Chapter 12

Enhancing Decision Making

LEARNING OBJECTIVES

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

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

CHAPTER OUTLINE

Interactive Sessions:

Analytics Help the Cincinnati Zoo Know Its Customers

Colgate-Palmolive Keeps Managers Smiling with Executive Dashboards

MONEYBALL: DATA-DRIVEN BASEBALL

On September 23, 2011, the film *Moneyball* opened in theaters across the United States, starring Brad Pitt as Billy Beane, the iconoclastic general manager of the Oakland Athletics. The film was based on the bestselling book by Michael Lewis that described how Beane led the underdog A's, with one of the tiniest budgets in Major League baseball, to win 103 games in 2002. Under Beane's watch, the A's made the playoffs five times in the next eight seasons.

At the opening of the 2002 baseball season, the wealthiest team was the New York Yankees, with a payroll of $126 million; the Oakland A's and Tampa Bay Devil Rays, each with payrolls of about $41 million, were the poorest. These disparities meant that only the wealthiest teams could afford the best players. A poor team, such as the A's, could only afford what the "better" teams rejected, and thus was almost certain to fail. That is, until Billy Beane and Moneyball entered the picture.

How did Beane do it? He took a close look at the data. Conventional baseball wisdom maintained that big-name highly athletic hitters and skillful young pitchers were the main ingredients for winning. Beane and his assistant general manager Paul DePodesta used advanced statistical analysis of player and team data to prove that wrong. The prevailing metrics for predicting wins, losses, and player performance, such as batting averages, runs batted in, and stolen bases, were vestiges of the early years of baseball and the statistics that were available at that time. Baseball talent scouts used these metrics, as well as their gut intuition, to size up talent for their teams.

Beane and DePodesta found that a different set of metrics, namely, the percentage of time a hitter was on base or forced opposing pitchers to throw a high number of pitches, was more predictive of a team's chances of winning a game. So Beane sought out affordable players who met these criteria (including those who drew lots of "walks") and had been overlooked or rejected by the well-funded teams. He didn't care if a player was overweight or seemed past his prime-he only focused on the numbers. Beane was able to field a consistently winning team by using advanced analytics to gain insights into each player's value and contribution to team success that other richer teams had overlooked.

Beane and his data-driven approach to baseball had a seismic impact on the game. After observing the A's phenomenal success in 2002, the Boston Red Sox used the talents of baseball statistician Bill James and adopted Beane's strategy, only with more money. Two years later, they won the World Series.

Although many experts continue to believe that traditional methods of player evaluation, along with gut instinct, money, an

d luck, are still the key ingredients for winning teams, the major league teams acknowledge that statistical analysis has a place in baseball. To some degree, most major league teams have embraced sabermetrics, the application of statistical analysis to baseball records to evaluate the performance of individual players. The New York Yankees, New York Mets, San Diego Padres, St. Louis Cardinals, Boston Red Sox, Washington Nationals, Arizona Diamondbacks,

Cleveland Indians, and Toronto Blue Jays have all hired full-time sabermetric analysts.

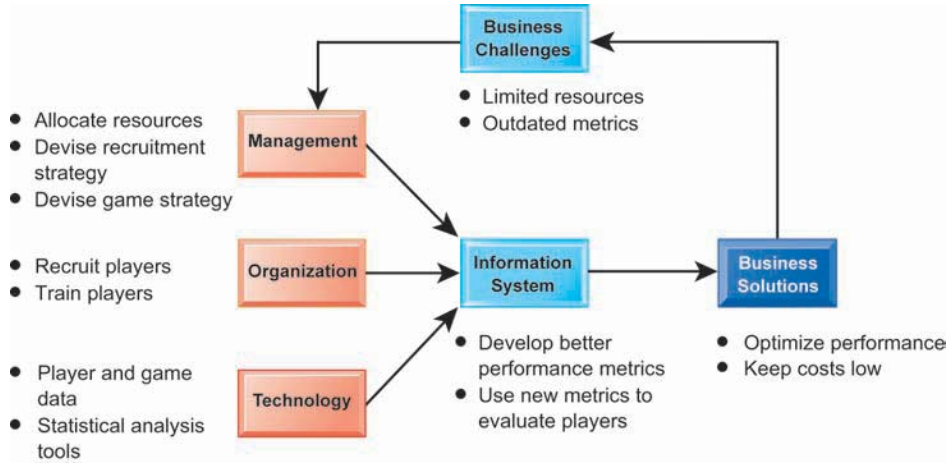
Since all the major league teams use sabermetrics in one way or another to guide their decisions, the A's no longer have the competitive edge they once enjoyed when they were the only ones with this knowledge. Even though Beane hasn't taken the A's to the playoffs since 2006, he remains a highly sought after speaker on the corporate management lecture circuit. It's easy to see why. Moneyball isn't just about baseball—it's about learning how to use data as a competitive weapon, especially in environments where resources are scarce and innovation is essential.

Sources: Don Peppers, "Baseball, Business, and Big Data," FastCompany.com, April 24, 2012; Matthew Futterman, "Baseball after Moneyball," *The Wall Street Journal*, September 22, 2011; Adam Sternberge, "Billy Beane of 'Moneyball' Has Given Up on His Own Hollywood Ending," *The New York Times*, September 21, 2011; and Michael Lewis, *Moneyball: The Art of Winning an Unfair Game*, 2003.

Baseball has been, according to the subtitle of Moneyball, an "unfair game." Given the huge disparities in MLB team budgets, wealthier teams definitely have the advantage in recruiting the best players. But by using advanced analytics to guide decisions about what players to recruit and cultivate, Billy Beane was able to turn the underdog Oakland Athletics into a winning team. Baseball is a business and this opening case has important lessons for other businesses as well: You can be more efficient and competitive if, like Moneyball, you know how to use data to drive your decisions.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. Managers at major league baseball teams were hamstrung by earlier models of decision making that used the wrong metrics to predict team performance. Teams with low budgets such as the Oakland A's were stuck in a rut because they could not afford the most highly skilled players, and the advantage went to the teams with the biggest budgets. Beane and Paul DePodesta ran sophisticated statistical analyses of player and game data to devise a better set of metrics for predicting performance. Of course, an individual player's skill is still very important, but Beane showed that a team composed of less skilled players could still win if it focused on players with high on-base percentages and pitchers with large numbers of ground-outs. Beane was able forge a team that delivered a first-rate performance much more cost effectively that competitors because he paid attention to the data.

Here are some questions to think about: Some have said Moneyball isn't really about baseball. What are the implications of this statement? What can businesses learn from Moneyball? What if all businesses were run like Moneyball?



12.1 Decision Making and Information Systems

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

BUSINESS VALUE OF IMPROVED DECISION MAKING

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

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

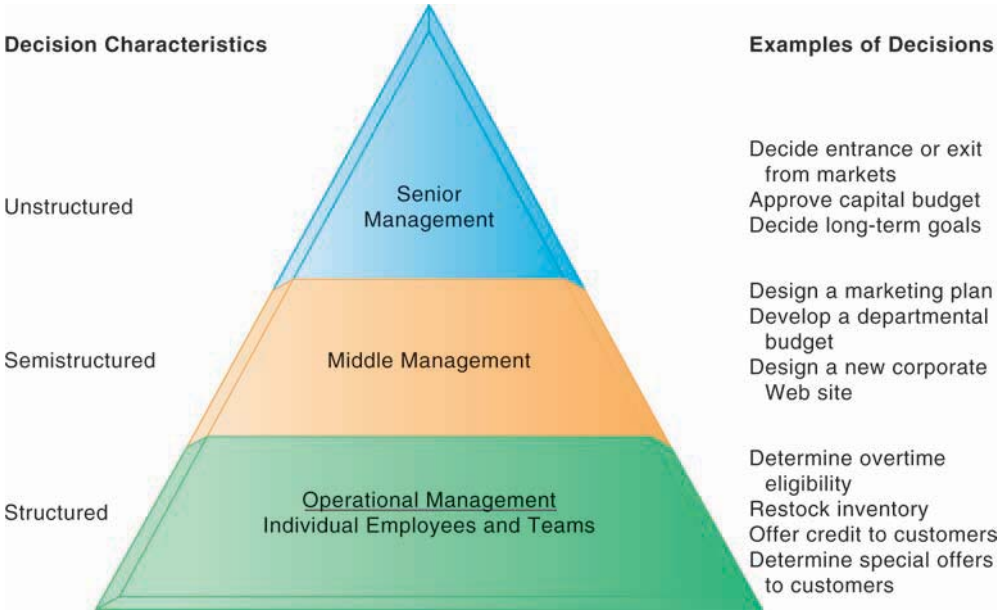
TYPES OF DECISIONS

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

TABLE 12.1 BUSINESS VALUE OF ENHANCED DECISION MAKING

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

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



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

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

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

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

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

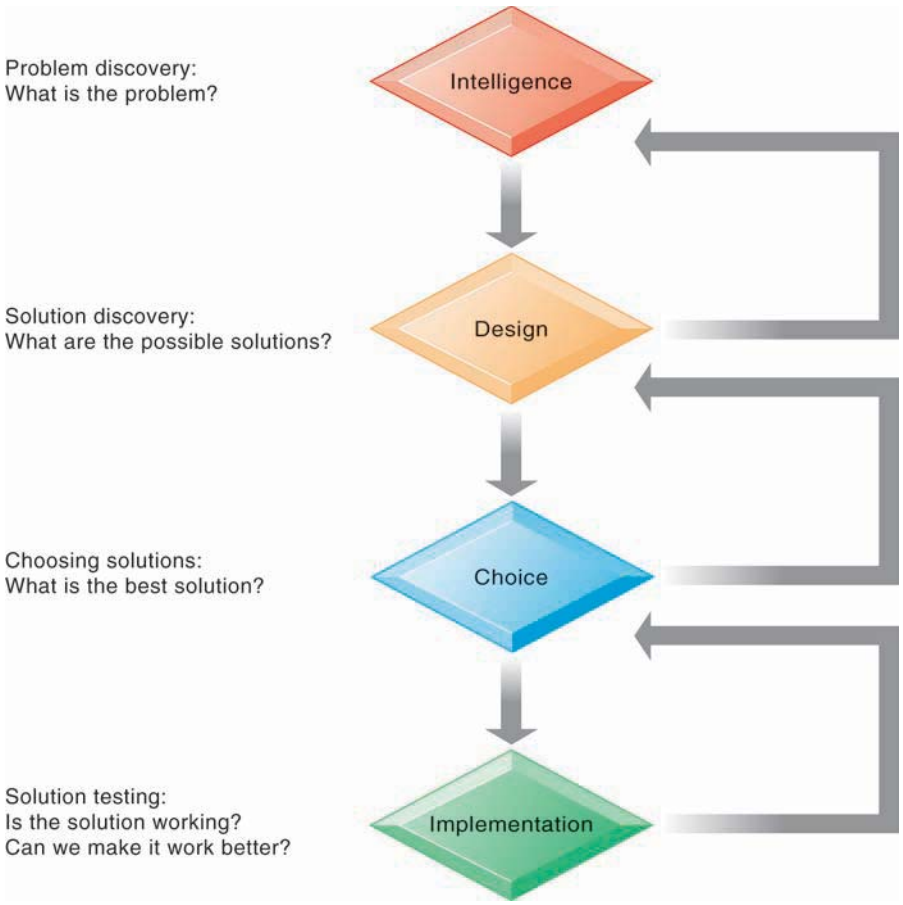
Operational management and rank-and-file employees tend to make more structured decisions. For example, a supervisor on an assembly line has to decide whether an hourly paid worker is entitled to overtime pay. If the employee worked more than eight hours on a particular day, the supervisor would routinely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

A sales account representative often has to make decisions about extending credit to customers by consulting the firm's customer database that contains credit information. If the customer met the firm's prespecified criteria for granting credit, the account representative would grant that customer credit to make a purchase. In both instances, the decisions are highly structured and are routinely made thousands of times each day in most large firms. The answer has been preprogrammed into the firm's payroll and accounts receivable systems.

THE DECISION-MAKING PROCESS

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

FIGURE 12.2 STAGES IN DECISION MAKING



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

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

Design involves identifying and exploring various solutions to the problem.

Choice consists of choosing among solution alternatives.

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

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

MANAGERS AND DECISION MAKING IN THE REAL WORLD

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

Managerial Roles

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

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

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

Observers find that managerial behavior actually has five attributes that differ greatly from the classical description. First, managers perform a great deal of work at an unrelenting pace—studies have found that managers engage in more than 600 different activities each day, with no break in their pace. Second, managerial activities are fragmented; most activities last for less than nine minutes, and only 10 percent of the activities exceed one hour in duration. Third, managers prefer current, specific, and ad hoc information (printed information often will be too old). Fourth, they prefer oral forms of

communication to written forms because oral media provide greater flexibility, require less effort, and bring a faster response. Fifth, managers give high priority to maintaining a diverse and complex web of contacts that act as an informal information system and helps them execute their personal agendas and short- and long-term goals.

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

Interpersonal Roles. Managers act as figureheads for the organization when they represent their companies to the outside world and perform symbolic duties, such as giving out employee awards, in their **interpersonal role**. Managers act as leaders, attempting to motivate, counsel, and support subordinates. Managers also act as liaisons between various organizational levels; within each of these levels, they serve as liaisons among the members of the management team. Managers provide time and favors, which they expect to be returned.

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

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

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

TABLE 12.2 MANAGERIAL ROLES AND SUPPORTING INFORMATION SYSTEMS

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

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

Real-World Decision Making

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

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

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

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

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

Organizational Inertia and Politics. Organizations are bureaucracies with limited capabilities and competencies for acting decisively. When environments change and businesses need to adopt new business models to

TABLE 12.3 INFORMATION QUALITY DIMENSIONS

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

survive, strong forces within organizations resist making decisions calling for major change. Decisions taken by a firm often represent a balancing of the firm's various interest groups rather than the best solution to the problem.

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

HIGH-VELOCITY AUTOMATED DECISION MAKING

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

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

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

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

12.2 Business Intelligence in the Enterprise

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

- What are business intelligence (BI) and business analytics (BA)
- Who makes business intelligence and business analytics hardware and software?
- Who are the users of business intelligence?
- What kinds of analytical tools come with a BI/BA suite?
- How do managers use these tools?
- What are some examples of firms who have used these tools?
- What management strategies are used for developing BI/BA capabilities?

WHAT IS BUSINESS INTELLIGENCE?

When we think of humans as intelligent beings we often refer to their ability to take in data from their environment, understand the meaning and significance of the information, and then act appropriately. Can the same be said of business firms? The answer appears to be a qualified "yes." All organizations, including business firms, do indeed take in information from their environments, attempt to understand the meaning of the information, and then attempt to act on the information. Just like human beings, some business firms do this well, and others poorly.

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

So, stripped to its essentials, business intelligence and analytics are about integrating all the information streams produced by a firm into a single, coherent enterprise-wide set of data, and then, using modeling, statistical analysis tools (like normal distributions, correlation and regression analysis, Chi square analysis, forecasting, and cluster analysis), and data mining tools (pattern discovery and machine learning), to make sense out of all these data so managers can make better decisions and better plans, or at least know quickly when their firms are failing to meet planned targets.

One company that uses business intelligence is Hallmark Cards. The company uses SAS Analytics software to improve its understanding of buying patterns that could lead to increased sales at more than 3,000 Hallmark Gold Crown stores in the United Sates. Hallmark wanted to strengthen its relationship with frequent buyers. Using data mining and predictive modeling, the company determined how to market to various consumer segments during holidays

and special occasions as well as adjust promotions on the fly. Hallmark is able to determine which customer segments are most influenced by direct mail, which should be approached through e-mail, and what specific messages to send each group. Business intelligence has helped boost Hallmark sales to its loyalty program members by 5 to 10 percent. Another organization that has benefited from business intelligence is the Cincinnati Zoo, as described in the Interactive Session on Organizations.

Business Intelligence Vendors

It is important to remember that business intelligence and analytics are products defined by technology vendors and consulting firms. They consist of hardware and software suites sold primarily by large system vendors to very large Fortune 500 firms. The largest five providers of these products are Oracle, SAP, IBM, Microsoft, and SAS (see Table 12.4). Microsoft's products are aimed at small to medium-sized firms, and they are based on desktop tools familiar to employees (such as Excel spreadsheet software), Microsoft SharePoint collaboration tools, and Microsoft SQL Server database software. According to the International Data Corporation, the global business intelligence and analytics market was $35.1 billion in 2012 and is expected to reach $50.7 billion by 2016 (Kern, 2012). This makes business intelligence and business analytics one of the fastest growing and largest segments in the U.S. software market.

THE BUSINESS INTELLIGENCE ENVIRONMENT

Figure 12.3 (on page 495) gives an overview of a business intelligence environment, highlighting the kinds of hardware, software, and management capabilities that the major vendors offer and that firms develop over time. There are six elements in this business intelligence environment:

- **Data from the business environment:** Businesses must deal with both structured and unstructured data from many different sources, including big data. The data need to be integrated and organized so that they can be analyzed and used by human decision makers.
- **Business intelligence infrastructure:** The underlying foundation of business intelligence is a powerful database system that captures all the relevant data to operate the business. The data may be stored in transactional databases or combined and integrated into an enterprise-data warehouse or series of interrelated data marts.

TABLE 12.4 MARKET LEADERS AND SHARE FOR THE TOP BUSINESS INTELLIGENCE VENDORS

VENDOR	MARKET SHARE	BUSINESS INTELLIGENCE SOFTWARE
Oracle	19.3%	Oracle Business Intelligence Foundation Suite
SAP	14.5%	SAP BusinessObjects BI
IBM	13.8%	IBM Cognos
Microsoft	7.4%	Microsoft Excel, PowerPivot, SQL Server 2012 Business Intelligence
SAS Institute	7.1%	SAS Enterprise Business Intelligence

INTERACTIVE SESSION: ORGANIZATIONS

ANALYTICS HELP THE CINCINNATI ZOO KNOW ITS CUSTOMERS

Founded in 1873, the Cincinnati Zoo & Botanical Garden is one of the world's top-rated zoological institutions, and the second oldest zoo in the United States. It is also one of the nation's most popular attractions, a Top 10 Zagat-rated Zoo, and a *Parents Magazine* Top Zoo for Children. The Zoo's 71-acre site is home to more than 500 animal and 3,000 plant species. About 1.3 million people visit this zoo each year.

Although the Zoo is a nonprofit organization partially subsidized by Hamilton County, more than two-thirds of its $26 million annual budget is paid from fundraising efforts, and the remainder comes from admission fees, food, and gifts. To increase revenue and improve performance, the Zoo's senior management team embarked on a comprehensive review of its operations. The review found that management had limited knowledge and understanding of what was actually happening in the Zoo on a day-to-day basis, other than how many people visited every day and the Zoo's total revenue.

Who is coming to the Zoo? How often do they come? What do they do and what do they buy? Management had no idea. Each of the Zoo's four income streams—admissions, membership, retail, and food service—had different point-of-sale platforms, and the food service business, which brings in $4 million a year, still relied on manual cash registers. Management had to sift through paper receipts just to understand daily sales totals.

The Zoo had compiled a spreadsheet that collected visitors' zip codes, hoping to use the data for geographic and demographic analysis. If the data could be combined with insight into visitor activity at the Zoo—what attractions they visited, what they ate and drank, and what they bought at the gift shops—the information would be extremely valuable for marketing.

To achieve this, however, the Zoo needed to change its information systems to focus more on an alytics and data management. The Zoo replaced its four legacy point-of-sale systems with a single platform—Galaxy POS from Gateway Ticketing Systems. It then enlisted IBM and BrightStar Partners (a consulting firm partnering with IBM) to build a centralized data warehouse and implement IBM Cognos Business Intelligence to provide real-time analytics and reporting.

Like all outdoor attractions, the Zoo's business is highly weather-dependent. On rainy days, attendance falls off sharply, often leaving the Zoo overstaffed and overstocked. If the weather is unusually hot, sales of certain items such as ice cream and bottled water are likely to rise, and the Zoo may run out of these items.

The Zoo now feeds weather forecast data from the U.S. National Oceanic and Atmospheric Administration (NOAA) Web site into its business intelligence system. By comparing current forecasts to historic attendance and sales data during similar weather conditions, the Zoo is able to make more accurate decisions about labor scheduling and inventory planning.

As visitors scan their membership cards at the Zoo's entrance, exit, attractions, restaurants, and stores, or use the Zoo's Loyalty Rewards card, the Zoo's system captures these data and analyzes them to determine usage and spending patterns down to the individual customer level. This information helps the Zoo segment visitors based on their spending and visitation behaviors and use this information to target marketing and promotions specifically for each customer segment.

One customer segment the Zoo identified consisted of people who spent nothing other than the price of admissions during their visit. If each of these people spent $20 on their next visit to the Zoo, the Zoo would take in an extra $260,000, which is almost 1 percent of its entire budget. The Zoo used its customer information to devise a direct mail marketing campaign in which this type of visitor would be offered a discount for some of the Zoo's restaurants and gift shops. Loyal customers are also rewarded with targeted marketing and recognition programs.

Instead of sending a special offer to its entire mailing list, the Zoo is able to tailor campaigns more precisely to smaller groups of people, increasing its chances of identifying the people who were most likely to respond to its mailings. More targeted marketing helped the Zoo cut $40,000 from its annual marketing budget.

Management had observed that food sales tend to trail off significantly after 3 p.m. each day, and started closing some of the Zoo's food outlets at that time. But more detailed data analysis showed that a big spike in soft-serve ice cream sales occurs during the last hour

before the Zoo closes. As a result, the Zoo's soft-serve ice cream outlets are open for the entire day.

The Zoo's Beer Hut concession features six different brands, which are typically rotated based on sales volume and the seasons. With IBM analytics, management can now instantly identify which beer is selling best, on what day, and at what time to make sure inventory meets demand. Previously, it took 7 to 14 days to get this information, which required hiring part-time staff to sift through register tapes.

