the dashboards are in use, with expected total savings of \$230 million per year once the dashboards are rolled out at all 16 refineries.

The terms "scorecard" and "dashboard" are often used interchangeably, but there's an important distinction. Scorecards are all about tracking against defined metrics, and most scorecards are attached to a methodology, such as the Balanced Scorecard or TQM, says Mychelle Mollot, VP of worldwide marketing, analytics, and performance management at IBM. "Top executives have actually laid out a map for where they want to drive the business, and they've created metrics that will drive the behavior that will get them there," Mollot says.

Whether they call their decision-support tools scorecards or dashboards, only a small percentage of leading companies have actually mapped out enterprisewide goals with a formal methodology. Some companies come up with their own methodologies, but the key question is whether it's a comparative decision-support interface: Does it track performance trends relative to predefined goals? A much larger chunk of companies use dashboard-style interfaces that simply monitor the health of the business. "These types of decision-support tools aren't often attached to a grand methodology or linked down to the bottom of the organization," Mollot says.

At ElKay Manufacturing, a \$1 billion plumbing fixture and cabinetry maker, the CFO has led the company to embrace new approaches toward evaluation and reporting. The conventional budgeting process, by contrast, often takes too long, it's a fixed contract, and "compensation schemes tied to it tend to encourage all sorts of bad behavior, like people sandbagging

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or just budgeting amounts based on last year's budget," says Adam Bauer, corporate planning manager at Elkay.

Elkay's stated strategy is to grow profitably, so its sales-related scorecards and dashboards include profit metrics so salespeople don't just drive revenue at the expense of the bottom line. Controller John Hrudicka says the company's decision-support tools have identified initiatives that produced more than \$13 million in hard-dollar profit improvements while "helping us transform our culture to a profit mind-set."

Elkay put most of its decision-support technologies in place over the last two years. It tapped Host Analytics' software-as-a-service financial performance management system, which it uses for budgeting, planning, reporting, and end-of-quarter financial consolidation.

The system also supported the move, completed in September, to 18-month budgeting and planning cycles. Elkay chose Acorn Performance Analyzer software for activity-based costing: analyses that reveal the true cost of delivering products (including manufacturing, distribution, sales and marketing, and warranty claims), as well as the true cost of sustaining customers (including products purchased, discounts applied, and ongoing service and support costs).

For decision support, Oracle Business Intelligence Enterprise Edition pulls information from multiple enterprise systems to deliver multilevel scorecards and dashboards. "It starts with the corporate scorecard and it rolls down from there to the divisions and all the way down to individual-employee goals that affect bonuses at the end of the year," Bauer says. Bottom-up feedback, he says, is gathered during quarterly strategy reviews.

Few companies have worked as hard or as long at data-driven decision making as Johnson & Johnson. There is an iterative process of assessing opportunities, developing goals, implementing improvements, and then monitoring their success with the aid of decision-support tools. Indeed, fact-based decision making is now "part of the culture at J&J," says Karl Schmidt, vice president of business improvement, who leads a nine-person internal management consulting group.

J&J is decentralized, so there's no single, overarching corporate dashboard. There are separate dashboards—or in some cases, balanced scorecards—within the pharmaceutical, consumer, and medical device and diagnostics product divisions, as well as the dozens of companies in each of those groups. The key performance indicators include a mix of financial metrics (revenue, net income, cash flow); customer metrics (satisfaction, loyalty, market share); internal process metrics

(product development, manufacturing efficiency, fulfillment); and employee metrics (engagement, satisfaction).

"It comes down to fact-based decision making," he says. "In tough economic times, you want the best available data and analysis to make better decisions."

Some of the most decision-support-savvy executives can be found in e-commerce. For example, Patrick Byrne, CEO of Overstock.com, is said to use dashboards to help set his daily schedule. If the problem of the day is gross profit margins, that will drive who he calls in for a discussion. "If you get invited into a meeting with that kind of metrics-oriented CEO, you better have your hands on the data, including the detail at the next level down," says David Schrader, director of strategy and marketing at Teradata, the vendor behind Overstock's data warehousing environment.

Overstock can roll up its profit and loss statement every two hours, "which is absolutely world class," Schrader says. That capability gives executives accurate, up-to-date insight into the financial results they can expect, and it also drives operational decisions such as spot buys of TV advertising.

Whether a company is an e-commerce powerhouse or not, digital marketing channels like e-mail, social media, and online advertising networks are increasingly important. Thus, top executives should be watching forward-looking, upstream measures such as Web site performance, Web-driven lead generation, and sales pipeline information. Here, again, you must be careful to select the right metrics.

"A lot of people are measuring the wrong thing, like how many people came in the door," Schrader says. "What you really want to measure is how many people came in the door and became qualified leads."

And once prospects become customers, you'll want to know if they are good or bad customers. That's where analyses such as activity-based costing and customer segmentation come in. Lessons learned should come full circle and be reapplied to lead-generation campaigns and marketing offers.

Considering all the IT systems now in place, the growing dominance of Internet-based marketing, and the intensely digital nature of services-based industries, there's no doubt that data-driven decision making is the way forward. But the key questions are: How prepared are these organizations to synthesize and share key performance indicators? How prepared are executives to draw insight from information?

Source: Adapted from Doug Henschen, "Execs Want Focus on Goals, Not Just Metrics," *InformationWeek*, November 13, 2009.

CASE STUDY QUESTIONS

1. What is the difference between a "dashboard" and a "scorecard"? Why is it important that managers know the difference between the two? What can they learn from each?
2. In what ways have the companies mentioned in the case benefited from their adoption of "fact-based" decision making? Provide several examples from the case to illustrate your answer.
3. Information quality is central to the approach toward decision making taken by these organizations. What other elements must be present for this approach to be successful (technology, people, culture, and so forth)?

REAL WORLD ACTIVITIES

1. A number of major companies have launched projects geared toward improving their business analytics and decision-making capabilities in the last few years. Go online and research other examples in this trend. What are the similarities with the ones chronicled in the case? What are the differences? Prepare a report that includes a section contrasting your new examples with the ones in the case.
2. If you had to apply the ideas discussed in the case to your academic career, what would your dashboard and/or scorecard look like? What would be the sources of information? How would you measure whether you are making progress toward attaining your goals? Break into small groups to discuss these issues.

FIGURE 10.2 Information requirements of decision makers. The type of information required by directors, executives, managers, and members of self-directed teams is directly related to the level of management decision making involved and the structure of decision situations they face.

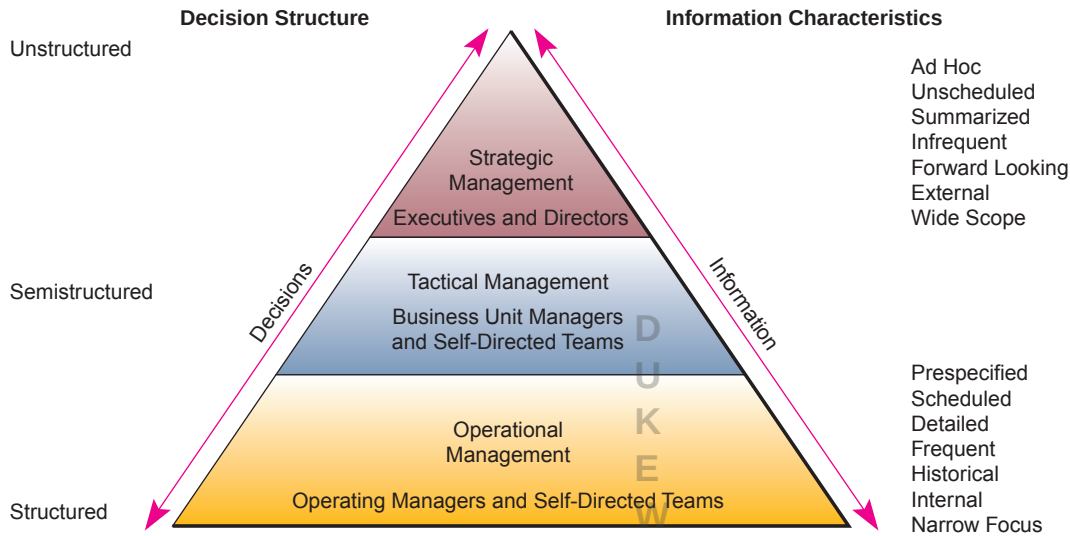
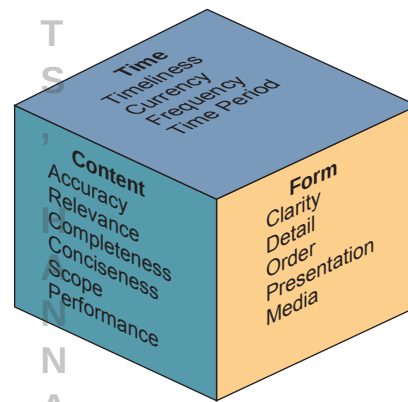


FIGURE 10.3

A summary of the attributes of information quality. This figure outlines the attributes that should be present in high-quality information products.



Time Dimension

Timeliness
Currency
Frequency
Time Period

Information should be provided when it is needed.
Information should be up-to-date when it is provided.
Information should be provided as often as needed.
Information can be provided about past, present, and future time periods.

Content Dimension

Accuracy
Relevance

Completeness
Conciseness
Scope

Information should be free from errors.
Information should be related to the information needs of a specific recipient for a specific situation.
All the information that is needed should be provided.
Only the information that is needed should be provided.
Information can have a broad or narrow scope, or an internal or external focus.
Information can reveal performance by measuring activities accomplished, progress made, or resources accumulated.

Form Dimension

Clarity

Detail
Order
Presentation

Media

Information should be provided in a form that is easy to understand.
Information can be provided in detail or summary form.
Information can be arranged in a predetermined sequence.
Information can be presented in narrative, numeric, graphic, or other forms.
Information can be provided in the form of printed paper documents, video displays, or other media.

FIGURE 10.4 Examples of decisions by the type of decision structure and level of management.

Decision Strategic	Operational Management	Tactical Management	Structure Management
Unstructured	Cash management	Business process reengineering	New e-business initiatives
		Workgroup performance analysis	Company reorganization
Semistructured	Credit management	Employee performance appraisal	Product planning
	Production scheduling	Capital budgeting	Mergers and acquisitions
	Daily work assignment	Program budgeting	Site location
Structured	Inventory control	Program control	

Decision Structure

One way to understand decision making is to look at **decision structure**. Decisions made at the operational management level tend to be more *structured*, those at the tactical level are more *semistructured*, and those at the strategic management level are more *unstructured*. Structured decisions involve situations in which the procedures to follow, when a decision is needed, can be specified in advance. The inventory reorder decisions that most businesses face are a typical example. Unstructured decisions involve decision situations in which it is not possible to specify in advance most of the decision procedures to follow. Most decisions related to long-term strategy can be thought of as unstructured (e.g., “What product lines should we develop over the next five years?”). Most business decision situations are semistructured; that is, some decision procedures can be prespecified but not enough to lead to a definite recommended decision. For example, decisions involved in starting a new line of e-commerce services or making major changes to employee benefits would probably range from unstructured to semistructured. Finally, decisions that are unstructured are those for which no procedures or rules exist to guide the decision makers toward the correct decision. In these types of decisions, many sources of information must be accessed, and the decision often rests on experience and “gut feeling.” One example of an unstructured decision might be the answer to the question, “What business should we be in 10 years from now?” Figure 10.4 provides a variety of examples of business decisions by type of decision structure and level of management.

Therefore, information systems must be designed to produce a variety of information products to meet the changing needs of decision makers throughout an organization. For example, decision makers at the strategic management level may look to *decision support systems* to provide them with more summarized, ad hoc, unscheduled reports, forecasts, and external intelligence to support their more unstructured planning and policymaking responsibilities. Decision makers at the operational management level, in contrast, may depend on *management information systems* to supply more prespecified internal reports emphasizing detailed current and historical data comparisons that support their more structured responsibilities in day-to-day operations. Figure 10.5 compares the information and decision support capabilities of management information systems and decision support systems, which we will explore in this chapter.

Decision Support Trends

The emerging class of applications focuses on personalized decision support, modeling, information retrieval, data warehousing, what-if scenarios, and reporting.

As we discussed in Chapter 1, using information systems to support business decision making has been one of the primary thrusts of the business use of information technology. During the 1990s, however, both academic researchers and business practitioners began to report that the traditional managerial focus originating in classic management information systems (1960s), decision support systems (1970s), and executive information systems (1980s) was expanding. The fast pace of new information technologies like PC hardware and software suites, client/server networks, and networked PC versions of DSS

FIGURE 10.5

Comparing the major differences in the information and decision support capabilities of management information systems and decision support systems.

	Management Information Systems	Decision Support Systems
• Decision support provided	Provide information about the performance of the organization	Provide information and decision support techniques to analyze specific problems or opportunities
• Information form and frequency	Periodic, exception, demand, and push reports and responses	Interactive inquiries and responses
• Information format	Prespecified, fixed format	Ad hoc, flexible, and adaptable format
• Information processing methodology	Information produced by extraction and manipulation of business data	Information produced by analytical modeling of business data

software made decision support available to lower levels of management, as well as to nonmanagerial individuals and self-directed teams of business professionals.

This trend has accelerated with the dramatic growth of the Internet, as well as of intranets and extranets that inter-network with companies and their stakeholders. The e-business and e-commerce initiatives that are being implemented by many companies are also expanding the information and decision support uses and the expectations of a company's employees, managers, customers, suppliers, and other business partners. Figure 10.6 illustrates that all business stakeholders expect easy and instant access to information and Web-enabled self-service data analysis. Today's businesses are responding with a variety of personalized and proactive Web-based analytical techniques to support the decision-making requirements of all of their constituents.

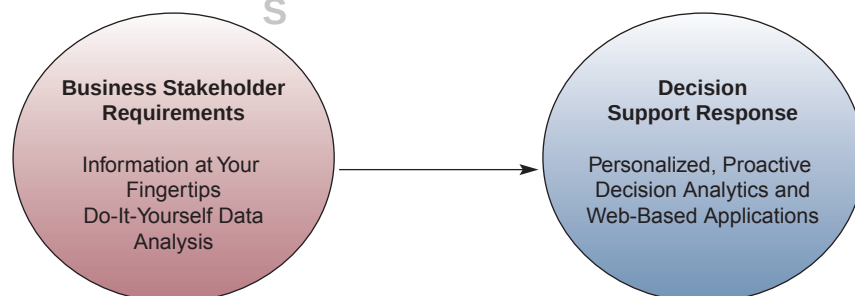
Thus, the growth of corporate intranets and extranets, as well as the Web, has accelerated the development and use of "executive-class" information delivery and decision support software tools by lower levels of management and by individuals and teams of business professionals. In addition, this dramatic expansion has opened the door to the use of such **business intelligence (BI)** tools by the suppliers, customers, and other business stakeholders of a company for customer relationship management, supply chain management, and other e-business applications.

In 1989, Howard Dresner (later a Gartner Group analyst) proposed BI as an umbrella term to describe "concepts and methods to improve business decision making by using fact-based support systems." It was not until the late 1990s that this usage became widespread. Today, BI is considered a necessary and mission critical element in crafting and executing a firm's strategy. Consider the following findings from a 2009 Gartner Group study:

- Because of lack of information, processes, and tools, through 2012, more than 35 percent of the top 5,000 global companies will regularly fail to make insightful decisions about significant changes in their business and markets.

FIGURE 10.6

A business must meet the information and data analysis requirements of its stakeholders with more personalized and proactive Web-based decision support.



- By 2012, business units will control at least 40 percent of the total budget for business intelligence.
- By 2010, 20 percent of organizations will have an industry-specific analytic application, delivered via software as a service, as a standard component of their business intelligence portfolio.
- In 2009, collaborative decision making will emerge as a new product category that combines social software with business intelligence platform capabilities.

When you consider some of these findings, it becomes easy to see that BI is rapidly becoming the mainstay for business decision making in the modern organization. Before long, it will evolve into a competitive necessity for many industries.

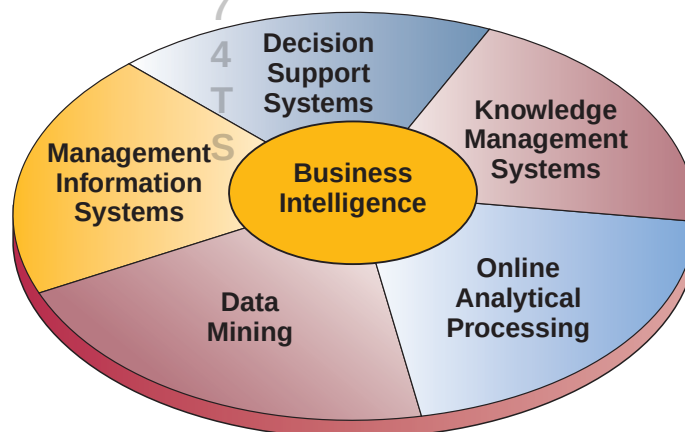
As with all concepts in business-related technologies, business intelligence has evolved from Dresner's original definition focusing on concepts and methods to a more action-oriented approach referred to as *business analytics*. Business analytics (BA) refers to the skills, technologies, applications, and practices applied to a continuous iterative exploration and investigation of a business's historical performance to gain insight and drive the strategic business planning process. Business analytics focuses on developing new insights and understanding of business performance based on data and statistical methods. In contrast, business intelligence traditionally focuses on using a consistent set of metrics to both measure past performance and guide business planning, which is also based on data and statistical methods.

Business analytics makes much more extensive use of data, statistical and quantitative analysis, explanatory and predictive modeling, and fact-based management to drive decision making. Analytics may be used as input for human decisions or may drive fully automated decisions. Business intelligence is more associated with querying, reporting, online analytical processing (OLAP), and "alerts." In other words, querying, reporting, OLAP, and alert tools can answer the questions: *what happened; how many; how often; where; where exactly is the problem; and what actions are needed*. Business analytics, in contrast, can answer the questions: *why is this happening; what if these trends continue; what will happen next (that is, predict); and what is the best that can happen (that is, optimize)*. One of the most common techniques and approaches associated with business analytics is data mining, a concept introduced in Chapter 5 and discussed again later in this chapter.

Figure 10.7 highlights several major information technologies that are being customized, personalized, and Web-enabled to provide key business information and analytical tools for managers, business professionals, and business stakeholders. We highlight the trends toward such business intelligence applications in the various types of information and decision support systems that are discussed in this chapter.

FIGURE 10.7

Business intelligence applications are based on personalized and Web-enabled information analysis, knowledge management, and decision support technologies.



Hyatt Hotels: Dashboards Integrate Financial and Operational Information

A few years ago, executives at Chicago-based Hyatt Hotels decided the company needed a way to consolidate its disparate financial data so that it could more easily forecast future sales and plan its business accordingly. In other words, the company wanted to install a typical financial performance management layer, with dashboards and scorecards for top-level managers. But after some discussion on the matter, the installation grew to be not so typical.

Gebhard Rainer, Hyatt's vice president of hotel finance and systems, wanted to combine these financial elements—budgeting, planning, modeling, and reporting—with operational data from the hotels themselves. The idea was that a complete picture of the company's business, available on a daily basis to executives as well as hotel managers, was not possible without having the two together in the same dashboard.

Motivating the concept was a changing world, with terrorist risks and natural disasters causing an ever-shifting array of business variables. Rainer, in a Middle Eastern country in the aftermath of a terrorist attack several years ago, confronted these issues firsthand—as did the company, which owns hotels in New Orleans and along the hurricane-ravaged Gulf Coast. The first line of business is the safety of hotel guests. But in terms of the big picture, hotel companies must re-forecast their business goals from the ground up based on a set of entirely new metrics dealing with issues from resource allocation to skittish tourists rethinking their travel plans. It wasn't a job for spreadsheets.

Hyatt was among the first of Hyperion's customers to adopt System 9. The company selected Hyperion based on its “integrateability” with its source systems, as well as its user-friendliness. At first, Hyatt wanted a small-scale installation, delivering the System 9 dashboards to about 40 executive users. “This phase was a ‘show-me-what-you-can-do’ thing,” says Sufel Barkat, Hyatt's assistant vice president for financial systems. “We simply wanted to understand the capability of the tools. The next stage will have a much bigger impact.” The ultimate plan is to spread the system throughout the Hyatt organization to its many subsidiaries, in the United States and abroad, and to its individual properties—full-blown operational BI. Eventually, hotel managers will have access to dashboards so that everyone is on the same page, and so that local employees can make local decisions based on the same information viewed at headquarters.

