Introduction to Information Systems

CHAPTER OUTLINE	LEARNING OBJECTIVES
1.1 Why Should I Study Information Systems?	**1.1** Identify the reasons why being an informed user of information systems is important in today's world.
1.2 Overview of Computer-Based Information Systems	**1.2** Describe the various types of computer-based information systems in an organization.
1.3 How Does IT Impact Organizations?	**1.3** Discuss ways in which information technology can affect managers and nonmanagerial workers.
1.4 Importance of Information Systems to Society	**1.4** Identify positive and negative societal effects of the increased use of information technology.

Opening Case

The Digital Transformation of the *New York Times*

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(All references to newspapers and the newspaper industry in this case refer to print newspapers.)

The Problem

For roughly two centuries, various technologies have impacted newspapers and forced them to adjust. In the late 1820s, for example, two New York newspapers, the *Journal of Commerce* and the *Courier and Enquirer*, were competing for readers. Both publications used the technology of that time in the form of Pony Express riders to deliver news from other cities and fast boats to meet incoming vessels and obtain foreign news a few hours earlier than their competitors.

In 1845, James Gordon Bennett, the editor of the *New York Herald*, asserted that the telegraph would put many newspapers out of business. In fact, his predictions turned out to be erroneous. Although telegraph wires could deliver news more rapidly than any previous technologies, they had a "last-mile" problem; specifically, they could not disseminate news quickly to thousands of people. Only newspapers could do that. In fact, the telegraph actually made newspapers more attractive to readers and increased their sales because the telegraph enabled newspapers to report on more stories and report on them more quickly.

By 1930, some 21 million Americans had purchased radios, which enabled them to hear information before a newspaper could be delivered. Consequently, newspapers lost some advertising revenue to this new medium. However, although a radio could provide news in a brief five-minute highlight, listeners still had to rely on a newspaper to provide supporting details.

In the 1950s, television continued the decline of newspapers as the source of daily news for many people. As with radio, newspapers lost advertising revenue to television. Again, however, television could provide news in brief segments, but listeners still turned to newspapers for the details.

In the 1990s, the rapid growth of the Internet provided online media choices to the average reader while further diminishing newspapers as a source of news. The Internet continued the trend of the telegraph, radio, and television by bringing news to the consumer faster and—in the case of television—more visually than newspapers.

Newspapers have other problems. As opposed to online media, they are constrained by their physical format and by physical manufacturing and distribution as well as by expensive union contracts, printing presses, and fleets of delivery vehicles. Furthermore, online media offer advertisers full-motion video and sound. Finally, Internet search functions enable online media advertisers to carefully target readers who have revealed what they are looking for.

The Internet provides a convenient vehicle for classified advertising, particularly in categories such as jobs, motor vehicles, and real estate. Free services such as Craigslist have created major problems for the classified advertising departments of newspapers, some of which depend on classified ads for 70 percent of their advertising revenue. Online advertising has caused newspapers to increase subscription prices while at the same time decreasing advertising rates.

Other technologies have also impacted newspapers. Today, many people obtain their news from blogs, social media, mobile computing, and newsbots. A *newsbot* is a type of software designed to gather articles from newsgroups or from news websites.

The result of almost 200 years of technology impacts is that the newspaper industry has experienced decreasing classified advertising and circulation, leading to decreasing revenue. According to the Pew Research Center, people "take their news" today in these ways: 46 percent watch it, 36 percent read it, and 18 percent hear it.

The *New York Times* is an excellent example of the problems facing the print journalism industry. The financial crisis of 2008 damaged the paper's advertising revenue as many companies decreased their advertising budgets. In fact, between 2005 and 2010, the paper suffered a $600 million loss in print advertising. The *Times* responded by taking a series of dramatic steps: (1) it took out a $250 million loan from Mexican billionaire Carlos Slim in exchange for a 17 percent stake in the company, (2) it sold its Manhattan headquarters to real estate investment company W. P. Carey & Co. and then leased it back from the buyer, and (3) it sold assets, such as **About.com** and its stake in the Boston Red Sox baseball team.

The fundamental question confronting the *Times* is whether high-impact, high-cost journalism can be successful in a radically different news environment. Finding new digital revenue has become the paper's top business priority.

In 2014, the *Times* assessed its digital efforts and found problems in integrating its employees in the technology group with traditional, mainstream journalists and editors. These problems included the emphasis on print journalism over the paper's digital efforts and a resistance to change on the part of journalists and editors. The *Times* realized that it had to emphasize its digital initiatives.

Digital Solutions

The *Times* is currently undergoing a digital transformation. The paper believes that the transformation will improve its profitability, enhance the quality of its journalism, and secure its future. The primary goals of the transformation are to invest heavily in a core offering (which for the *Times* is journalism) and to continuously add new online services and features, ranging from personalized fitness advice and interactive newsbots to virtual reality films, that will make a subscription indispensable to its existing customers and more attractive to future subscribers. If the *Times* can achieve these two goals, then the paper can maximize advertising revenue, which is essential for the paper's survival.