The Zoo's ability to make better decisions about operations has led to dramatic improvements in sales. Six months after deploying its business intelligence solution, the Zoo achieved a 30.7 percent increase in food sales and a 5.9 percent increase in retail sales compared to the same period a year earlier.

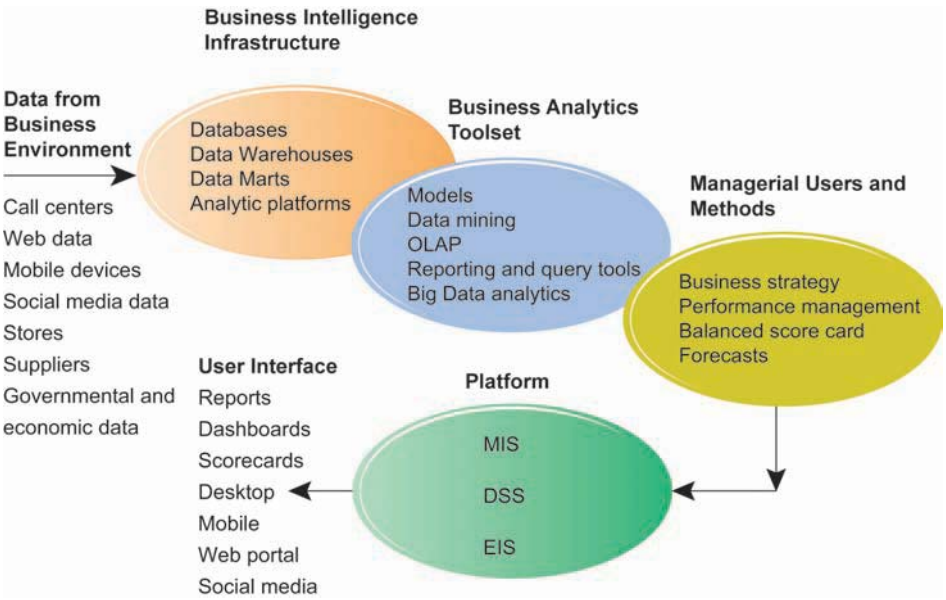
Sources: Justin Kern, "Analytics: Coming to a Zoo, Museum, or Park Near You," *Information Management*, August 28, 2012; IBM Corporation, "Cincinnati Zoo Improves Customer Experience and Enhances Performance," 2011; Nucleus Research, "IBM ROI Case Study: Cincinnati Zoo," July 2011; and www.cincinnatizoo.org, accessed May 26, 2012.

CASE STUDY QUESTIONS

1. What management, organization, and technology factors were behind the Cincinnati Zoo losing opportunities to increase revenue?
2. Why was replacing legacy point-of-sale systems and implementing a data warehouse essential to an information system solution?
3. How did the Cincinnati Zoo benefit from business intelligence? How did it enhance operational performance and decision making? What role was played by predictive analytics?
4. Visit the IBM Cognos Web site and describe the business intelligence tools that would be the most useful for the Cincinnati Zoo.

- **Business analytics toolset:** A set of software tools are used to analyze data and produce reports, respond to questions posed by managers, and track the progress of the business using key indicators of performance.

FIGURE 12.3 BUSINESS INTELLIGENCE AND ANALYTICS FOR DECISION SUPPORT



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

- **Managerial users and methods:** Business intelligence hardware and software are only as intelligent as the human beings who use them. Managers impose order on the analysis of data using a variety of managerial methods that define strategic business goals and specify how progress will be measured. These include business performance management and balanced scorecard approaches focusing on key performance indicators and industry strategic analyses focusing on changes in the general business environment, with special attention to competitors. Without strong senior management oversight, business analytics can produce a great deal of information, reports, and online screens that focus on the wrong matters and divert attention from the real issues. You need to remember that, so far, only humans can ask intelligent questions.
- **Delivery platform—MIS, DSS, ESS:** The results from business intelligence and analytics are delivered to managers and employees in a variety of ways, depending on what they need to know to perform their jobs. MIS, DSS, and ESS, which we introduced in Chapter 2, deliver information and knowledge to different people and levels in the firm—operational employees, middle managers, and senior executives. In the past, these systems could not share data and operated as independent systems. Today, one suite of hardware and software tools in the form of a business intelligence and analytics package is able to integrate all this information and bring it to managers' desktop or mobile platforms.
- **User interface:** Business people are no longer tied to their desks and desktops. They often learn quicker from a visual representation of data than from a dry report with columns and rows of information. Today's business analytics software suites emphasize visual techniques such as dashboards and scorecards. They also are able to deliver reports on BlackBerrys, iPhones, and other mobile handhelds as well as on the firm's Web portal. BA software is adding capabilities to post information on Twitter, Facebook, or internal social media to support decision making in an online group setting rather than in a face-to-face meeting.

BUSINESS INTELLIGENCE AND ANALYTICS CAPABILITIES

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

- **Production reports:** These are predefined reports based on industry-specific requirements (see Table 12.5).
- **Parameterized reports:** Users enter several parameters as in a pivot table to filter data and isolate impacts of parameters. For instance, you might want to enter region and time of day to understand how sales of a product vary by region and time. If you were Starbucks, you might find that customers in the East buy most of their coffee in the morning, whereas in the Northwest customers buy coffee throughout the day. This finding might lead to different marketing and ad campaigns in each region. (See the discussion of pivot tables in Section 12.3.)
- **Dashboards/scorecards:** These are visual tools for presenting performance data defined by users.
- **Ad hoc query/search/report creation:** These allow users to create their own reports based on queries and searches.

- **Drill down:** This is the ability to move from a high-level summary to a more detailed view.
- **Forecasts, scenarios, models:** These include the ability to perform linear forecasting, what-if scenario analysis, and analyze data using standard statistical tools.

Who Uses Business Intelligence and Business Analytics?

In previous chapters, we have described the different information constituencies in business firms—from senior managers to middle managers, analysts, and operational employees. This also holds true for BI and BA systems (see Figure 12.4). Over 80 percent of the audience for BI consists of casual users who rely largely on production reports. Senior executives tend to use BI to monitor firm activities using visual interfaces like dashboards and scorecards. Middle managers and analysts are much more likely to be immersed in the data and software, entering queries and slicing and dicing the data along different dimensions. Operational employees will, along with customers and suppliers, be looking mostly at prepackaged reports.

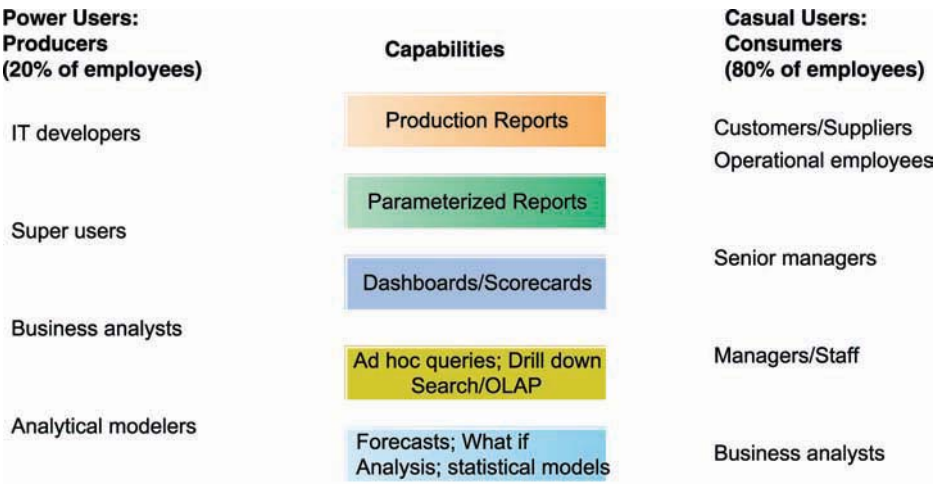
Production Reports

The most widely used output of a BI suite of tools are pre-packaged production reports. Table 12.5 illustrates some common predefined reports from Oracle's BI suite of tools.

Predictive Analytics

An important capability of business intelligence analytics is the ability to model future events and behaviors, such as the probability that a customer will respond to an offer to purchase a product. **Predictive analytics** use statistical analysis, data mining techniques, historical data, and assumptions about future conditions to predict future trends and behavior patterns. Variables that can be measured to predict future behavior are identified. For example, an insurance company might use variables such as age, gender, and driving record as

FIGURE 12.4 BUSINESS INTELLIGENCE USERS



Casual users are consumers of BI output, while intense power users are the producers of reports, new analyses, models, and forecasts.

TABLE 12.5 EXAMPLES OF BUSINESS INTELLIGENCE PREDEFINED PRODUCTION REPORTS

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

predictors of driving safety when issuing auto insurance policies. A collection of such predictors is combined into a predictive model for forecasting future probabilities with an acceptable level of reliability.

FedEx has been using predictive analytics to develop models that predict how customers will respond to price changes and new services, which customers are most at risk of switching to competitors, and how much revenue will be generated by new storefront or drop-box locations. The accuracy rate of FedEx's predictive analytics system ranges from 65 to 90 percent.

Predictive analytics are being incorporated into numerous business intelligence applications for sales, marketing, finance, fraud detection, and health care. One of the most well-known applications is credit scoring, which is used throughout the financial services industry. When you apply for a new credit card, scoring models process your credit history, loan application, and purchase data to determine your likelihood of making future credit payments on time. Telecommunications companies use predictive analytics to identify which customers are most profitable, which are most likely to leave, and which new services and plans will be most likely to retain customers. Health care insurers have been analyzing data for years to identify which patients are most likely to generate high costs.

Many companies employ predictive analytics to predict response to direct marketing campaigns. By identifying customers less likely to respond, companies are able to lower their marketing and sales costs by bypassing this group and focusing their resources on customers who have been identified as more promising. For instance, the U.S. division of The Body Shop plc used predictive analytics and its database of catalog, Web, and retail store customers to identify customers who were more likely to make catalog purchases. That information helped the company build a more precise and targeted mailing list for its catalogs, improving the response rate for catalog mailings and catalog revenues.

Big Data Analytics

Many online retailers have capabilities for making personalized online product recommendations to their Web site visitors to help stimulate purchases and guide their decisions about what merchandise to stock. However, most of these product recommendations are based on the behaviors of similar groups

of customers, such as those with incomes under $50,000 or whose ages are between 18–25. Now some are starting to analyze the tremendous quantities of online and in-store customer data they collect along with social media data to make these recommendations more individualized.

Major online companies such as Walmart, Netflix, and eBay are analyzing big data from their customer transactions and social media streams to create real-time personalized shopping experiences. These efforts are translating into higher customer spending and customer retention rates.

EBay uses Hunch.com, which it acquired in 2011, to deliver customized recommendations to individual users based on their specific set of tastes. Hunch has built a massive database that includes data from customer purchases, social networks, and signals from around the Web. Hunch is able to analyze the data to create a "taste graph" that maps users with their predicted affinity for products, services, Web sites, and other people, and use this information to create customized recommendations.

The Hunch "taste graph" includes predictions on about 500 million people, 200 million objects (such as videos, gadgets, or books), and 30 billion connections between people and objects. To generate accurate predictions in near real-time, Hunch transformed each person's tastes into a more manageable "taste fingerprint" extracted from the larger taste graph.

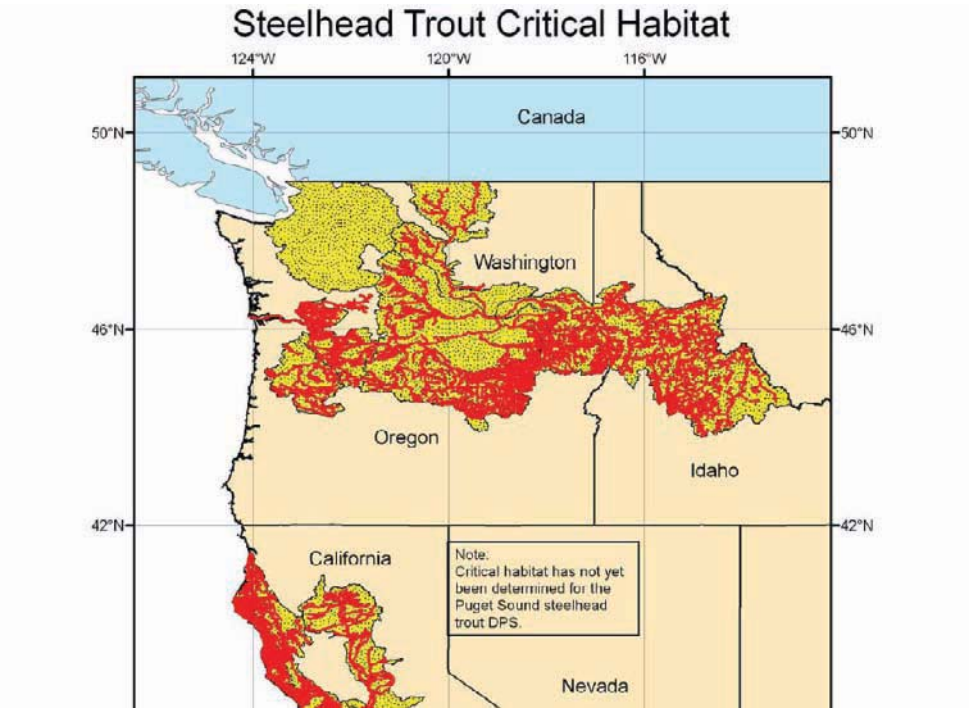
Hunch.com's prediction technology is helping eBay develop recommendations of items that might not be immediately obvious for users to purchase from its online marketplace. For example, for a coin collector purchasing on eBay, Hunch might recommend microscopes that are especially useful for coin analysis. Hunch could also become an important tool for eBay sellers if its customer profiles help them make better decisions about which items to offer, the content they use to describe their inventory, and perhaps even the advertising they use to promote their eBay listings (Grau, 2012).

Data Visualization, Visual Analytics, and Geographic Information Systems

By presenting data in visual form, **data visualization** and visual analytics tools help users see patterns and relationships in large amounts of data that would be difficult to discern if the data were presented as traditional lists of text or numbers. Data are presented in the form of rich graphs, charts, dashboards, and maps. People become more engaged when they can filter information that is presented visually and develop insights on their own.

Geographic information systems (GIS) are a special category of tools for helping decision makers visualize problems requiring knowledge about the geographic distribution of people or other resources. GIS software ties location data to points, lines, and areas on a map. Some GIS have modeling capabilities for changing the data and automatically revising business scenarios. GIS might be used to help state and local governments calculate response times to natural disasters and other emergencies or to help banks identify the best location for installing new branches or ATM terminals.

For example, Columbia, South Carolina-based First Citizens Bank uses GIS software from MapInfo to determine which markets to focus on for retaining customers and which to focus on for acquiring new customers. MapInfo also lets the bank drill down into details at the individual branch level and individualize goals for each branch. Each branch is able to see whether the greatest revenue opportunities are from mining its database of existing customers or from finding new customers.



The U.S. National Marine Fisheries Service (NMFS) created a GIS for identifying critical habitat for steelhead trout on the U.S. West Coast. Red areas show critical habitat. Pink-shaded areas indicate places where the steelhead trout are endangered, and dotted-yellow areas indicate places where the species is threatened.

MANAGEMENT STRATEGIES FOR DEVELOPING BI AND BA CAPABILITIES

There are two different strategies for adopting BI and BA capabilities for the organization: one-stop integrated solutions versus multiple best-of-breed vendor solutions. The hardware firms (IBM, HP, and now Oracle, which owns Sun Microsystems) want to sell your firm integrated hardware/software solutions that tend to run only on their hardware (the totally integrated solution). It's called "one-stop shopping." The software firms (SAP, SAS, and Microsoft) encourage firms to adopt the "best of breed" software and that runs on any machine they want. In this strategy, you adopt the best database and data warehouse solution, and select the best business intelligence and analytics package from whatever vendor you believe is best.

The first solution carries the risk that a single vendor provides your firm's total hardware and software solution, making your firm dependent on its pricing power. It also offers the advantage of dealing with a single vendor who can deliver on a global scale. The second solution offers greater flexibility and independence, but with the risk of potential difficulties integrating the software to the hardware platform, as well as to other software. Vendors always claim their software is "compatible" with other software, but the reality is that it can be very difficult to integrate software from different vendors. Microsoft in particular emphasizes building on its desktop interface and operating system (Windows), which are familiar to many users, and developing server applications that run on Microsoft local area networks. But data from hardware and software produced by different vendors will have to flow seamlessly into Microsoft workstations to make this strategy work. This may not be adequate for Fortune 500 firms needing a global networking solution.

Regardless of which strategy your firm adopts, all BI and BA systems lock the firm into a set of vendors and switching is very costly. Once you train thousands

of employees across the world on using a particular set of tools, it is extremely difficult to switch. When you adopt these systems, you are in essence taking in a new partner.

The marketplace is very competitive and given to hyperbole. One BI vendor claims "[Our tools] bring together a portfolio of services, software, hardware and partner technologies to create business intelligence solutions. By connecting intelligence across your company, you gain a competitive advantage for creating new business opportunities." As a manager, you will have to critically evaluate such claims, understand exactly how these systems could improve your business, and determine whether the expenditures are worth the benefits.

12.3 Business Intelligence Constituencies

There are many different constituencies that make up a modern business firm. Earlier in this text and in this chapter we identified three levels of management: lower supervisory (operational) management, middle management, and senior management (vice president and above, including executive or "C level" management, e.g. chief executive officer, chief financial officers, and chief operational officer.) Each of these management groups has different responsibilities and different needs for information and business intelligence, with decisions becoming less structured among higher levels of management (review Figure 12.1).

DECISION SUPPORT FOR OPERATIONAL AND MIDDLE MANAGEMENT

Operational and middle management are generally charged with monitoring the performance of key aspects of the business, ranging from the down-time of machines on a factory floor, to the daily or even hourly sales at franchise food stores, to the daily traffic at a company's Web site. Most of the decisions they make are fairly structured. Management information systems (MIS) are typically used by middle managers to support this type of decision making, and their primary output is a set of routine production reports based on data extracted and summarized from the firm's underlying transaction processing systems (TPS). Increasingly, middle managers receive these reports online on the company portal, and are able to interactively query the data to find out why events are happening. To save even more analysis time, managers turn to exception reports, which highlight only exceptional conditions, such as when the sales quotas for a specific territory fall below an anticipated level or employees have exceeded their spending limits in a dental care plan. Table 12.6 provides some examples of MIS applications.

Support for Semistructured Decisions

Some managers are "super users" and keen business analysts who want to create their own reports, and use more sophisticated analytics and models to find patterns in data, to model alternative business scenarios, or to test specific hypotheses. Decision-support systems (DSS) are the BI delivery platform for this category of users, with the ability to support semistructured decision making.

TABLE 12.6 EXAMPLES OF MIS APPLICATIONS

COMPANY	MIS APPLICATION
California Pizza Kitchen	Inventory Express application "remembers" each restaurant's ordering patterns and compares the amount of ingredients used per menu item to predefined portion measurements established by management. The system identifies restaurants with out-of-line portions and notifies their managers so that corrective actions will be taken.
PharMark	Extranet MIS identifies patients with drug-use patterns that place them at risk for adverse outcomes.
Black & Veatch	Intranet MIS tracks construction costs for various projects across the United States.
Taco Bell	Total Automation of Company Operations (TACO) system provides information on food, labor, and period-to-date costs for each restaurant.

DSS rely more heavily on modeling than MIS, using mathematical or analytical models to perform what-if or other kinds of analysis. "What-if" analysis, working forward from known or assumed conditions, allows the user to vary certain values to test results to predict outcomes if changes occur in those values. What happens if we raise product prices by 5 percent or increase the advertising budget by $1 million? **Sensitivity analysis** models ask what-if questions repeatedly to predict a range of outcomes when one or more variables are changed multiple times (see Figure 12.5). Backward sensitivity analysis helps decision makers with goal seeking: If I want to sell 1 million product units next year, how much must I reduce the price of the product?

Chapter 6 described multidimensional data analysis and OLAP as one of the key business intelligence technologies. Spreadsheets have a similar feature for multidimensional analysis called a **pivot table**, which manager "super users" and analysts employ to identify and understand patterns in business information that may be useful for semistructured decision making.

Figure 12.6 illustrates a Microsoft Excel 2010 pivot table that examines a large list of order transactions for a company selling online management training videos and books. It shows the relationship between two dimensions: the sales region and the source of contact (Web banner ad or e-mail) for each customer order. It answers the question: does the source of the customer make a difference in addition to region? The pivot table in this figure shows that most customers come from the West and that banner advertising produces most of the customers in all the regions.

One of the Hands-On MIS projects for this chapter asks you to use a pivot table to find answers to a number of other questions using the same list of transactions for the online training company as we used in this discussion. The complete Excel file for these transactions is available in MyMISLab. We have also added a Learning Track on creating pivot tables using Excel.