Hyatt ended up using a data warehouse from Teradata to cleanse operational information coming from the decentralized ERP systems of Hyatt's individual hotels around the world. The company also uses the warehouse to store and cleanse external marketing data, such as what the competition is up to, or market share in each region.

On the financial side, other sources include the proprietary company's general ledger system and an Oracle database—systems already consolidated and unified through Hyatt's original performance management outlay.

The next step will be to deliver the dashboards to between 500 and 600 users at Hyatt—all the way down to the regional manager level. The full-blown operational BI rollout will target around 3,000 users. So far, in these early stages, Barkat hasn't been able to quantify the results of System 9 with any real figures. But, he says, users have been providing feedback on metrics, which, to him, indicates a strong “cultural and business adaptation” among Hyatt's executive class.

Source: Adapted from Scott Eden, “Hyatt Merges Financial, Ops Data,” *InformationWeek*, January 17, 2006.

Decision Support Systems

Decision support systems are computer-based information systems that provide interactive information support to managers and business professionals during the decision-making process. Decision support systems use (1) analytical models, (2) specialized databases, (3) a decision maker's own insights and judgments, and (4) an interactive, computer-based modeling process to support semistructured business decisions.

Example

An example might help at this point. Sales managers typically rely on management information systems to produce sales analysis reports. These reports contain sales performance figures by product line, salesperson, sales region, and so on. A decision support system (DSS), however, would also interactively show a sales manager the effects on sales performance of changes in a variety of factors (e.g., promotion expense and salesperson compensation). The DSS could then use several criteria (e.g., expected gross margin and market share) to evaluate and rank alternative combinations of sales performance factors.

Therefore, DSS are designed to be ad hoc, quick-response systems that are initiated and controlled by business decision makers. Decision support systems are thus able to support directly the specific types of decisions and the personal decision-making styles and needs of individual executives, managers, and business professionals.

DSS Components

Unlike management information systems, decision support systems rely on **model bases**, as well as databases, as vital system resources. A DSS model base is a software component that consists of models used in computational and analytical routines that mathematically express relationships among variables. For example, a spreadsheet program might contain models that express simple accounting relationships among variables, such as Revenue 2 Expenses 5 Profit. A DSS model base could also include models and analytical techniques used to express much more complex relationships. For example, it might contain linear programming models, multiple regression forecasting models, and capital budgeting present value models. Such models may be stored in the form of spreadsheet models or templates, or statistical and mathematical programs and program modules. See Figure 10.8.

In addition, DSS software packages can combine model components to create integrated models that support specific types of decisions. DSS software typically contains built-in analytical modeling routines and also enables you to build your own models. Many DSS packages are now available in microcomputer and Web-enabled versions. Of course, electronic spreadsheet packages also provide some of the model building (spreadsheet models) and analytical modeling (what-if and goal-seeking analysis) offered by more powerful DSS software. As businesses become more aware of the power of decision support systems, they are using them in ever-increasing areas of the business. See Figure 10.9.

FIGURE 10.8

Components of a Web-enabled marketing decision support system. Note the hardware, software, model, data, and network resources involved.

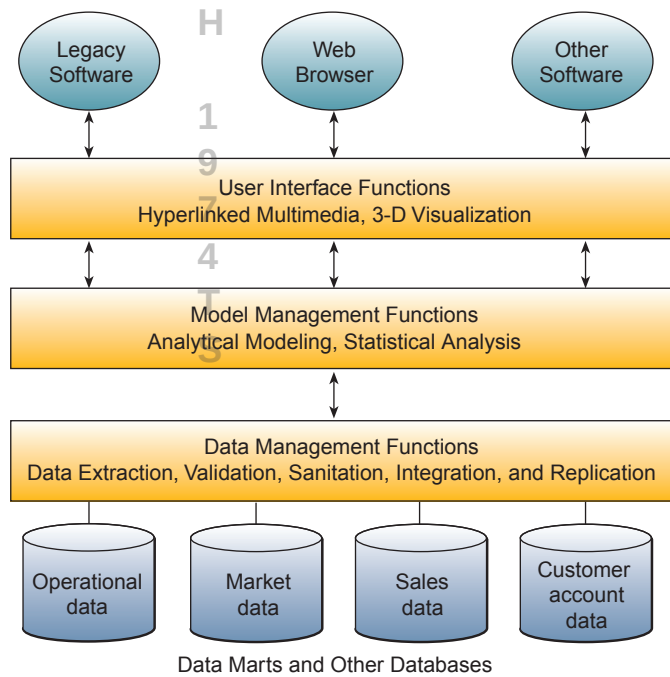


FIGURE 10.9 Many businesses are turning to decision support systems and their underlying models to improve a wide variety of business functions.

Analytics competitors make expert use of statistics and modeling to improve a wide variety of functions. Here are some common applications:		
Function	Description	Exemplars
Supply chain	Simulate and optimize supply chain flows; reduce inventory and stockouts.	Dell, Walmart, Amazon
Customer selection, loyalty, and service	Identify customers with the greatest profit potential; increase likelihood that they will want the product or service offering; retain their loyalty.	Harrah's, Capital One, Barclays
Pricing	Identify the price that will maximize yield or profit.	Progressive, Marriott
Human capital	Select the best employees for particular tasks or jobs at particular compensation levels.	New England Patriots, Oakland A's, Boston Red Sox
Product and service quality	Detect quality problems early and minimize them.	Honda, Intel
Financial performance	Better understand the drivers of financial performance and the effects of nonfinancial factors.	MCI, Verizon
Research and development	Improve quality, efficacy, and, where applicable, safety of products and services.	Novartis, Amazon, Yahoo

Source: Adapted from Thomas H. Davenport, "Competing on Analytics," *Harvard Business Review*, January 2006.

United Agri Products: Making Better Decisions Using Models and Data

You give employees electronic reports, maybe even a dashboard. But are you helping them make better day-to-day decisions?

Companies can't report their way to great results—though you wouldn't know it from their accumulation of underused reports and dashboards. Companies that get this critical point are moving away from IT-centric business intelligence (BI) programs and toward results-focused performance management. True: BI does more than just generate reports. But add in query and analysis tools, and sophisticated predictive and statistical analytics, and those tools and technologies are overwhelmingly under IT's control.

In contrast, performance management, or PM, is defined by business needs, providing decision makers with the data they need to make the right moves, ones that fit with company strategy.

Most often, companies incorporate performance management into their budgeting and financial processes, in what's called corporate or financial PM. The next step is operational PM, where they apply BI to practical, day-to-day decisions in the supply chain, sales, customer service, and other areas.

That's what's happening at United Agri Products (UAP), a unit of \$5 billion-a-year chemical and fertilizer supplier Agrium, which started doing operational PM projects using IBM's Cognos BI platform. "After years of IT preaching the value of BI to business, we reached a point of maturity where the roles started to reverse, and the business started coming to us with ideas," says David Wheat, UAP's director of decision support systems.

UAP's director of operations brought one such project to IT. The CEO had asked him to cut end-of-year inventory by \$25 million, a difficult task for an agricultural company given ever-changing weather conditions, crop disease, and insect infestations, all happening across a variety of regions.

"The operations director sketched out exactly what he wanted on a whiteboard," Wheat says. Then he said, "If I can know at any point in time what I have in inventory and can forecast what the consumption will be through the end of the season, I'll know what dollar amount I'll have left and I can go after the high-dollar overages."

With that context, Wheat laid out a model for a PM system that included what data he needed and when he had to have it in order to make decisions. And his model came complete with a financial target.

UAP lacked a sales forecasting application, so Wheat's team developed one by integrating relevant information—current inventory levels, open purchase orders, prior-year purchase histories, and predicted overages or shortages—into a single report. The application includes a daily alert that notifies managers in four regions whenever a purchase order has the potential to create excess season-ending inventory.

“All that data presented in one place, with exceptions highlighted in color, made problems jump right to the top for the director and his regional managers,” Wheat says. That information led managers to investigate open, unconfirmed purchase orders to see if they're justified. The result: “Within two weeks, UAP had canceled \$2 million worth of POs for products that weren't needed.”

Source: Adapted from Dough Henschen, “Decision Time,” *InformationWeek*, November 24, 2008.

Management Information Systems

Recall from Chapter 1 that **management information systems** were the original type of information system developed to support managerial decision making. An MIS produces information products that support many of the day-to-day decision-making needs of managers and business professionals. Reports, displays, and responses produced by management information systems provide information that these decision makers have specified in advance as adequately meeting their information needs. Such predefined information products satisfy the information needs of decision makers at the operational and tactical levels of the organization who are faced with more structured types of decision situations. For example, sales managers rely heavily on sales analysis reports to evaluate differences in performance among salespeople who sell the same types of products to the same types of customers. They have a pretty good idea of the kinds of information about sales results (by product line, sales territory, customer, salesperson, and so on) that they need to manage sales performance effectively.

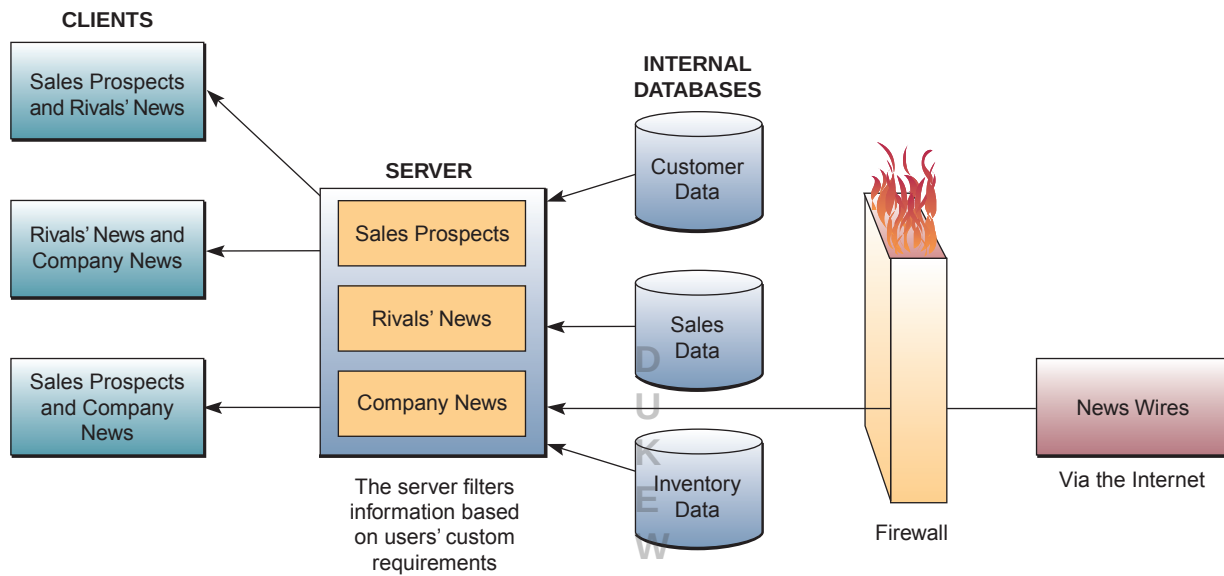
Managers and other decision makers use an MIS to request information at their networked workstations that supports their decision-making activities. This information takes the form of periodic, exception, and demand reports and immediate responses to inquiries. Web browsers, application programs, and database management software provide access to information in the intranet and other operational databases of the organization. Remember, operational databases are maintained by transaction processing systems. Data about the business environment are obtained from Internet or extranet databases when necessary.

Management information systems provide a variety of information products to managers. Four major **reporting alternatives** are provided by such systems.

Management Reporting Alternatives

- **Periodic Scheduled Reports.** This traditional form of providing information to managers uses a prespecified format designed to provide managers with information on a regular basis. Typical examples of such periodic scheduled reports are daily or weekly sales analysis reports and monthly financial statements.
- **Exception Reports.** In some cases, reports are produced only when exceptional conditions occur. In other cases, reports are produced periodically but contain information only about these exceptional conditions. For example, a credit manager can be provided with a report that contains only information on customers who have exceeded their credit limits. Exception reporting reduces *information overload* instead of overwhelming decision makers with periodic detailed reports of business activity.
- **Demand Reports and Responses.** Information is available whenever a manager demands it. For example, Web browsers, DBMS query languages, and report generators enable managers at PC workstations to get immediate responses or to find and obtain customized reports as a result of their requests for the information they need. Thus, managers do not have to wait for periodic reports to arrive as scheduled.
- **Push Reporting.** Information is *pushed* to a manager's networked workstation. Thus, many companies are using Webcasting software to broadcast selectively reports

FIGURE 10.10 An example of the components in a marketing intelligence system that uses the Internet and a corporate intranet system to “push” information to employees.



and other information to the networked PCs of managers and specialists over their corporate intranets. See Figure 10.10.

Online Analytical Processing

At a stockholder meeting, the former CEO of PepsiCo, D. Wayne Calloway, said: “Ten years ago I could have told you how Doritos were selling west of the Mississippi. Today, not only can I tell you how well Doritos sell west of the Mississippi, I can also tell you how well they are selling in California, in Orange County, in the town of Irvine, in the local Vons supermarket, in the special promotion, at the end of Aisle 4, on Thursdays.”

The competitive and dynamic nature of today’s global business environment is driving demands by business managers and analysts for information systems that can provide fast answers to complex business queries. The IS industry has responded to these demands with developments like analytical databases, data marts, data warehouses, data mining techniques, and multidimensional database structures (discussed in Chapter 5), and with specialized servers and Web-enabled software products that support **online analytical processing (OLAP)**.

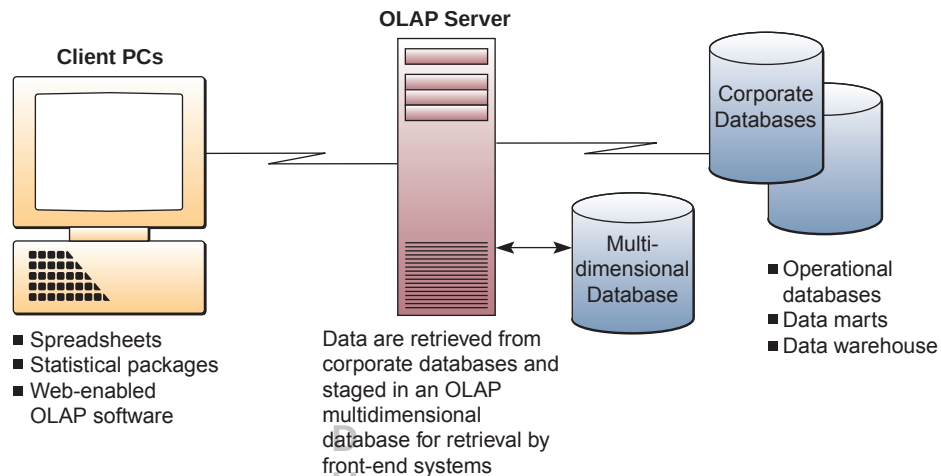
Online analytical processing enables managers and analysts to interactively examine and manipulate large amounts of detailed and consolidated data from many perspectives. OLAP involves analyzing complex relationships among thousands or even millions of data items stored in data marts, data warehouses, and other multidimensional databases to discover patterns, trends, and exception conditions. An OLAP session takes place online in real time, with rapid responses to a manager’s or analyst’s queries, so that the analytical or decision-making process is undisturbed. See Figure 10.11.

Online analytical processing involves several basic analytical operations, including consolidation, “drill-down,” and “slicing and dicing.” See Figure 10.12.

- **Consolidation.** Consolidation involves the aggregation of data, which can involve simple roll-ups or complex groupings involving interrelated data. For example, data about sales offices can be rolled up to the district level, and the district-level data can be rolled up to provide a regional-level perspective.
- **Drill-down.** OLAP can also go in the reverse direction and automatically display detailed data that comprise consolidated data. This process is called drill-down. For example, the sales by individual products or sales reps that make up a region’s sales totals could be easily accessed.

FIGURE 10.11

Online analytical processing may involve the use of specialized servers and multidimensional databases. OLAP provides fast answers to complex queries posed by managers and analysts using traditional and Web-enabled OLAP software.



- **Slicing and Dicing.** Slicing and dicing refers to the ability to look at the database from different viewpoints. One slice of the sales database might show all sales of a product type within regions. Another slice might show all sales by sales channel within each product type. Slicing and dicing is often performed along a time axis to analyze trends and find time-based patterns in the data.

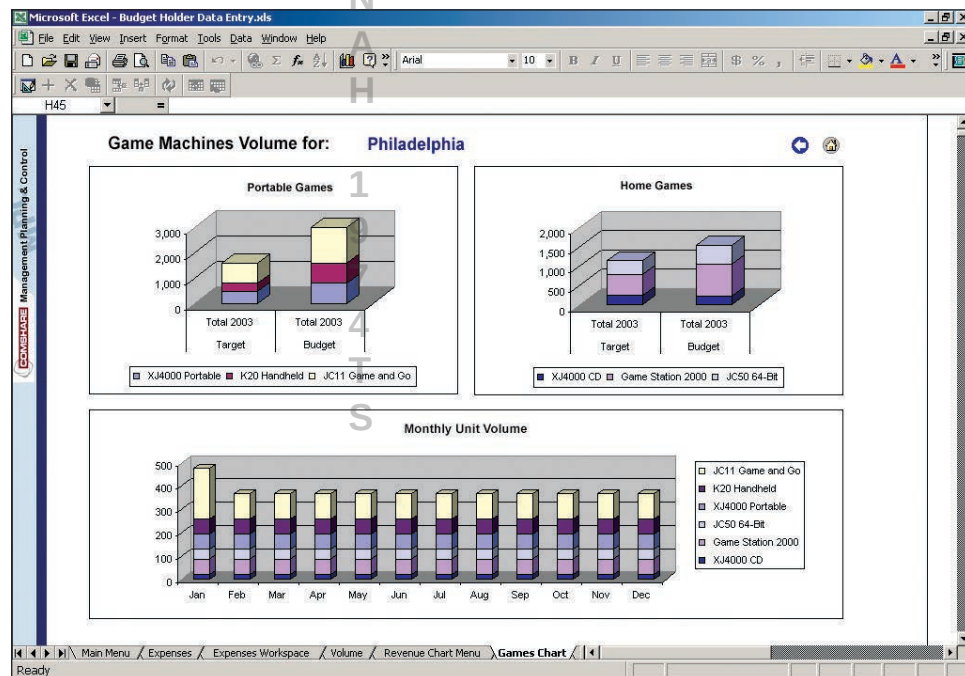
OLAP Examples

Probably the best way to understand the power of OLAP fully is to look at common business applications of the technique. The real power of OLAP comes from the marriage of data and models on a large scale. Through this marriage, managers can solve a variety of problems that previously would be considered too complex to tackle effectively. Common business areas where OLAP can solve complex problems include:

- Marketing and sales analysis
- Clickstream data
- Database marketing
- Budgeting

FIGURE 10.12

Comshare's Management Planning and Control software enables business professionals to use Microsoft Excel as their user interface for Web-enabled online analytical processing.



Source: Used with permission from Microsoft®.

- Financial reporting and consolidation
- Profitability analysis
- Quality analysis

Let's look at one or two examples of how OLAP can be used in the modern business setting.

It is near the end of a business quarter, and senior management is worried about the market acceptance of several new products. A marketing analyst is asked to provide an update to senior management. The problem is that the update must be delivered in less than an hour due to a last-minute request from the CEO. The analyst really only has a few minutes to analyze the market acceptance of several new products, so she decides to group 20 products that were introduced between six and nine months ago and compare their sales with a comparable group of 50 products introduced between two and three years ago. The analyst just defines two new, on-the-fly, product groupings and creates a ratio of the new group to the older group. She can then track this ratio of sales revenue or volume by any level of location, over time, by customer sector or by sales group. Defining the new groupings and the ratio takes a couple of minutes, and any of the analyses take a matter of a few seconds to generate, even though the database has tens of thousands of products and hundreds of locations. It takes no more than a total of 15 minutes to spot that some regions have not accepted the new products as fast as others.

Then, the analyst investigates whether this was because of inadequate promotion, unsuitability of the new products, lack of briefings of the sales force in the slow areas, or whether some areas always accept new products more slowly than others. Looking at other new product introductions by creating new groupings of products of different ages, she finds that the same areas are always conservative when introducing expensive new products. She then uses this information to see if the growth in the slow areas is in line with history and finds that some areas have taken off even more slowly than previously. Given the results of this analysis, senior management decides it is premature in its concern and tables further discussion until the next quarterly sales data can be assessed.