Today, the Beta Group is the hub for most of the *Times*'s digital initiatives. Beta employees collaborate with designers, developers, and editors. In addition to Cooking and Crossword—two of the original Beta apps—the group is now working on a number of features: Real Estate, an app for home listings; Well, a health and fitness blog that the group wants to turn into a suite of personalized training and advice services; Watching, an app dedicated to television and motion picture recommendations; and Wirecutter (**www.thewirecutter.com**), a gadget review site.

The rollout of these personal service features resembles the *Times*'s efforts in the 1970s, when the paper implemented several advertiser-friendly sections, such as Weekend, Home, and Living. Many *Times* employees dismissed these sections as a ploy to attract new readers that had little news value. That is, they viewed these services as clickbait. *Clickbait* is a negative term used to describe content targeted at generating online advertising revenue, often at the expense of quality or accuracy.

As the digital transformation of the *Times* has proceeded, the culture in the newsroom has been forced to adapt. For example, for several months, the paper's food editor insisted he had no idea what the Beta Group people were talking about. Ultimately, however, he embraced his new digital mission. In fact, in November 2016, he agreed to host a text message experiment called "Turkey Talk" to help readers prepare their Thanksgiving dinners.

Recent digital offerings from the *Times* include the following:

- During the 2016 presidential campaign, the *Times* created a Facebook Messenger newsbot that offered daily updates on the race in the voice of political reporter Nick Confessore. The bot was able to use natural language processing so that it could understand the questions posed to Confessore and respond to readers' queries using prewritten answers.
- Still Processing: A weekly podcast from Wesley Morris and Jenna Wortham about the intersection of pop culture and public policy.
- Puzzle Mania: A special print-only section in the Sunday *Times* that contains the "MegaPuzzle," a 728-clue crossword that was the largest ever created for the *Times.*
- Race/Related: A weekly e-mail newsletter with features and essays on race and ethnicity in America.

The *Times* is also experimenting with virtual reality. It is partnering with Google to send Google's Cardboard VR viewers to all of the *Times*'s 1.1 million Sunday print-edition subscribers, creating an NYT VR app that has been downloaded more than 1 million times. In addition, the two companies are producing 16 original VR films about topics as disparate as displaced refugees (*The Displaced*) and battling ISIS in Iraq (*The Fight for Falluja*).

In March 2016, Facebook made a proposition to the *Times*. If the newspaper would produce dozens of livestreams each month for Facebook Live, the company's new video platform, then Facebook would pay the *Times* $3 million per year. The *Times* began producing content in two weeks. Over the next few months, the Live team recruited more than 300 *Times* journalists to livestream anything and everything: press conferences, protests, political conventions, whatever. The project helped train hundreds of newsroom employees in how to frame a shot and speak on camera and all of the other skills necessary to produce journalism in the future.

Results

It is important to realize that the *Times* has implemented digital initiatives in the past. Specifically, the paper launched its website (**www.nytimes.com**) on January 22, 1996. At that time, it was updated once per day with stories from the print edition. In addition, it was free to read for anyone in the United States who had access to an Internet connection. Unfortunately, the website was updated far too infrequently, and it was not generating any income.

To resolve this problem, the *Times* allocated greater resources to improving and maintaining its website, enabling very rapid updates to its content. Interestingly, in May 2018, the top five most popular news

websites were Yahoo! News, Google News, the Huffington Post, CNN, and the *New York Times*.

In 2011, the paper implemented a paywall that for the first time required people to pay for full and regular access to **NYTimes.com**. A *paywall* on a website is an arrangement where access to content is restricted to users who have paid to subscribe to the site. The paywall became a significant success with more than 3.3 million people paying for a digital subscription in the first quarter of 2019. Significantly, during the first quarter of 2019 the *Times* added another 265,000 digital-only subscribers.

For 2018, the paper reported digital advertising revenue of $709 million. The paper's current goal for total digital revenue is $800 million by 2020 and 10 million total digital subscriptions by 2025. The *Times* senior management believes this revenue could fund the paper's global news-gathering operations either with or without a print edition.

To realize the additional $100 million, the *Times* must find new subscribers across all of its multiple platforms. The site's paywall remains its most powerful incentive to subscribe, which is why most new subscribers sign up after they have maximized their monthly allowance on **NYTimes.com**. Subscriptions through mobile and social media continue to lag behind desktop subscriptions.

The *Times* reported total 2018 revenue of $1.75 billion, even though the paper's 2018 print advertising revenue continued to decline. Interestingly, in 2018 *The Times* added 120 newsroom employees, bringing the total number of journalists to 1,600, the largest count in the paper's history.