In the past, much of this modeling was done with spreadsheets and small stand-alone databases. Today these capabilities are incorporated into large enterprise BI systems where they are able to analyze data from large corporate databases. BI analytics include tools for intensive modeling, some of which we described earlier. Such capabilities help Progressive Insurance identify the best customers for its products. Using widely available insurance industry data,

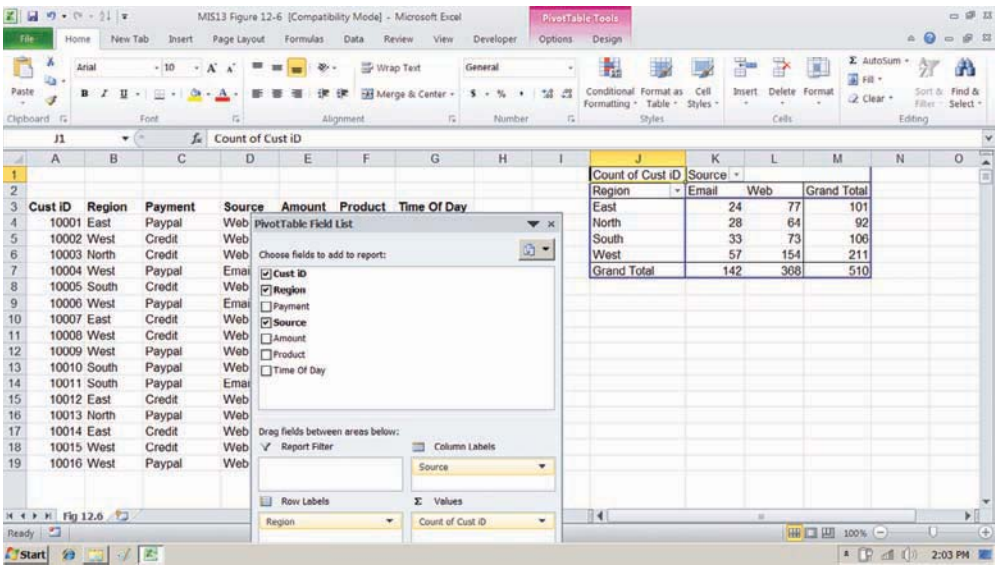
FIGURE 12.5 SENSITIVITY ANALYSIS

Total fixed costs	19000					
Variable cost per unit	3					
Average sales price	17					
Contribution margin	14					
Break-even point	1357					
		Variable Cost per Unit				
Sales	1357	2	3	4	5	6
Price	14	1583	1727	1900	2111	2375
	15	1462	1583	1727	1900	2111
	16	1357	1462	1583	1727	1900
	17	1267	1357	1462	1583	1727
	18	1188	1267	1357	1462	1583

This table displays the results of a sensitivity analysis of the effect of changing the sales price of a necktie and the cost per unit on the product's break-even point. It answers the question, "What happens to the break-even point if the sales price and the cost to make each unit increase or decrease?"

Progressive defines small groups of customers, or "cells," such as motorcycle riders aged 30 or above with college educations, credit scores over a certain level, and no accidents. For each "cell," Progressive performs a regression analysis to identify factors most closely correlated with the insurance losses that are typical for this group. It then sets prices for each cell, and uses simulation software to test whether this pricing arrangement will enable the company to make a profit. These analytic techniques, make it possible for Progressive to profitably insure customers in traditionally high-risk categories that other insurers would have rejected.

FIGURE 12.6 A PIVOT TABLE THAT EXAMINES CUSTOMER REGIONAL DISTRIBUTION AND ADVERTISING SOURCE



In this pivot table, we are able to examine where an online training company's customers come from in terms of region and advertising source.

DECISION SUPPORT FOR SENIOR MANAGEMENT: BALANCED SCORECARD AND ENTERPRISE PERFORMANCE MANAGEMENT METHODS

The purpose of executive support systems (ESS), introduced in Chapter 2, is to help C-level executive managers focus on the really important performance information that affect the overall profitability and success of the firm. There are two parts to developing ESS. First, you will need a methodology for understanding exactly what is "the really important performance information" for a specific firm that executives need, and second, you will need to develop systems capable of delivering this information to the right people in a timely fashion.

Currently, the leading methodology for understanding the really important information needed by a firm's executives is called the **balanced scorecard method** (Kaplan and Norton, 2004; Kaplan and Norton, 1992). The balanced score card is a framework for operationalizing a firm's strategic plan by focusing on measurable outcomes on four dimensions of firm performance: financial, business process, customer, and learning and growth (Figure 12.7).

Performance on each dimension is measured using **key performance indicators (KPIs)**, which are the measures proposed by senior management for understanding how well the firm is performing along any given dimension. For instance, one key indicator of how well an online retail firm is meeting its customer performance objectives is the average length of time required to deliver a package to a consumer. If your firm is a bank, one KPI of business process performance is the length of time required to perform a basic function like creating a new customer account.

FIGURE 12.7 THE BALANCED SCORECARD FRAMEWORK

In the balanced scorecard framework, the firm's strategic objectives are operationalized along four dimensions: financial, business process, customer, and learning and growth. Each dimension is measured using several KPIs.

The balanced scorecard framework is thought to be "balanced" because it causes managers to focus on more than just financial performance. In this view, financial performance is past history—the result of past actions—and managers should focus on the things they are able to influence today, such as business process efficiency, customer satisfaction, and employee training. Once a scorecard is developed by consultants and senior executives, the next step is automating a flow of information to executives and other managers for each of the key performance indicators. There are literally hundreds of consulting and software firms that offer these capabilities, which are described below. Once these systems are implemented, they are often referred to as ESS.

Another closely related popular management methodology is **business performance management (BPM)**. Originally defined by an industry group in 2004 (led by the same companies that sell enterprise and database systems like Oracle, SAP, and IBM), BPM attempts to systematically translate a firm's strategies (e.g., differentiation, low-cost producer, market share growth, and scope of operation) into operational targets. Once the strategies and targets are identified, a set of KPIs are developed that measure progress towards the targets. The firm's performance is then measured with information drawn from the firm's enterprise database systems. BPM uses the same ideas as balanced scorecard but with a stronger strategy flavor (BPM Working Group, 2004).

Corporate data for contemporary ESS are supplied by the firm's existing enterprise applications (enterprise resource planning, supply chain management, and customer relationship management). ESS also provide access to news services, financial market databases, economic information, and whatever other external data senior executives require. ESS also have significant **drill-down** capabilities if managers need more detailed views of data.

Well-designed ESS help senior executives monitor organizational performance, track activities of competitors, recognize changing market conditions, and identify problems and opportunities. Employees lower down in the corporate hierarchy also use these systems to monitor and measure business performance in their areas of responsibility. For these and other business intelligence systems to be truly useful, the information must be "actionable"—it must be readily available and also easy to use when making decisions. If users have difficulty identifying critical metrics within the reports they receive, employee productivity and business performance will suffer. The Interactive Session on Management shows how Colgate-Palmolive addressed this problem and helped its managers make more data-driven, actionable decisions.

GROUP DECISION-SUPPORT SYSTEMS (GDSS)

The DSS we have just described focus primarily on individual decision making. However, so much work is accomplished in groups within firms that a special category of systems called **group decision-support systems (GDSS)** has been developed to support group and organizational decision making.

A GDSS is an interactive computer-based system for facilitating the solution of unstructured problems by a set of decision makers working together as a group in the same location or in different locations. Collaboration systems and Web-based tools for videoconferencing and electronic meetings described earlier in this text support some group decision processes, but their focus is primarily on communication. GDSS, however, provide tools and technologies geared explicitly toward group decision making.

GDSS-guided meetings take place in conference rooms with special hardware and software tools to facilitate group decision making. The hardware includes

INTERACTIVE SESSION: MANAGEMENT

COLGATE-PALMOLIVE KEEPS MANAGERS SMILING WITH EXECUTIVE DASHBOARDS

Colgate-Palmolive Company is the second largest consumer products company in the world whose products are marketed in over 200 countries and territories. The company had 38,600 employees worldwide and $16.734 billion in annual revenue in 2011. Colgate has been keeping people smiling and clean around the world, with more than three-quarters of its sales in recent years coming from outside the United States. Colgate's brands in oral products, soap, and pet food, are global names, including Colgate, Palmolive, Mennen, Softsoap, Irish Spring, Protex, Sorriso, Kolynos, Elmex, Tom's of Maine, Ajax, Axion, Fabuloso, Soupline, and Suavitel, as well as Hill's Science Diet and Hill's Prescription Diet.

The secret to continued growth and stability for the past two decades has been Colgate's ability to move its brands off shore to Latin America, Europe and Asia. In the past, Colgate divided the world into geographic regions: Latin American, Europe, Asia, and North America. Each region had its own information systems. As long as the regions did not need to share resources or information this patchwork system worked, more or less. This all changed as global operations became more integrated and senior management needed to oversee and coordinate these operations more closely.

Colgate had been a global SAP user since the early 1990s, but it was running five separate ERP systems to serve its different geographic regions. Over a period of time, disparities in the data developed between different geographic regions and between the data used at the corporate level and the data used by an individual region or business unit. The data were constantly changing. For example, every time a sales report was run, it showed different numbers for orders and shipments. Colgate wanted more usable data to drive business decisions and all of its managers and business units worldwide to use the same version of the data.

Colgate chose to solve this problem by creating a single global data repository using SAP NetWeaver Business Warehouse, SAP's analytical, reporting and data warehousing solution. Colgate's regional ERP systems feed their data to the warehouse, where the data are standardized and formatted for enterprise-wide reporting and analysis. This eliminates differences in data across the enterprise.

One of the outputs of the warehouse for senior managers is a daily HTML table showing a series of financial and operational metrics for the day compared to the previous month and quarter. The data the executives see is exactly the same as what their peers in all Colgate regions and business units see.

However, the data were not being used by enough employees in their decision making to have an impact on business benefits. Colgate's power users had no trouble using the reporting and analytical tools provided by the warehouse, and they were satisfied with the matrix reports from the system. Colgate's senior managers and other casual users, on the other hand, did not feel comfortable running ad hoc reports or drilling down into the layers of data to answer questions the data brought to light. They did not have much time to spend developing reports, and the standard reports produced for them by the warehouse lacked navigation and drill down capabilities. Tables had no color coding so users could only interpret the data by scrutinizing the numbers on the table.

Eventually Colgate's senior managers and other casual users began requesting deeper access to the warehouse data in a more timely and user-friendly format. They wanted reports that were easier to run and where the data could be interpreted faster. Senior management requested customizable, real-time dashboards that could be more easily used to drive performance improvement.

Colgate's information systems specialists then implemented SAP NetWeaver BW Accelerator to speed up data loads and improve user perception and adoption and SAP BusinessObjects Web Intelligence to build customized reports. SAP BusinessObjects Web Intelligence provides a powerful, intuitive interface that enables business analysts and non-technical business professionals to ask spontaneous questions about their data. Casual business users can use simple drag-and-drop techniques to access data sources and create interactive reports that drill, slice and format information based on their needs. Tools for cutting edge visualization allow end users to view two- and three-dimensional charts and hone in on specific areas of focus.

Colgate started using SAP's BusinessObjects tools to build user-friendly dashboards, and quickly

created dashboard prototypes for management to review. Once management approved the dashboard design, the dashboards were populated with production data. Now Colgate's senior managers are running the dashboards to monitor the business from a high level.

Employee training was essential to the dashboards' success. Members of Colgate's global information systems development team created customized courses for Colgate's 65 business intelligence experts and ran the classroom training. The training identified people that could be used as resources for developing the reporting tools. When word spread about the dashboards' capabilities, Colgate's power users signed up for the classes as well.

For Colgate, better reporting tools that can support different kinds of users have greatly expanded the use of business intelligence throughout the company. Currently about 4000 users interact with Colgate's SAP systems daily but this number is expected to expand to 15,000 to 20,000 users in the future. People who are accustomed to seeing reports stuffed with numbers are finding that they can use the information presented in dashboards to make faster decisions. For example, managers can determine positive or negative financial conditions by simply looking for where dashboard reports use the color green, which reflects improvements in Colgate's financial position. Executives who formerly relied on other people to obtain their custom reports and data are able to access the information on their own. They can see real data from the system much more easily and quickly.

Sources: Paul Ziobro, "Colgate Shows Improved Growth," *Wall Street Journal*, April 26, 2012; Colgate Palmolive Corporation, "SEC Form 10K for the Fiscal Year Ending December 31, 2011," Colgate Palmolive Corporation, February 26, 2012; David Hannon, "Colgate-Palmolive Empowers Senior Leaders with Executive Dashboards," SAP InsiderPROFILES, April–June 2011; www.colgatepalmolive.com, accessed July 22, 2012; and SAP, "Placing Relevant Business Content within Business User Reach," 2011.

CASE STUDY QUESTIONS

1. Describe the different types of business intelligence users at Colgate-Palmolive.
2. Describe the "people" issues that were affecting Colgate's ability to use business intelligence.
3. What management, organization, and technology factors had to be addressed in providing business intelligence capabilities for each type of user?
4. What kind of decisions does Colgate's new business intelligence capability support? Give three examples. What is their potential business impact?

computer and networking equipment, overhead projectors, and display screens. Special electronic meeting software collects, documents, ranks, edits, and stores the ideas offered in a decision-making meeting. The more elaborate GDSS use a professional facilitator and support staff. The facilitator selects the software tools and helps organize and run the meeting.

A sophisticated GDSS provides each attendee with a dedicated desktop computer under that person's individual control. No one will be able to see what individuals do on their computers until those participants are ready to share information. Their input is transmitted over a network to a central server that stores information generated by the meeting and makes it available to all on the meeting network. Data can also be projected on a large screen in the meeting room.

GDSS make it possible to increase meeting size while at the same time increasing productivity because individuals contribute simultaneously rather than one at a time. A GDSS promotes a collaborative atmosphere by guaranteeing contributors' anonymity so that attendees focus on evaluating the ideas themselves without fear of personally being criticized or of having their ideas rejected based on the contributor. GDSS software tools follow structured methods

for organizing and evaluating ideas and for preserving the results of meetings, enabling nonattendees to locate needed information after the meeting. GDSS effectiveness depends on the nature of the problem and the group and on how well a meeting is planned and conducted.

Learning Track Module

The following Learning Track provides content relevant to topics covered in this chapter:

1. Building and Using Pivot Tables

Review Summary

1. *What are the different types of decisions and how does the decision-making process work?*

   The different levels in an organization (strategic, management, operational) have different decision-making requirements. Decisions can be structured, semistructured, or unstructured, with structured decisions clustering at the operational level of the organization and unstructured decisions at the strategic level. Decision making can be performed by individuals or groups and includes employees as well as operational, middle, and senior managers. There are four stages in decision making: intelligence, design, choice, and implementation. Systems to support decision making do not always produce better manager and employee decisions that improve firm performance because of problems with information quality, management filters, and organizational culture.

2. *How do information systems support the activities of managers and management decision making?*

   Early classical models of managerial activities stress the functions of planning, organizing, coordinating, deciding, and controlling. Contemporary research looking at the actual behavior of managers has found that managers' real activities are highly fragmented, variegated, and brief in duration and that managers shy away from making grand, sweeping policy decisions.

   Information technology provides new tools for managers to carry out both their traditional and newer roles, enabling them to monitor, plan, and forecast with more precision and speed than ever before and to respond more rapidly to the changing business environment. Information systems have been most helpful to managers by providing support for their roles in disseminating information, providing liaisons between organizational levels, and allocating resources. However, information systems are less successful at supporting unstructured decisions. Where information systems are useful, information quality, management filters, and organizational culture can degrade decision making.

3. *How do business intelligence and business analytics support decision making?*

   Business intelligence and analytics promise to deliver correct, nearly real-time information to decision makers, and the analytic tools help them quickly understand the information and take action. A business intelligence environment consists of data from the business environment, the BI infrastructure, a BA toolset, managerial users and methods, a BI delivery platform (MIS, DSS, or ESS), and the user interface. There are six analytic functionalities that BI systems deliver to achieve these ends: predefined production reports, parameterized reports, dashboards and scorecards, ad hoc queries and searches, the ability to drill down to detailed views of data, and the ability to model scenarios and create forecasts.

4. *How do different decision-making constituencies in an organization use business intelligence?*

   Operational and middle management are generally charged with monitoring the performance of their firm. Most of the decisions they make are fairly structured. Management information systems (MIS) producing routine production reports are typically used to support this type of decision making.

For making unstructured decisions, middle managers and analysts will use decision-support systems (DSS) with powerful analytics and modeling tools, including spreadsheets and pivot tables. Senior executives making unstructured decisions use dashboards and visual interfaces displaying key performance information affecting the overall profitability, success, and strategy of the firm. The balanced scorecard and business performance management are two methodologies used in designing executive support systems (ESS).

5. *What is the role of information systems in helping people working in a group make decisions more efficiently?*
   Group decision-support systems (GDSS) help people working together in a group arrive at decisions more efficiently. GDSS feature special conference room facilities where participants contribute their ideas using networked computers and software tools for organizing ideas, gathering information, making and setting priorities, and documenting meeting sessions.

Key Terms

Balanced scorecard method, 504
Behavioral models, 488
Business performance management (BPM), 505
Choice, 488
Classical model of management, 488
Data visualization, 499
Decisional role, 489
Design, 488
Drill-down, 505
Geographic information systems (GIS), 499
Group decision-support systems (GDSS), 505
Implementation, 488
Informational role, 489
Intelligence, 488
Interpersonal role, 489
Key performance indicators (KPIs), 504
Managerial roles, 489
Pivot table, 502
Predictive analytics, 497
Semistructured decisions, 486
Sensitivity analysis, 502
Structured decisions, 486
Unstructured decisions, 486

Review Questions

1. What are the different types of decisions and how does the decision-making process work?
   - List and describe the different levels of decision making and decision-making constituencies in organizations. Explain how their decision-making requirements differ.
   - Distinguish between an unstructured, semistructured, and structured decision.
   - List and describe the stages in decision making.
2. How do information systems support the activities of managers and management decision making?
   - Compare the descriptions of managerial behavior in the classical and behavioral models.
   - Identify the specific managerial roles that can be supported by information systems.
3. How do business intelligence and business analytics support decision making?
   - Define and describe business intelligence and business analytics.
   - List and describe the elements of a business intelligence environment.
   - List and describe the analytic functionalities provided by BI systems.
   - Compare two different management strategies for developing BI and BA capabilities.
4. How do different decision-making constituencies in an organization use business intelligence?
   - List each of the major decision-making constituencies in an organization and describe the types of decisions each makes.
   - Describe how MIS, DSS, or ESS provide decision support for each of these groups.
   - Define and describe the balanced scorecard method and business performance management.
5. What is the role of information systems in helping people working in a group make decisions more efficiently?
   - Define a group decision-support system (GDSS) and explain how it differs from a DSS.
   - Explain how a GDSS works and how it provides value for a business.

Discussion Questions

1. As a manager or user of information systems, what would you need to know to participate in the design and use of a DSS or an ESS? Why?
2. If businesses used DSS, GDSS, and ESS more widely, would managers and employees make better decisions? Why or why not?
3. How much can business intelligence and business analytics help companies refine their business strategy? Explain your answer.

Hands-On MIS Projects

The projects in this section give you hands-on experience identifying opportunities for DSS, using a spreadsheet pivot table to analyze sales data, and online retirement planning tools for financial planning.

Management Decision Problems

1. Dealerships for Subaru and other automobile manufacturers keep records of the mileage of cars they sell and service. Mileage data are used to remind customers of when they need to schedule service appointments, but they are used for other purposes as well. What kinds of decisions does this piece of data support at the local level and at the corporate level? What would happen if this piece of data were erroneous, for example, showing mileage of 130,000 instead of 30,000? How would it affect decisionmaking? Assess its business impact.
2. Applebee's is the largest casual dining chain in the world, with over 1800 locations throughout the U.S. and also in 20 other countries. The menu features beef, chicken, and pork items, as well as burgers, pasta, and seafood. Applebee's CEO wants to make the restaurant more profitable by developing menus that are tastier and contain more items that customers want and are willing to pay for despite rising costs for gasoline and agricultural products. How might business intelligence help management implement this strategy? What pieces of data would Applebee's need to collect? What kinds of reports would be useful to help management make decisions on how to improve menus and profitability?

Improving Decision Making: Using Pivot Tables to Analyze Sales Data

Software skills: Pivot tables
Business skills: Analyzing sales data

This project gives you an opportunity to learn how to use Excel's PivotTable feature to analyze a database or data list. Use the data file for Online Management Training Inc. described earlier in the chapter. This is a list of the sales transactions at OMT for one day. You can find this spreadsheet file at MyMISLab. Use Excel's PivotTable to help you answer the following questions:

- Where are the average purchases higher? The answer might tell managers where to focus marketing and sales resources, or pitch different messages to different regions.
- What form of payment is the most common? The answer could be used to emphasize in advertising the most preferred means of payment.
- Are there any times of day when purchases are most common? Do people buy are products while at work (likely during the day) or at home (likely in the evening)?
- What's the relationship between region, type of product purchased, and average sales price?

We provide instructions on how to use Excel PivotTables in our Learning Tracks.

Improving Decision Making: Using a Web-Based DSS for Retirement Planning

Software skills: Internet-based software
Business skills: Financial planning

This project will help develop your skills in using Web-based DSS for financial planning.

The Web sites for CNN Money and Kiplinger feature Web-based DSS for financial planning and decision making. Select either site to plan for retirement. Use your chosen site to determine how much you need to save to have enough income for your retirement. Assume that you are 50 years old and plan to retire in 16 years. You have one dependant and $100,000 in savings. Your current annual income is $85,000. Your goal is to be able to generate an annual retirement income of $60,000, including Social Security benefit payments.

Use the Web site you have selected to determine how much money you need to save to help you achieve your retirement goal. To calculate your estimated Social Security benefit, use the Quick Calculator at the Social Security Administration Web site

Critique the site—its ease of use, its clarity, the value of any conclusions reached, and the extent to which the site helps investors understand their financial needs and the financial markets.

Video Cases

Video Cases and Instructional Videos illustrating some of the concepts in this chapter are available. Contact your instructor to access these videos.

Collaboration and Teamwork Project

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

Zynga Wins with Business Intelligence

CASE STUDY

The world's fastest growing gaming company doesn't boast top-of-the-line graphics, heart-pounding action, or masterful storytelling. It doesn't make games for the Playstation, Xbox, or Wii. The company in question is Zynga, and if you have a Facebook account, odds are you're already well aware of its most popular games. Zynga's explosive growth illustrates the potential of social gaming and the ability of social networks to provide critical data about a company's customers.

Founded in 2007 by Mark Pincus and a group of other entrepreneurs, Zynga is the leading developer of social network games, such as *CityVille*, *Texas HoldEm Poker*, and *FarmVille*. These games, along with Zynga's *Empires & Allies* game, are the four most frequently used applications on Facebook. Zynga's games have over 290 million monthly active users and 65 million daily players whose gaming keystrokes and clicks generate 3 terabytes of data every day. Since its inception, Zynga has put a priority on data analytics to guide the management of its games and the business decisions of the company.