In another example, let's consider a general merchandise retailer who has joined the e-tailing ranks, wants the company Web site to be as "sticky" as possible, and has begun to analyze clickstream data to surmise why customers might leave the site prematurely. The company sharpened its analysis to determine the value of abandoned shopping carts. When a customer leaves the site in the middle of a shopping trip, for whatever reason, the company looks to see what products were in the abandoned cart. The data are then compared with similar data from other carts to examine:

- How much revenue the abandoned carts represented (in other words, the amount of revenue that was lost because of the customer's early departure).
- Whether the products in the cart were high-profit items or loss leaders.
- Whether the same products were found in other abandoned carts.
- The volume of products and the number of different product categories in the cart.
- Whether the total bill for the abandoned carts consistently fell within a certain dollar range.
- How the average and total bills for abandoned carts compared with unabandoned carts (those that made it through the checkout process).

The results of using OLAP to conduct this analysis trigger some interesting theories. For instance, it is possible that none of the products in the cart was appealing enough to a particular customer to keep that customer shopping. The customer might have been annoyed by frequent inquiries, such as "Are you ready to check out?" At a particular dollar total, the customer might have changed his or her mind about the entire shopping trip and left. It's also possible that a number or mix of products in a cart reminded the customer of another site that might offer a steeper discount for similar purchases.

Admittedly, some of these theories are mere guesses. After all, maybe the customer's Internet connection was on the fritz, or the site had a bug that abruptly booted the user. When examined regularly and with consistent metrics, however, clickstreams can reveal interesting patterns. After several analyses, the e-tailer decides to make some changes to the Web site.

First, the e-tailer tweaks the site to show a rolling total as items are added to the cart, thereby allowing the customer to see the total charge during the shopping time and to check out once the magic budget limit is reached. In addition, rather than requiring the customer to go to another page for specific product information, the site now invites the customer to see pop-up product information with a click of the right mouse button, keeping the buy mode alive. Finally, the vendor decides to integrate the clickstream data with more specific customer behavior information, including information from the CRM system.

Rather than just examining a customer's navigation patterns and guessing about which actions to take, the e-tailer can combine those patterns with more specific customer data (such as previous purchases in that product category, key demographic and psychographic data, or lifetime value score) to provide a complete view of that customer's value and interests. That kind of analysis will show you whether the lost customer was a one-time-only shopper or a high-value customer. A tailored e-mail message or electronic coupon—perhaps targeting one of the products left behind on a prior trip—could make all the difference the next time that high-value customer logs on.

Here's a real-world example of how OLAP can help solve complex business problems.

Direct Energy: Mining BI to Keep Its Customers

Even before bad debt shook the mortgage industry, Direct Energy was feeling its effects, including eroding revenue streams due to customer churn. Until then, the company effectively mined its way out in the best fashion: business intelligence. "Various groups were pulling data from various systems and not having integrated information," explains John Katsinos, vice president of IS for Direct Energy's mass markets operations. "There was no way to tie together a customer's end-to-end lifecycle."

Without that holistic view of customer records, it was difficult for Direct Energy analysts to understand, let alone prevent, customer churn. So began BI Jumpstart, the company's initiative to give its analysts insight into customer actions that precipitate into the dropping of Direct Energy services, as well as tools for forecasting bad debt. The result has been savings of tens of millions of dollars and a more proactive approach to customer retention via more accurate pricing, forecasting, and targeted marketing.

"We wanted to mitigate the risk to our business and customer base, and to grow our customer base and revenue," Katsinos adds.

"That meant being able to understand customer data at a level where we can forecast and predict behavior," Katsinos kicked off BI Jumpstart by assembling a crack analytics team consisting of an IS project manager, a data modeler, a pair of ETL developers, an analytic developer, a BI architect, and a BI administrator. That group then implemented a "multilayered business intelligence" strategy that, Katsinos explains, comprises data warehousing, data marts, OLAP repositories, and ETL.

The result is a data miner's dream: Direct Energy analysts can use the integrated BI program to predict what customers in which areas are likely to turn over, and then adjust the company's services, pricing, and marketing campaigns accordingly.

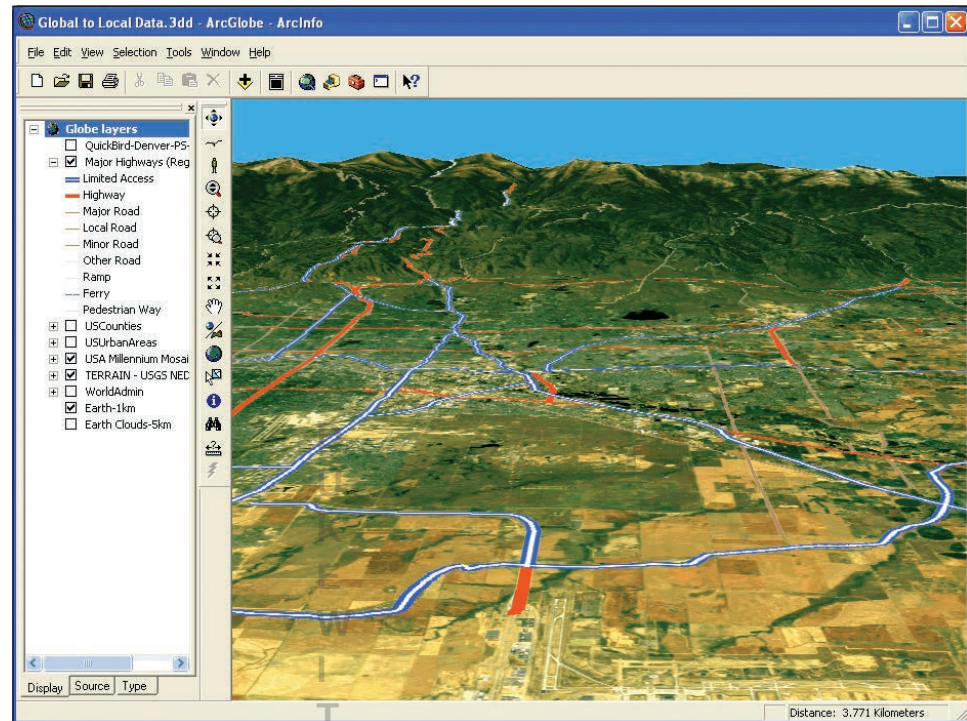
For example, with BI Jumpstart in place, Direct Energy can now determine why one of its offerings experiences a 2 percent churn while another sees 20 percent of its customers dropping the service.

More than an initiative geared toward new revenue streams, BI Jumpstart helps Direct Energy make the most of what it already has. "Now, we can slice and dice any way we want," Katsinos says.

Source: Adapted from Tom Sullivan, "Direct Energy Mines BI to Conserve Revenue Streams," *InfoWorld*, November 17, 2008.

FIGURE 10.13

Geographic information systems facilitate the mining and visualization of data associated with a geophysical location.



Source: Courtesy of Rockware Inc.

Geographic Information and Data Visualization Systems

Geographic information systems (GIS) and **data visualization systems (DVS)** are special categories of DSS that integrate computer graphics with other DSS features. A geographic information system is a DSS that uses *geographic databases* to construct and display maps, as well as other graphics displays that support decisions affecting the geographic distribution of people and other resources. Many companies are using GIS technology along with *global positioning system* (GPS) devices to help them choose new retail store locations, optimize distribution routes, or analyze the demographics of their target audiences. For example, companies like Levi Strauss, Arby's, Consolidated Rail, and Federal Express use GIS packages to integrate maps, graphics, and other geographic data with business data from spreadsheets and statistical packages. GIS software such as MapInfo and Atlas GIS is used for most business GIS applications. See Figure 10.13.

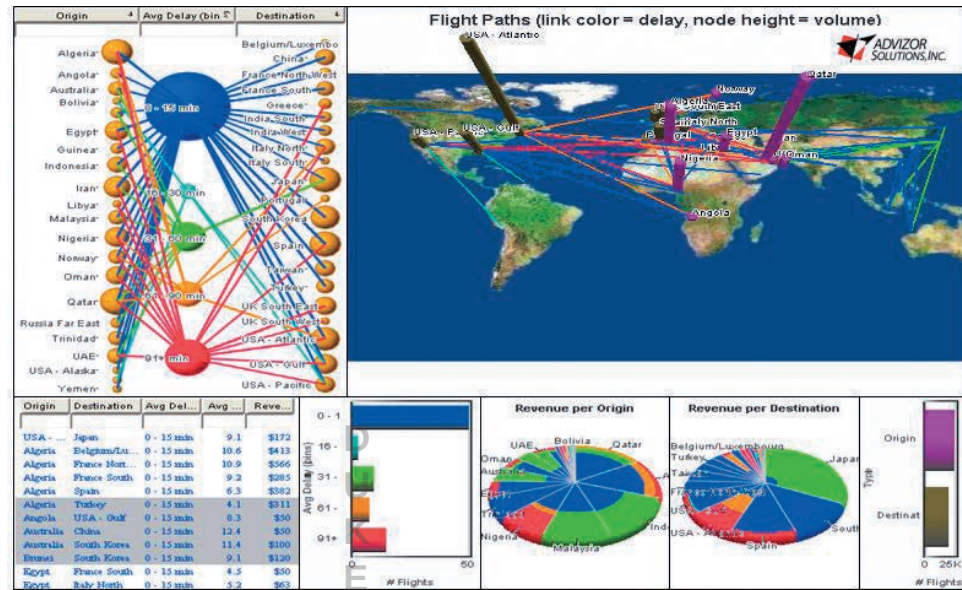
Data visualization systems represent complex data using interactive, three-dimensional, graphical forms such as charts, graphs, and maps. DVS tools help users interactively sort, subdivide, combine, and organize data while the data are in their graphical form. This assistance helps users discover patterns, links, and anomalies in business or scientific data in an interactive knowledge discovery and decision support process. Business applications like data mining typically use interactive graphs that let users drill down in real time and manipulate the underlying data of a business model to help clarify their meaning for business decision making. Figure 10.14 is an example of airline flight analysis by a data visualization system.

The concept of the geographic information system and data visualization is not a new one. One of the first recorded uses of the concept occurred in September 1854. During a 10-day period, 500 people, all from the same section of London, England, died of cholera. Dr. John Snow, a local physician, had been studying this cholera epidemic for some time. In trying to determine the source of the cholera, Dr. Snow located every cholera death in the Soho district of London by marking the location of the home of each victim with a dot on a map he had drawn. Figure 10.15 contains a replica of his original map.

As can be seen on the map, Dr. Snow marked the deaths with dots, and the 11 Xs represent water pumps. By examining the scattering and clustering of the dots, Dr. Snow observed that the victims of the cholera shared one common attribute: They all lived

FIGURE 10.14

Using a data visualization system to analyze airplane flights by segment and average delay, with drill-down to details.



Source: Courtesy of ADVIZOR Solutions, Inc. www.advisorsolutions.com.

FIGURE 10.15

Replica of Dr. John Snow's cholera epidemic map.



Source: E.R. Tufte, *The Visual Display of Quantitative Information*, 2nd ed. (Cheshire, Connecticut: Graphics Press, 2001), p. 24.

near—and drank from—the Broad Street water pump. To test his hypothesis, Dr. Snow requested that the handle of the pump be removed, thus rendering it inoperable. Within a very short time, the cholera epidemic, which claimed more than 500 lives, was over.

JPMorgan and Panopticon: Data Visualization Helps Fixed Income Traders

Visualizing and understanding vast quantities of credit market data can be overwhelming using traditional techniques such as charts and tables. Navigating through this data to find specific reports and analytical information can also prove daunting, and traditional information delivery mechanisms have tended to provide unruly volumes of data. The Internet is today the obvious delivery mechanism for such market data and proprietary analyses, yet the providers of such services must deliver more intuitive visualization and navigation to provide better value to their customers.

Fixed income research and analytics providers are looking at new means of visualizing data to provide more valuable and intuitive services to their users by going beyond simple online tables, charts, and document repositories.

JPMorgan created their CreditMap application using Panopticon Developer in order to provide their customers with a graphical representation of real-time activity in the corporate bond market. JPMorgan blurred the lines between providing informative research and valuable analytics, which has enabled them to win the Euromoney award for “Best Online Fixed Income Research.”

JPMorgan was able to provide their users with quicker access to their existing online information using new visualization and navigation tools. To do this, they implemented Panopticon’s interactive treemap visualization as a presentation layer and navigation system that provides a bird’s-eye view of the data, at the same time allowing the user to drill down to specific reports and analytics.

JPMorgan’s CreditMap allows users to visualize information through the use of color, size, and proximity in any way they desire with an easily customizable interface. This interface acts as a catalyst, enabling users to recognize patterns, analyze information, and make decisions more quickly and more accurately than ever before. Before CreditMap, the brokerage firm’s customers could read text reports on the corporate bond market and view various tables of statistical information. But the market is so extensive that it could be difficult to keep things in perspective or to be aware of many of the investment opportunities.

CreditMap presents the corporate bond universe as a quilt of rectangles on a computer screen. The quilt is divided into industry sectors, and the rectangles within each sector represent bond issues. The size of the rectangle indicates the size of the issue, and the color indicates the issue’s performance. So at a glance, investors can see which sectors and which individual issues are hot, and whether an issue’s size fits their investment needs. Clicking on a rectangle opens a window that gives basic information on the issue—including its ratings and the name and phone number of the analyst who covers the issue—along with a drop-down menu offering detailed research.

“Panopticon treemaps have greatly enhanced our users’ ability to visualize the credit markets and utilize analytics—it was an important contributing factor to us winning the Euromoney award,” says Lee McGinty, head of European Portfolio & Index Strategy at JPMorgan.

Source: Adapted from *Case Study: JPMorgan CreditMap*, www.panopticon.com, March 2008.

Using Decision Support Systems

A decision support system involves an interactive **analytical modeling** process. For example, using a DSS software package for decision support may result in a series of displays in response to alternative what-if changes entered by a manager. This differs from the demand responses of management information systems because decision makers are not demanding prespecified information; rather, they are exploring possible alternatives. Thus, they do not have to specify their information needs in advance. Instead, they use the DSS to find the information they need to help them make a decision. This is the essence of the decision support system concept.

Four basic types of analytical modeling activities are involved in using a decision support system: (1) what-if analysis, (2) sensitivity analysis, (3) goal-seeking analysis, and (4) optimization analysis. Let’s briefly look at each type of analytical modeling that can be used for decision support. See Figure 10.16.

What-If Analysis

In **what-if analysis**, a user makes changes to variables, or relationships among variables, and observes the resulting changes in the values of other variables. For example, if you were using a spreadsheet, you might change a revenue amount (a variable) or a tax rate formula (a relationship among variables) in a simple financial spreadsheet model. Then you could command the spreadsheet program to recalculate all affected variables in the

FIGURE 10.16
Activities and examples of the major types of analytical modeling.

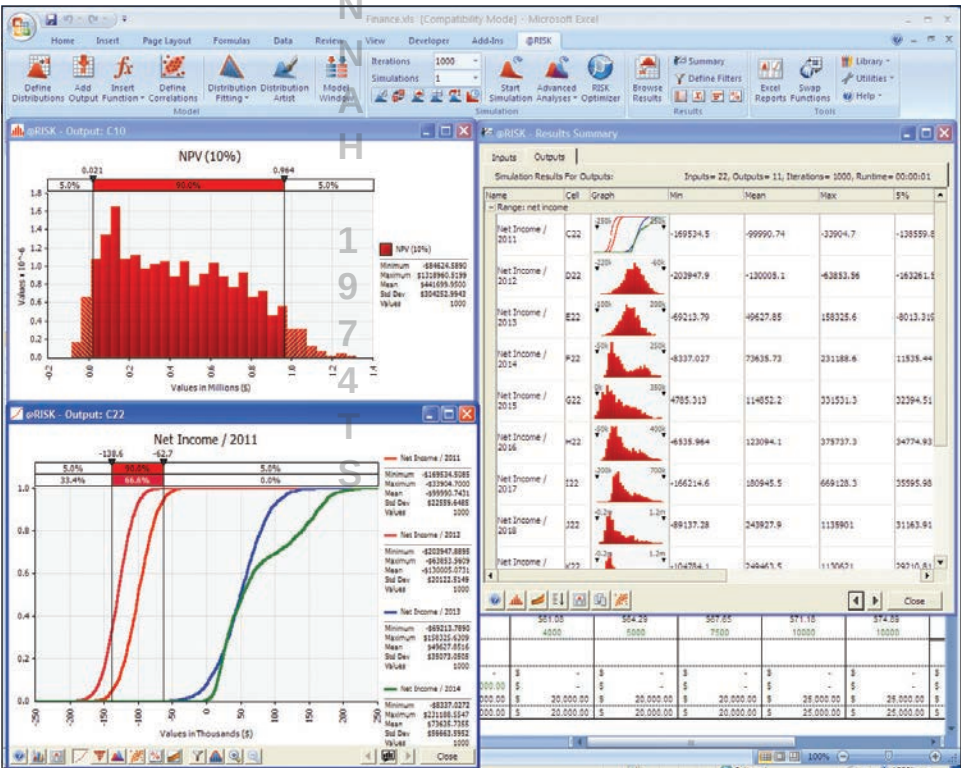
Type of Analytical Modeling	Activities and Examples
What-if analysis	Observing how changes to selected variables affect other variables. <i>Example:</i> What if we cut advertising by 10 percent? What would happen to sales?
Sensitivity analysis	Observing how repeated changes to a single variable affect other variables. <i>Example:</i> Let's cut advertising by \$100 repeatedly so we can see its relationship to sales.
Goal-seeking analysis	Making repeated changes to selected variables until a chosen variable reaches a target value. <i>Example:</i> Let's try increases in advertising until sales reach \$1 million.
Optimization analysis	Finding an optimum value for selected variables, given certain constraints. <i>Example:</i> What's the best amount of advertising to have, given our budget and choice of media?

spreadsheet instantly. A managerial user would be able to observe and evaluate any changes that occurred to the values in the spreadsheet, especially to a variable such as net profit after taxes. To many managers, net profit after taxes is an example of the *bottom line*, that is, a key factor in making many types of decisions. This type of analysis would be repeated until the manager was satisfied with what the results revealed about the effects of various possible decisions. Figure 10.17 is an example of what-if analysis.

Sensitivity Analysis

Sensitivity analysis is a special case of what-if analysis. Typically, the value of only one variable is changed repeatedly, and the resulting changes on other variables are observed. As such, sensitivity analysis is really a case of what-if analysis that involves repeated changes to only one variable at a time. Some DSS packages automatically make

FIGURE 10.17
This what-if analysis, performed by @RISK for Excel, involves the evaluation of probability distributions of net income and net present value (NPV) generated by changes to values for sales, competitors, product development, and capital expenses.



Source: @RISK software. Image courtesy of Palisade Corporation.

repeated small changes to a variable when asked to perform sensitivity analysis. Typically, decision makers use sensitivity analysis when they are uncertain about the assumptions made in estimating the value of certain key variables. In our previous spreadsheet example, the value of revenue could be changed repeatedly in small increments, and the effects on other spreadsheet variables observed and evaluated. This process would help a manager understand the impact of various revenue levels on other factors involved in decisions being considered. A typical example might be determining at what point the interest rate on a loan makes a project no longer feasible. By varying the interest rate used in a net present value calculation, for example, a manager can determine the range of acceptable interest rates under which a project can move forward. Approaching the problem this way allows the manager to make decisions about a forthcoming project without knowing the actual cost of the money being borrowed.

Goal-Seeking Analysis

Goal-seeking analysis reverses the direction of the analysis done in what-if and sensitivity analyses. Instead of observing how changes in a variable affect other variables, goal-seeking analysis (also called *how-can* analysis) sets a target value (goal) for a variable and then repeatedly changes other variables until the target value is achieved. For example, you could specify a target value (goal) of \$2 million in net profit after taxes for a business venture. Then you could repeatedly change the value of revenue or expenses in a spreadsheet model until you achieve a result of \$2 million. Thus, you would discover the amount of revenue or level of expenses the business venture needs to reach the goal of \$2 million in after-tax profits. Therefore, this form of analytical modeling would help answer the question, “How can we achieve \$2 million in net profit after taxes?” instead of the question, “What happens if we change revenue or expenses?” So, goal-seeking analysis is another important method of decision support.

Optimization Analysis

Optimization analysis is a more complex extension of goal-seeking analysis. Instead of setting a specific target value for a variable, the goal is to find the optimum value for one or more target variables, given certain constraints. Then one or more other variables are changed repeatedly, subject to the specified constraints, until you discover the best values for the target variables. For example, you could try to determine the highest possible level of profits that could be achieved by varying the values for selected revenue sources and expense categories. Changes to such variables could be subject to constraints, such as the limited capacity of a production process or limits to available financing. Optimization typically is accomplished using software like the Solver tool in Microsoft Excel and other software packages for optimization techniques, such as linear programming.