The bottom line: The *Times*'s digital initiatives are helping to counter its losses in print advertising, enabling the newspaper to remain profitable.

Sources: Compiled from J. Peiser, "The New York Times Co. Reports $709 Million in Digital Revenue for 2018," *The New York Times*, February 6, 2019; R. Edmonds, "The New York Times Passes 3 Million Mark in Paid Digital Subscribers," *Poynter*, November 1, 2018; J. Peiser, "New York Times Co. Reports Revenue Growth as Digital Subscriptions Rise," *New York Times*, May 3, 2018; S. Ember, "New York Times Co. Subscription Revenue Surpassed $1 Billion in 2017," *New York Times*, February 8, 2018; C. McLellan, "Digital Transformation: Retooling Business for a New Age," *ZDNet*, March 1, 2017; S. Ember, "New York Times Co.'s Decline in Print Advertising Tempered by Digital Gains," *New York Times*, February 2, 2017; "Top 15 Most Popular News Websites," *The eBusiness Guide*, February 2017; G. Snyder, "The New York Times Claws Its Way into the Future," *Wired*, February 2, 2017; J. Benton, This Is *The New York Times'* Digital Path Forward," *NiemanLab*, January 17, 2017; "Digital Transformation in the U.S.," *IDC InfoBrief*, January, 2017; M. Smith, "So You Think You Chose to Read This Article?" *BBC News*, July 22, 2016; A. Mitchell, J. Gottfried, M. Barthel, and E. Shearer, "Pathways to News," *Pew Research Center*, July 7, 2016; S. Elvery, "ABC NewsBot: The Bots Are Coming for You…and They Have Election News!," *ABC News*, June 30, 2016; T. Bernard, "TechCrunch Launches a Personalized News Recommendations Bot on Facebook Messenger," *TechCrunch*, April 19, 2016; T. Saperstein, "The Future of Print: Newspapers Struggle to Survive in the Age of Technology," *Harvard Political Review*, December 6, 2014; E. Dans, "Adapt or Die: The Simple Truth about Technology and the Newspaper Industry," *Medium.com*, August 4, 2014; J. Bruce, "Newspaper Advertising vs. Radio Advertising—and the Winner Is…," *Mediaspace Solutions*, July 22, 2014; M. Ingram, "The Internet Didn't Invent Viral Content or Clickbait Journalism—There's Just More of It Now, and It Happens Faster," *GigaOM*, April 1, 2014; S. O'Hear, "A First Look at Echobox, an Analytics Tool for News Sites That Actually Helps Drive Traffic," *TechCrunch*, February 17, 2014; "Newspapers and Technology," *The Economist*, December 17, 2009; D. Lieberman, "Newspaper Closings Raise Fears about Industry," *USA Today*, March 17, 2009; P. Sullivan, "As the Internet Grows Up, the News Industry Is Forever Changed," *Washington Post*, June 19, 2006; and www.nytimes.com, accessed July 6, 2017.

Questions

1. Explain why implementing a digital transformation was a strategic necessity for the *New York Times*. (*Hint:* How do you "take your news?")
2. Discuss the variety of technological (digital) efforts the *Times* undertook during its digital transformation.
3. Can you think of other digital initiatives the *Times* might use to increase circulation and enhance its bottom line?

Introduction

Before we proceed, we need to define information technology and information systems. **Information technology (IT)** refers to any computer-based tool that people use to work with information and to support an organization's information and information-processing needs. An **information system (IS)** collects, processes, stores, analyzes, and disseminates information for a specific purpose.

IT has far-reaching effects on individuals, organizations, and our planet. Although this text is largely devoted to the many ways in which IT is transforming modern organizations, you will also learn about the significant impacts of IT on individuals and societies, the global economy, and our physical environment. In addition, IT is making our world smaller, enabling more and more people to communicate, collaborate, and compete, thereby leveling the competitive playing field.

This text focuses on the successful applications of IT in organizations; that is, how organizations can use IT to solve business problems and achieve competitive advantage in the marketplace. However, not all business problems can be solved with IT. Therefore, you must continue to develop your business skills!

When you graduate, you will either start your own business or work for an organization, whether it is public sector, private sector, for-profit, or not-for-profit. Your organization will have to survive and compete in an environment that has been radically transformed by information technology. This environment is global, massively interconnected, intensely competitive, 24/7/365, real time, rapidly changing, and information intensive. To compete successfully, your organization must use IT effectively.

As you read this chapter and this text, keep in mind that the information technologies you will learn about are important to businesses of all sizes. No matter which area of business you

major in, which industry you work for, or the size of your company, you will benefit from learning about IT. Who knows? Maybe you will use the tools you learn about in this class to make your great idea a reality by becoming an entrepreneur and starting your own business!