The company relies heavily on its data to improve user retention and to increase collaboration among its gamers. In the words of Ken Rudin, chief of data analytics at Zynga, to be useful, data must be "actionable"—it has to be information that allows Zynga to make noticeable improvements to its games. Generating and storing game data is only half of the battle. Zynga also uses two analytics teams—a reporting team and analytics team—to work with the data and make concrete recommendations for business improvements based on that data.

There are three key metrics that drive the economics of social gaming: churn rates, the viral coefficient, and revenue per user. Churn, which we discuss in Chapter 9, is the loss rate of game players. Social gaming can have an extraordinarily high churn rate, about 50 percent per month on average. That means that half the new players signing up for a game today will be gone in a month.

The viral coefficient is a measure of the effectiveness of existing game players for drawing new players, an important capability for social network platforms. For example, if 100 Farmville users are likely to cause 5 of their friends to sign up in a given month, that would result in a viral coefficient of 1.05.

Expected revenue per user is an estimate of the lifetime revenue that a game player will generate, based on an estimate of monthly revenue per user and the churn rate. For instance, if the average monthly revenue is $5 per user and the churn rate is 50 percent, the expected revenue can be estimated as $5 the first month + $2.50 the second month + $1.25 the third month, and so forth, or approximately $20.

The first wave of social gaming applications on Facebook tried to increase the viral coefficient with Wall postings advertising in-game actions by players. This approach created too much "Wall spam," or game-related postings that made it difficult for social network users to identify posts by friends. Facebook and other social networking platforms then demanded that gaming firms reduce their Wall spam.

As a result, Zynga turned to social graph analysis. For social games, the "social graph," or relationships between friends, is somewhat different from that of the social networking platform itself. For example, in Zynga's *Mafia Wars* game, players might have two types of friends—those who actively play the game and a more passive group that signed on to help expand a friend's Mafia organization and then leave the game or play very infrequently. Players don't always interact the same way with these two groups, with gifts and offers of help more frequent within the active group. Guiding game players to communicate appropriately with these different types of relationships helps increase revenue and virality while reducing churn. A social gaming company such as Zynga will thus try to improve the player experience to make every aspect of the game more profitable.

Technology from Vertica Systems, an analytic database management company, helps solve this problem. Vertica's Massively Parallel Processing (MPP) architecture enables customers to deploy its analytics platform using industry standard hardware or cloud solutions as building blocks called "nodes." Users can build clusters consisting of 1, 10, or 100 or more nodes, putting thousands of processors, terabytes of computer memory, and petabytes of disk storage to work as a single parallel cluster.

A small start-up company can deploy Vertica on a single node, adding new nodes as needed.

Vertica's data warehouse is columnar, which means that data are stored in columns instead of rows. This allows Zynga's data to be more tightly compressed, at a rate of 10 to 1 (10 terabytes of data become 1 terabyte of compressed data). Vertica's data warehouse is able to work with this compressed data, which improves performance by reducing processor demands, memory, and disk input/output at processing time. Traditional database management systems can't work with compressed data. As a result, Zynga achieves rates of performance that are 50 to 100 times faster than the data warehouses used by other companies.

Vertica software is also able to manipulate the database for social graph analysis, transposing all of an individual user's interactions with other users into a single row, and it can do this quickly. Relational database platforms are unable to cope with the massive volume of data created by all the connections in a social graph.

Zynga's social graph-related data are streamed in real time to a dedicated Vertica cluster where the graph is generated daily. Every night, the models resulting from this graph are fed back into its games for use the next day. Zynga runs as many as 130 experiments to tweak and adjust its games each day and then observe how players react. Within minutes after releasing a new feature, Zynta is able to find out whether millions of players liked it or not. On the basis of this new knowledge, Zynga may make as many as 100 daily updates to its products.

With this business intelligence solution, Zynga has been able to improve the targeting of items such as gifts to effectively increase the level of interaction between active players while minimizing spam to passive players. Zynga is now in a position to identify groups of users with similar behavior or common paths for even more precise targeting of game-related promotions and activities.

Zynga's revenue rose from $121 million in 2009 to $1.14 billion in 2011. Clearly, Zynga's methods are working. Traditional game-makers like Activision Blizzard and Electronic Arts are noting Zynga's growth and success and have moved towards a similar business model. For example, Electronic Arts launched a free Facebook version of the classic game *The Sims*. The game now has 40 million active monthly players and was Facebook's fastest growing app for much of 2011.

Zynga's business model is to offer free games geared towards a larger, more casual gaming audience, and to generate revenue by selling virtual goods in game. The idea of virtual goods has been around for years, most notably in Second Life and other virtual worlds, where users can buy apparel and accessories for their avatars. But Zynga's attention to detail and ability to glean important information from countless terabytes of data generated by its users on a daily basis has set it apart.

For example, product managers in Zynga's *FishVille* Facebook game discovered that players bought a certain type of fish in game, the translucent anglerfish, more frequently than the rest. Zynga began offering fish similar to the anglerfish for about $3 apiece, and *FishVille* players responded by buying many more fish than usual. Analytics have also shown that Zynga's gamers tend to buy more in-game goods when they are offered as limited edition items. Zynga sells advertising, both in and around its games, but the vast majority of its revenue comes from its virtual goods sales.

Zynga also benefits from using Facebook as its gaming platform. When users install a Zynga application, they allow Zynga access to all of their profile information, including their names, genders, and lists of friends. Zynga then uses that information to determine what types of users are most likely to behave in certain ways. Zynga particularly hopes to determine which types of users are most likely to become "whales," or big spenders that buy hundreds of dollars of virtual goods each month. Though only 5 percent of Zynga's active users contribute to corporate revenue, that subset of users is so dedicated that they account for nearly all of the company's earnings.

Zynga's games make heavy use of Facebook's social features. For example, in *CityVille*, users must find friends to fill fictional posts at their "City Hall" to successfully complete the structure. All of Zynga's games have features like this, but Facebook hasn't always fully supported all of Zynga's efforts. Zynga's Facebook apps were formerly able to send messages directly to Facebook members, but they disabled the feature after complaints that it was a form of spam. Still, if your friends use Zynga's Facebook apps, chances are you've seen advertisements encouraging you to play as well in your News Feed.

Zynga's success has disrupted the video game industry. Traditional video game companies begin with an idea for a game that they hope players will buy and enjoy, and then make the game. Zynga begins with a game, but then studies data to determine how its players play, what types of players are most active, and what virtual goods players buy.

Then, Zynga uses the data to get players to play longer, tell more friends, and buy even more goods.

Not everybody is thrilled with Zynga's data-driven approach to making games. Many game industry veterans believe Zynga's games are overly simplistic and have many of the same game elements. The company has also been the target of several lawsuits alleging that Zynga copied other companies' games. Even developers within Zynga have sometimes bristled at the company's prioritization of data analysis over creativity in game design. Some question Zynga's ability to prosper over the long term, saying it would be difficult for the company to create new games to replace old ones whose novelty is fading. In 2011–2012, the average amount of revenue from Zynga's core users dropped 10 percent even though its overall number of users expanded. Zynga's business model also assumes Facebook will continue to operate in the same manner and that customers will continue to expect the same quality of games. That may not always be the case.

In other words, Zynga's games lack artistry. But Zynga readily admits that its target audience is the segment of gamers that prefer casual games, and its goal is to make games that nearly anyone can play. Gamers that want a game requiring high levels of skill or sophisticated graphics can get their fix elsewhere. Zynga is using the measurability of Facebook activity to guide its game management, and this is helping the company create a finely tailored user experience that hasn't been seen before in gaming.

To reduce its reliance on Facebook, Zynga introduced its own independent gaming platform called Project Z in March 2012. The new platform enables customers to play some of Zynga's popular titles from its Web site rather than by accessing them through Facebook. A service called Zynga With Friends will match up players who do not know one another and might not have Facebook profiles or might be playing the game on a mobile application.

That same month Zynga announced it had purchased OMGPop Inc., the maker of the popular *Draw Something* mobile game, which asks players to make sketches illustrating words and have others guess what they drew. Zynga's management hopes that *Draw Something* will be part of a larger plan to build a mobile gaming network based on a portfolio of mobile, casual, and social games across a variety of social networks and platfoms. DreamWorks Animation will work with Zynga to place additional advertising within the game, creating another new source of revenue.

Will these efforts be enough to sustain Zynga's competitive advantage? Will Zynga's business model hold up as more of the Internet goes mobile? It's still too early to tell, but you can bet that Zynga will be poring over the data to find out.

Sources: David Streitfeld and Jenna Wortham, "The News Isn't Good for Zynga, Maker of FarmVille," *The New York Times*, July 25, 2012; Jenna Wortham, "Zynga's Plan to Get Its Groove Back: More Games and Social Upgrades," *The New York Times*, June 26, 2012; Lance Ulanoff, "Zynga Wants to Be a Mobile Gaming Network," *Mashable*, May 30, 2012; Ian Sherr, "Game Changer for Zynga: No Facebook," *The Wall Street Journal*, March 1, 2012 and "Zynga Defends Acquisition," *The Wall Street Journal*, May 24, 2012; David Streitfeld, "Zynga Seeks to Match Up Players for Online Games," *The New York Times*, March 1, 2012; Nick Wingfield, "Virtual Products, Real Profits," *The Wall Street Journal*, September 9, 2011; "The Impact of Social Graphing Analysis on the Bottom Line: How Zynga Performs Graph Analysis with the Vertica Analytics Platform," www.vertica.com, accessed June 2, 2012; and Jacquelyn Gavron, "Vertica: The Analytics Behind all the Zynga Games," *ReadWrite Enterprise*, July 18, 2011.

CASE STUDY QUESTIONS

1. It has been said that Zynga is "an analytics company masquerading as a games company." Discuss the implications of this statement.
2. What role does business intelligence play in Zynga's business model?
3. Give examples of three kinds of decisions supported by business intelligence at Zynga.
4. How much of a competitive advantage does business intelligence provide for Zynga? Explain.
5. What problems can business intelligence solve for Zynga? What problems can't it solve?

PART FOUR

Building and Managing Systems

Part Four focuses on building and managing systems in organizations. This part answers questions such as: What activities are required to build a new information system? What alternative approaches are available for building system solutions? How should information systems projects be managed to ensure that new systems provide genuine business benefits and work successfully in the organization? What issues must be addressed when building and managing global systems?

Chapter 13

Building Information Systems

LEARNING OBJECTIVES

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

1. How does building new systems produce organizational change?
2. What are the core activities in the systems development process?
3. What are the principal methodologies for modeling and designing systems?
4. What are the alternative methods for building information systems?
5. What are new approaches for system building in the digital firm era?

Interactive Sessions:

Burton Snowboards Speeds Ahead with Nimble Business Processes

What Does It Take to Go Mobile?

CHAPTER OUTLINE

NEW SYSTEMS AND BUSINESS PROCESSES PUT MONEYGRAM "ON THE MONEY"

If you use PayPal, you may not have heard of MoneyGram, but millions of people around the globe use this service to send money anywhere within minutes. Dallas-headquartered MoneyGram is one of the world's largest money transfer businesses in the world, with 256,000 partner agents ranging from Walmart to tobacco shops in Paris where customers can send and receive money. In 2011, MoneyGram generated $1.3 billion in revenue.

For a global money transfer company, it's essential to be able to move money between two points around the world within minutes. MoneyGram uses an automated financial management system to make this happen. The system handles hundreds of thousands of money transfer transactions each day and ensures that all of the retail stores, banks, and other MoneyGram agents receive proper financial settlement and commissions for each money transfer.

Despite many years of double-digit growth, MoneyGram's operations were not working well. The company was saddled with outdated systems that required the use of spreadsheets and time-consuming manual processes to calculate payments and close the books each month. Those systems were adequate for a long time, but eventually their complexity and lack of scalability constrained MoneyGram's ability to address market demands, add new products, and serve the sales team. Moreover, lack of a central data storehouse made it difficult to create reports, analyze market opportunities, and spot bottlenecks in the system.

Senior management decided to examine MoneyGram's business processes and legacy systems, some of which were redundant. It assembled the company's top business and technology managers, including the company's chief financial officer, controller, treasurer, and its executive vice president of operations and technology. They concluded that in addition to updating technology, MoneyGram needed to change some of its key business processes.

Culturally, MoneyGram's managers made changes in staff responsibilities to make employees more aware of the company's business processes and ways to improve them. Employees were instructed to understand each step in the business processes they were part of, instead of their own individual job functions. The company used numerous Webinars and other tools to show employees how business processes were being altered.

To that end, MoneyGram created a subset of managers called global process owners or GPOs. Each GPO is responsible for the performance of an individual process, such as cash management, customer onboarding, or credit processing. GPOs were asked to define the current state of their processes, how processes impacted each other, and how they felt they could be improved. They also defined how the success of their process could be measured, and were tasked with gathering performance data to gauge that improvement.

MoneyGram still uses GPOs in its operations., along with subprocess owners (SPOs), who are responsible for handling

day-to-day activities and problems. This new process orientation has moved MoneyGram from the old siloed departments to cross-functional work groups that collaborate closely with a long-range view of what's best for the business.

For the technology to support its new global processes, MoneyGram selected Oracle's E-Business Suite with the Oracle Incentive Compensation module. Oracle E-Business Suite consists of enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM) applications using Oracle's relational database management system. Oracle Incentive Compensation module automates the process of designing, administering, and analyzing variable compensation programs. Management believed the Oracle software was capable of handling the customization work required to integrate with the processes used by the company's back-office and proprietary agents and to handle other unique business requirements. The Oracle system included capabilities for creating, viewing, and managing customer information online.

MoneyGram started implementing Oracle E-Business Suite in September 2012. The new software and business processes streamlined most of MoneyGram's back-office operations, making it easier to process more customer transactions and settlements with agents and billers and to update the company's General Ledger. New partners can be added at a much faster rate.

Commissions are critical for driving profitability in MoneyGram's existing and new products. MoneyGram must track a large number of different plans for calculating the commissions of its partner agents throughout the world. Its legacy system was unable to automate many of the commission plans, so MoneyGram had to use spreadsheets and manual processes to manage several hundred commission plans. MoneyGram built a flexible commission model using Oracle Incentive Compensation that has been able to automate more than 90 percent of its nonstandard commission plans.

In the past, new regional innovations took months to plan, but the Oracle implementation has cut that time by approximately 40 percent. New product introductions will integrate seamlessly with MoneyGram's back-end processes so that new transactions are recorded and accounted for correctly. The new Oracle system allows MoneyGram to configure the processes simply by adjusting currently existing parameters instead of developing new software. MoneyGram is less likely to go to market with a product that has to be initially run on manual processes.

Having an enterprise-wide repository of data located centrally allows MoneyGram employees to better serve customers and agents conducting the money transfers. Centralized data are up-to-date and easily available. Reports used to take 40 hours and three employees to create but now take 80 percent less time. Those workers can spend more time analyzing reports and less time putting them together.

The cost savings of consolidating more than 40 MoneyGram legacy IT systems into one enterprise-wide implementation of Oracle E-business Suite amount to millions of dollars. The company can now handle more transactions without having to hire additional staff. The company estimates that the Oracle software will pay for itself within one year.

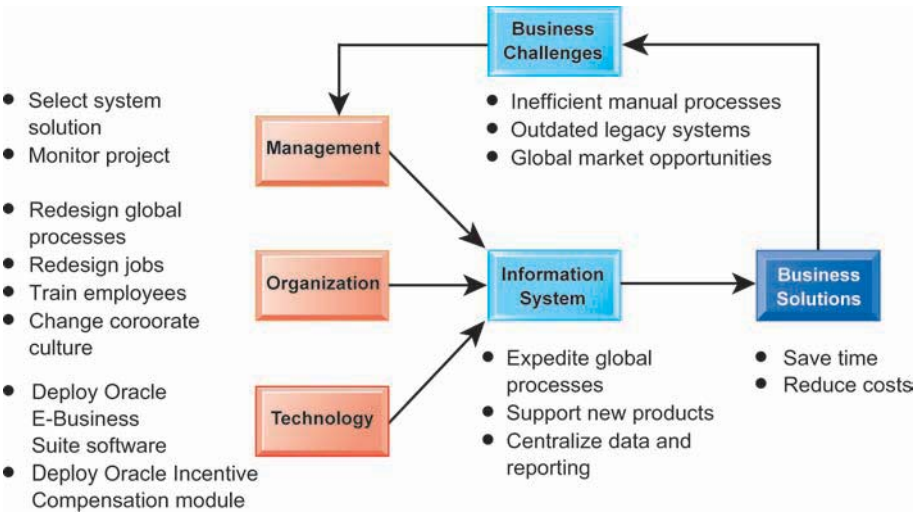
Sources: Alan Joch, "On the Money" and "MoneyGram Exploits the Flexibility of Oracle Incentive Compensation," *Profit Magazine*, February 2012; MoneyGram, "MoneyGram, Advance America Renew Contract at Over 2,400 Stores Across USA," August 6, 2012; and www.moneygram.com, accessed August 26, 2012.

The experience of MoneyGram illustrates some of the steps required to design and build new information systems. Building the new financial management system entailed analyzing the organization's problems with existing information systems, assessing information requirements, selecting appropriate technology, and redesigning business processes and jobs. Management had to oversee the systems-building effort and evaluate benefits and costs. The new information system represented a process of planned organizational change.

The chapter-opening case calls attention to important points raised by this case and this chapter. MoneyGram's global operations were hampered by outdated information systems and inefficient manual processes, which raised costs and limited the company's ability to add new products and compensation plans for new partner agents so that it could continue to expand globally.

Management decided to replace 40 outdated legacy systems with an enterprise-wide software suite that could create a single source of centralized data for the company, and support global operations, new financial products, and the back-office accounting of compensation and payment transfers with much less manual effort. The solution entailed not just the application of new technology but changes to corporate culture, business processes, and job functions. Employee education and training were essential. Thanks to the new system, MoneyGram is in a much stronger position to expand globally, add new partner agents, and support new financial products and payment plans.

Here are some questions to think about: What are the advantages and challenges of using an enterprise-wide software suite such as Oracle E-Business Suite in a global company such as MoneyGram? How much did the new system change the way MoneyGram ran its business?



13.1 Systems as Planned Organizational Change

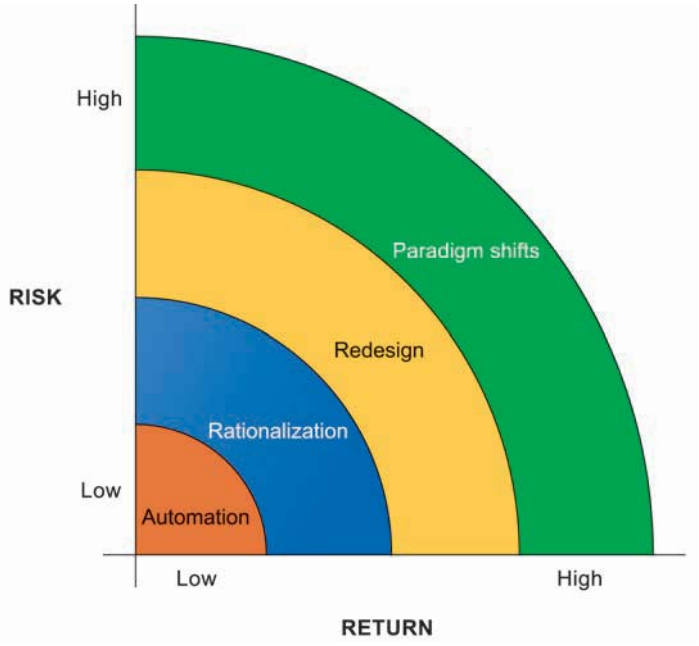
Building a new information system is one kind of planned organizational change. The introduction of a new information system involves much more than new hardware and software. It also includes changes in jobs, skills, management, and organization. When we design a new information system, we are redesigning the organization. System builders must understand how a system will affect specific business processes and the organization as a whole.

SYSTEMS DEVELOPMENT AND ORGANIZATIONAL CHANGE

Information technology can promote various degrees of organizational change, ranging from incremental to far-reaching. Figure 13.1 shows four kinds of structural organizational change that are enabled by information technology: (1) automation, (2) rationalization, (3) business process redesign, and (4) paradigm shifts. Each carries different risks and rewards.

The most common form of IT-enabled organizational change is **automation**. The first applications of information technology involved assisting employees with performing their tasks more efficiently and effectively. Calculating paychecks and payroll registers, giving bank tellers instant access to customer deposit records, and developing a nationwide reservation network for airline ticket agents are all examples of early automation.

FIGURE 13.1 ORGANIZATIONAL CHANGE CARRIES RISKS AND REWARDS



The most common forms of organizational change are automation and rationalization. These relatively slow-moving and slow-changing strategies present modest returns but little risk. Faster and more comprehensive change—such as redesign and paradigm shifts—carries high rewards but offers substantial chances of failure.

A deeper form of organizational change—one that follows quickly from early automation—is **rationalization of procedures**. Automation frequently reveals new bottlenecks in production and makes the existing arrangement of procedures and structures painfully cumbersome. Rationalization of procedures is the streamlining of standard operating procedures. For example, MoneyGram's system for handling global money transfers is effective not only because it uses computer technology but also because the company simplified its business processes for back-office operations. Fewer manual steps are required.

Rationalization of procedures is often found in programs for making a series of continuous quality improvements in products, services, and operations, such as total quality management (TQM) and six sigma. **Total quality management (TQM)** makes achieving quality an end in itself and the responsibility of all people and functions within an organization. TQM derives from concepts developed by American quality experts such as W. Edwards Deming and Joseph Juran, but it was popularized by the Japanese. **Six sigma** is a specific measure of quality, representing 3.4 defects per million opportunities. Most companies cannot achieve this level of quality, but use six sigma as a goal for driving ongoing quality improvement programs.