Casual Male Retail Group: On-Demand Business Intelligence

Ask Dennis Hernreich, COO and CFO of Casual Male Retail Group, what his life was like before he switched to an on-demand business intelligence reporting application, and he remembers the frustration all too easily.

Casual Male Retail Group, a specialty retailer of big and tall men’s apparel with \$464 million in annual sales, was using a legacy on-premise reporting application for its catalog operations. (The company also has 520 retail outlets and e-commerce operations.) Yet the reporting features built into the system were “extremely poor,” as Hernreich describes them: “Visibility to the business? Terrible. Real-time information? Doesn’t exist. How are we doing with certain styles by size? Don’t know.”

“It was unacceptable,” Hernreich says. In addition, you could only view those “canned” reports (which lacked features such as exception reporting) by making a trip to the printer for a stack of printouts. “It was hundreds of pages,” he recalls. “That’s just not how you operate today.”

It’s not as though Casual Male didn’t have all this information; it just didn’t have an intuitive and easy way to see the sales and inventory trends for its catalog business in real time. That changed in 2004, when Casual Male began to use a on-demand BI tool from vendor Oco (www.oco-inc.com), which takes all of Casual Male’s data, builds and maintains a data warehouse for it off-site, and creates “responsive, real-time

reporting dashboards that give us and our business users information at their fingertips,” Hernreich says.

Today, Hernreich and Casual Male’s merchandise planners and buyers have access to easy-to-consume dashboards full of catalog data: “What styles are selling today? How much inventory are we selling today? Where are we short? Where do we need to order? How are we selling by size? What are we out of stock in?” he says. “All of these basic questions, in terms of running the business—that’s what we’re learning every day from these reports.”

Best of all, those annoying trips to the printer have ended.

Source: Adapted from Thomas Wailgum, “Business Intelligence and On-Demand: The Perfect Marriage?” *CIO Magazine*, March 27, 2008.

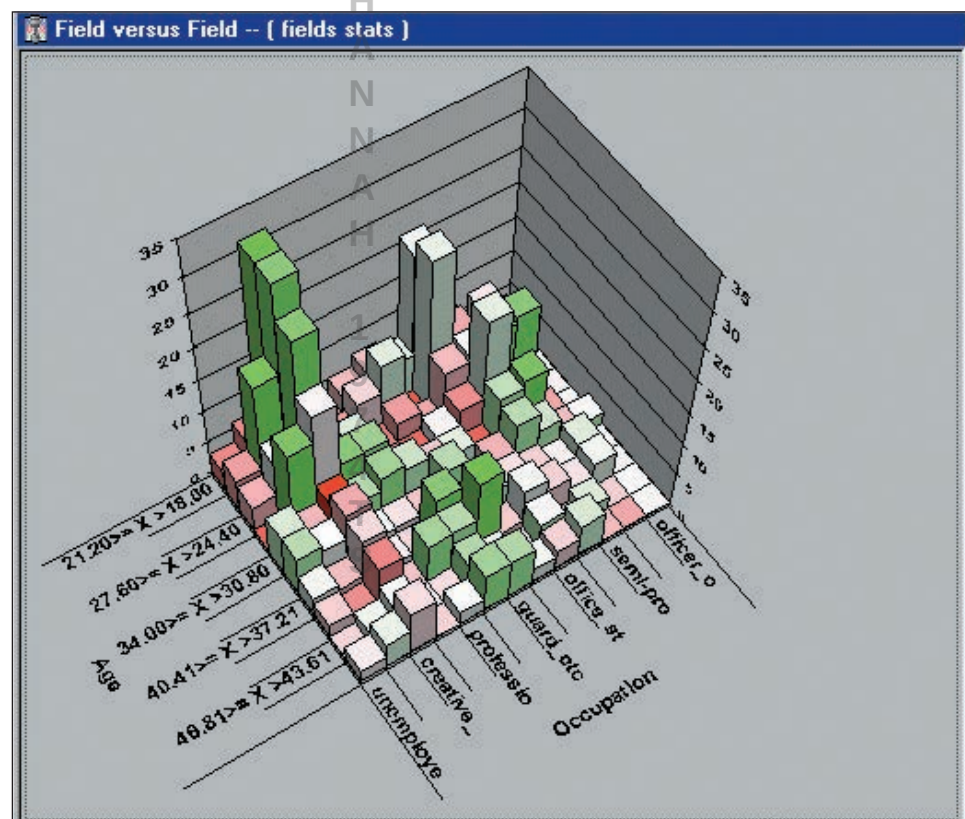
Data Mining for Decision Support

We discussed **data mining** and data warehouses in Chapter 5 as vital tools for organizing and exploiting the data resources of a company. Thus, data mining’s main purpose is to provide decision support to managers and business professionals through a process referred to as *knowledge discovery*. Data mining software analyzes the vast stores of historical business data that have been prepared for analysis in corporate data warehouses and tries to discover patterns, trends, and correlations hidden in the data that can help a company improve its business performance.

Data mining software may perform regression, decision tree, neural network, cluster detection, or market basket analysis for a business. See Figure 10.18. The data mining process can highlight buying patterns, reveal customer tendencies, cut redundant costs, or uncover unseen profitable relationships and opportunities. For example, many companies use data mining to find more profitable ways to perform successful direct mailings, including e-mailings, or discover better ways to display products in a store,

FIGURE 10.18

Data mining software helps discover patterns in business data, like this analysis of customer demographic information.



Source: Courtesy of XpertRule Software.

design a better e-commerce Web site, reach untapped profitable customers, or recognize customers or products that are unprofitable or marginal.

Market basket analysis (MBA) is one of the most common and useful types of data mining for marketing and is a key technique in business analytics. The purpose of market basket analysis is to determine which products customers purchase together with other products. MBA takes its name from the concept of customers throwing all of their purchases into a shopping cart (a market basket) during grocery shopping. It can be very helpful for a retailer or any other company to know which products people purchase as a group. A store could use this information to place products frequently sold together into the same area, and a catalog or World Wide Web merchant could use it to determine the layouts of a catalog and order form. Direct marketers could use the basket analysis results to determine which new products to offer their prior customers.

In some cases, the fact that items are sold together is obvious; every fast-food restaurant asks its customers “Would you like fries with that?” whenever a customer orders a sandwich. Sometimes, however, the fact that certain items would be sold together is far from obvious. A well-known example is the relationship between beer and diapers. A supermarket performing a basket analysis discovered that diapers and beer sell well together on Thursdays. Although the result makes some sense—couples stock up on supplies for themselves and for their children before the weekend starts—it’s far from intuitive. The strength of market basket analysis is as follows: By using computer data mining tools, it’s not necessary for a person to think of which products consumers would logically buy together; instead, the customers’ sales data speak for themselves. This is a good example of data-driven marketing.

Consider some of the typical applications of MBA:

- **Cross Selling.** Offer the associated items when customer buys any items from your store.
- **Product Placement.** Items that are associated (such as bread and butter, tissues and cold medicine, potato chips and beer) can be put near each other. If the customers see them, it has higher probability that they will purchase them together.
- **Affinity Promotion.** Design the promotional events based on associated products.
- **Survey Analysis.** The fact that both independent and dependent variables of market basket analysis are nominal (categorical) data type makes MBA very useful to analyze questionnaire data.
- **Fraud Detection.** Based on credit card usage data, we may be able to detect certain purchase behaviors that can be associated with fraud.
- **Customer Behavior.** Associating purchase with demographic, and socioeconomic data (such as age, gender, and preference) may produce very useful results for marketing.

Once it is known that customers who buy one product are likely to buy another, it is possible for a company to market the products together or make the purchasers of one product target prospects for another. If customers who purchase diapers are already likely to purchase beer, they’ll be even more likely to buy beer if there happens to be a beer display just outside the diaper aisle. Likewise, if it’s known that customers who buy a sweater from a certain mail-order catalog have a propensity toward buying a jacket from the same catalog, sales of jackets can be increased by having the telephone representatives describe and offer the jacket to anyone who calls in to order the sweater. By targeting customers who are already known to be likely buyers, the effectiveness of a given marketing effort is significantly increased—regardless of whether the marketing takes the form of in-store displays, catalog layout design, or direct offers to customers.

Boston Celtics: Using Data Analytics to Price Tickets

Boston Celtics executives are taking advantage of a data analytics tool in their annual January task of setting prices for the 18,600 seats in TD Banknorth Garden. The NBA team installed the StratBridge.net tool from StratBridge Inc. to monitor consumer demand through real-time displays of sold and available seats in its home arena. Now team officials are also using the tool during the month-long project to set base ticket prices for the next season.

The new tool has helped the organization quickly develop promotions and sales strategies to fill available seats and to analyze revenue based on long-term sales trends, says Daryl Morey, senior vice president of operations and information for the Celtics. “Until we had this tool, it was very difficult to create dynamic packages because our ticket providers didn’t have a rapid way to see which seats were open,” Morey says. “Now we can actually see in real time every single seat and how much it is sold for.”

The basketball team has already seen a “seven figure” return on investment fueled by five-figure revenue boosts every one to two weeks since it began to use StratBridge.net in 2006, according to Morey. Before using data analytics, sales executives used Excel spreadsheets to adjust pricing. In that system, pricing could be adjusted only for all the seats within each of 12 large sections in the arena. “It was a leap of faith looking at the data at that level,” says Morey.

Using the analytics tool, for example, planners found that ticket buyers tended to favor aisle seating in certain sections; as a result, the team now focuses on marketing the inner seats. Now, in the ticket office, group- and individual-ticket sellers can see an image of the arena seating chart on a plasma TV screen with different color blocks indicating real-time availability and revenue for home games. Sales executives can access this information from their desktops to study buying trends and design new promotions.

StratBridge.net extracts data from internal and external sources and displays it visually in Internet browsers and Microsoft Office applications. The analysis can be presented to users in Word, Excel, PowerPoint, and Adobe PDF files. Bill Hostmann, an analyst at Gartner Inc., said companies trying to market “perishable” products like basketball games, hotel rooms, or live television broadcasts are beginning to turn to this type of data analysis, which was first perfected in the airline industry. “You’re seeing more and more of this kind of analytical functionality being embedded in the application itself as a part of the process, as opposed to being done on a quarterly or weekly basis,” Hostmann said. “The ROI is very fast on these types of applications.”

Source: Adapted from Heather Havenstein, “Celtics Turn to Data Analytics Tool for Help Pricing Tickets,” *Computerworld*, January 6, 2006.

Executive Information Systems

Executive information systems (EIS) are information systems that combine many of the features of management information systems and decision support systems. When they were first developed, their focus was on meeting the strategic information needs of top management. Thus, the first goal of executive information systems was to provide top executives with immediate and easy access to information about a firm’s *critical success factors* (CSFs), that is, key factors that are critical to accomplishing an organization’s strategic objectives. For example, the executives of a retail store chain would probably consider factors such as its e-commerce versus traditional sales results or its product line mix to be critical to its survival and success.

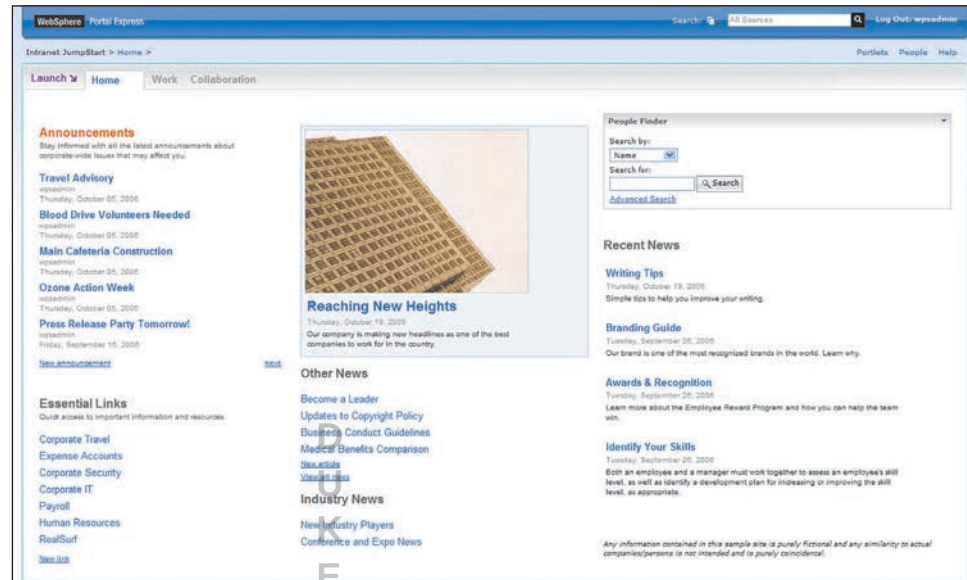
Yet managers, analysts, and other knowledge workers use executive information systems so widely that they are sometimes humorously called “everyone’s information systems.” More popular alternative names are enterprise information systems (EIS) and executive support systems (ESS). These names also reflect the fact that more features, such as Web browsing, e-mail, groupware tools, and DSS and expert system capabilities, are being added to many systems to make them more useful to managers and business professionals.

Features of an EIS

In an EIS, information is presented in forms tailored to the preferences of the executives using the system. For example, most executive information systems emphasize the use of a graphical user interface, as well as graphics displays that can be customized to

FIGURE 10.19

This Web-based executive information system provides managers and business professionals with a variety of personalized information and analytical tools for decision support.



Source: Courtesy of International Business Machines Corporation.

the information preferences of executives using the EIS. Other information presentation methods used by an EIS include exception reporting and trend analysis. The ability to *drill down*, which allows executives to retrieve displays of related information quickly at lower levels of detail, is another important capability.

Figure 10.19 shows one of the displays provided by the Web-enabled Hyperion executive information system. Notice that this display is simple and brief, and note how it provides users of the system with the ability to drill down quickly to lower levels of detail in areas of particular interest to them. In addition to the drill-down capability, the Hyperion EIS emphasizes trend analysis and exception reporting. Thus, a business user can quickly discover the direction in which key factors are heading and the extent to which critical factors are deviating from expected results.

Executive information systems have spread into the ranks of middle management and business professionals as their feasibility and benefits have been recognized and as less expensive systems for client/server networks and corporate intranets became available. For example, one popular EIS software package reports that only 3 percent of its users are top executives.

PureSense and Farming: Watering Plans Based on Minute-by-Minute Data

Derk VanKonynenburg used to think the information he got from measuring the soil moisture every 15 minutes on his 1,500-acre fruit and almond orchard was as precise as he could possibly need. He gets the data from probes that measure moisture in the soil and send readings over a wireless link to a collection station. From there, it's relayed to a data center, and VanKonynenburg accesses the data online from a PC, helping him decide when and how much to water the trees.

Once VanKonynenburg and his partners got accustomed to the feed, however, they wanted even more data, and they wanted it better. "We decided we needed a measurement every minute," he says.

That's right. On this one midsize farm around Modesto, California, a farmer is measuring the soil moisture every single minute of the day to make irrigation decisions.

Understand that VanKonynenburg isn't looking at that moisture count minute-by-minute like a stock ticker, waiting to hit the water switch. He looks about once a day to create an irrigation plan. But because the farm irrigates in bursts—say, seven minutes on and 14 minutes off—collecting readings every 15 minutes wasn't accurate enough. With better understanding of moisture needs, "We think it may allow us to lower our water use another 10 percent," says VanKonynenburg, "and 10 percent is a huge number."

PureSense was founded by a team of technologists and farmers determined to give farmers a better sense of what's going on in the ground on their farms, beyond just giving them weather data and related calculations. Farmers have been "running blind for years," says John Williamson, cofounder and chief operating officer of PureSense, which says it has about 200 customers, mostly in California.

VanKonynenburg is also looking for more uses for the data he's collecting on soil moisture, temperature, and sunshine. He'd like to use the dashboard he gets from PureSense, which is focused on irrigation decisions, to determine risks for certain pests, fungus, and bacteria to determine the best time to spray for them. Like any busy executive, he wants one decision-making dashboard.

Irrigation, like most elements of farming, won't become automated. Soil moisture provides insight into what's happening in the fields and allows more informed decisions, but there are still critical judgments to be made. "You need data and then you need smart people with enough experience to interpret that," VanKonynenburg says. "A lot of those decisions are subjective."

Although he could access his moisture sensor data on an iPhone, he laughs off the idea. "I'm 69 years old," he says, adding that checking data once a day on the computer is fine. Then, a moment later, VanKonynenburg can't help but confess: "I suspect that a year from now, I will be carrying one."

Source: Adapted from Chris Murphy, "Make Every Drop Count," *InformationWeek*, November 16, 2009.

Enterprise Portals and Decision Support

Enterprise Information Portals

Don't confuse portals with the executive information systems that have been used in some industries for many years. Portals are for everyone in the company, and not just for executives. You want people on the front lines making decisions using browsers and portals rather than just executives using specialized executive information system software.

We mentioned previously in this chapter that major changes and expansions are taking place in traditional MIS, DSS, and EIS tools for providing the information and modeling managers need to support their decision making. Decision support in business is changing, driven by rapid developments in end-user computing and networking; Internet and Web technologies; and Web-enabled business applications. One of the key changes taking place in management information and decision support systems in business is the rapid growth of enterprise information portals.

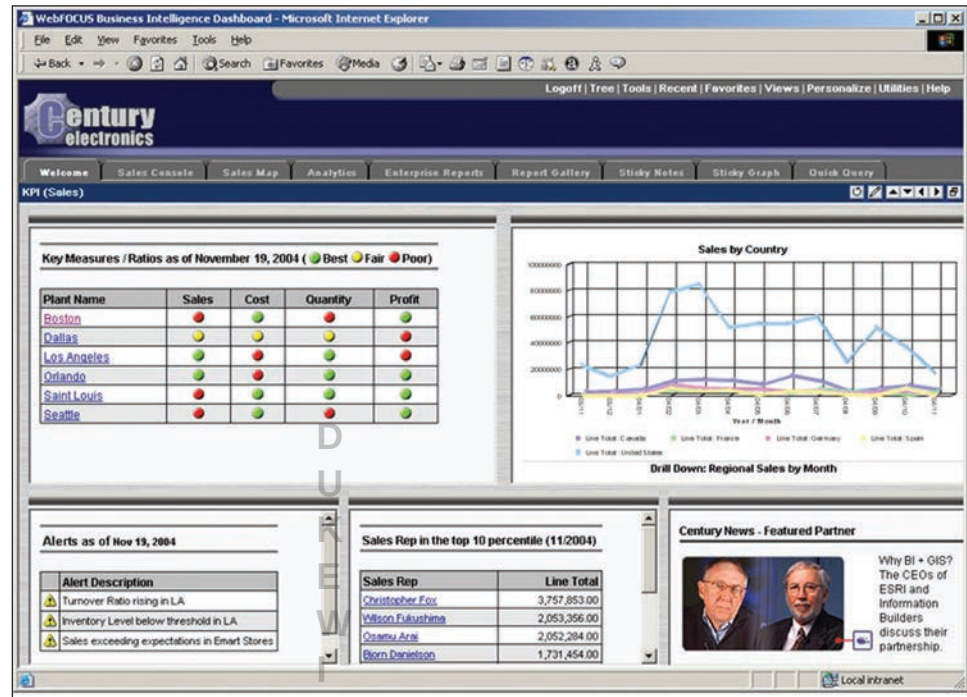
A user checks his e-mail, looks up the current company stock price, checks his available vacation days, and receives an order from a customer—all from the browser on his desktop. That is the next-generation intranet, also known as a corporate or enterprise information portal. With it, the browser becomes the dashboard to daily business tasks.

An **enterprise information portal (EIP)** is a Web-based interface and integration of MIS, DSS, EIS, and other technologies that give all intranet users and selected extranet users access to a variety of internal and external business applications and services. For example, internal applications might include access to e-mail, project Web sites, and discussion groups; human resources Web self-services; customer, inventory, and other corporate databases; decision support systems; and knowledge management systems. External applications might include industry, financial, and other Internet news services; links to industry discussion groups; and links to customer and supplier Internet and extranet Web sites. Enterprise information portals are typically tailored or personalized to the needs of individual business users or groups of users, giving them a personalized *digital dashboard* of information sources and applications. See Figure 10.20.

The business benefits of enterprise information portals include providing more specific and selective information to business users, providing easy access to key corporate intranet Web site resources, delivering industry and business news, and providing better access to company data for selected customers, suppliers, or business partners. Enterprise information portals can also help avoid excessive surfing by employees across company

FIGURE 10.20

An enterprise information portal can provide a business professional with a personalized workplace of information sources, administrative and analytical tools, and relevant business applications.



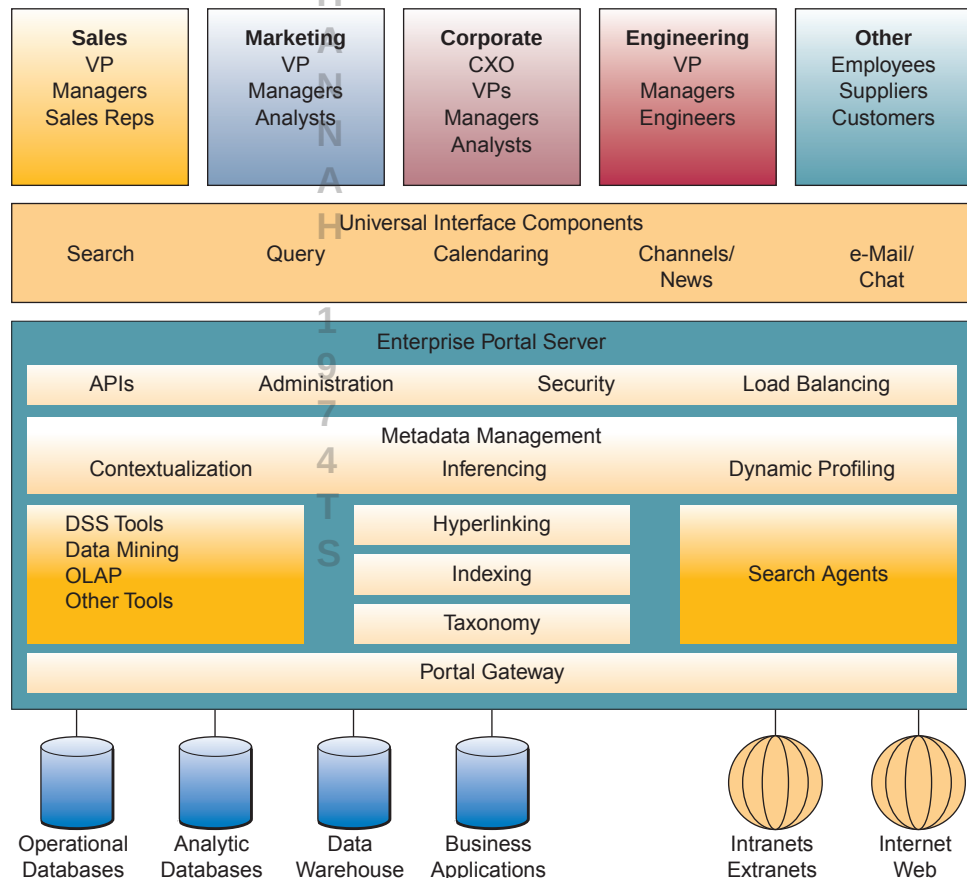
Source: Courtesy of Information Builders.

and Internet Web sites by making it easier for them to receive or find the information and services they need, thus improving the productivity of a company's workforce.

Figure 10.21 illustrates how companies are developing enterprise information portals as a way to provide Web-enabled information, knowledge, and decision

FIGURE 10.21

The components of this enterprise information portal identify it as a Web-enabled decision support system that can be personalized for executives, managers, employees, suppliers, customers, and other business partners.



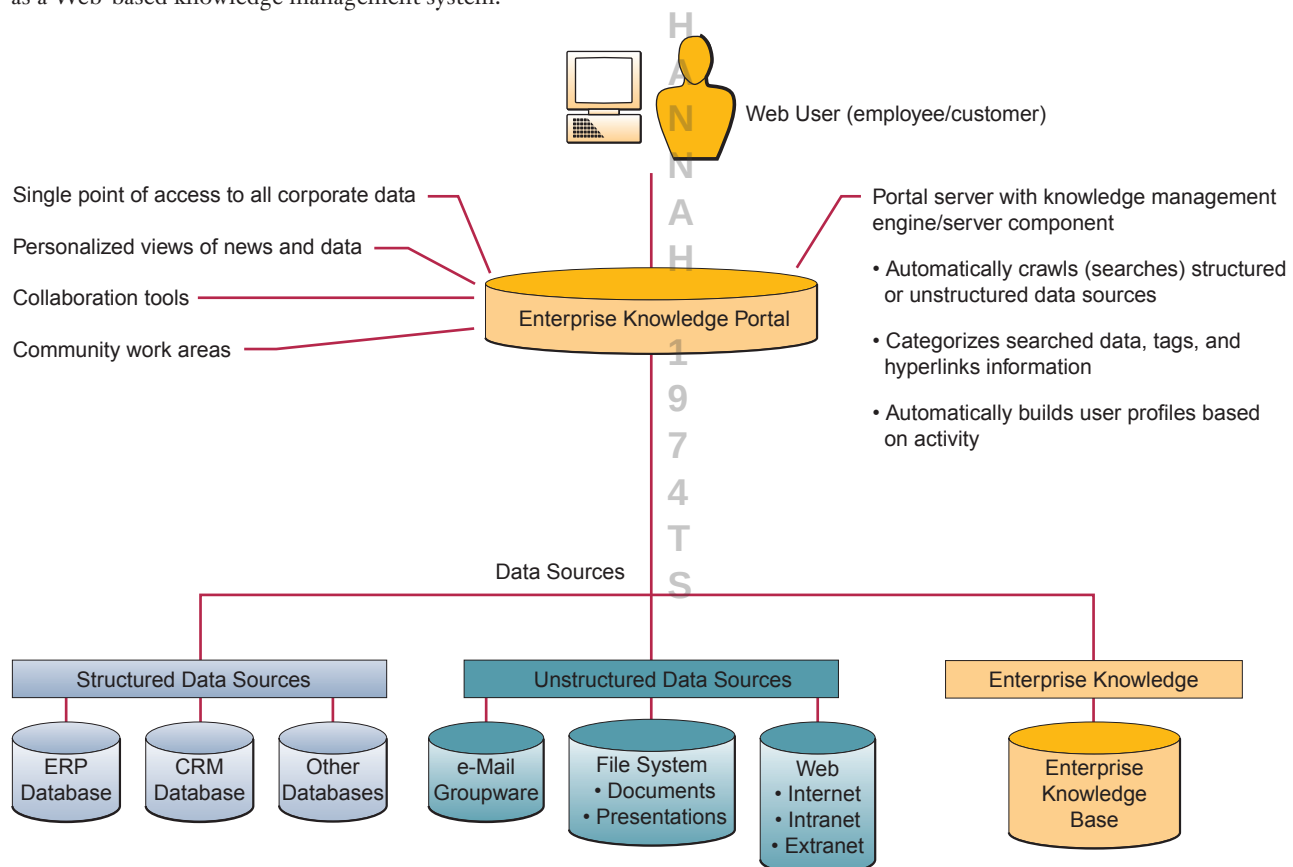
support to their executives, managers, employees, suppliers, customers, and other business partners. The enterprise information portal is a customized and personalized Web-based interface for corporate intranets, which gives users easy access to a variety of internal and external business applications, databases, and services. For example, the EIP in Figure 10.20 might give a qualified user secure access to DSS, data mining, and OLAP tools; the Internet and the Web; the corporate intranet; supplier or customer extranets; operational and analytical databases; a data warehouse; and a variety of business applications.

Knowledge Management Systems

We introduced **knowledge management systems** in Chapter 2 as the use of information technology to help gather, organize, and share business knowledge within an organization. In many organizations, hypermedia databases at corporate intranet Web sites have become the *knowledge bases* for storage and dissemination of business knowledge. This knowledge frequently takes the form of best practices, policies, and business solutions at the project, team, business unit, and enterprise levels of the company.

For many companies, enterprise information portals are the entry to corporate intranets that serve as their knowledge management systems. That's why such portals are called **enterprise knowledge portals** by their vendors. Thus, enterprise knowledge portals play an essential role in helping companies use their intranets as knowledge management systems to share and disseminate knowledge in support of business decision making by managers and business professionals. See Figure 10.22. Now let's look at an example of a knowledge management system in business.

FIGURE 10.22 This example of the capabilities and components of an enterprise knowledge portal emphasizes its use as a Web-based knowledge management system.



Northrop Grumman: Passing Knowledge Down through Generations

In 1997, with the Cold War well behind them, thousands of engineers who had helped design and maintain the B-2 bomber were asked to leave the integrated systems sector of Northrop Grumman. As the nearly 12,000 workers filed out the door, leaving only 1,200 from a staff of 13,000, they took with them years of experience and in-depth knowledge about what was considered at the time to be the most complex aircraft ever built.

Northrop Grumman knew it had to keep enough of that know-how to support the division's long-term maintenance of the B-2 bomber, so a newly formed knowledge management team identified top experts and videotaped interviews with them before they left. But it was hard to get everything in a single interview, says Scott Shaffar, Northrop Grumman's director of knowledge management for the Western region of the integrated systems sector. "We did lose some of that knowledge," says Shaffar. "In an exit interview, you can capture certain things, but not a lifetime of experience."

Several years later, the company uses a variety of tools to retain and transfer knowledge from its engineers—well before they retire. Shaffar and his team have put in place document management systems and common work spaces that record how an engineer did his job for future reference. They have started programs that bring together older and younger engineers across the country to exchange information via e-mail or in person about technical problems, and they are using software that helps people find experts within the company.

Although most companies won't face the sudden departure of thousands of skilled workers, as Northrop Grumman did in the late 1990s, they and government agencies alike will need to prepare for the loss of important experience and technical knowledge as the baby boomer generation gets ready to retire over the coming decade. By 2010, more than half of all workers in the United States will be over 40. While most top managers are aware that they'll soon have a lot of workers retiring, few are doing much to prepare for the event. That's often because it's hard to quantify the cost of losing knowledge.

At Northrop Grumman, times have changed since its massive downsizing in the 1990s. Although a large percentage of its workforce is nearing retirement, the average age of employees has dropped from the high 40s to the mid 40s in the past four years since the company started hiring more college grads. Shaffar says he is now working on balancing the more gradual transfer of knowledge from older to younger workers, with the need to capture some crucial expertise quickly before it's too late. For example, Northrop Grumman engineers who are competing on a proposal for a "crew exploration vehicle," which is being designed to replace the space shuttle and travel to the moon (and eventually to Mars), met with a group of retirees who worked on the Apollo program that sent men to the moon more than 35 years ago.

Using a PC program called Quindi and a camera attached to a laptop, a facilitator recorded retirees telling stories about how they grappled with the technical problems of sending a man to the moon. These tales will be available as Web pages for engineers working on this project. Shaffar acknowledges that employees would rather go to another person than a system for advice, but he says the exercise helped capture knowledge that otherwise soon would be gone.

Most important, Shaffar has learned that the problem goes beyond looking at what skills you have right now. "There have always been new generations, and we're not any different in that way," he says. "Mentoring, training and passing on knowledge is not something you can do at the last minute. You have to plan ahead."

Source: Adapted from Susannah Patton, "How to Beat the Baby Boomer Retirement Blues," *CIO Magazine*, January 15, 2006.

SECTION II

Artificial Intelligence Technologies in Business

Business and AI

Artificial intelligence (AI) technologies are being used in a variety of ways to improve the decision support provided to managers and business professionals in many companies. See Figure 10.23. For example:

AI-enabled applications are at work in information distribution and retrieval, database mining, product design, manufacturing, inspection, training, user support, surgical planning, resource scheduling, and complex resource management.

Indeed, for anyone who schedules, plans, allocates resources, designs new products, uses the Internet, develops software, is responsible for product quality, is an investment professional, heads up IT, uses IT, or operates in any of a score of other capacities and arenas, AI technologies already may be in place and providing competitive advantage.

Read the Real World Case on the next page. We can learn a lot about innovative uses of virtual reality in business from this example.

An Overview of Artificial Intelligence

What is artificial intelligence? **Artificial intelligence (AI)** is a field of science and technology based on disciplines such as computer science, biology, psychology, linguistics, mathematics, and engineering. The goal of AI is to develop computers that can simulate the ability to think, as well as see, hear, walk, talk, and feel. A major thrust of artificial intelligence is the simulation of computer functions normally associated with human intelligence, such as reasoning, learning, and problem solving, as summarized in Figure 10.24.

Debate has raged about artificial intelligence since serious work in the field began in the 1950s. Technological, moral, and philosophical questions about the possibility of intelligent, thinking machines are numerous. For example, British AI pioneer Alan Turing in 1950 proposed a test to determine whether machines could think. According to the Turing test, a computer could demonstrate intelligence if a human interviewer, conversing with an unseen human and an unseen computer, could not tell which was which. Although much work has been done in many of the subgroups that fall under the AI umbrella, critics believe that no computer can truly pass the Turing test. They claim that it is just not possible to develop intelligence to impart true humanlike capabilities to computers, but progress continues. Only time will tell whether we will achieve the ambitious goals of artificial intelligence and equal the popular images found in science fiction.

One derivative of the Turing test that is providing real value to the online community is a CAPTCHA. A **CAPTCHA** (Completely Automated Public Turing test to tell Computers and Humans Apart) is a type of challenge-response test used in a wide variety of computing applications to determine that the user is really a human and not a computer posing as one. A CAPTCHA is sometimes described as a reverse Turing test because it is administered by a machine and targeted to a human, in contrast to the standard Turing test that is typically administered by a human and targeted to a machine. The process involves one computer (such as a server for a retail Web site) asking a user to complete a simple test that the computer is able to generate and grade. Because other computers are unable to solve the CAPTCHA, any user entering a correct solution is presumed to be human. A common type of CAPTCHA requires that the user type the letters of a distorted image, sometimes with the addition of an obscured sequence of letters or digits that appears on the screen. No doubt you have seen this when registering for a new account with a merchant or checking out from an online purchase. Figure 10.25 shows several common examples of CAPTCHA patterns.

REAL WORLD

CASE

2

Kimberly-Clark Corp.: Shopping for Virtual Products in Virtual Stores

Using a new tool developed by Kimberly-Clark Corp., a woman stood surrounded by three screens showing a store aisle, a retina-tracking device recording her every glance. At Kimberly-Clark, innovation doesn't stop with developing more-absorbent diapers or stronger paper towels. The consumer-goods maker also is using IT to help retailers market and sell products—and not just the ones made by Kimberly-Clark.

Virtual reality technology has found its footing in many industries and applications, including health care, automotive, and aerospace. Now, consumer goods manufacturer Kimberly-Clark has incorporated proprietary virtual reality technology into its new Innovation Design Studio, and it expects big payback from its technological leap.

Asked by a Kimberly-Clark researcher to find a big box of Huggies Natural Fit diapers in size three, the woman pushed forward on a handle like that of a shopping cart, and the video simulated her progress down the aisle. Spotting the distinctive red packages of Huggies, she turned the handle to the right to face a dizzying array of diapers. After pushing a button to get a kneeling view of the shelves, she reached forward and tapped the screen to put the box she wanted in her virtual cart.

Kimberly-Clark hopes these virtual shopping aisles will help it better understand consumer behavior and make the testing of new products faster, more convenient, and more precise.

The mobile testing unit is usually based in a new high-tech studio that Kimberly-Clark completed in the basement of a

nondescript office building in Appleton, Wisconsin. The cavernous room also features a U-shaped floor-to-ceiling screen that re-creates in vivid detail interiors of the big retailers that sell the company's products—a tool that the company will use in presentations to executives in bids to win shelf space. A separate area is reserved for real replicas of store interiors, which can be customized to match the flooring, light fixtures, and shelves of retailers such as Target Corp. and Walmart Stores Inc.

As the fragmented television market raises doubts about the effectiveness of traditional ads and competition for shelf space increases, manufacturers and retailers are intensifying their focus on ways to get consumers' attention while they are in the store.

The efforts go well beyond the usual cardboard displays and sample handouts. A group including manufacturers Procter & Gamble Co., Coca-Cola Co., and General Mills Inc., and retailers Kroger Co. and Walmart announced the results of a test that tracked shoppers' movement in stores using a combination of infrared beams and human observation.

Nielsen Co. plans to syndicate such data and sell it to clients, much as it does with television ratings.

"By engaging ourselves and our customers in this virtual world, we can spark better ideas to improve the shopping experience and collaborate on new product concepts and innovations," says Ramin Elvaz, Kimberly-Clark vice president of North Atlantic Insight, Strategy and Growth.

Kimberly-Clark says its studio allows researchers and designers to get a fast read on new product designs and displays without having to stage real-life tests in the early stages of development. Doing the research in a windowless basement, rather than an actual test market, also avoids tipping off competitors early in the development process.

"We're trying to test ideas faster, cheaper, and better," says Ramin Elvaz, a vice president at Kimberly-Clark focusing on strategy.

Before, new product testing typically took eight months to two years. Now, that time is cut in half, he says. Projects that test well with the virtual-reality tools will be fast-tracked to real-store trials, Mr. Elvaz says.

Once product design options have been determined, Kimberly-Clark brings retail executives into the studio so they can see how the new product would actually look on the shelf and fit in with the existing assortment—an important factor in decisions the retailers make on space.

The company declined to reveal how much it spent to build the Appleton studio. "We made a significant investment in the studio and expect it will yield a positive return with our customers in the future," a spokesman says.

The battle for shelf space is accelerating as consumer-products companies have introduced more and more new products. Meanwhile, retailers are churning out more of their own private-label products. The rate of new-product launches has grown steadily since 2000, with more than 40,000 new packaged-goods introductions in 2007, says Tom

FIGURE 10.23



Virtual reality technologies enable companies to develop and test new products without actually making them.

Source: © Toru Hanai/Reuters/Landov.

Vierhile, director of Productscan Online, market research firm Datamonitor's database of new products.

However, Kimberly-Clark is particularly enthusiastic about how the design center can help its retail partners improve their in-store designs and merchandising. For example, using the virtual reality technology and K-C SmartStation, the manufacturer can create store models, allowing retailers to envision hypothetical store designs and merchandising concepts. Likewise, eye-tracking technology in the high-tech kiosk allows the study of consumers' reactions in simulated shopping settings to determine how different environments or packaging affect buying decisions.

Inside the center's virtual reality theater, visitors are surrounded by screens on which rear-projection equipment displays virtual images powered by applications running on eight Hewlett-Packard high-end rack-mount PCs. The system's 3-D capabilities were developed with RedDotSquare. Sensors embedded in the walls, ceilings, and floor detect the visitors' movements, track their locations, and can even tell exactly what they're looking at, says Kurt Schweitzer, director, IT business partner for marketing, strategy, and innovation. This allows the system to further immerse visitors by making things happen around them, such as opening a door near where they're standing or changing their perspective on what's going on, he says.

The center lets store managers use "multiple senses and not just visualization" to assess product display effectiveness, Schweitzer says. The front screen of the immersion center is more than 20 feet wide and is flanked by two side screens that rest at 45-degree angles, creating a wraparound effect.

The wings can move inward to 90-degree angles, forming a three-sided box. "When you step into that 8-foot-high physical space, the word immersive takes on a whole new meaning," Schweitzer says.

To sell retailers on new products, manufacturers are revealing more about their product pipelines to drum up interest early on. Over the past several months, Kimberly-Clark says it has brought in executives from major chains, including Target, Walmart and Kroger, to see the Appleton facility. Kimberly-Clark uses the data from its virtual-reality tests with consumers to tout how products in development perform.

"It no longer works to show up on a retailer's doorstep with your new product and say, 'Isn't this pretty?'" Mr. Eivaz

says. "We need to be an indispensable partner to our retailers and show we can do more for them."

When grocery chain Safeway Inc. asked its major manufacturers for display suggestions to lift traffic through its center aisles in late 2005, Kimberly-Clark used an early version of the virtual-reality modeling technology it was developing for the new studio to pitch for more room for its Huggies diapers and other baby products. The company created three-dimensional models of a store display that resembled a nursery, complete with a giant, colorful bathtub.

The company had consumers navigate the store virtually, testing how easily they could find certain items in the area.

"We hadn't seen that type of technology applied to that type of traditional merchandising and store decor before," says Michael Minasi, Safeway's president of marketing. When it tested the display inside its stores, sales of items in that section increased. Nevertheless, in the end, reality set limits. "Some of the decor and decoration components were easier to do virtually than they were to do in the real world, mostly from a cost and implementation standpoint," Minasi says. However, a version of Kimberly-Clark's concept was put in place at a handful of Safeway stores.