A more powerful type of organizational change is **business process redesign**, in which business processes are analyzed, simplified, and redesigned. Business process redesign reorganizes workflows, combining steps to cut waste and eliminate repetitive, paper-intensive tasks. (Sometimes the new design eliminates jobs as well.) It is much more ambitious than rationalization of procedures, requiring a new vision of how the process is to be organized.

A widely cited example of business process redesign is Ford Motor Company's invoiceless processing, which reduced headcount in Ford's North American Accounts Payable organization of 500 people by 75 percent. Accounts payable clerks used to spend most of their time resolving discrepancies between purchase orders, receiving documents, and invoices. Ford redesigned its accounts payable process so that the purchasing department enters a purchase order into an online database that can be checked by the receiving department when the ordered items arrive. If the received goods match the purchase order, the system automatically generates a check for accounts payable to send to the vendor. There is no need for vendors to send invoices.

Rationalizing procedures and redesigning business processes are limited to specific parts of a business. New information systems can ultimately affect the design of the entire organization by transforming how the organization carries out its business or even the nature of the business. For instance, the long-haul trucking and transportation firm Schneider National used new information systems to change its business model. Schneider created a new business managing logistics for other companies. This more radical form of business change is called a **paradigm shift**. A paradigm shift involves rethinking the nature of the business and the nature of the organization.

Paradigm shifts and reengineering often fail because extensive organizational change is so difficult to orchestrate (see Chapter 14). Why, then, do so many corporations contemplate such radical change? Because the rewards are equally high (see Figure 13.1). In many instances, firms seeking paradigm shifts and pursuing reengineering strategies achieve stunning, order-of-magnitude increases in their returns on investment (or productivity). Some of these success stories, and some failure stories, are included throughout this book.

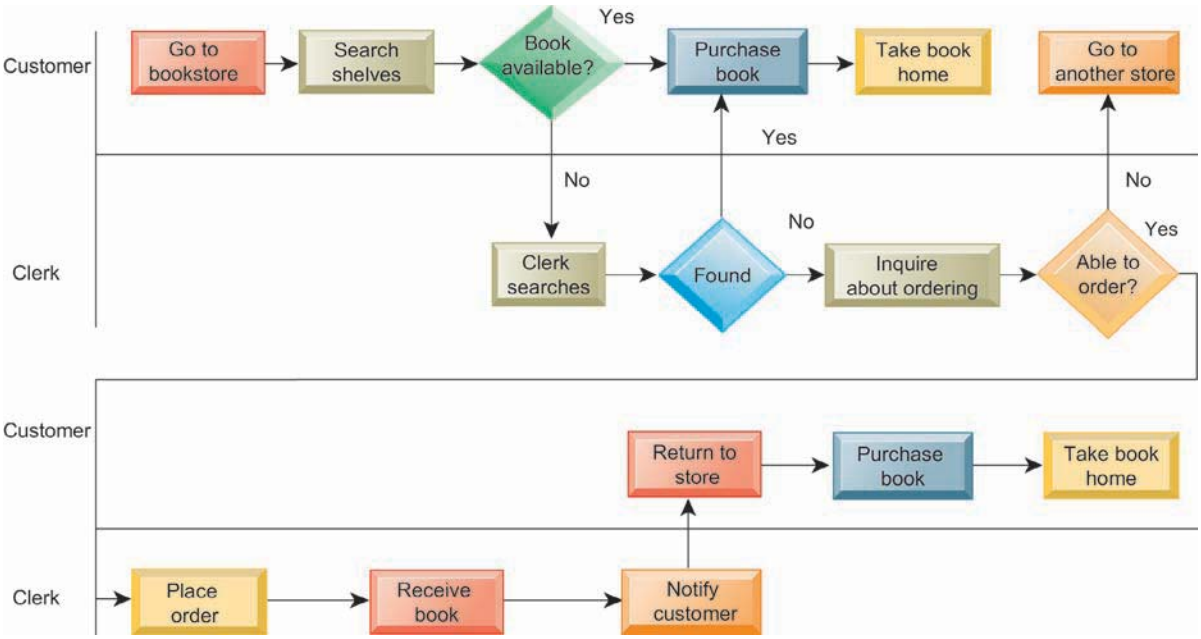
BUSINESS PROCESS REDESIGN

Like MoneyGram, described in the chapter-opening case, many businesses today are trying to use information technology to improve their business processes. Some of these systems entail incremental process change, but others require more far-reaching redesign of business processes. To deal with these changes, organizations are turning to business process management. **Business process management** provides a variety of tools and methodologies to analyze existing processes, design new processes, and optimize those processes. BPM is never concluded because process improvement requires continual change. Companies practicing business process management go through the following steps:

1. **Identify processes for change:** One of the most important strategic decisions that a firm can make is not deciding how to use computers to improve business processes, but understanding what business processes need improvement. When systems are used to strengthen the wrong business model or business processes, the business can become more efficient at doing what it should not do. As a result, the firm becomes vulnerable to competitors who may have discovered the right business model. Considerable time and cost may also be spent improving business processes that have little impact on overall firm performance and revenue. Managers need to determine what business processes are the most important and how improving these processes will help business performance.
2. **Analyze existing processes:** Existing business processes should be modeled and documented, noting inputs, outputs, resources, and the sequence of activities. The process design team identifies redundant steps, paper-intensive tasks, bottlenecks, and other inefficiencies.

Figure 13.2 illustrates the "as-is" process for purchasing a book from a physical bookstore. Consider what happens when a customer visits a physical bookstore and searches its shelves for a book. If he or she finds the book, that

FIGURE 13.2 AS-IS BUSINESS PROCESS FOR PURCHASING A BOOK FROM A PHYSICAL BOOKSTORE



Purchasing a book from a physical bookstore requires many steps to be performed by both the seller and the customer.

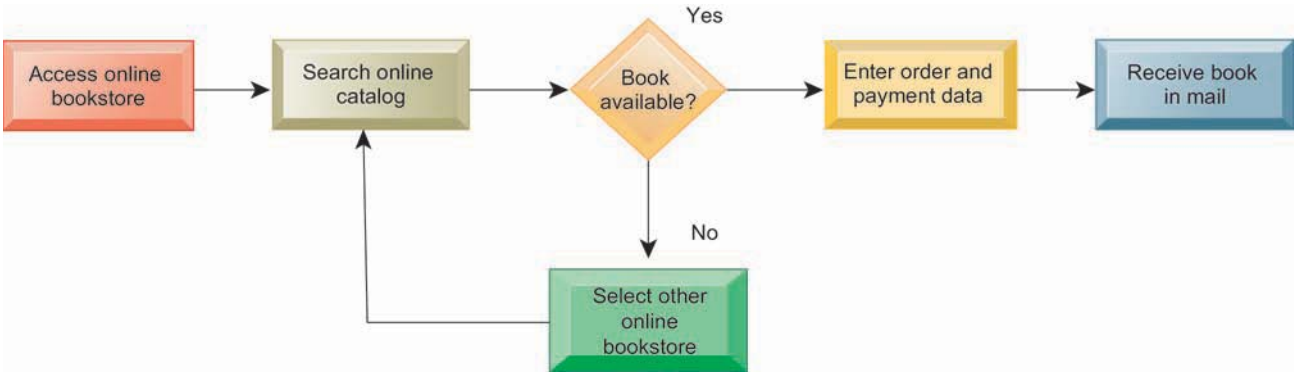
person takes it to the checkout counter and pays for it via credit card, cash, or check. If the customer is unable to locate the book, he or she must ask a bookstore clerk to search the shelves or check the bookstore's inventory records to see if it is in stock. If the clerk finds the book, the customer purchases it and leaves. If the book is not available locally, the clerk inquires about ordering it for the customer, from the bookstore's warehouse or from the book's distributor or publisher. Once the ordered book arrives at the bookstore, a bookstore employee telephones the customer with this information. The customer would have to go to the bookstore again to pick up the book and pay for it. If the bookstore is unable to order the book for the customer, the customer would have to try another bookstore. You can see that this process has many steps and might require the customer to make multiple trips to the bookstore.

3. **Design the new process:** Once the existing process is mapped and measured in terms of time and cost, the process design team will try to improve the process by designing a new one. A new streamlined "to-be" process will be documented and modeled for comparison with the old process.

Figure 13.3 illustrates how the book-purchasing process can be redesigned by taking advantage of the Internet. The customer accesses an online bookstore over the Internet from his or her computer. He or she searches the bookstore's online catalog for the book he or she wants. If the book is available, the customer orders the book online, supplying credit card and shipping address information, and the book is delivered to the customer's home. If the online bookstore does not carry the book, the customer selects another online bookstore and searches for the book again. This process has far fewer steps than that for purchasing the book in a physical bookstore, requires much less effort on the part of the customer, and requires less sales staff for customer service. The new process is therefore much more efficient and time-saving.

The new process design needs to be justified by showing how much it reduces time and cost or enhances customer service and value. Management first measures the time and cost of the existing process as a baseline. In our example, the time required for purchasing a book from a physical bookstore might range from 15 minutes (if the customer immediately finds what he or she wants) to 30 minutes if the book is in stock but has to be located by sales staff. If the book has to be ordered from another source, the process might

FIGURE 13.3 REDESIGNED PROCESS FOR PURCHASING A BOOK ONLINE



Using Internet technology makes it possible to redesign the process for purchasing a book so that it requires fewer steps and consumes fewer resources.

take one or two weeks and another trip to the bookstore for the customer. If the customer lives far away from the bookstore, the time to travel to the bookstore would have to be factored in. The bookstore will have to pay the costs for maintaining a physical store and keeping the book in stock, for sales staff on site, and for shipment costs if the book has to be obtained from another location.

The new process for purchasing a book online might only take several minutes, although the customer might have to wait several days or a week to receive the book in the mail and will have to pay a shipping charge. But the customer saves time and money by not having to travel to the bookstore or make additional visits to pick up the book. Booksellers' costs are lower because they do not have to pay for a physical store location or for local inventory.

4. **Implement the new process:** Once the new process has been thoroughly modeled and analyzed, it must be translated into a new set of procedures and work rules. New information systems or enhancements to existing systems may have to be implemented to support the redesigned process. The new process and supporting systems are rolled out into the business organization. As the business starts using this process, problems are uncovered and addressed. Employees working with the process may recommend improvements.

5. **Continuous measurement:** Once a process has been implemented and optimized, it needs to be continually measured. Why? Processes may deteriorate over time as employees fall back on old methods, or they may lose their effectiveness if the business experiences other changes.

Although many business process improvements are incremental and ongoing, there are occasions when more radical change must take place. Our example of a physical bookstore redesigning the book-purchasing process so that it can be carried out online is an example of this type of radical, far-reaching change. When properly implemented, business process redesign produces dramatic gains in productivity and efficiency, and may even change the way the business is run. In some instances, it drives a "paradigm shift" that transforms the nature of the business itself.

This actually happened in book retailing when Amazon challenged traditional physical bookstores with its online retail model. By radically rethinking the way a book can be purchased and sold, Amazon and other online bookstores have achieved remarkable efficiencies, cost reductions, and a whole new way of doing business.

BPM poses challenges. Executives report that the largest single barrier to successful business process change is organizational culture. Employees do not like unfamiliar routines and often try to resist change. This is especially true of projects where organizational changes are very ambitious and far-reaching. Managing change is neither simple nor intuitive, and companies committed to extensive process improvement need a good change management strategy (see Chapter 14).

Tools for Business Process Management

Over 100 software firms provide tools for various aspects of BPM, including IBM, Oracle, and TIBCO. These tools help businesses identify and document processes requiring improvement, create models of improved processes, capture and enforce business rules for performing processes, and integrate existing systems to support new or redesigned processes. BPM software tools

also provide analytics for verifying that process performance has been improved and for measuring the impact of process changes on key business performance indicators.

Some BPM tools document and monitor business processes to help firms identify inefficiencies, using software to connect with each of the systems a company uses for a particular process to identify trouble spots. Canadian mutual fund company AIC used Sajus BPM monitoring software to check inconsistencies in its process for updating accounts after each client transaction. Sajus specializes in goal-based process management, which focuses on finding the causes of organizational problems through process monitoring before applying tools to address those problems.

Another category of tools automate some parts of a business process and enforce business rules so that employees perform that process more consistently and efficiently.

For example, American National Insurance Company (ANCO), which offers life insurance, medical insurance, property casualty insurance, and investment services, used Pega BPM workflow software to streamline customer service processes across four business groups. The software built rules to guide customer service representatives through a single view of a customer's information that was maintained in multiple systems. By eliminating the need to juggle multiple applications simultaneously to handle customer and agent requests, the improved process increased customer service representative workload capacity by 192 percent.

A third category of tools helps businesses integrate their existing systems to support process improvements. They automatically manage processes across the business, extract data from various sources and databases, and generate transactions in multiple related systems. For example, the Star Alliance of 15 airlines, including United and Lufthansa, used BPM to create common processes shared by all of its members by integrating their existing systems. One project created a new service for frequent fliers on member airlines by consolidating 90 separate business processes across nine airlines and 27 legacy systems. The BPM software documented how each airline processed frequent flier information to help airline managers model a new business process that showed how to share data among the various systems.

The Interactive Session on Organizations provides an example of a company that benefited competitively from business process management. As with any company that rapidly expands from a small business to a global brand, Burton Snowboards found that some of its business processes had become outdated. Burton has made serious efforts to improve these processes and turn their weaknesses into strengths.

13.2 Overview of Systems Development

New information systems are an outgrowth of a process of organizational problem solving. A new information system is built as a solution to some type of problem or set of problems the organization perceives it is facing. The problem may be one in which managers and employees realize that the organization is not performing as well as expected, or that the organization should take advantage of new opportunities to perform more successfully.

The activities that go into producing an information system solution to an organizational problem or opportunity are called **systems development**.

INTERACTIVE SESSION: ORGANIZATIONS

BURTON SNOWBOARDS SPEEDS AHEAD WITH NIMBLE BUSINESS PROCESSES

When we hear "snowboarding", we tend to think of snow-covered slopes, acrobatic jumps, and high-flying entertainment. We don't usually think of improving business process efficiency. But snowboarding is business for Burton Snowboards, an industry pioneer and market leader. Founded in 1977 by Jake Burton Carpenter and headquartered in Burlington, Vermont, Burton designs, manufactures, and markets equipment, clothing, and related accessories for snowboarders. Today, Burton is a global enterprise that serves customers in 27 countries and has offices in Japan, Austria, and throughout the United States.

At its peak, Burton controlled over 40 percent of the U.S. snowboarding market, and it remains the market leader amidst a growing number of competitors. Now, as Burton continues to expand into a global company, it has a new set of problems: improving its systems for inventory, supply chain, purchasing, and customer service.

Stocking and managing inventory is a difficult problem for Burton, whose inventory changes dramatically depend on product line updates and the time of the year. Burton takes feedback from its customers very seriously, and will move quickly to meet their needs. For instance, if a rider tests a jacket and recommends repositioning a zipper, Burton's production line must be able to make this modification quickly and easily. Being dynamic and adaptable is a competitive necessity.

Burton has implemented and currently maintains SAP enterprise software, an Oracle database, a SUSE Linux enterprise server, and commodity hardware. That's a long way from a lone woodworking shop in Vermont. Before making these upgrades, Burton's information systems were a hodgepodge of inconsistently implemented and underutilized software. The company had to manually allocate product to customers and orders. In 1997, Burton first deployed SAP to begin upgrading its IT landscape, and the company has continued to use SAP since that time. But Burton needed to do more with its systems.

Two of Burton's IT goals, established by CIO Kevin Ubert, are to "strengthen the foundation," and keep their systems "simple, standard, (and) supportable." The foundation Ubert referred to is SAP Enterprise Resource Planning (ERP) software. Rather than buying new software to solve IT problems, Burton decided that it would explore basic functionalities of SAP ERP software that it had not used yet. Often, Burton could resolve problems this way without adding new layers of complexity to its IT infrastructure, and the company gained proficiency with SAP enterprise software in the process. Burton aims for a standard, traditional version of software whenever possible, realizing that with more bells and whistles comes increased maintenance costs and steeper learning curves to understanding the software.

SAP analysts helped Burton identify the top five transactions that were the most critical to its business operations and that needed optimization from a systems standpoint. Burton had to identify unnecessarily complicated processes, backlogs, and design gaps in the flow of its business processes. For example, the available-to-promise process was taking hours to complete. (Available to promise, in response to customer order inquiries, reports on available quantities of a requested product and delivery due dates.) Burton wanted to speed up this process so that its dealers and retail customers would have more precise information about the availability of products not currently in stock. Completing this process now takes 20 minutes.

Other processes in need of improvement included the order-to-cash process (receiving and processing customer sales, including order entry, fulfillment, distribution, and payment); the handling of overdue purchase orders in the procure-to-pay process, which consists of all the steps from purchasing goods from a supplier to paying the supplier; and the electronic data interchange (EDI) inventory feed extract transaction. Burton has an assortment of warehouses that pass inventory data to one another automatically using EDI systems. Thousands of items are moving from warehouse to warehouse and thousands of transactions occur each day at each warehouse. Burton found that the process of reporting inventory was inefficient, and both suppliers and customers could not easily determine up-to-date information on which items were in stock at which warehouse.

SAP and Burton worked together to improve communication between warehouses and supply chain efficiency.

A management dashboard developed with the help of SAP shows how smoothly a critical process is running at a certain point in time. Information from the dashboard helps Burton's key users discover inconsistencies, gaps, or other areas that they should be monitoring more closely.

All of these process improvements proved especially valuable during what Burton calls its "reorder" season. Burton's dealers place orders to stock their stores well before winter sets in. As consumers start buying the merchandise, the dealers reorder with Burton to replenish their stock or to buy new products. Now they are able to see more timely product availability data, and receive orders more rapidly.

Sources: Lauren Bonneau, "How Burton Snowboards Remains as Nimble as Its Riders," SAP InsiderPROFILES, April–June 2011; "The Burton Corporation Company Profile," Yahoo! Finance, accessed August 27, 2012; and www.burton.com, accessed August 27, 2012.

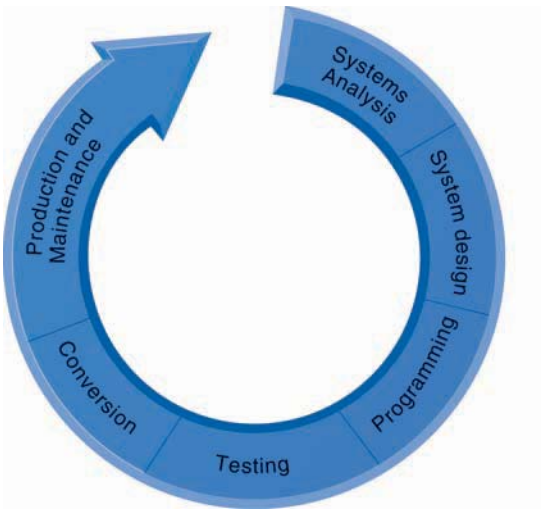
CASE STUDY QUESTIONS

1. Analyze Burton using the value chain and competitive forces models.
2. Why are the business processes described in this case such an important source of competitive advantage for Burton?
3. Explain exactly how these process improvements enhance Burton's operational performance and decision making.

Systems development is a structured kind of problem solved with distinct activities. These activities consist of systems analysis, systems design, programming, testing, conversion, and production and maintenance.

Figure 13.4 illustrates the systems development process. The systems development activities depicted usually take place in sequential order. But some of the activities may need to be repeated or some may take place simultaneously, depending on the approach to system building that is being employed (see Section 13.4).

FIGURE 13.4 THE SYSTEMS DEVELOPMENT PROCESS



Building a system can be broken down into six core activities.

SYSTEMS ANALYSIS

Systems analysis is the analysis of a problem that a firm tries to solve with an information system. It consists of defining the problem, identifying its causes, specifying the solution, and identifying the information requirements that must be met by a system solution.

The systems analyst creates a road map of the existing organization and systems, identifying the primary owners and users of data along with existing hardware and software. The systems analyst then details the problems of existing systems. By examining documents, work papers, and procedures, observing system operations, and interviewing key users of the systems, the analyst can identify the problem areas and objectives a solution would achieve. Often, the solution requires building a new information system or improving an existing one.

The systems analysis also includes a **feasibility study** to determine whether that solution is feasible, or achievable, from a financial, technical, and organizational standpoint. The feasibility study determines whether the proposed system is expected to be a good investment, whether the technology needed for the system is available and can be handled by the firm's information systems specialists, and whether the organization can handle the changes introduced by the system.

Normally, the systems analysis process identifies several alternative solutions that the organization can pursue and assess the feasibility of each. A written systems proposal report describes the costs and benefits, and the advantages and disadvantages, of each alternative. It is up to management to determine which mix of costs, benefits, technical features, and organizational impacts represents the most desirable alternative.

Establishing Information Requirements

Perhaps the most challenging task of the systems analyst is to define the specific information requirements that must be met by the chosen system solution. At the most basic level, the **information requirements** of a new system involve identifying who needs what information, where, when, and how. Requirements analysis carefully defines the objectives of the new or modified system and develops a detailed description of the functions that the new system must perform. Faulty requirements analysis is a leading cause of systems failure and high systems development costs (see Chapter 14). A system designed around the wrong set of requirements will either have to be discarded because of poor performance or will need to undergo major modifications. Section 13.3 describes alternative approaches to eliciting requirements that help minimize this problem.

Some problems do not require an information system solution but instead need an adjustment in management, additional training, or refinement of existing organizational procedures. If the problem is information related, systems analysis still may be required to diagnose the problem and arrive at the proper solution.

SYSTEMS DESIGN

Systems analysis describes what a system should do to meet information requirements, and **systems design** shows how the system will fulfill this objective. The design of an information system is the overall plan or model for that system. Like the blueprint of a building or house, it consists of all the specifications that give the system its form and structure.

The systems designer details the system specifications that will deliver the functions identified during systems analysis. These specifications should address all of the managerial, organizational, and technological components of the system solution. Table 13.1 lists the types of specifications that would be produced during systems design.

Like houses or buildings, information systems may have many possible designs. Each design represents a unique blend of all technical and organizational components. What makes one design superior to others is the ease and efficiency with which it fulfills user requirements within a specific set of technical, organizational, financial, and time constraints.

The Role of End Users

User information requirements drive the entire system-building effort. Users must have sufficient control over the design process to ensure that the system reflects their business priorities and information needs, not the biases of the technical staff. Working on design increases users' understanding and acceptance of the system. As we describe in Chapter 14, insufficient user involvement in the design effort is a major cause of system failure. However, some systems require more user participation in design than others, and Section 13.3 shows how alternative systems development methods address the user participation issue.

COMPLETING THE SYSTEMS DEVELOPMENT PROCESS

The remaining steps in the systems development process translate the solution specifications established during systems analysis and design into a fully operational information system. These concluding steps consist of programming, testing, conversion, production, and maintenance.

TABLE 13.1 DESIGN SPECIFICATIONS

OUTPUT	PROCESSING	DOCUMENTATION
Medium	Computations	Operations documentation
Content	Program modules	Systems documentation
Timing	Required reports	User documentation
INPUT	Timing of outputs	CONVERSION
Origins	MANUAL PROCEDURES	Transfer files
Flow	What activities	Initiate new procedures
Data entry	Who performs them	Select testing method
USER INTERFACE	When	Cut over to new system
Simplicity	How	TRAINING
Efficiency	Where	Select training techniques
Logic	CONTROLS	Develop training modules
Feedback	Input controls (characters, limit, reasonableness)	Identify training facilities
Errors	Processing controls (consistency, record counts)	ORGANIZATIONAL CHANGES
DATABASE DESIGN	Output controls (totals, samples of output)	Task redesign
Logical data model	Procedural controls (passwords, special forms)	Job design
Volume and speed requirements	SECURITY	Process design
File organization and design	Access controls	Organization structure design
Record specifications	Catastrophe plans	Reporting relationships
	Audit trails	

Programming

During the **programming** stage, system specifications that were prepared during the design stage are translated into software program code. Today, many organizations no longer do their own programming for new systems. Instead, they purchase the software that meets the requirements for a new system from external sources such as software packages from a commercial software vendor, software services from an application service provider, or outsourcing firms that develop custom application software for their clients (see Section 13.3).

Testing

Exhaustive and thorough **testing** must be conducted to ascertain whether the system produces the right results. Testing answers the question, "Will the system produce the desired results under known conditions?" As Chapter 5 noted, some companies are starting to use cloud computing services for this work.

The amount of time needed to answer this question has been traditionally underrated in systems project planning (see Chapter 14). Testing is time-consuming: Test data must be carefully prepared, results reviewed, and corrections made in the system. In some instances, parts of the system may have to be redesigned. The risks resulting from glossing over this step are enormous.

Testing an information system can be broken down into three types of activities: unit testing, system testing, and acceptance testing. **Unit testing**, or program testing, consists of testing each program separately in the system. It is widely believed that the purpose of such testing is to guarantee that programs are error-free, but this goal is realistically impossible. Testing should be viewed instead as a means of locating errors in programs, focusing on finding all the ways to make a program fail. Once they are pinpointed, problems can be corrected.

System testing tests the functioning of the information system as a whole. It tries to determine whether discrete modules will function together as planned and whether discrepancies exist between the way the system actually works and the way it was conceived. Among the areas examined are performance time, capacity for file storage and handling peak loads, recovery and restart capabilities, and manual procedures.

Acceptance testing provides the final certification that the system is ready to be used in a production setting. Systems tests are evaluated by users and reviewed by management. When all parties are satisfied that the new system meets their standards, the system is formally accepted for installation.

The systems development team works with users to devise a systematic test plan. The **test plan** includes all of the preparations for the series of tests we have just described.

Figure 13.5 shows an example of a test plan. The general condition being tested is a record change. The documentation consists of a series of test plan screens maintained on a database (perhaps a PC database) that is ideally suited to this kind of application.

Conversion is the process of changing from the old system to the new system. Four main conversion strategies can be employed: the parallel strategy, the direct cutover strategy, the pilot study strategy, and the phased approach strategy.

In a **parallel strategy,** both the old system and its potential replacement are run together for a time until everyone is assured that the new one functions correctly. This is the safest conversion approach because, in the event of errors or processing disruptions, the old system can still be used as a backup. However, this approach is very expensive, and additional staff or resources may be required to run the extra system.

FIGURE 13.5 A SAMPLE TEST PLAN TO TEST A RECORD CHANGE

Procedure	Address and Maintenance "Record Change Series"		Test Series 2		
	Prepared By:	Date:	Version:		
Test Ref.	Condition Tested	Special Requirements	Expected Results	Output On	Next Screen
2.0	Change records				
2.1	Change existing record	Key field	Not allowed		
2.2	Change nonexistent record	Other fields	"Invalid key" message		
2.3	Change deleted record	Deleted record must be available	"Deleted" message		
2.4	Make second record	Change 2.1 above	OK if valid	Transaction file	V45
2.5	Insert record		OK if valid	Transaction file	V45
2.6	Abort during change	Abort 2.5	No change	Transaction file	V45

When developing a test plan, it is imperative to include the various conditions to be tested, the requirements for each condition tested, and the expected results. Test plans require input from both end users and information systems specialists.

The **direct cutover strategy** replaces the old system entirely with the new system on an appointed day. It is a very risky approach that can potentially be more costly than running two systems in parallel if serious problems with the new system are found. There is no other system to fall back on. Dislocations, disruptions, and the cost of corrections may be enormous.

The **pilot study strategy** introduces the new system to only a limited area of the organization, such as a single department or operating unit. When this pilot version is complete and working smoothly, it is installed throughout the rest of the organization, either simultaneously or in stages.

The **phased approach strategy** introduces the new system in stages, either by functions or by organizational units. If, for example, the system is introduced by function, a new payroll system might begin with hourly workers who are paid weekly, followed six months later by adding salaried employees (who are paid monthly) to the system. If the system is introduced by organizational unit, corporate headquarters might be converted first, followed by outlying operating units four months later.

Moving from an old system to a new one requires that end users be trained to use the new system. Detailed **documentation** showing how the system works from both a technical and end-user standpoint is finalized during conversion time for use in training and everyday operations. Lack of proper training and documentation contributes to system failure, so this portion of the systems development process is very important.

Production and Maintenance

After the new system is installed and conversion is complete, the system is said to be in **production**. During this stage, the system will be reviewed by both users and technical specialists to determine how well it has met its original objectives and to decide whether any revisions or modifications are in order. In some instances, a formal **postimplementation audit** document is

prepared. After the system has been fine-tuned, it must be maintained while it is in production to correct errors, meet requirements, or improve processing efficiency. Changes in hardware, software, documentation, or procedures to a production system to correct errors, meet new requirements, or improve processing efficiency are termed **maintenance**.

Approximately 20 percent of the time devoted to maintenance is used for debugging or correcting emergency production problems. Another 20 percent is concerned with changes in data, files, reports, hardware, or system software. But 60 percent of all maintenance work consists of making user enhancements, improving documentation, and recoding system components for greater processing efficiency. The amount of work in the third category of maintenance problems could be reduced significantly through better systems analysis and design practices. Table 13.2 summarizes the systems development activities.

MODELING AND DESIGNING SYSTEMS: STRUCTURED AND OBJECT-ORIENTED METHODOLOGIES

There are alternative methodologies for modeling and designing systems. Structured methodologies and object-oriented development are the most prominent.

Structured Methodologies

Structured methodologies have been used to document, analyze, and design information systems since the 1970s. **Structured** refers to the fact that the techniques are step by step, with each step building on the previous one. Structured methodologies are top-down, progressing from the highest, most abstract level to the lowest level of detail—from the general to the specific.

Structured development methods are process-oriented, focusing primarily on modeling the processes, or actions that capture, store, manipulate, and distribute data as the data flow through a system. These methods separate data

TABLE 13.2 SYSTEMS DEVELOPMENT

CORE ACTIVITY	DESCRIPTION
Systems analysis	Identify problem(s) Specify solutions Establish information requirements
Systems design	Create design specifications
Programming	Translate design specifications into program code
Testing	Perform unit testing Perform systems testing Perform acceptance testing
Conversion	Plan conversion Prepare documentation Train users and technical staff
Production and maintenance	Operate the system Evaluate the system Modify the system

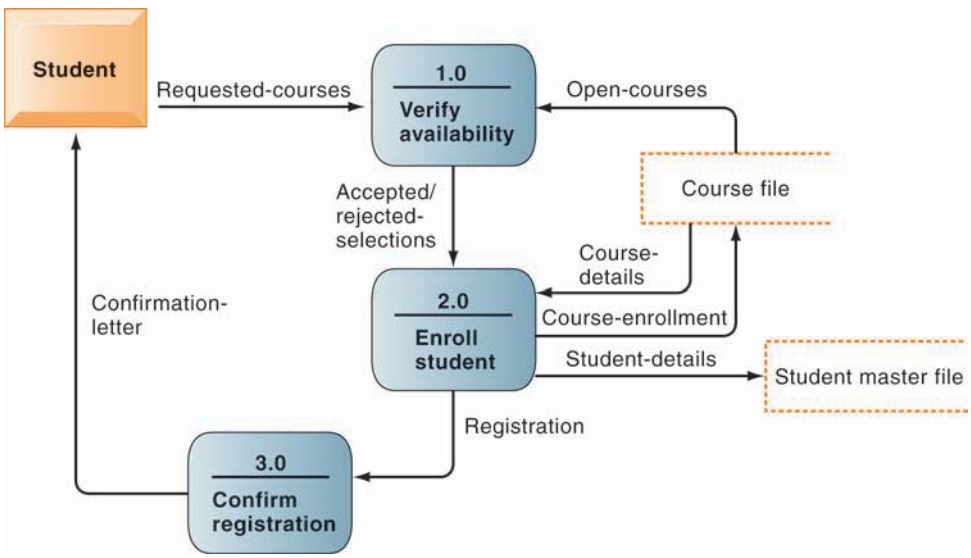
from processes. A separate programming procedure must be written every time someone wants to take an action on a particular piece of data. The procedures act on data that the program passes to them.

The primary tool for representing a system's component processes and the flow of data between them is the **data flow diagram (DFD)**. The data flow diagram offers a logical graphic model of information flow, partitioning a system into modules that show manageable levels of detail. It rigorously specifies the processes or transformations that occur within each module and the interfaces that exist between them.

Figure 13.6 shows a simple data flow diagram for a mail-in university course registration system. The rounded boxes represent processes, which portray the transformation of data. The square box represents an external entity, which is an originator or receiver of information located outside the boundaries of the system being modeled. The open rectangles represent data stores, which are either manual or automated inventories of data. The arrows represent data flows, which show the movement between processes, external entities, and data stores. They contain packets of data with the name or content of each data flow listed beside the arrow.

This data flow diagram shows that students submit registration forms with their name, identification number, and the numbers of the courses they wish to take. In process 1.0, the system verifies that each course selected is still open by referencing the university's course file. The file distinguishes courses that are open from those that have been canceled or filled. Process 1.0 then determines which of the student's selections can be accepted or rejected. Process 2.0 enrolls the student in the courses for which he or she has been accepted. It updates the university's course file with the student's name and identification number and recalculates the class size. If maximum enrollment has been reached, the course number is flagged as closed. Process 2.0 also updates the

FIGURE 13.6 DATA FLOW DIAGRAM FOR MAIL-IN UNIVERSITY REGISTRATION SYSTEM



The system has three processes: Verify availability (1.0), Enroll student (2.0), and Confirm registration (3.0). The name and content of each of the data flows appear adjacent to each arrow. There is one external entity in this system: the student. There are two data stores: the student master file and the course file.

university's student master file with information about new students or changes in address. Process 3.0 then sends each student applicant a confirmation-of-registration letter listing the courses for which he or she is registered and noting the course selections that could not be fulfilled.

The diagrams can be used to depict higher-level processes as well as lower-level details. Through leveled data flow diagrams, a complex process can be broken down into successive levels of detail. An entire system can be divided into subsystems with a high-level data flow diagram. Each subsystem, in turn, can be divided into additional subsystems with second-level data flow diagrams, and the lower-level subsystems can be broken down again until the lowest level of detail has been reached.

Another tool for structured analysis is a data dictionary, which contains information about individual pieces of data and data groupings within a system (see Chapter 6). The data dictionary defines the contents of data flows and data stores so that systems builders understand exactly what pieces of data they contain. **Process specifications** describe the transformation occurring within the lowest level of the data flow diagrams. They express the logic for each process.

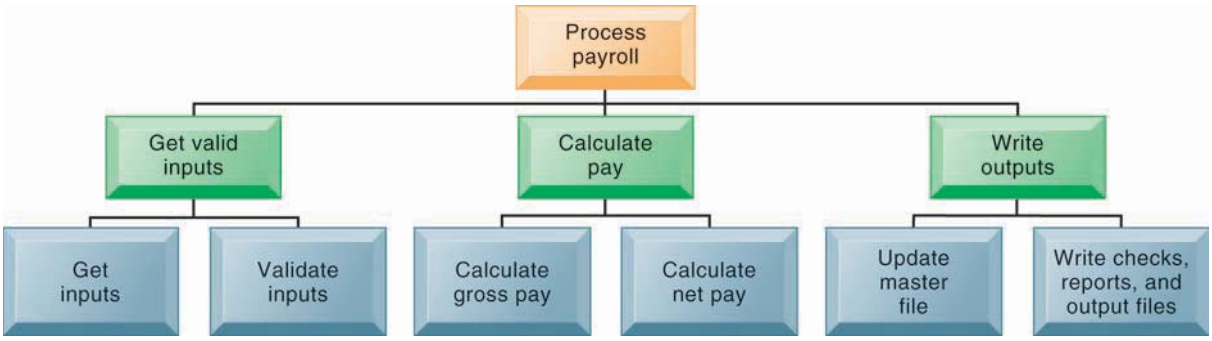
In structured methodology, software design is modeled using hierarchical structure charts. The **structure chart** is a top-down chart, showing each level of design, its relationship to other levels, and its place in the overall design structure. The design first considers the main function of a program or system, then breaks this function into subfunctions, and decomposes each subfunction until the lowest level of detail has been reached. Figure 13.7 shows a high-level structure chart for a payroll system. If a design has too many levels to fit onto one structure chart, it can be broken down further on more detailed structure charts. A structure chart may document one program, one system (a set of programs), or part of one program.

Object-Oriented Development

Structured methods are useful for modeling processes, but do not handle the modeling of data well. They also treat data and processes as logically separate entities, whereas in the real world such separation seems unnatural. Different modeling conventions are used for analysis (the data flow diagram) and for design (the structure chart).

Object-oriented development addresses these issues. Object-oriented development uses the **object** as the basic unit of systems analysis and design.

FIGURE 13.7 HIGH-LEVEL STRUCTURE CHART FOR A PAYROLL SYSTEM



This structure chart shows the highest or most abstract level of design for a payroll system, providing an overview of the entire system.

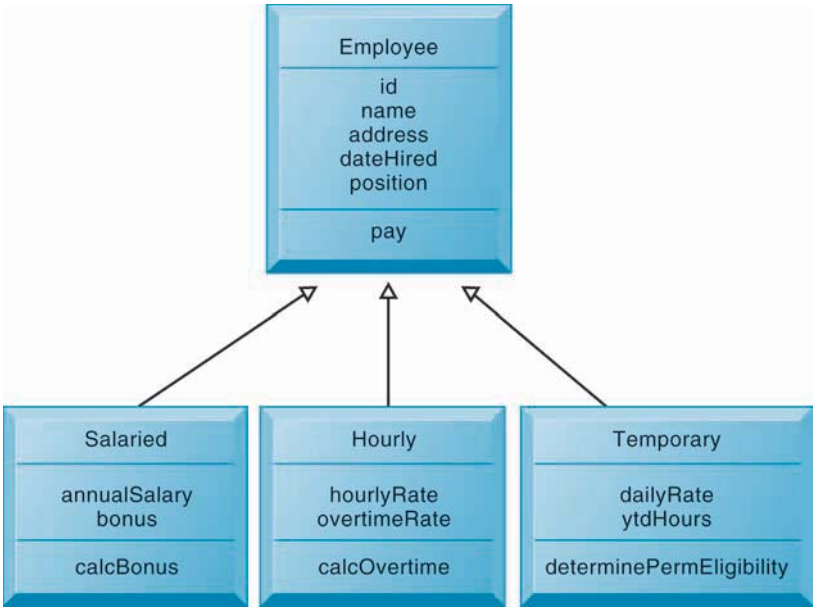
An object combines data and the specific processes that operate on those data. Data encapsulated in an object can be accessed and modified only by the operations, or methods, associated with that object. Instead of passing data to procedures, programs send a message for an object to perform an operation that is already embedded in it. The system is modeled as a collection of objects and the relationships among them. Because processing logic resides within objects rather than in separate software programs, objects must collaborate with each other to make the system work.

Object-oriented modeling is based on the concepts of *class* and *inheritance*. Objects belonging to a certain class, or general categories of similar objects, have the features of that class. Classes of objects in turn can inherit all the structure and behaviors of a more general class and then add variables and behaviors unique to each object. New classes of objects are created by choosing an existing class and specifying how the new class differs from the existing class, instead of starting from scratch each time.

We can see how class and inheritance work in Figure 13.8, which illustrates the relationships among classes concerning employees and how they are paid. Employee is the common ancestor, or superclass, for the other three classes. Salaried, Hourly, and Temporary are subclasses of Employee. The class name is in the top compartment, the attributes for each class are in the middle portion of each box, and the list of operations is in the bottom portion of each box. The features that are shared by all employees (id, name, address, date hired, position, and pay) are stored in the Employee superclass, whereas each subclass stores features that are specific to that particular type of employee. Specific to hourly employees, for example, are their hourly rates and overtime rates. A solid line from the subclass to the superclass is a generalization path showing that the subclasses Salaried, Hourly, and Temporary have common features that can be generalized into the superclass Employee.

Object-oriented development is more iterative and incremental than traditional structured development. During analysis, systems builders document

FIGURE 13.8 CLASS AND INHERITANCE



This figure illustrates how classes inherit the common features of their superclass.

the functional requirements of the system, specifying its most important properties and what the proposed system must do. Interactions between the system and its users are analyzed to identify objects, which include both data and processes. The object-oriented design phase describes how the objects will behave and how they will interact with one other. Similar objects are grouped together to form a class, and classes are grouped into hierarchies in which a subclass inherits the attributes and methods from its superclass.

The information system is implemented by translating the design into program code, reusing classes that are already available in a library of reusable software objects, and adding new ones created during the object-oriented design phase. Implementation may also involve the creation of an object-oriented database. The resulting system must be thoroughly tested and evaluated.

Because objects are reusable, object-oriented development could potentially reduce the time and cost of writing software because organizations can reuse software objects that have already been created as building blocks for other applications. New systems can be created by using some existing objects, changing others, and adding a few new objects. Object-oriented frameworks have been developed to provide reusable, semicomplete applications that the organization can further customize into finished applications.

Computer-Aided Software Engineering

Computer-aided software engineering (CASE)—sometimes called *computer-aided systems engineering*—provides software tools to automate the methodologies we have just described to reduce the amount of repetitive work the developer needs to do. CASE tools also facilitate the creation of clear documentation and the coordination of team development efforts. Team members can share their work easily by accessing each other's files to review or modify what has been done. Modest productivity benefits can also be achieved if the tools are used properly.

CASE tools provide automated graphics facilities for producing charts and diagrams, screen and report generators, data dictionaries, extensive reporting facilities, analysis and checking tools, code generators, and documentation generators. In general, CASE tools try to increase productivity and quality by:

- Enforcing a standard development methodology and design discipline
- Improving communication between users and technical specialists
- Organizing and correlating design components and providing rapid access to them using a design repository
- Automating tedious and error-prone portions of analysis and design
- Automating code generation and testing and control rollout

CASE tools contain features for validating design diagrams and specifications. CASE tools thus support iterative design by automating revisions and changes and providing prototyping facilities. A CASE information repository stores all the information defined by the analysts during the project. The repository includes data flow diagrams, structure charts, entity-relationship diagrams, data definitions, process specifications, screen and report formats, notes and comments, and test results.

To be used effectively, CASE tools require organizational discipline. Every member of a development project must adhere to a common set of naming conventions and standards as well as to a development methodology. The best CASE tools enforce common methods and standards, which may discourage their use in situations where organizational discipline is lacking.

13.3 Alternative Systems-Building Approaches

Systems differ in terms of their size and technological complexity and in terms of the organizational problems they are meant to solve. A number of systems-building approaches have been developed to deal with these differences. This section describes these alternative methods: the traditional systems life cycle, prototyping, application software packages, end-user development, and outsourcing.

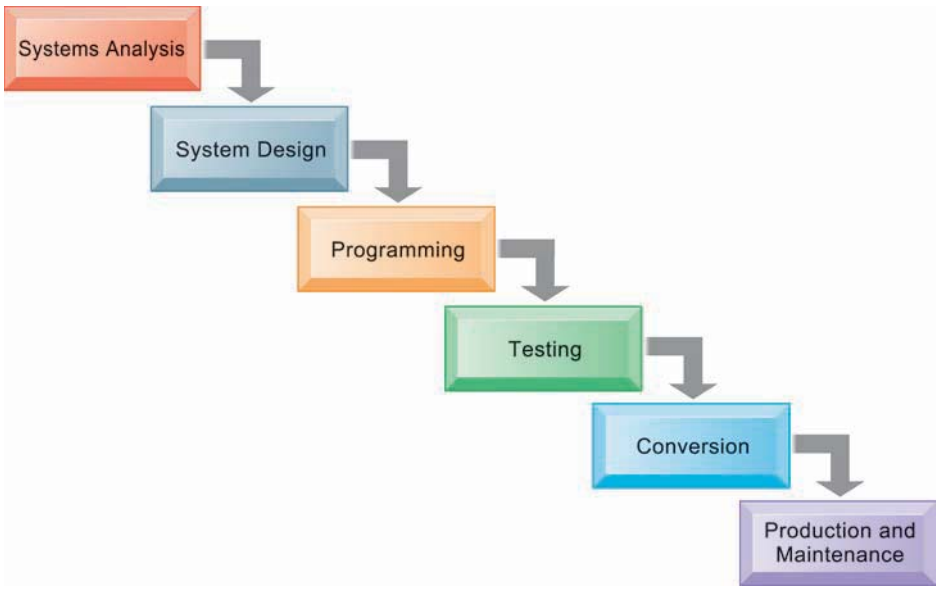
TRADITIONAL SYSTEMS LIFE CYCLE

The **systems life cycle** is the oldest method for building information systems. The life cycle methodology is a phased approach to building a system, dividing systems development into formal stages, as illustrated in Figure 13.9. Systems development specialists have different opinions on how to partition the systems-building stages, but they roughly correspond to the stages of systems development we have just described.