In the store-model section of its new studio, Kimberly-Clark goes to elaborate lengths with its re-creations aimed to impress retail executives. Once, the company readied the studio for visitors from Target. The store's branded shopping carts were lined up at the doorway, next to a stand holding recent Target sales fliers and a faux ATM. Standing behind a pharmacy counter was a Kimberly-Clark employee outfitted in a lab coat with a Target logo. Target's standard white tiles covered the floor, its beige light fixtures hung above, and Target store shelves were fully stocked with diapers and other baby products made by Kimberly-Clark and its competitors.

"What if you just spent a lot of money on a package's shade of red but it doesn't look good in their store?" says Don Quigley, president of Kimberly-Clark's consumer sales and customer development, North America. "This is where you can spot that, before you ship a single case of product."

Source: Adapted from Ellen Byron, "A Virtual View of the Store Aisle," *Wall Street Journal*, October 3, 2007; Jill Jusko, "Kimberly-Clark Embraces Virtual Reality," *IndustryWeek*, December 1, 2007; and Marianne Kolbasuk McGee, "InformationWeek 500: Kimberly-Clark's Virtual Product Demo Center Yields Real Ideas on How to Sell More Products," *InformationWeek*, September 17, 2007.

CASE STUDY QUESTIONS

1. What are the business benefits derived from the technology implementation described in the case? Also discuss benefits other than those explicitly mentioned in the case.
2. Are virtual stores like this one just an incremental innovation on the way marketing tests new product designs? Or do they have the potential to radically reinvent the way these companies work? Explain your reasons.
3. What other industries could benefit from deployments of virtual reality like the one discussed in the case? Leaving aside the cost of the technology, what new products or services could you envision within those industries? Provide several examples.

REAL WORLD ACTIVITIES

1. What is the current cutting-edge technology in virtual reality, and how are companies using it? Go online to research this topic and prepare a presentation to share your work.
2. With technologies like these, will consumers entirely do away with retailers sometime in the future, shopping only through virtual representations of a retail store? Will consumers even want it to look like a retail store? Break into small groups to propose arguments for and against these questions.

FIGURE 10.24

Some of the attributes of intelligent behavior. AI is attempting to duplicate these capabilities in computer-based systems.

Attributes of Intelligent Behavior
• Think and reason.
• Use reason to solve problems.
• Learn or understand from experience.
• Acquire and apply knowledge.
• Exhibit creativity and imagination.
• Deal with complex or perplexing situations.
• Respond quickly and successfully to new situations.
• Recognize the relative importance of elements in a situation.
• Handle ambiguous, incomplete, or erroneous information.

The Domains of Artificial Intelligence

Figure 10.26 illustrates the major **domains** of AI research and development. Note that AI **applications** can be grouped under three major areas—cognitive science, robotics, and natural interfaces—though these classifications do overlap, and other classifications can be used. Also note that expert systems are just one of many important AI applications. Let's briefly review each of these major areas of AI and some of their current technologies. Figure 10.27 outlines some of the latest developments in commercial applications of artificial intelligence.

Cognitive Science. This area of artificial intelligence is based on research in biology, neurology, psychology, mathematics, and many allied disciplines. It focuses on researching how the human brain works and how humans think and learn. The results of such research in *human information processing* are the basis for the development of a variety of computer-based applications in artificial intelligence.

Applications in the cognitive science area of AI include the development of *expert systems* and other *knowledge-based systems* that add a knowledge base and some reasoning capability to information systems. Also included are *adaptive learning systems* that can modify their behaviors on the basis of information they acquire as they operate. Chess-playing systems are primitive examples of such applications, though many more applications are being implemented. *Fuzzy logic* systems can process data that are incomplete or ambiguous, that is, *fuzzy data*. Thus, they can solve semistructured

FIGURE 10.25

Examples of typical CAPTCHA patterns that can be easily solved by humans but prove difficult to detect by a computer.

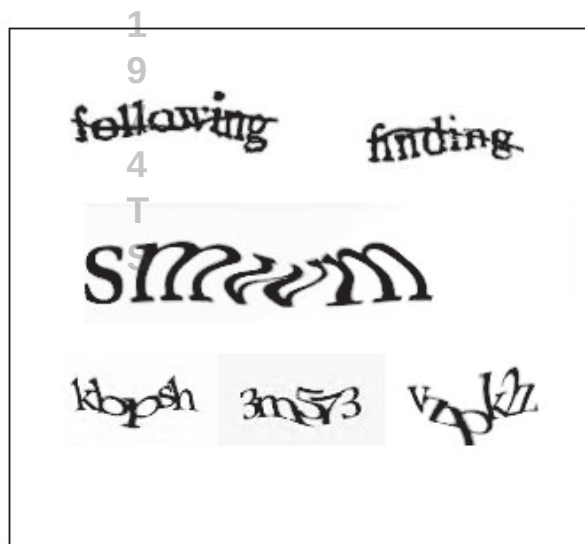
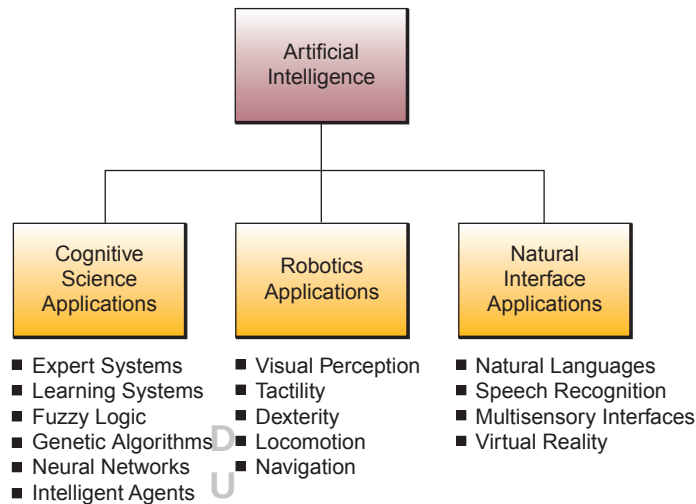


FIGURE 10.26

The major application areas of artificial intelligence. Note that the many applications of AI can be grouped into the three major areas of cognitive science, robotics, and natural interfaces.



problems with incomplete knowledge by developing approximate inferences and answers, as humans do. *Neural network* software can learn by processing sample problems and their solutions. As neural nets start to recognize patterns, they can begin to program themselves to solve such problems on their own. *Genetic algorithm* software uses Darwinian (survival of the fittest), randomizing, and other mathematics functions

FIGURE 10.27

Examples of some of the latest commercial applications of AI.

Commercial Applications of AI	
Decision Support	• Intelligent work environment that will help you capture the <i>why</i> as well as the <i>what</i> of engineered design and decision making. • Intelligent human–computer interface (HCI) systems that can understand spoken language and gestures, and facilitate problem solving by supporting organizationwide collaborations to solve particular problems. • Situation assessment and resource allocation software for uses that range from airlines and airports to logistics centers.
Information Retrieval	• AI-based intranet and Internet systems that distill tidal waves of information into simple presentations. • Natural language technology to retrieve any sort of online information, from text to pictures, videos, maps, and audio clips, in response to English questions. • Database mining for marketing trend analysis, financial forecasting, maintenance cost reduction, and more.
Virtual Reality	• X-ray–like vision enabled by enhanced-reality visualization that allows brain surgeons to “see through” intervening tissue to operate, monitor, and evaluate disease progression. • Automated animation interfaces that allow users to interact with virtual objects via touch (e.g., medical students can “feel” what it’s like to suture severed aortas).
Robotics	• Machine-vision inspections systems for gauging, guiding, identifying, and inspecting products and providing competitive advantage in manufacturing. • Cutting-edge robotics systems, from microrobots and hands and legs to cognitive robotic and trainable modular vision systems.

to simulate evolutionary processes that can generate increasingly better solutions to problems. In addition, *intelligent agents* use expert system and other AI technologies to serve as software surrogates for a variety of end-user applications.

Robotics. AI, engineering, and physiology are the basic disciplines of **robotics**. This technology produces robot machines with computer intelligence and computer-controlled, humanlike physical capabilities. This area thus includes applications designed to give robots the powers of sight, or visual perception; touch, or tactile capabilities; dexterity, or skill in handling and manipulation; locomotion, or the physical ability to move over any terrain; and navigation, or the intelligence to find one's way to a destination.

Natural Interfaces. The development of natural interfaces is considered a major area of AI applications and is essential to the natural use of computers by humans. For example, the development of *natural languages* and speech recognition are major thrusts of this area of AI. Being able to talk to computers and robots in conversational human languages and have them “understand” us as easily as we understand each other is a goal of AI research. This goal involves research and development in linguistics, psychology, computer science, and other disciplines. Other natural interface research applications include the development of multisensory devices that use a variety of body movements to operate computers, which is related to the emerging application area of *virtual reality*. Virtual reality involves using multisensory human–computer interfaces that enable human users to experience computer-simulated objects, spaces, activities, and “worlds” as if they actually exist. Now, let's look at some examples of how AI is becoming increasingly more relevant in the business world.

Artificial Intelligence Gets Down to Business

Today, AI systems can perform useful work in “a very large and complex world,” says Eric Horvitz, an AI researcher at Microsoft Research (MSR). “Because these small software agents don't have a complete representation of the world, they are uncertain about their actions. So they learn to understand the probabilities of various things happening, they learn the preferences of users and costs of outcomes and, perhaps most important, they are becoming self-aware.”

These abilities derive from something called machine learning, which is at the heart of many modern AI applications. In essence, a programmer starts with a crude model of the problem he's trying to solve but builds in the ability for the software to adapt and improve with experience.

Speech recognition software gets better as it learns the nuances of your voice, for example, and over time Amazon.com more accurately predicts your preferences as you shop online. Machine learning is enabled by clever algorithms, of course, but what has driven it to prominence in recent years is the availability of huge amounts of data, both from the Internet and, more recently, from a proliferation of physical sensors.

For instance, Microsoft Research has combined sensors, machine learning, and analysis of human behavior in a road traffic prediction model. Predicting traffic bottlenecks would seem to be an obvious and not very difficult application of sensors and computer forecasting. But MSR realized that most drivers hardly need to be warned that the interstate heading out of town will be jammed at 5 p.m. on Monday. What they really need to know is where and when anomalies, or “surprises,” are occurring and, perhaps more important, where they will occur. So MSR built a “surprise forecasting” model that learns from traffic history to predict surprises 30 minutes in advance based on actual traffic flows captured by sensors. In tests, it has been able to predict about 50 percent of the surprises on roads in the Seattle

area, and it is in use now by several thousand drivers who receive alerts on their Windows Mobile devices.

Few organizations need to make sense of as much data as do search engine companies. For example, if a user searches Google for “toy car” and then clicks on a Walmart ad that appears at the top of the results, what’s that worth to Walmart, and how much should Google charge for that click? The answers lie in an AI specialty that employs “digital trading agents,” which companies like Walmart and Google use in automated online auctions.

Michael Wellman, a University of Michigan professor and an expert in these markets, explains: “There are millions of keywords, and one advertiser may be interested in hundreds or thousands of them. They have to monitor the prices of the keywords and decide how to allocate their budget, and it’s too hard for Google or Yahoo to figure out what a certain keyword is worth. They let the market decide that through an auction process.”

When the “toy car” query is submitted, in a fraction of a second Google looks up which advertisers are interested in those keywords, then looks at their bids and decides whose ads to display and where to put them on the page. “The problem I’m especially interested in,” Wellman says, “is how should an advertiser decide which keywords to bid on, how much to bid and how to learn over time—based on how effective their ads are—how much competition there is for each keyword.”

Source: Adapted from Gary Anthes, “Future Watch: A.I. Comes of Age,” *Computerworld*, January 26, 2009.

Expert Systems

One of the most practical and widely implemented applications of artificial intelligence in business is the development of expert systems and other knowledge-based information systems. A knowledge-based information system (KBIS) adds a knowledge base to the major components found in other types of computer-based information systems. An **expert system (ES)** is a knowledge-based information system that uses its knowledge about a specific, complex application area to act as an expert consultant to end users. Expert systems provide answers to questions in a very specific problem area by making humanlike inferences about knowledge contained in a specialized knowledge base. They must also be able to explain their reasoning process and conclusions to a user, so expert systems can provide decision support to end users in the form of advice from an expert consultant in a specific problem area.

Components of an Expert System

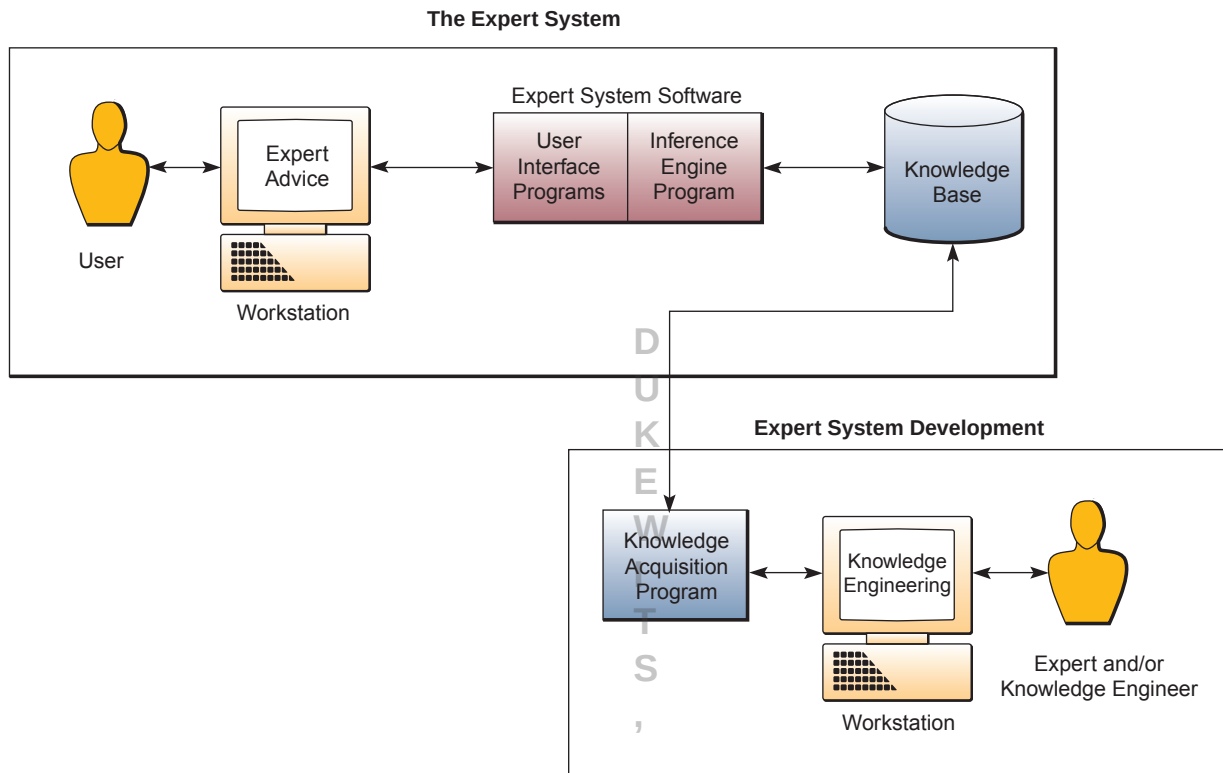
The components of an expert system include a knowledge base and software modules that perform inferences on the knowledge in the knowledge base and communicate answers to a user’s questions. Figure 10.28 illustrates the interrelated components of an expert system. Note the following components:

FIGURE 10.28

A summary of four ways that knowledge can be represented in an expert system’s knowledge base.

Methods of Knowledge Representation
• Case-Based Reasoning. Representing knowledge in an expert system’s knowledge base in the form of cases, that is, examples of past performance, occurrences, and experiences.
• Frame-Based Knowledge. Knowledge represented in the form of a hierarchy or network of <i>frames</i>. A frame is a collection of knowledge about an entity consisting of a complex package of data values describing its attributes.
• Object-Based Knowledge. Knowledge represented as a network of objects. An object is a data element that includes both data and the methods or processes that act on those data.
• Rule-Based Knowledge. Knowledge represented in the form of rules and statements of fact. Rules are statements that typically take the form of a premise and a conclusion, such as If (condition), Then (conclusion).

FIGURE 10.29 Components of an expert system. The software modules perform inferences on a knowledge base built by an expert and/or knowledge engineer. This provides expert answers to an end user's questions in an interactive process.



- Knowledge Base.** The knowledge base of an expert system contains (1) facts about a specific subject area (e.g., *John is an analyst*) and (2) heuristics (rules of thumb) that express the reasoning procedures of an expert on the subject (e.g., *IF John is an analyst, THEN he needs a workstation*). There are many ways that such knowledge is represented in expert systems. Examples are *rule-based*, *frame-based*, *object-based*, and *case-based* methods of knowledge representation. See Figure 10.29.
- Software Resources.** An expert system software package contains an inference engine and other programs for refining knowledge and communicating with users. The **inference engine** program processes the knowledge (such as rules and facts) related to a specific problem. It then makes associations and inferences resulting in recommended courses of action for a user. User interface programs for communicating with end users are also needed, including an explanation program to explain the reasoning process to a user if requested. Knowledge acquisition programs are not part of an expert system but are software tools for knowledge base development, as are *expert system shells*, which are used for developing expert systems.

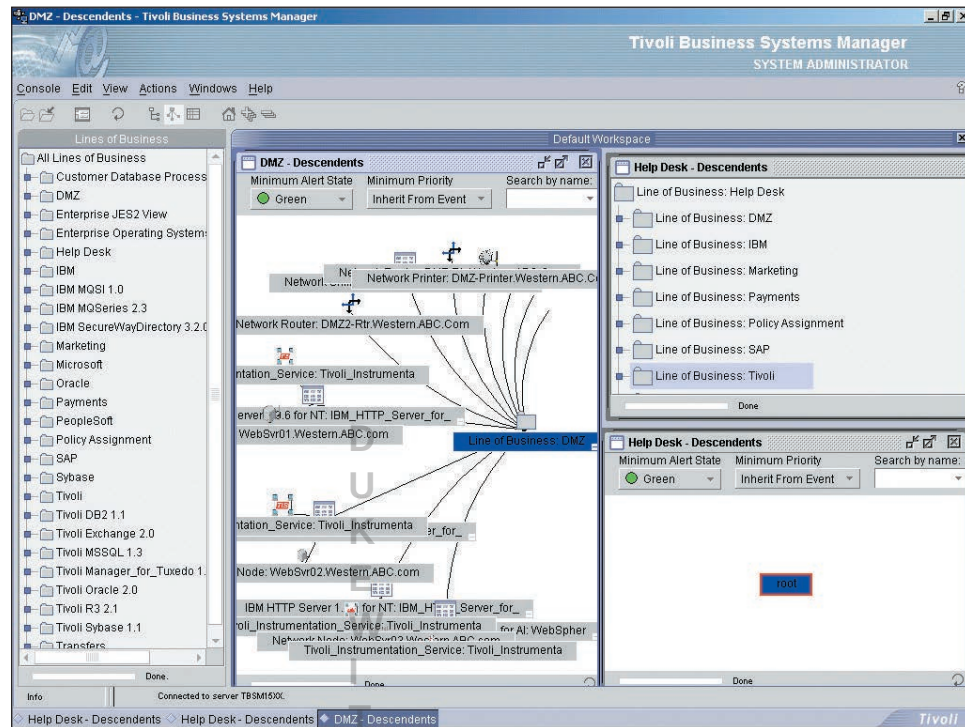
Expert System Applications

Using an expert system involves an interactive computer-based session in which the solution to a problem is explored, with the expert system acting as a consultant to an end user. The expert system asks questions of the user, searches its knowledge base for facts and rules or other knowledge, explains its reasoning process when asked, and gives expert advice to the user in the subject area being explored. For example, Figure 10.30 illustrates an expert system application.

Expert systems are being used for many different types of applications, and the variety of applications is expected to continue to increase. You should realize, however,

FIGURE 10.30

Tivoli Business Systems Manager by IBM automatically monitors and manages the computers in a network with proactive expert system software components based on IBM's extensive mainframe systems management expertise.



Source: Courtesy of International Business Machines Corporation.

that expert systems typically accomplish one or more generic uses. Figure 10.31 outlines five generic categories of expert system activities, with specific examples of actual expert system applications. As you can see, expert systems are being used in many different fields, including medicine, engineering, the physical sciences, and business. Expert systems now help diagnose illnesses, search for minerals, analyze compounds, recommend repairs, and do financial planning. So from a strategic business standpoint, expert systems can be and are being used to improve every step of the product cycle of a business, from finding customers to shipping products to providing customer service.