The systems life cycle methodology maintains a formal division of labor between end users and information systems specialists. Technical specialists, such as systems analysts and programmers, are responsible for much of the systems analysis, design, and implementation work; end users are limited to providing information requirements and reviewing the technical staff's work. The life cycle also emphasizes formal specifications and paperwork, so many documents are generated during the course of a systems project.

The systems life cycle is still used for building large complex systems that require a rigorous and formal requirements analysis, predefined specifications, and tight controls over the system-building process. However, the systems life cycle approach can be costly, time-consuming, and

FIGURE 13.9 THE TRADITIONAL SYSTEMS DEVELOPMENT LIFE CYCLE



The systems development life cycle partitions systems development into formal stages, with each stage requiring completion before the next stage can begin.

inflexible. Although systems builders can go back and forth among stages in the life cycle, the systems life cycle is predominantly a "waterfall" approach in which tasks in one stage are completed before work for the next stage begins. Activities can be repeated, but volumes of new documents must be generated and steps retraced if requirements and specifications need to be revised. This encourages freezing of specifications relatively early in the development process. The life cycle approach is also not suitable for many small desktop systems, which tend to be less structured and more individualized.

PROTOTYPING

Prototyping consists of building an experimental system rapidly and inexpensively for end users to evaluate. By interacting with the prototype, users can get a better idea of their information requirements. The prototype endorsed by the users can be used as a template to create the final system.

The **prototype** is a working version of an information system or part of the system, but it is meant to be only a preliminary model. Once operational, the prototype will be further refined until it conforms precisely to users' requirements. Once the design has been finalized, the prototype can be converted to a polished production system.

The process of building a preliminary design, trying it out, refining it, and trying again has been called an **iterative** process of systems development because the steps required to build a system can be repeated over and over again. Prototyping is more explicitly iterative than the conventional life cycle, and it actively promotes system design changes. It has been said that prototyping replaces unplanned rework with planned iteration, with each version more accurately reflecting users' requirements.

Steps in Prototyping

Figure 13.10 shows a four-step model of the prototyping process, which consists of the following:

Step 1: *Identify the user's basic requirements*. The systems designer (usually an information systems specialist) works with the user only long enough to capture the user's basic information needs.

Step 2: *Develop an initial prototype*. The systems designer creates a working prototype quickly, using tools for rapidly generating software.

Step 3: *Use the prototype*. The user is encouraged to work with the system to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.

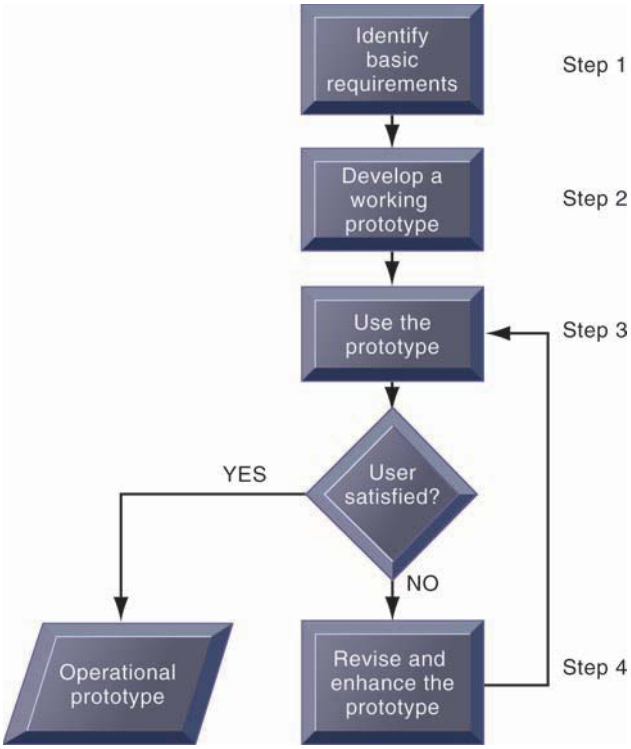
Step 4: *Revise and enhance the prototype*. The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns to Step 3. Steps 3 and 4 are repeated until the user is satisfied.

When no more iterations are required, the approved prototype then becomes an operational prototype that furnishes the final specifications for the application. Sometimes the prototype is adopted as the production version of the system.

Advantages and Disadvantages of Prototyping

Prototyping is most useful when there is some uncertainty about requirements or design solutions and often used for designing an information system's **end-user interface** (the part of the system with which end users interact,

FIGURE 13.10 THE PROTOTYPING PROCESS



The process of developing a prototype can be broken down into four steps. Because a prototype can be developed quickly and inexpensively, systems builders can go through several iterations, repeating steps 3 and 4, to refine and enhance the prototype before arriving at the final operational one.

such as online display and data entry screens, reports, or Web pages). Because prototyping encourages intense end-user involvement throughout the systems development life cycle, it is more likely to produce systems that fulfill user requirements.

However, rapid prototyping can gloss over essential steps in systems development. If the completed prototype works reasonably well, management may not see the need for reprogramming, redesign, or full documentation and testing to build a polished production system. Some of these hastily constructed systems may not easily accommodate large quantities of data or a large number of users in a production environment.

END-USER DEVELOPMENT

Some types of information systems can be developed by end users with little or no formal assistance from technical specialists. This phenomenon is called **end-user development**. A series of software tools categorized as fourth-generation languages makes this possible. **Fourth-generation languages** are software tools that enable end users to create reports or develop software applications with minimal or no technical assistance. Some of these fourth-generation tools also enhance professional programmers' productivity.

Fourth-generation languages tend to be nonprocedural, or less procedural, than conventional programming languages. Procedural languages require specification of the sequence of steps, or procedures, that tell the computer

what to do and how to do it. Nonprocedural languages need only specify what has to be accomplished rather than provide details about how to carry out the task.

Table 13.3 shows that there are seven categories of fourth-generation languages: PC software tools, query languages, report generators, graphics languages, application generators, application software packages, and very high-level programming languages. The table shows the tools ordered in terms of ease of use by nonprogramming end users. End users are most likely to work with PC software tools and query languages. **Query languages** are software tools that provide immediate online answers to requests for information that are not predefined, such as "Who are the highest-performing sales representatives?" Query languages are often tied to data management software and to database management systems (see Chapter 6).

On the whole, end-user-developed systems can be completed more rapidly than those developed through the conventional systems life cycle. Allowing users to specify their own business needs improves requirements gathering and often leads to a higher level of user involvement and satisfaction with the system. However, fourth-generation tools still cannot replace conventional tools

TABLE 13.3 CATEGORIES OF FOURTH-GENERATION LANGUAGES

FOURTH-GENERATION TOOL	DESCRIPTION	EXAMPLE	
PC software tools	General-purpose application software packages for PCs.	Microsoft Excel Microsoft Access	**Oriented toward end users**
Query language	Languages for retrieving data stored in databases or files. Capable of supporting requests for information that are not predefined.	SQL	
Report generator	Extract data from files or databases to create customized reports in a wide range of formats not routinely produced by an information system. Generally provide more control over the way data are formatted, organized, and displayed than query languages.	Crystal Reports	
Graphics language	Retrieve data from files or databases and display them in graphic format. Some graphics software can perform arithmetic or logical operations on data as well.	SAS/GRAPH Systat	
Application generator	Contain preprogrammed modules that can generate entire applications, including Web sites, greatly speeding development. A user can specify what needs to be done, and the application generator will create the appropriate program code for input, validation, update, processing, and reporting.	WebFOCUS QuickBase	
Application software package	Software programs sold or leased by commercial vendors that eliminate the need for custom-written, in-house software.	Oracle PeopleSoft HCM mySAP ERP	
Very high-level programming language	Generate program code with fewer instructions than conventional languages, such as COBOL or FORTRAN. Designed primarily as productivity tools for professional programmers.	APL Nomad2	**Oriented toward IS**

for some business applications because they cannot easily handle the processing of large numbers of transactions or applications with extensive procedural logic and updating requirements.

End-user computing also poses organizational risks because it occurs outside of traditional mechanisms for information systems management and control. When systems are created rapidly, without a formal development methodology, testing and documentation may be inadequate. Control over data can be lost in systems outside the traditional information systems department. To help organizations maximize the benefits of end-user applications development, management should control the development of end-user applications by requiring cost justification of end-user information system projects and by establishing hardware, software, and quality standards for user-developed applications.

APPLICATION SOFTWARE PACKAGES AND OUTSOURCING

Chapter 5 points out that much of today's software is not developed in-house but is purchased from external sources. Firms can rent the software from a software service provider, they can purchase a software package from a commercial vendor, or they can have a custom application developed by an outside outsourcing firm.

Application Software Packages

During the past several decades, many systems have been built on an application software package foundation. Many applications are common to all business organizations—for example, payroll, accounts receivable, general ledger, or inventory control. For such universal functions with standard processes that do not change a great deal over time, a generalized system will fulfill the requirements of many organizations.

If a software package can fulfill most of an organization's requirements, the company does not have to write its own software. The company can save time and money by using the prewritten, predesigned, pretested software programs from the package. Package vendors supply much of the ongoing maintenance and support for the system, including enhancements to keep the system in line with ongoing technical and business developments.

If an organization has unique requirements that the package does not address, many packages include capabilities for customization. **Customization** features allow a software package to be modified to meet an organization's unique requirements without destroying the integrity of the packaged software. If a great deal of customization is required, additional programming and customization work may become so expensive and time-consuming that they negate many of the advantages of software packages.

When a system is developed using an application software package, systems analysis will include a package evaluation effort. The most important evaluation criteria are the functions provided by the package, flexibility, user friendliness, hardware and software resources, database requirements, installation and maintenance efforts, documentation, vendor quality, and cost. The package evaluation process often is based on a **Request for Proposal (RFP)**, which is a detailed list of questions submitted to packaged-software vendors.

When a software package is selected, the organization no longer has total control over the systems design process. Instead of tailoring the systems design

specifications directly to user requirements, the design effort will consist of trying to mold user requirements to conform to the features of the package. If the organization's requirements conflict with the way the package works and the package cannot be customized, the organization will have to adapt to the package and change its procedures.

Outsourcing

If a firm does not want to use its internal resources to build or operate information systems, it can outsource the work to an external organization that specializes in providing these services. Cloud computing and software as a service (SaaS) providers, which we described in Chapter 5, are one form of outsourcing. Subscribing companies use the software and computer hardware provided by the service as the technical platform for their systems. In another form of outsourcing, a company could hire an external vendor to design and create the software for its system, but that company would operate the system on its own computers. The outsourcing vendor might be domestic or in another country.

Domestic outsourcing is driven primarily by the fact that outsourcing firms possess skills, resources, and assets that their clients do not have. Installing a new supply chain management system in a very large company might require hiring an additional 30 to 50 people with specific expertise in supply chain management software, licensed from a vendor. Rather than hire permanent new employees, most of whom would need extensive training in the software package, and then release them after the new system is built, it makes more sense, and is often less expensive, to outsource this work for a 12-month period.

In the case of **offshore outsourcing**, the decision tends to be much more cost-driven. A skilled programmer in India or Russia earns about USD $10,000–$20,000 per year, compared to $73,000 per year for a comparable programmer in the United States. The Internet and low-cost communications technology have drastically reduced the expense and difficulty of coordinating the work of global teams in faraway locations. In addition to cost savings, many offshore outsourcing firms offer world-class technology assets and skills. Wage inflation outside the United States has recently eroded some of these advantages, and some jobs have moved back to the United States.

Nevertheless, there is a very strong chance that at some point in your career, you'll be working with offshore outsourcers or global teams. Your firm is most likely to benefit from outsourcing if it takes the time to evaluate all the risks and to make sure outsourcing is appropriate for its particular needs. Any company that outsources its applications must thoroughly understand the project, including its requirements, method of implementation, anticipated benefits, cost components, and metrics for measuring performance.

Many firms underestimate costs for identifying and evaluating vendors of information technology services, for transitioning to a new vendor, for improving internal software development methods to match those of outsourcing vendors, and for monitoring vendors to make sure they are fulfilling their contractual obligations. Companies will need to allocate resources for documenting requirements, sending out RFPs, handling travel expenses, negotiating contracts, and project management. Experts claim it takes from three months to a full year to fully transfer work to an offshore partner and make sure the vendor thoroughly understands your business.

Outsourcing offshore incurs additional costs for coping with cultural differences that drain productivity and dealing with human resources issues, such as terminating or relocating domestic employees. All of these hidden costs undercut some of the anticipated benefits from outsourcing. Firms should be especially cautious when using an outsourcer to develop or to operate applications that give it some type of competitive advantage.

General Motors Corporation (GM) had outsourced 90 percent of its IT services, including its data centers and application development. The company recently decided to bring 90 percent of its IT infrastructure in-house, with only 10 percent managed by outsourcers. Lowering costs is important, but GM's primary reason for cutting back outsourcing is to take back control of its information systems, which it believes were preventing the company from responding quickly to competitive opportunities. Bringing information systems in-house will make it easier for GM to cut its sprawling list of IT applications by at least 40 percent, move to a more standardized platform, complete innovative IT projects more quickly, and get a better grip on customer and production data, which had been housed in too many different systems. The automaker will consolidate 23 data centers worldwide into just two, both in Michigan, and run four software development centers (Murphy, 2012).

Figure 13.11 shows best- and worst-case scenarios for the total cost of an offshore outsourcing project. It shows how much hidden costs affect the total project cost. The best case reflects the lowest estimates for additional costs, and the worst case reflects the highest estimates for these costs. As you can see, hidden costs increase the total cost of an offshore outsourcing project by an extra 15 to 57 percent. Even with these extra costs, many firms will benefit from offshore outsourcing if they manage the work well. Under the worst-case scenario, a firm would still save about 15 percent.

FIGURE 13.11 TOTAL COST OF OFFSHORE OUTSOURCING

TOTAL COST OF OFFSHORE OUTSOURCING

Cost of outsourcing contract			$10,000,000	
Hidden Costs	Best Case	Additional Cost ($)	Worst Case	Additional Cost ($)
1. Vendor selection	0%	20,000	2%	200,000
2. Transition costs	2%	200,000	3%	300,000
3. Layoffs & retention	3%	300,000	5%	500,000
4. Lost productivity/cultural issues	3%	300,000	27%	2,700,000
5. Improving development processes	1%	100,000	10%	1,000,000
6. Managing the contract	6%	600,000	10%	1,000,000
Total additional costs		1,520,000		5,700,000
	Outstanding Contract ($)	Additional Cost ($)	Total Cost ($)	Additional Cost
Total cost of outsourcing (TCO) best case	10,000,000	1,520,000	11,520,000	15.2%
Total cost of outsourcing (TCO) worst case	10,000,000	5,700,000	15,700,000	57.0%

If a firm spends $10 million on offshore outsourcing contracts, that company will actually spend 15.2 percent in extra costs even under the best-case scenario. In the worst-case scenario, where there is a dramatic drop in productivity along with exceptionally high transition and layoff costs, a firm can expect to pay up to 57 percent in extra costs on top of the $10 million outlay for an offshore contract.

13.4 Application Development for the Digital Firm

In the digital firm environment, organizations need to be able to add, change, and retire their technology capabilities very rapidly to respond to new opportunities, including the need to provide applications for mobile platforms. Companies are starting to use shorter, more informal development processes that provide fast solutions. In addition to using software packages and external service providers, businesses are relying more heavily on fast-cycle techniques such as rapid application development, joint application design, agile development, and reusable standardized software components that can be assembled into a complete set of services for e-commerce and e-business.

RAPID APPLICATION DEVELOPMENT (RAD)

Object-oriented software tools, reusable software, prototyping, and fourth-generation language tools are helping systems builders create working systems much more rapidly than they could using traditional systems-building methods and software tools. The term **rapid application development (RAD)** is used to describe this process of creating workable systems in a very short period of time. RAD can include the use of visual programming and other tools for building graphical user interfaces, iterative prototyping of key system elements, the automation of program code generation, and close teamwork among end users and information systems specialists. Simple systems often can be assembled from prebuilt components. The process does not have to be sequential, and key parts of development can occur simultaneously.

Sometimes a technique called **joint application design (JAD)** is used to accelerate the generation of information requirements and to develop the initial systems design. JAD brings end users and information systems specialists together in an interactive session to discuss the system's design. Properly prepared and facilitated, JAD sessions can significantly speed up the design phase and involve users at an intense level.

Agile development focuses on rapid delivery of working software by breaking a large project into a series of small subprojects that are completed in short periods of time using iteration and continuous feedback. Each mini-project is worked on by a team as if it were a complete project, including planning, requirements analysis, design, coding, testing, and documentation. Improvement or addition of new functionality takes place within the next iteration as developers clarify requirements. This helps to minimize the overall risk, and allows the project to adapt to changes more quickly. Agile methods emphasize face-to-face communication over written documents, encouraging people to collaborate and make decisions quickly and effectively.

COMPONENT-BASED DEVELOPMENT AND WEB SERVICES

We have already described some of the benefits of object-oriented development for building systems that can respond to rapidly changing business environments, including Web applications. To further expedite software creation, groups of objects have been assembled to provide software components for common functions such as a graphical user interface or online ordering

capability that can be combined to create large-scale business applications. This approach to software development is called **component-based development**, and it enables a system to be built by assembling and integrating existing software components. Increasingly, these software components are coming from cloud services. Businesses are using component-based development to create their e-commerce applications by combining commercially available components for shopping carts, user authentication, search engines, and catalogs with pieces of software for their own unique business requirements.

Web Services and Service-Oriented Computing

Chapter 5 introduced *Web services* as loosely coupled, reusable software components delivered using Extensible Markup Language (XML) and other open protocols and standards that enable one application to communicate with another with no custom programming required to share data and services. In addition to supporting internal and external integration of systems, Web services can be used as tools for building new information system applications or enhancing existing systems. Because these software services use a universal set of standards, they promise to be less expensive and less difficult to weave together than proprietary components.

Web services can perform certain functions on their own, and they can also engage other Web services to complete more complex transactions, such as checking credit, procurement, or ordering products. By creating software components that can communicate and share data regardless of the operating system, programming language, or client device, Web services can provide significant cost savings in systems building while opening up new opportunities for collaboration with other companies.

MOBILE APPLICATION DEVELOPMENT

Developing applications for mobile platforms is quite different from development for PCs and their much larger screens. The reduced size of mobile devices makes using fingers and multitouch gestures much easier than typing and using keyboards. Mobile apps need to be optimized for the specific tasks they are to perform, they should not try to carry out too many tasks, and they should be designed for usability. The user experience for mobile interaction is fundamentally different from using a desktop or laptop PC. Saving resources—bandwidth, screen space, memory, processing, data entry, and user gestures—is a top priority.

When a full Web site created for the desktop shrinks to the size of a smartphone screen, it is difficult for the user to navigate through the site. The user must continually zoom in and out and scroll to find relevant material. Therefore, companies usually design Web sites specifically for mobile interfaces and create multiple mobile sites to meet the needs of smartphones, tablets, and desktop browsers. This equates to at least three sites with separate content, maintenance, and costs. Currently, Web sites know what device you are using because your browser will send this information to the server when you log on. Based on this information, the server will deliver the appropriate screen.

One solution to the problem of having three different Web sites is to use **responsive Web design**. Responsive Web design enables Web sites to automatically change layouts according to the visitor's screen resolution, whether on a desktop, tablet, or smartphone. This approach uses a mix of flexible

grids and layouts, flexible images, and media queries that optimize the design for different viewing contexts. As the user switches from his or her laptop to an iPad, iPhone, or Android handheld, the Web site automatically accommodates the changing resolution and image size. This eliminates the need for separate design and development work for each new device. With responsive design, users across a broad range of devices and browsers will have access to a single source of content, laid out to be easy to read and navigate with a minimum of resizing, panning, and scrolling.

There are three main platforms for mobile apps—iPhone/iPad, Android, and Windows Phone. Each of the platforms for mobile applications has an integrated development environment, such as Apple's iOS SDK (software development kit) for the iPhone/iPad, which provides tools for writing, testing, and deploying applications in the target platform environment. Larger companies or business owners with programming experience use these software development kits to create apps from scratch. App development can also be outsourced to specialized app development firms that charge as much as $20,000 to design and develop an app and additional fees to update the software. A number of firms such as Red Foundry offer app templates for small businesses that cannot afford high-paid programmers. The Interactive Session on Technology describes how some companies have addressed the challenges of mobile development we have just identified.

Learning Track Modules

The following Learning Tracks provide content relevant to topics covered in this chapter:

1. Unified Modeling Language (UML)
2. A Primer on Business Process Design and Documentation
3. A Primer on Business Process Management

INTERACTIVE SESSION: TECHNOLOGY

WHAT DOES IT TAKE TO GO MOBILE?

"How should we go mobile?" Almost every company today is asking that question. By 2013, more people will use their mobile phones than PCs to go online, and there will be one mobile device for every person on earth by 2015. The number of Web searches performed on mobile devices has more than quadrupled since 2010. Customers expect, and even demand, to be able to use a mobile device of their choice to obtain information or perform a transaction anywhere and at any time. So if a company wants to stay connected to its customers, it needs some sort of mobile presence.

What do companies do, and where do they start? Developing mobile apps or a mobile Web site has some special challenges. The user experience on a mobile device is fundamentally different from that on a PC. There are special features on mobile devices such as location-based services that that give firms the potential to interact with customers in meaningful new ways. Firms need to be able to take advantage of those features while delivering an experience that is appropriate to a small screen. There are multiple mobile platforms to work with—iPhone, Android, Windows Phone, and possibly BlackBerry, and a firm may need a different version of an application to run on each of these. You can't just port a Web site or desktop application to a smartphone or tablet. It's a different systems development process.

It's important to understand how, why, and where customers use mobile devices and how these mobile experiences change business interactions and behavior. For example, do customers who use an app handle a greater number of transactions on their own and use the phone less? Do they spend more or less time researching products and shopping from a mobile device?

Deckers Outdoor Corporation, the parent company of brands such as UGG Australia, Teva, and Simple Shoes, spent considerable time studying its customers' mobile behavior. It looked at how customers use their mobile devices while shopping and researching brands to find out how consumers would connect with its brand through the mobile channel. When people use mobile devices, how do they research the products? What information do they want about brand? Are they looking for information about product features, product reviews, or retail store locations?

Decker's customer analysis showed that when consumers use mobile devices inside a Deckers store, what is most important is a seamless interaction. The customer wants to be able to look at a product on his or her mobile device and see the same information on that device as that person would obtain in the store, plus some additional information, such as consumer reviews.

A mobile strategy involves much more than selecting mobile devices, operating systems, and applications. It also involves changes to business processes, changing the way people work and the way a firm interacts with its customers. Mobile technology can streamline processes, make them more portable, and enhance them with capabilities such as touch interfaces, location and mapping features, alerts, texting, cameras, and video functionality. The technology can also create less efficient processes or fail to deliver benefits if the mobile application is not properly designed.

USAA, the giant financial services company serving members of the U.S. military and their families, is acutely aware of the need to ensure that mobile technology is aligned with its customer-facing business processes and leads to genuine improvements. The company is using mobile technology to refine its business processes and provide simpler and more powerful ways for customers to interact with the company.

USAA, launched its Web site in 1997 and went mobile ten years later, with about 90 percent of its interactions with customers taking place on these two self-service channels. In 2011, USAA handled 183 million customer contacts through the mobile channel alone, and expects the mobile channel will be its primary point of contact with customers in the next two years. USAA has 100 dedicated mobile developers writing apps for devices using the iPhone, iPad, and Android operating systems, along with apps for the BlackBerry and Windows Phone 7.

USAA developed a smartphone accident report and claims app that enables customers to snap a photo and submit a claim directly from the site of an accident. The app is also able to send geographic information system (GIS) data to a towing service and display nearby car rental locations. Another mobile app supports photo deposits: a customer can capture an image of a check with

a smartphone and automatically submit it to the bank. The money is instantly deposited in the customer's account. This system eliminates the labor and expense of processing paper checks, and the time required to mail the check and wait three days for the deposit to clear. In 2011, USAA Federal Savings Bank processed $6.4 billion in deposits through this mobile app.

The mobile app also displays loan and credit card balances, shopping services, homeowners and auto insurance policy information, Home Circle and Auto Circle buying services, retirement products and information, ATM and taxi locators, and a communities feature that lets users see what others are posting about USAA on Twitter, Facebook, and YouTube.

A real estate company may want to display a completely different site to mobile users who are looking for house information after driving by a "For Sale" sign. The realtor may want to optimize the mobile interface to include specific listing and contact information to capture the lead immediately and keep the load time fast. If the mobile site is simply a more user-friendly version of the desktop site, the conversions may not be as high.

Ryland Homes, one of the top U.S. new home builders, has a conventional Web site, but it wanted to be able to engage customers using mobile technology as well. The company revamped its mobile Web site in March 2011 to increase sales leads by helping potential customers with mobile phones find its locations, look at its products, register with the company, and call directly. Ryland's development team made the site easier to read and capable of fitting on a smartphone or tablet screen without requiring users to pinch and zoom. It used jQuery Mobile software and responsive Web design to create variations of the site that were appropriate for different smartphone or tablet models employed by users. (The jQuery Mobile framework allows developers to design a single Web site or application that will work on all popular smartphone, tablet, and desktop platforms, eliminating the need to write unique apps for each mobile device or operating system.) Ryland focused on features such as location-based driving directions to nearby communities, clickable phone numbers, and brief online registrations to increase the chances of making a sale. The site shows nearby communities in order of distance, based on the location of the mobile device.

Sources: Samuel Greengard, "Mobility Transforms the Customer Relationship," *Baseline*, February 2012; William Atkinson, "How Deckers Used a Mobile Application to Build Customer Traffic," *CIO Insight*, November 9, 2011; "Going Mobile: A Portable Approach to Process Improvement," *Business Agility Insights*, June 2012; Google Inc., "Ryland Homes Opens Doors to Local Sales with Mobile Site for Home-Buyers," 2011.

CASE STUDY QUESTIONS

1. What management, organization, and technology issues need to be addressed when building mobile applications?
2. How does user requirement definition for mobile applications differ from that in traditional systems analysis?
3. Describe the business processes changed by USAA's mobile applications before and after the applications were deployed.

Review Summary

1. *How does building new systems produce organizational change?*

   Building a new information system is a form of planned organizational change. Four kinds of technology-enabled change are (a) automation, (b) rationalization of procedures, (c) business process redesign, and (d) paradigm shift, with far-reaching changes carrying the greatest risks and rewards. Many organizations are using business process management to redesign work flows and business processes in the hope of achieving dramatic productivity breakthroughs. Business process management is also useful for promoting, total quality management (TQM), six sigma, and other initiatives for incremental process improvement.

2. *What are the core activities in the systems development process?*

   The core activities in systems development are systems analysis, systems design, programming, testing, conversion, production, and maintenance. Systems analysis is the study and analysis of problems of existing systems and the identification of requirements for their solutions. Systems design provides the specifications for an information system solution, showing how its technical and organizational components fit together.

3. *What are the principal methodologies for modeling and designing systems?*

   The two principal methodologies for modeling and designing information systems are structured methodologies and object-oriented development. Structured methodologies focus on modeling processes and data separately. The data flow diagram is the principal tool for structured analysis, and the structure chart is the principal tool for representing structured software design. Object-oriented development models a system as a collection of objects that combine processes and data. Object-oriented modeling is based on the concepts of class and inheritance.

4. *What are the alternative methods for building information systems?*

   The oldest method for building systems is the systems life cycle, which requires that information systems be developed in formal stages. The stages must proceed sequentially and have defined outputs; each requires formal approval before the next stage can commence. The systems life cycle is useful for large projects that need formal specifications and tight management control over each stage of systems building, but it is very rigid and costly.

   Prototyping consists of building an experimental system rapidly and inexpensively for end users to interact with and evaluate. Prototyping encourages end-user involvement in systems development and iteration of design until specifications are captured accurately. The rapid creation of prototypes can result in systems that have not been completely tested or documented or that are technically inadequate for a production environment.

   Using a software package reduces the amount of design, programming, testing, installation, and maintenance work required to build a system. Application software packages are helpful if a firm does not have the internal information systems staff or financial resources to custom develop a system. To meet an organization's unique requirements, packages may require extensive modifications that can substantially raise development costs.

   End-user development is the development of information systems by end users, either alone or with minimal assistance from information systems specialists. End-user-developed systems can be created rapidly and informally using fourth-generation software tools. However, end-user development may create information systems that do not necessarily meet quality assurance standards and that are not easily controlled by traditional means.

   Outsourcing consists of using an external vendor to build (or operate) a firm's information systems instead of the organization's internal information systems staff. Outsourcing can save application development costs or enable firms to develop applications without an internal information systems staff. However, firms risk losing control over their information systems and becoming too dependent on external vendors. Outsourcing also entails hidden costs, especially when the work is sent offshore.

5. *What are new approaches for system building in the digital firm era?*

   Companies are turning to rapid application design (RAD), joint application design (JAD), agile development, and reusable software components to accelerate the systems development process. RAD uses object-oriented software, visual programming, prototyping, and fourth-generation tools for very rapid creation of systems. Agile development breaks a large project into a series of small subprojects that are completed in short periods of time using iteration and continuous feedback. Component-based development expedites application development by grouping objects into suites of software components that can be combined to create large-scale business applications. Web services provide a common set of standards that enable organizations to link their systems regardless of their technology platform through standard plug- and-play architecture. Mobile application development must pay attention to simplicity, usability, and the need to optimize tasks for tiny screens.

Key Terms

Acceptance testing, 530
Agile development, 544
Automation, 520
Business process management, 522
Business process redesign, 521
Component-based development, 545
Computer-aided software engineering (CASE), 536
Conversion, 530
Customization, 541
Data flow diagram (DFD), 533
Direct cutover strategy, 531
Documentation, 531
End-user development, 539
End-user interface, 538
Feasibility study, 528
Fourth-generation languages, 539
Information requirements, 528
Iterative, 538
Joint application design (JAD), 544
Maintenance, 532
Object, 534
Object-oriented development, 534
Offshore outsourcing, 542
Paradigm shift, 521
Parallel strategy, 530
Phased approach strategy, 531
Pilot study strategy, 531
Postimplementation audit, 531
Process specifications, 534
Production, 531
Programming, 530
Prototype, 538
Prototyping, 538
Query languages, 540
Rapid application development (RAD), 544
Rationalization of procedures, 521
Request for Proposal (RFP), 541
Responsive Web design, 545
Six sigma, 521
Structure chart, 534
Structured, 532
Systems analysis, 528
Systems design, 528
Systems development, 525
Systems life cycle, 537
System testing, 530
Test plan, 530
Testing, 530
Total quality management (TQM), 521
Unit testing, 530

Review Questions

1. How does building new systems produce organizational change?
   - Describe each of the four kinds of organizational change that can be promoted with information technology.
   - Define business process management and describe the steps required to carry it out.
   - Explain how information systems support process changes that promote quality in an organization.
2. What are the core activities in the systems development process?
   - Distinguish between systems analysis and systems design. Describe the activities for each.
   - Define information requirements and explain why they are difficult to determine correctly.
   - Explain why the testing stage of systems development is so important. Name and describe the three stages of testing for an information system.
   - Describe the role of programming, conversion, production, and maintenance in systems development.
3. What are the principal methodologies for modeling and designing systems?
   - Compare object-oriented and traditional structured approaches for modeling and designing systems.
4. What are the alternative methods for building information systems?
   - Define the traditional systems life cycle. Describe each of its steps and its advantages and disadvantages for systems building.
   - Define information system prototyping. Describe its benefits and limitations. List and describe the steps in the prototyping process.
   - Define an application software package. Explain the advantages and disadvantages of developing information systems based on software packages.
   - Define end-user development and describe its advantages and disadvantages. Name some policies and procedures for managing end-user development.

- Describe the advantages and disadvantages of using outsourcing for building information systems.

5. What are new approaches for system building in the digital firm era?

- Define rapid application development (RAD) and agile development and explain how they can speed up system-building.
- Explain how component-based development and Web services help firms build and enhance their information systems.
- Explain the features of mobile application development and responsive Web design.

Discussion Questions

1. Why is selecting a systems development approach an important business decision? Who should participate in the selection process?

2. Some have said that the best way to reduce systems development costs is to use application software packages or fourth-generation tools. Do you agree? Why or why not?

3. Why is is so important to understand how a business process works when trying to develop a new information system?

Hands-On MIS Projects

The projects in this section give you hands-on experience analyzing business processes, designing and building a customer system for auto sales, and analyzing Web site information requirements.

Management Decision Problems

1. For an additional fee, a customer purchasing a Sears Roebuck appliance, such as a washing machine, can purchase a three-year service contract. The contract provides free repair service and parts for the specified appliance using an authorized Sears service provider. When a person with a Sears service contract needs to repair an appliance, such as a washing machine, he or she calls the Sears Repairs & Parts department to schedule an appointment. The department makes the appointment and gives the caller the date and approximate time of the appointment. The repair technician arrives during the designated time framework and diagnoses the problem. If the problem is caused by a faulty part, the technician either replaces the part if he is carrying the part with him or orders the replacement part from Sears. If the part is not in stock at Sears, Sears orders the part and gives the customer an approximate time when the part will arrive. The part is shipped directly to the customer. After the part has arrived, the customer must call Sears to schedule a second appointment for a repair technician to replace the ordered part. This process is very lengthy. It may take two weeks to schedule the first repair visit, another two weeks to order and receive the required part, and another week to schedule a second repair visit after the ordered part has been received.

- Diagram the existing process.
- What is the impact of the existing process on Sears' operational efficiency and customer relationships?
- What changes could be made to make this process more efficient? How could information systems support these changes? Diagram the new improved process.

2. Management at your agricultural chemicals corporation has been dissatisfied with production planning. Production plans are created using best guesses of demand for each product, which are based on how much of each product has been ordered in the past. If a customer places an unexpected order or requests a change to an existing order after it has been placed, there is no way to adjust production plans. The company may have to tell customers it can't fill their orders, or it may run up extra costs maintaining additional inventory to prevent stock-outs.

At the end of each month, orders are totaled and manually keyed into the company's production planning system. Data from the past month's production and inventory systems are manually entered into the firm's order management system. Analysts from the sales department and from the production department analyze the data from their respective systems to determine what the sales targets and production targets should be for the next month. These estimates are usually different. The analysts then get together at a high-level planning meeting to revise the production and sales targets to take into account senior management's goals for market share, revenues, and profits. The outcome of the meeting is a finalized production master schedule.

The entire production planning process takes 17 business days to complete. Nine of these days are required to entire and validate the data. The remaining days are spent developing and reconciling the production and sales targets and finalizing the production master schedule.

- Draw a diagram of the existing production planning process.
- Analyze the problems this process creates for the company.
- How could an enterprise system solve these problems? In what ways could it lower costs? Diagram what the production planning process might look like if the company implemented enterprise software.

Improving Decision Making: Using Database Software to Design a Customer System for Auto Sales

Software skills: Database design, querying, reporting, and forms
Business skills: Sales lead and customer analysis

This project requires you to perform a systems analysis and then design a system solution using database software.

Ace Auto Dealers specializes in selling new vehicles from Subaru in Portland, Oregon. The company advertises in local newspapers and is listed as an authorized dealer on the Subaru Web site and other major Web sites for auto buyers. The company benefits from a good local word-of-mouth reputation and name recognition.

Ace does not believe it has enough information about its customers. It cannot easily determine which prospects have made auto purchases, nor can it identify which customer touch points have produced the greatest number of sales leads or actual sales so it can focus advertising and marketing more on the channels that generate the most revenue. Are purchasers discovering Ace from newspaper ads, from word of mouth, or from the Web?

Prepare a systems analysis report detailing Ace's problem and a system solution that can be implemented using PC database management software. Then use database software to develop a simple system solution. In MyMISLab, you will find more information about Ace and its information requirements to help you develop the solution.

Achieving Operational Excellence: Analyzing Web Site Design and Information Requirements

Software skills: Web browser software
Business skills: Information requirements analysis, Web site design

Visit the Web site of your choice and explore it thoroughly. Prepare a report analyzing the various functions provided by that Web site and its information requirements. Your report should answer these questions: What functions does the Web site perform? What data does it use? What are its inputs, outputs, and processes? What are some of its other design specifications? Does the Web site link to any internal systems or systems of other organizations? What value does this Web site provide the firm?

Video Cases

Video Cases and Instructional Videos illustrating some of the concepts in this chapter are available. Contact your instructor to access these videos.

Collaboration and Teamwork Project

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

Honam Petrochemical's Quest for Better Management Reports

CASE STUDY

You may soon hear more about Honam Petrochemical Corporation (HPC). Headquartered in Seoul, South Korea, this company manufactures and sells petrochemical products, including synthetic resins; synthetic industrial materials, including ethylene glycol and ethylene oxide for making polyester; automobile antifreeze solutions; benzene; propylene; and ethylene. HPC has about 1,700 employees, and its 2011 revenues were close to US$7.3 billion. It's a leader in Korea's heavy chemical industry.

HPC's primary market is South Korea, but the company has set its sights on becoming a top-tier chemical company throughout Asia and achieving sales of US$10 billion. Honam plans to do this by strengthening its existing businesses, extending its overseas business, and developing new businesses. Honam has nine affiliate companies in China, Malaysia, Indonesia, Pakistan, and the United Kingdom, and overseas branches in Shanghai, Qingdao, Guangzhou, Hong Kong, Moscow, and New York City.

To manage its far-flung operations, HPC needs reliable reports that are able to accurately measure management performance and provide useful, accurate information for increasing sales and reducing costs. HPC's existing systems provided managers with reports to guide their business decisions, but in many cases the data in the reports were out-of-date and "sanitized." Individual managers were processing and manipulating the data to make their departments "look better" to senior management. The report data were also somewhat stale and presented only on a periodic basis.

Executives at the chemical firm wanted access to the data before they went through manipulation or processing. They didn't want each department's own interpretation of reports. Instead, executives wanted to see current data to get a real view of what was actually happening on the plant floor or in the sales office.

Developing a business intelligence solution specifically for executives requires a good deal of up-front requirements gathering. HPC's executive decision makers did not want to work with last quarter's numbers. They wanted anytime access to the most timely data, but they did not want to be overloaded with unnecessary data so they could focus on the "watch-up indicators" considered crucial to the business. They wanted up-to-the-minute reports that they could see quickly on their desktops. They also wanted access via the Web or their mobile devices. Finally, HPC executives wanted enterprise-wide data that could be accessed and shared easily across various business units and functions to support the company's expansion geographically and by product line.

These requirements drove the technology selection process. HPC's information systems team reviewed a number of different software products and vendors and selected SAP BusinessObjects Dashboards and SAP BusinessObjects Web Intelligence. The company already had seven years' experience running SAP's ERP system, so this vendor seemed like an appropriate choice.

SAP BusinessObjects Dashboards is a drag-and-drop visualization tool designed to create interactive analytics for powerful, personalized dashboards based on SAP's BusinessObjects business intelligence platform. BusinessObjects software tools can be used for performance management, planning, reporting, query and analysis, and enterprise information management, and provide self-service access to data from databases and Excel spreadsheets. SAP BusinessObjects Web Intelligence is an ad hoc query, reporting, and analysis tool that is used to create queries or use existing reports, format retrieved information, and perform analysis to understand trends and root causes.

Once HPC's project team determined the business intelligence tools for the solution, its focus turned to determining which data and reports were required by the company's 200 high-level users of the new system. The information systems team started by asking executives to list existing reports they were already receiving and to assess the usefulness of each. The list was cut to a more manageable size and the executives were asked if there were any additional reports or data from which their organizational groups could benefit. These findings were very useful in determining the right set of reports and dashboards for HPC executives.

Once these user requirements were clarified, the information systems team designed a system that

could extract data from a SAP NetWeaver Business Warehouse and present them to executives using the SAP BusinessObjects Dashboards software and SAP Crystal Reports, an application for designing and generating reports from a wide range of data sources. A highly intuitive Web-based user interface was created to make the system very accessible. This interface was so simple and well-designed that users required little training on how to use the system or to access data and reports.

To encourage users to start working with the system, members of the information systems department visited various manufacturing plants where the system was being rolled out and had in-depth discussions with executives about the system's benefits as well as how to use it. Even after the system was up and running, the information systems department continues to run campaigns to ensure that executives are using the system—and using it in the most effective way.

HPC used a phased approach in implementing the new system. Rather than pushing a new system onto executives early in the ERP life cycle, HPC waited until the company was experienced with ERP software and confident in its data quality and its data collection and processing methods. According to HPC CIO Jong Pyo Kim, nothing would sidetrack an executive-level system more quickly than inaccurate or untimely data flowing into an executive's dashboard.

Kim also emphasized the importance of benchmarking before designing and implementing an executive-facing system. Most manufacturing executives will want access to similar data and performance indicators, so benchmarking with other companies in the industry can provide a good look at what data brings the most value.

HPC's system went live in January 2011, and executives started immediately accessing reports and dashboards on a daily, weekly, and monthly basis. The system enabled them to view key performance information such as manufacturing costs by plant, transportation costs, daily production and inventory rates, and global product price trends, and the information can be displayed visually in dashboards and management cockpits. Thirty executives tested mobile devices providing anytime, anywhere access to the new system. Delivery of the information is personalized and differentiated for high-level executives, middle managers, and front-line employees.

It is still too early to assess the long-term business impact of the system, but one benefit was immediate: Executives no longer are limited to sanitized, stale data in an outdated presentation format. Management discussions and decisions are based on timely, consistent, and accurate company-wide data. Because the system reduces the time required to collect, process, and track the data, executive decision making takes place more rapidly. HPC's information systems are now ready for global information-sharing as the company expands.

Sources: Microsoft Corporation, "Case Study: Honam Petrochemical," May 7, 2012; David Hannon, "Searching Beyond Sanitized Data," *SAPInsider* PROFILES, July 2011; David Steier, "Visualizing Success: Analytic User Interfaces that Drive Business," *Information Management*, July/August, 2011; and "Honam Petrochemical Strategy and Financial Highlights from ICIS,"www.icis.com, accessed July 21, 2011.

CASE STUDY QUESTIONS

1. List and describe the information requirements of HPC's new management system. What problems was the new system designed to solve?
2. To what extent were "people" problems affecting management decision making at HPC? What were some of the management, organization, and technology issues that had to be addressed by the new system? How did the system's designers make the system more "people-friendly?"
3. What role did end users play in developing HPC's new system? How did the project team make sure users were involved? What would have happened to the project if they had not done this?
4. What other steps did HPC take to make sure the system was successful?
5. What types of system-building methods and tools did HPC use for building its system?
6. What were the benefits of the new system? How did it change the way Honam ran its business? How successful was this system solution?