Benefits of Expert Systems

An expert system captures the expertise of an expert or group of experts in a computer-based information system. Thus, it can outperform a single human expert in many problem situations. That's because an expert system is faster and more consistent, can have the knowledge of several experts, and does not get tired or distracted by overwork or stress. Expert systems also help preserve and reproduce the knowledge of experts. They allow a company to preserve the expertise of an expert before she leaves the organization. This expertise can then be shared by reproducing the software and knowledge base of the expert system.

Limitations of Expert Systems

The major limitations of expert systems arise from their limited focus, inability to learn, maintenance problems, and developmental cost. Expert systems excel only in solving specific types of problems in a limited domain of knowledge. They fail miserably in solving problems requiring a broad knowledge base and subjective problem solving. They do well with specific types of operational or analytical tasks but falter at subjective managerial decision making.

Expert systems may also be difficult and costly to develop and maintain. The costs of knowledge engineers, lost expert time, and hardware and software resources may be too high to offset the benefits expected from some applications. Also, expert systems can't maintain themselves; that is, they can't learn from experience but instead must be

FIGURE 10.31

Major application categories and examples of typical expert systems. Note the variety of applications that can be supported by such systems.

Application Categories of Expert Systems	
•	Decision Management. Systems that appraise situations or consider alternatives and make recommendations based on criteria supplied during the discovery process: Loan portfolio analysis Employee performance evaluation Insurance underwriting Demographic forecasts
•	Diagnostic/Troubleshooting. Systems that infer underlying causes from reported symptoms and history: Equipment calibration Help desk operations Software debugging Medical diagnosis
•	Design/Configuration. Systems that help configure equipment components, given existing constraints: Computer option installation Manufacturability studies Communications networks Optimum assembly plan
•	Selection/Classification. Systems that help users choose products or processes, often from among large or complex sets of alternatives: Material selection Delinquent account identification Information classification Suspect identification
•	Process Monitoring/Control. Systems that monitor and control procedures or processes: Machine control (including robotics) Inventory control Production monitoring Chemical testing

taught new knowledge and modified as new expertise is needed to match developments in their subject areas.

Although there are practical applications for expert systems, applications have been limited and specific because, as discussed, expert systems are narrow in their domain of knowledge. An amusing example of this is the user who used an expert system designed to diagnose skin diseases to conclude that his rusty old car had likely developed measles. In addition, once some of the novelty had worn off, most programmers and developers realized that common expert systems were just more elaborate versions of the same decision logic used in most computer programs. Today, many of the techniques used to develop expert systems can now be found in most complex programs without any fuss about them.

Healthways: Applying Expert Systems to Health Care

Healthways, the U.S. leader in health and care support for well and chronically ill populations, relies on SAS to identify high-risk patients and implement preventative actions. The company knows that a key to successful disease management is the correct identification of those members in greatest need of care. Using SAS, Healthways reduces costs and helps to improve member health outcomes by predicting who is at most risk for developing specific health problems. In doing so, it is able to coordinate intervention plans that address care designed to avoid complications down the road.

Healthways provides disease and care management to more than two million health-plan members in all 50 states, the District of Columbia, Guam, and Puerto Rico. The company provides its services on behalf of the nation's leading health plans. It employs thousands of nurses at call centers throughout the country who collect data and provide clinical support to health-plan members and their physicians.

At Healthways, the goal is to empower health-plan members to manage their health effectively. The company achieves its objective using SAS for data mining and a group of robust artificial intelligence neural networks. To support predictive analytics, Healthways accesses hundreds of data points involving care for millions of health-plan members.

"We want to develop predictive models that not only identify and classify patients who are at risk, but also anticipate who is at the highest risk for specific diseases and complications and then determine which of those are most likely to comply with recommended standards of care," says Adam Hobgood, Director of Statistics at Healthways' Center for Health Research. "Most of all we want to predict their likelihood of success with our support programs. By identifying high-risk patients and implementing preventative actions against future conditions, we hope to head off the increased costs of care before they occur."

With SAS, Healthways builds predictive models that assess patient risk for certain outcomes and establishes starting points for providing services. Once Healthways loads patient risk-stratification levels into its own "clinical expert system," the system evaluates clinical information from hospitals, data that nurses collect by phone, and information that employer groups and health-plan members report.

Finally, the clinical expert system adjusts the initial risk-stratification levels based on the new inputs and expert clinical judgment. The resulting approach to member stratification is a hybrid solution that incorporates sophisticated artificial intelligence neural network predictive models, clinically relevant rule-based models, and expert clinician judgment.

"It's a very powerful hybrid solution, and we have worked closely with clinical experts in the company to integrate the neural network predictive model with our world-class clinical expert system," says Matthew McGinnis, Senior Director of Healthways' Center for Health Research. "The ability of our highly experienced clinicians to use their expert clinical judgment further complements the model and rounds out our hybrid approach to stratification. We believe that sophisticated statistical models are necessary to help risk-stratify our significant member populations, and by coupling this with the expertly trained clinical mind, we have created a hybrid solution that is unrivaled in the industry."

Source: Adapted from "Healthways Heads Off Increased Costs with SAS," www.sas.com, accessed April 25, 2009.

Developing Expert Systems

What types of problems are most suitable to expert system solutions? One way to answer this question is to look at examples of the applications of current expert systems, including the generic tasks they can accomplish, as were summarized in Figure 10.31. Another way is to identify criteria that make a problem situation suitable for an expert system. Figure 10.32 outlines some important criteria.

Figure 10.32 emphasizes that many real-world situations do not fit the suitability criteria for expert system solutions. Hundreds of rules may be required to capture the assumptions, facts, and reasoning that are involved in even simple problem situations. For example, a task that might take an expert a few minutes to accomplish might require an expert system with hundreds of rules and take several months to develop.

The easiest way to develop an expert system is to use an **expert system shell** as a developmental tool. An expert system shell is a software package consisting of an expert system without its kernel, that is, its knowledge base. This leaves a *shell* of

FIGURE 10.32

Criteria for applications that are suitable for expert systems development.

Suitability Criteria for Expert Systems	
• Domain.	The domain, or subject area, of the problem is relatively small and limited to a well-defined problem area.
• Expertise.	Solutions to the problem require the efforts of an expert. That is, a body of knowledge, techniques, and intuition is needed that only a few people possess.
• Complexity.	Solution of the problem is a complex task that requires logical inference processing, which would not be handled as well by conventional information processing.
• Structure.	The solution process must be able to cope with ill-structured, uncertain, missing, and conflicting data, and a problem situation that changes with the passage of time.
• Availability.	An expert exists who is articulate and cooperative, and who has the support of the management and end users involved in the development of the proposed system.

software (the inference engine and user interface programs) with generic inferencing and user interface capabilities. Other development tools (e.g., rule editors, user interface generators) are added in making the shell a powerful expert system development tool.

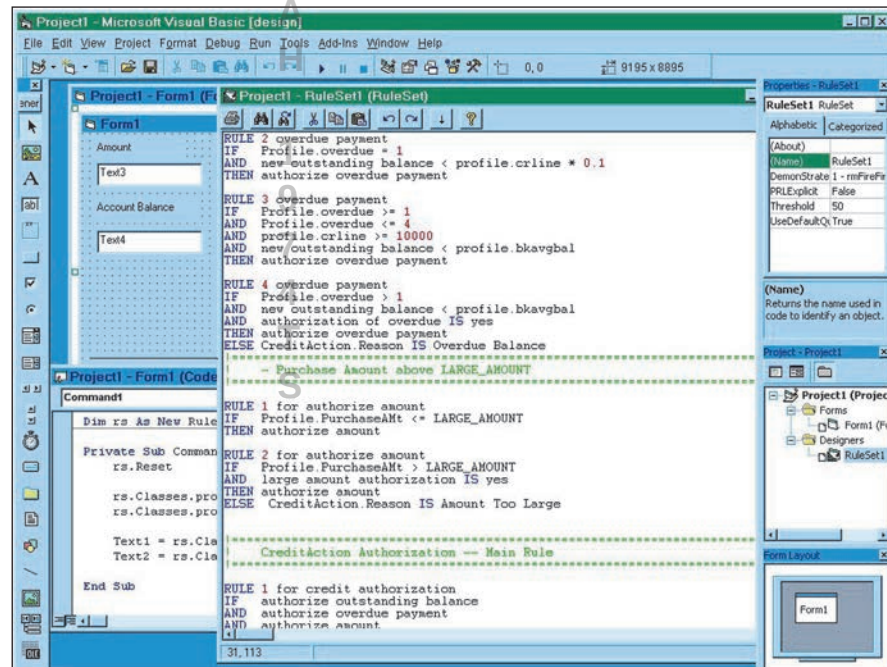
Expert system shells are now available as relatively low-cost software packages that help users develop their own expert systems on microcomputers. They allow trained users to develop the knowledge base for a specific expert system application. For example, one shell uses a spreadsheet format to help end users develop IF-THEN rules, automatically generating rules based on examples furnished by a user. Once a knowledge base is constructed, it is used with the shell's inference engine and user interface modules as a complete expert system on a specific subject area. Other software tools may require an IT specialist to develop expert systems. See Figure 10.33.

Knowledge Engineering

A **knowledge engineer** is a professional who works with experts to capture the knowledge (facts and rules of thumb) they possess. The knowledge engineer then builds the knowledge base (and the rest of the expert system if necessary), using an iterative, prototyping process until the expert system is acceptable. Thus, knowledge engineers perform a role similar to that of systems analysts in conventional information systems development.

FIGURE 10.33

Using the Visual Rule Studio and Visual Basic to develop rules for a credit management expert system.



Once the decision is made to develop an expert system, a team of one or more domain experts and a knowledge engineer may be formed. Experts skilled in the use of expert system shells could also develop their own expert systems. If a shell is used, facts and rules of thumb about a specific domain can be defined and entered into a knowledge base with the help of a rule editor or other knowledge acquisition tool. A limited working prototype of the knowledge base is then constructed, tested, and evaluated using the inference engine and user interface programs of the shell. The knowledge engineer and domain experts can modify the knowledge base, and then retest the system and evaluate the results. This process is repeated until the knowledge base and the shell result in an acceptable expert system.

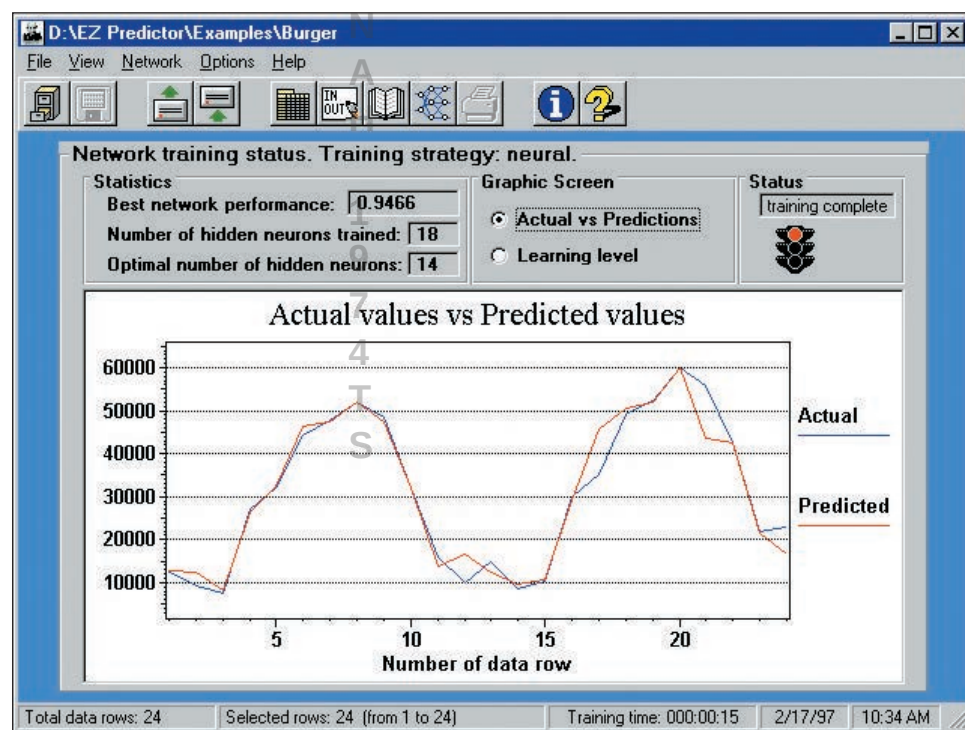
Neural Networks

Neural networks are computing systems modeled after the brain's meshlike network of interconnected processing elements, called *neurons*. Of course, neural networks are a lot simpler in architecture (the human brain is estimated to have more than 100 billion neuron brain cells!). Like the brain, however, the interconnected processors in a neural network operate in parallel and interact dynamically. This interaction enables the network to "learn" from data it processes. That is, it learns to recognize patterns and relationships in these data. The more data examples it receives as input, the better it can learn to duplicate the results of the examples it processes. Thus, the neural network will change the strengths of the interconnections between the processing elements in response to changing patterns in the data it receives and the results that occur. See Figure 10.34.

Modern
Neurosurgery:
Neural Nets Help
Save Lives

Neurosurgery, surgery performed on the brain and spinal cord, has advanced to extraordinary levels of skill and success in just the last decade. One of the most common applications of neurosurgical techniques is the removal of brain tumors. Currently, surgeons search for tumors manually using a metal biopsy needle inserted into the brain. Guided by ultrasound and modern imaging techniques such as MRI/CT scans, they primarily use tactile feedback to localize the tumor. This method, however, can be imprecise, as the tumors can easily shift during surgery, causing

FIGURE 10.34
Evaluating the training
status of a neural network
application.



healthy tissue to be mistakenly treated as tumorous tissue. This inaccuracy can increase the risk of a stroke should a needle accidentally sever an artery.

A new technique, which is a combination of hardware and software, has been developed that gives neurosurgeons the ability to find their way through the brain while doing less damage as they operate. The primary piece of the hardware is a robotic probe that has on its tip several miniature sensors: an endoscope that transmits images and instruments that measure tissue density and blood flow. This probe is inserted into the brain and guided through it by a robotic mechanism that is more precise and accurate than human hands.

The real power in this miracle technique, however, is the sophisticated, adaptable neural network software that provides an instant in-depth analysis of the data gathered by the probe. Surgeons are able to look at a computer screen in the operating room and see a vast array of useful real-time information about what is going on in the patient's brain, such as whether the probe is encountering healthy tissue, blood vessels, or a tumor. The neural net software is adaptable in that it learns from experience the difference between normal tissue and tumorous tissue. Laboratory biopsy test results are used to validate the data used for training the neural net software. Once trained, the neural net can be used to identify in real time abnormal tissues encountered during surgical operations. Once learned, the probe is robotically advanced and stops immediately when it detects a signature significantly different from what was learned to be normal tissue. At this point, tissue identification is performed automatically, and the results presented to the surgeon. The surgeon can then treat the abnormal tissue appropriately and without delay.

This new technique gives surgeons finer control of surgical instruments during delicate brain operations. Overall, the new technique will increase the safety, accuracy, and efficiency of surgical procedures.

Source: Adapted from Bioluminate Inc., Press Release, "Bioluminate to Develop 'Smart Probe' for Early Breast Cancer Detection," December 5, 2002; and "NASA Ames Research Center Report," Smart Surgical Probe, Bioluminate Inc., 2003.

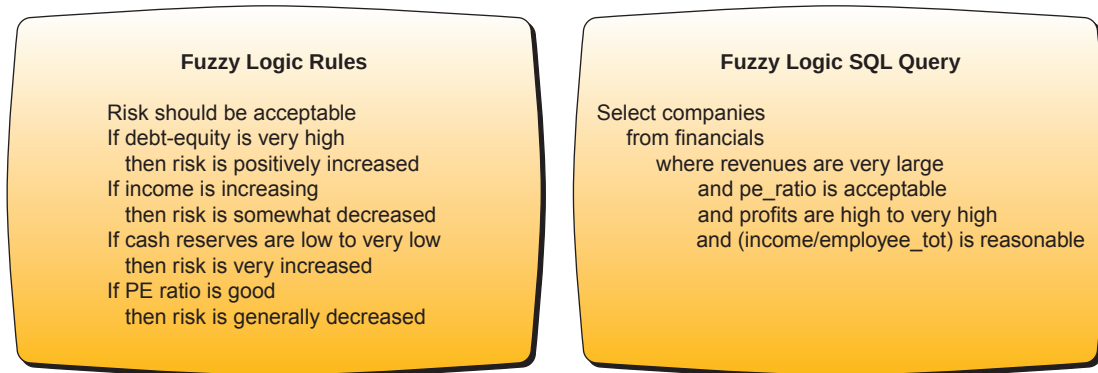
For example, a neural network can be trained to learn which credit characteristics result in good or bad loans. Developers of a credit evaluation neural network could provide it with data from many examples of credit applications and loan results to process, with opportunities to adjust the signal strengths between its neurons. The neural network would continue to be trained until it demonstrated a high degree of accuracy in correctly duplicating the results of recent cases. At that point, it would be trained enough to begin making credit evaluations of its own.

Fuzzy Logic Systems

In spite of their funny name, **fuzzy logic** systems represent a small, but serious, application of AI in business. Fuzzy logic is a method of reasoning that resembles human reasoning, in that it allows for approximate values and inferences (fuzzy logic) and incomplete or ambiguous data (fuzzy data) instead of relying only on *crisp data*, such as binary (yes/no) choices. For example, Figure 10.35 illustrates a partial set of rules (fuzzy rules) and a fuzzy SQL query for analyzing and extracting credit risk information on businesses that are being evaluated for selection as investments.

Notice how fuzzy logic uses terminology that is deliberately imprecise, such as *very high*, *increasing*, *somewhat decreased*, *reasonable*, and *very low*. This language enables fuzzy systems to process incomplete data and quickly provide approximate, but acceptable, solutions to problems that are difficult for other methods to solve. Thus, fuzzy logic queries of a database, such as the SQL query shown in Figure 10.35, promise to improve the extraction of data from business databases. It is important to note that fuzzy logic isn't fuzzy or imprecise thinking. Fuzzy logic actually brings precision to decision scenarios where it previously didn't exist.

FIGURE 10.35 An example of fuzzy logic rules and a fuzzy logic SQL query in a credit risk analysis application.



Fuzzy Logic in Business

Examples of applications of fuzzy logic are numerous in Japan but rare in the United States. The United States has preferred to use AI solutions like expert systems or neural networks, but Japan has implemented many fuzzy logic applications, especially the use of special-purpose fuzzy logic microprocessor chips, called fuzzy process controllers. Thus, the Japanese ride on subway trains, use elevators, and drive cars that are guided or supported by fuzzy process controllers made by Hitachi and Toshiba. Many models of Japanese-made products also feature fuzzy logic microprocessors. The list is growing and includes autofocus cameras, autostabilizing camcorders, energy-efficient air conditioners, self-adjusting washing machines, and automatic transmissions.

Genetic Algorithms

The use of **genetic algorithms** is a growing application of artificial intelligence. Genetic algorithm software uses Darwinian (survival of the fittest), randomizing, and other mathematical functions to simulate an evolutionary process that can yield increasingly better solutions to a problem. Genetic algorithms were first used to simulate millions of years in biological, geological, and ecosystem evolution in just a few minutes on a computer. Genetic algorithm software is being used to model a variety of scientific, technical, and business processes.

Genetic algorithms are especially useful for situations in which thousands of solutions are possible and must be evaluated to produce an optimal solution. Genetic algorithm software uses sets of mathematical process rules (*algorithms*) that specify how combinations of process components or steps are to be formed. This process may involve trying random process combinations (*mutation*), combining parts of several good processes (*crossover*), and selecting good sets of processes and discarding poor ones (*selection*) to generate increasingly better solutions. Figure 10.36 illustrates a business use of genetic algorithm software.

United Distillers: Moving Casks Around with Genetic Algorithms

United Distillers (now part of Diageo PLC) is the largest and most profitable spirits company in the world. United Distillers' two grain distilleries account for more than one-third of total grain whiskey production, and the company's Johnnie Walker brand is the world's top whiskey, achieving sales of up to 120 million bottles a year.

Nevertheless, Christine Wright, Inventory and Supply Manager at United Distillers, points out that some parts of the business attract less attention than others: "Each week, 20,000 casks are moved in and out of our 49 warehouses throughout Scotland to provide the whiskey needed for the blending program. Warehousing is a physical and laborious process and has tended to be the forgotten side of the business." The introduction of genetic algorithm computer technology, however, during the past year has given a fillip to the blend selection process at United Distillers.

"We want to maximize our operational efficiency without compromising the quality," states Christine Wright. United Distillers' Blackgrange warehouse site alone houses approximately 3 million casks, indicating the scale of the challenge. Of the 20,000 casks that are moved each week, 10,000 are not used but are moved only to allow access to those

identified by the selection process. “Although we had 100 percent accurate positional information about all the stock, casks had to be selected numerically. Given the practical challenges involved in warehouse management, casks are seldom stored numerically.”

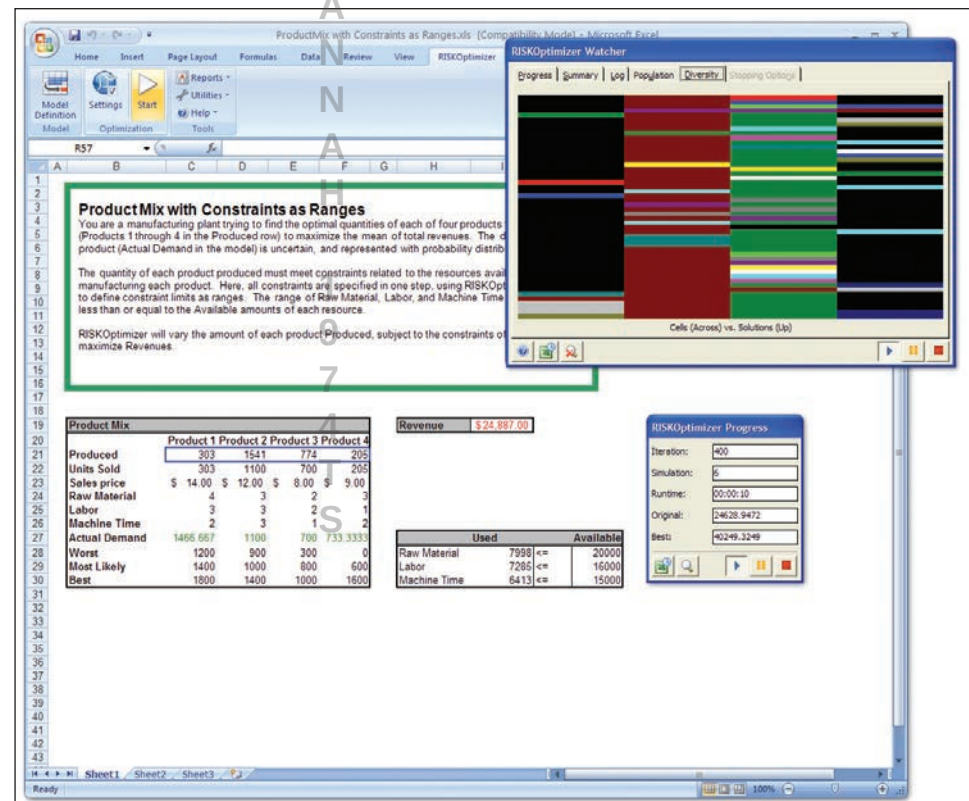
Information held on the system about recipes, site constraints, and the blending program is given to the XpertRule package, which works out the best combinations of stocks to produce the blends. This information is supplemented with positional information about the casks. The system then optimizes the selection of required casks, keeping to a minimum the number of “doors” (warehouse sections) from which the casks must be taken and the number of casks that need to be moved to clear the way. Other constraints must be satisfied, such as the current working capacity of each warehouse and the maintenance and restocking work that may be in progress. Lancashire-based expert systems specialist XpertRule Software Limited has worked closely with United Distillers to develop the software application using XpertRule. The system is based on the use of genetic algorithms and adopts the Darwinian principle of natural selection to optimize the selection process.

“The incidence of non-productive cask movements has plummeted from a high of around 50 percent to a negligible level of around 4 percent and our cask handling rates have almost doubled.” She adds: “The new technology enables staff to concentrate on what they want to achieve, rather than the mechanism of how to go about it. They can concentrate on the constraints that they wish to impose and get the system to do the leg work of finding the best scenario within those constraints. It means that the business can be driven by primary objectives.” “Not only does the lack of wasted effort allow warehouse staff to get on with their work, but it enables them to plan ahead and organize long-term maintenance programs. It encourages a mind-set that is strategic, rather than reactive, and empowers managers to manage their own sites.”

Source: Adapted from XpertRule Case Study, “A Break from Tradition in Blend Selection at United Distillers & Vintners,” http://www.xperrule.com/pages/case_ud.htm, accessed April 23, 2008.

FIGURE 10.36

Risk Optimizer software combines genetic algorithms with a risk simulation function in this airline yield optimization application.



Source: RiskOptimizer software. Image courtesy of Palisade Corporation.

Virtual Reality

Virtual reality (VR) is computer-simulated reality. Virtual reality is a fast-growing area of artificial intelligence that had its origins in efforts to build more natural, realistic, multisensory human–computer interfaces. So virtual reality relies on multisensory input/output devices such as a tracking headset with video goggles and stereo earphones, a *data glove* or jumpsuit with fiber-optic sensors that track your body movements, and a *walker* that monitors the movement of your feet. Then you can experience computer-simulated “virtual worlds” three-dimensionally through sight, sound, and touch. Virtual reality is also called *telepresence*. For example, you can enter a computer-generated virtual world, look around and observe its contents, pick up and move objects, and move around in it at will. Thus, virtual reality allows you to interact with computer-simulated objects, entities, and environments as if they actually exist. See Figure 10.37.

VR Applications

Current applications of virtual reality are wide-ranging and include computer-aided design (CAD), medical diagnostics and treatment, scientific experimentation in many physical and biological sciences, flight simulation for training pilots and astronauts, product demonstrations, employee training, and entertainment, especially 3-D video arcade games. CAD is the most widely used industrial VR application. It enables architects and other designers to design and test electronic 3-D models of products and structures by entering the models themselves and examining, touching, and manipulating sections and parts from all angles. This scientific-visualization capability is also used by pharmaceutical and biotechnology firms to develop and observe the behavior of computerized models of new drugs and materials and by medical researchers to develop ways for physicians to enter and examine a virtual reality of a patient’s body.

VR becomes *telepresence* when users, who can be anywhere in the world, use VR systems to work alone or together at a remote site. Typically, this involves using a VR system to enhance the sight and touch of a human who is remotely manipulating equipment to accomplish a task. Examples range from virtual surgery, where surgeon and patient may be on either side of the globe, to the remote use of equipment in hazardous environments such as chemical plants or nuclear reactors.

The hottest VR application today is Linden Lab’s *Second Life*. Here, users can create avatars to represent them, teleport to any of the thousands of locations in *Second Life*, build personal domains, “buy” land, and live out their wildest fantasies. *Second Life* has grown to enormous proportions, although actual statistics regarding size and

FIGURE 10.37

This landscape architect uses a virtual reality system to view and move through the design of the Seattle Commons, an urban design proposal for downtown Seattle.



Source: © George Steinmetz/Corbis.

number of users are constantly in dispute. Today, *Second Life* is home to individuals, commercial organizations, universities, governments (the Maldives was the first country to open an embassy in *Second Life*), churches, sports entertainment, art exhibits, live music, and theater. Just about anything goes in *Second Life* and, as technologies advance, the lines between your first life and your second one may begin to blur—stay tuned.

There has been increasing interest in the potential social impact of new virtual reality technologies. It is believed by many that virtual reality will lead to a number of important changes in human life and activity. For example:

- Virtual reality will be integrated into daily life and activity and will be used in various human ways.
- Techniques will be developed to influence human behavior, interpersonal communication, and cognition (i.e., virtual genetics).
- As we spend more and more time in virtual space, there will be a gradual “migration to virtual space,” resulting in important changes in economics, worldview, and culture.
- The design of virtual environments may be used to extend basic human rights into virtual space, to promote human freedom and well-being or to promote social stability as we move from one stage in sociopolitical development to the next.
- Virtual reality will soon engage all of the senses including smell, taste, and touch.

Norsk Hydro: Drilling Decisions Made in a Virtual Oil Field

Norsk Hydro, based in Oslo, Norway, is a *Fortune* 500 energy and aluminum supplier operating in more than 40 countries worldwide. It is a leading offshore producer of oil and gas, the world's third-largest aluminum supplier, and a leader in the development of renewable energy sources. Norsk Hydro is also an innovator in the use of virtual reality technology. It uses VR to make decisions that, if wrong, could cost the company millions in lost revenues and, more important, could harm the environment. One example of its successful use of VR is the Troll Oil Field project.

The Troll Oil Field is located in the North Sea. The eastern part of the field has an oil column only 39–46 feet wide, but with in-place reserves of approximately 2.2 billion barrels. The oil is produced by horizontal wells located 1.5–5 feet above the point where the oil and seawater make contact.

During one drilling of a horizontal well, the drill bit was in sand of relatively low quality. No further good-quality reservoir sands were predicted from the geological model along the planned well track. Approximately 820 feet remained to the planned total depth, so a major decision to terminate the well required confirmation. If the decision to terminate the well was the right decision, the cost of drilling to that date would be lost, but no further loss or damage to the environment would occur. If, however, the decision to terminate the well was the wrong decision, valuable oil reserves would be lost forever.

Virtual reality technology was fundamental in deciding whether to terminate the well. All relevant data were loaded into the system for review. During a virtual reality session, the well team discovered a mismatch between the seismic data and the geological model. Based on this observation, they made a quick reinterpretation of some key seismic horizons and updated the geological model locally around the well.

The updated model changed the prognosis for the remaining section of the well from poor-quality sand to high-quality sand. It was decided to continue drilling, and the new prognosis was proven correct. As a result, 175 meters of extra-high-quality sand with an estimated production volume of 100,000 standard cubic meters of oil were drilled in the last section of the well.

Source: Adapted from Norsk Hydro Corporate Background, www.hydro.com, 2004; and Schlumberger Information Solutions, “Norsk Hydro Makes a Valuable Drilling Decision,” Schlumberger Technical Report GMP-5911, 2002.

FIGURE 10.38
Examples of different types
of intelligent agents.

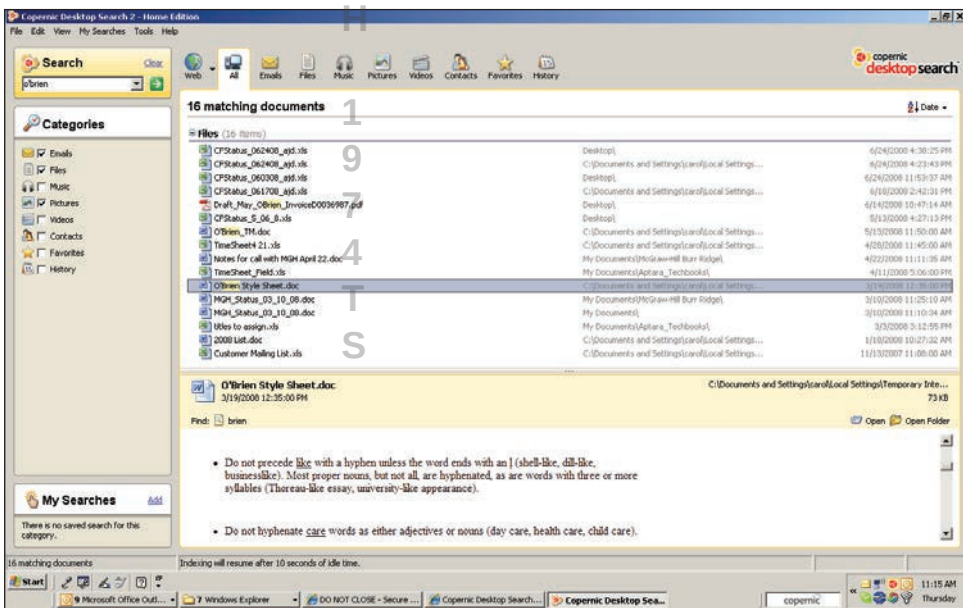
Types of Intelligent Agents
User Interface Agents • Interface Tutors. Observe user computer operations, correct user mistakes, and provide hints and advice on efficient software use. • Presentation Agents. Show information in a variety of reporting and presentation forms and media based on user preferences. • Network Navigation Agents. Discover paths to information and provide ways to view information that are preferred by a user. • Role-Playing Agents. Play what-if games and other roles to help users understand information and make better decisions.
Information Management Agents • Search Agents. Help users find files and databases, search for desired information, and suggest and find new types of information products, media, and resources. • Information Brokers. Provide commercial services to discover and develop information resources that fit the business or personal needs of a user. • Information Filters. Receive, find, filter, discard, save, forward, and notify users about products received or desired, including e-mail, voice mail, and all other information media.

Intelligent Agents

Intelligent agents are growing in popularity as a way to use artificial intelligence routines in software to help users accomplish many kinds of tasks in e-business and e-commerce. An intelligent agent is a *software surrogate* for an end user or a process that fulfills a stated need or activity. An intelligent agent uses its built-in and learned knowledge base about a person or process to make decisions and accomplish tasks in a way that fulfills the intentions of a user. Sometimes an intelligent agent is given a graphic representation or persona, such as Einstein for a science advisor, Sherlock Holmes for an information search agent, and so on. Thus, intelligent agents (also called *software robots* or “bots”) are special-purpose, knowledge-based information systems that accomplish specific tasks for users. Figure 10.38 summarizes major types of intelligent agents.

The wizards found in Microsoft Office and other software suites are among the most well-known examples of intelligent agents. These wizards are built-in capabilities

FIGURE 10.39
Intelligent agent software
such as Copernic can help
you access information from
a variety of categories and
form a variety of sources.



Source: Courtesy of Copernic.

that can analyze how an end user is using a software package and offer suggestions on how to complete various tasks. Thus, wizards might help you change document margins, format spreadsheet cells, query a database, or construct a graph. Wizards and other software agents are also designed to adjust to your way of using a software package so that they can anticipate when you will need their assistance. See Figure 10.39.

The use of intelligent agents is growing rapidly as a way to simplify software use, search Web sites on the Internet and corporate intranets, and help customers do comparison shopping among the many e-commerce sites on the Web. Intelligent agents are becoming necessary as software packages become more sophisticated and powerful, as the Internet and the World Wide Web become more vast and complex, and as information sources and e-commerce alternatives proliferate exponentially. In fact, some commentators forecast that much of the future of computing will consist of intelligent agents performing their work for users.

Security Uses of Intelligent Software Agents

In 2002, the Army began to use intelligent software agents instead of people to route the background files of soldiers who required security clearance to the proper authorities for review. *The result:* A process that once took days now takes 24 hours. The Army reduced its year-long backlog, and the Army Central Clearance Facility in Fort Meade, Maryland, can now handle 30 percent more requests a year. The intelligent agent retrieves the necessary background information from existing records and builds an electronic folder for each case. It then examines the file to determine whether it's a clean case or there are warning signs, such as financial problems, arrests, or anything to indicate that a person might be susceptible to improper influence. Human investigators take closer looks at the tough cases.

Intelligent agents are semiautonomous, proactive, and adaptive software systems that can act on a user's behalf. Give an intelligent agent a goal, such as to help a U.S. ambassador pick a safe evacuation route following a terrorist attack in a foreign country, and it creates the best plan after gathering weather information, news reports, airplane schedules, road information, and police reports.

Such agents can also help investigators identify unusual patterns of activity, says Henry Lieberman, research scientist and leader of the Software Agents Group at the MIT Media Lab in Cambridge, Massachusetts. "Law enforcement can say to an intelligent agent, 'Let me know when any person arrived from a sensitive Middle Eastern country that was recently involved in a large bank transfer.' Or government agencies like the Securities and Exchange Commission can use them to monitor financial statements for fraud. Maybe they could have caught the whole Enron thing earlier."

Nevertheless, the issue of trust may deter their widespread adoption in business. "People just aren't used to using these kinds of things yet," says Lieberman. "When you first start using one of these agents, you have to watch it closely to make sure it's doing what you want. But performance improves over time. And the agent just makes a proposal. Then it's up to you."

Source: Adapted from Stephanie Overby, "Security Strategy Includes Intelligent Software Agents," *CIO Magazine*, January 1, 2003.

Summary

- **Information, Decisions, and Management.** Information systems can support a variety of management decision-making levels and decisions. These include the three levels of management activity (strategic, tactical, and operational decision making) and three types of decision structures (structured, semistructured, and unstructured). Information systems provide a wide range of information products to support these types of decisions at all levels of the organization.
- **Decision Support Trends.** Major changes are taking place in traditional MIS, DSS, and EIS tools for providing the information, and modeling managers need to

support their decision making. Decision support in business is changing, driven by rapid developments in end-user computing and networking; Internet and Web technologies; and Web-enabled business applications. The growth of corporate intranets and extranets, as well as the Web, has accelerated the development of “executive-class” interfaces like enterprise information portals and Web-enabled business intelligence software tools, as well as their use by lower levels of management and individuals and teams of business professionals. In addition, the growth of e-commerce and e-business applications has expanded the use of enterprise portals and DSS tools by the suppliers, customers, and other business stakeholders of a company.

- **Management Information Systems.** Management information systems provide prespecified reports and responses to managers on a periodic, exception, demand, or push reporting basis to meet their need for information to support decision making.
- **OLAP and Data Mining.** Online analytical processing interactively analyzes complex relationships among large amounts of data stored in multidimensional databases. Data mining analyzes the vast amounts of historical data that have been prepared for analysis in data warehouses. Both technologies discover patterns, trends, and exception conditions in a company’s data that support business analysis and decision making.
- **Decision Support Systems.** Decision support systems are interactive, computer-based information systems that use DSS software and a model base and database to provide information tailored to support semistructured and unstructured decisions faced by individual managers. They are designed to use a decision maker’s own insights and judgments in an ad hoc, interactive, analytical modeling process leading to a specific decision.
- **Executive Information Systems.** Executive information systems are information systems originally designed to support the strategic information needs of top management; however, their use is spreading to lower levels of management and business professionals. EIS are easy to use and enable executives to retrieve information tailored to their needs and preferences. Thus, EIS can provide information about a company’s critical success factors to executives to support their planning and control responsibilities.
- **Enterprise Information and Knowledge Portals.** Enterprise information portals provide a customized and personalized Web-based interface for corporate intranets to give their users easy access to a variety of internal and

external business applications, databases, and information services that are tailored to their individual preferences and information needs. Thus, an EIP can supply personalized Web-enabled information, knowledge, and decision support to executives, managers, and business professionals, as well as to customers, suppliers, and other business partners. An enterprise knowledge portal is a corporate intranet portal that extends the use of an EIP to include knowledge management functions and knowledge base resources so that it becomes a major form of knowledge management system for a company.

- **Artificial Intelligence.** The major application domains of artificial intelligence (AI) include a variety of applications in cognitive science, robotics, and natural interfaces. The goal of AI is the development of computer functions normally associated with human physical and mental capabilities, such as robots that see, hear, talk, feel, and move, and software capable of reasoning, learning, and problem solving. Thus, AI is being applied to many applications in business operations and managerial decision making, as well as in many other fields.
- **AI Technologies.** The many application areas of AI are summarized in Figure 10.26, including neural networks, fuzzy logic, genetic algorithms, virtual reality, and intelligent agents. Neural nets are hardware or software systems based on simple models of the brain’s neuron structure that can learn to recognize patterns in data. Fuzzy logic systems use rules of approximate reasoning to solve problems when data are incomplete or ambiguous. Genetic algorithms use selection, randomizing, and other mathematical functions to simulate an evolutionary process that can yield increasingly better solutions to problems. Virtual reality systems are multisensory systems that enable human users to experience computer-simulated environments as if they actually existed. Intelligent agents are knowledge-based software surrogates for a user or process in the accomplishment of selected tasks.
- **Expert Systems.** Expert systems are knowledge-based information systems that use software and a knowledge base about a specific, complex application area to act as expert consultants to users in many business and technical applications. Software includes an inference engine program that makes inferences based on the facts and rules stored in the knowledge base. A knowledge base consists of facts about a specific subject area and heuristics (rules of thumb) that express the reasoning procedures of an expert. The benefits of expert systems (such as preservation and replication of expertise) must be balanced with their limited applicability in many problem situations.

DUKEWITS', HANNAN, AHS1974TS

Key Terms and Concepts

These are the key terms and concepts of this chapter. The page number of their first explanation is in parentheses.

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|--------------------------------|---------------------------------------|--|
| 1. Analytical modeling (407) | c. Sensitivity analysis (408) | 3. Business intelligence (BI) (395) |
| a. Goal-seeking analysis (409) | d. What-if analysis (407) | 4. Data mining (410) |
| b. Optimization analysis (409) | 2. Artificial intelligence (AI) (418) | 5. Data visualization system (DVS) (405) |