The modern environment is intensely competitive not only for your organization but for you as well. You must compete with human talent from around the world. Therefore, you personally will have to make effective use of IT.

Accordingly, this chapter begins with a discussion of three reasons why you should become knowledgeable about IT. Next, it distinguishes among data, information, and knowledge, and it differentiates computer-based information systems from application programs. Finally, it considers the impacts of information systems on organizations and on society in general.

1.1 Why Should I Study Information Systems?

Author Lecture Videos are available exclusively in ***WileyPLUS*.**
Apply the Concept activities are available in the Appendix and in ***WileyPLUS.***

Your use of IT makes you part of the most connected generation in history: You have grown up online; you are, quite literally, never out of touch, and you use more information technologies (in the form of digital devices) for more tasks and are bombarded with more information than any generation in history. The *MIT Technology Review* refers to you as *Homo conexus*. Information technologies are so deeply embedded in your lives that your daily routines would be almost unrecognizable to a college student just 20 years ago.

Essentially, you practice *continuous computing*, surrounded by a movable information network. This network is created by constant cooperation among the digital devices you carry (e.g., laptops, tablets, and smartphones), the wired and wireless networks that you access as you move about, and Web-based tools for finding information and communicating and collaborating with other people. Your network enables you to pull information about virtually anything from anywhere, at any time, and to push your own ideas back to the Web, from wherever you are, via a mobile device. Think of everything you do online, often with your smartphone: register for classes; take classes (and not just at your university); access class syllabi, information, PowerPoints, and lectures; research class papers and presentations; conduct banking; pay your bills; research, shop, and purchase products from companies and other people; sell your "stuff"; search for and apply for jobs; make your travel reservations (hotel, airline, rental car); create your own blog and post your own podcasts and videos to it; design your own page on Facebook and LinkedIn; make and upload videos to YouTube; take, edit, and print your own digital photographs; stream music and movies to your personal libraries; use RSS feeds to create your personal electronic newspaper; text and tweet your friends and family throughout your day; send Snaps; order a ride from Uber; select a place or room to rent on Airbnb; and many other activities. (*Note:* If any of these terms are unfamiliar to you, don't worry. You will learn about everything mentioned here in detail later in this text.)

Let's put the preceding paragraph in perspective. What would a typical day for you be like if you had no access to computing devices of any kind, including your phone?

The Informed User—You!

So the question is: Why should you learn about information systems and information technology? After all, you can comfortably use a computer (or other electronic devices) to perform many activities, you have been surfing the Web for years, and you feel confident that you can manage any IT application that your organization's MIS department installs. Let's look at three reasons why you should learn about Information Systems and IT.

MIS The first reason to learn about information systems and information technology is to become an **informed user**; that is, a person knowledgeable about Information Systems and IT. In general, informed users obtain greater value from whichever technologies they use. You will enjoy many benefits from being an informed user of IT, including the following:

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FIGURE 1.1 **MIS provides what users see and use on their computers.**

- You will benefit more from your organization's IT applications because you will understand what is "behind" those applications (see **Figure 1.1**). That is, what you see on your computer screen is brought to you by your MIS department, who are operating "behind" your screen.
- You will be in a position to enhance the quality of your organization's IT applications with your input.
- Even as a new graduate, you will quickly be in a position to recommend—and perhaps to help select—which IT applications your organization will use.
- Being an informed user will keep you abreast of both new information technologies and rapid developments in existing technologies. Remaining "on top of things" will help you to anticipate the impacts that "new and improved" technologies will have on your organization and to make recommendations regarding the adoption and use of these technologies.
- You will understand how using IT can improve your organization's performance and teamwork as well as your own productivity.
- If you have ideas of becoming an entrepreneur, then being an informed user will help you to utilize IT when you start your own business.

The second reason to learn about Information Systems and IT is that the organization you join will undoubtedly be undergoing a digital transformation. In fact, digital transformation has become one of the most important strategies for organizations. The Data Warehousing Institute (**www.tdwi.org**) predicted that, by the end of 2018, approximately two-thirds of chief executive officers of the *Forbes* Global 2000 companies would have digital transformation at the center of their corporate strategy. (The Global 2000 is a list of the 2,000 largest public companies in the world, ranked by *Forbes* magazine.)

Digital transformation is the business strategy that leverages IT to dramatically improve employee, customer, and business partner relationships; to support continuous improvement in business operations and business processes; and to develop new business models and businesses. The information technologies that drive digital transformation include the following:

- Big Data (see Chapter 5)
- Business analytics (see Chapter 12)
- Social computing (see Chapter 9)

- Mobile computing (see Chapter 8)
- The Internet of Things (see Chapter 8)
- Agile systems development methods (see Chapter 13)
- Cloud computing (see Technology Guide 3)
- Artificial intelligence (see Technology Guide 4)

You see examples of digital transformation in this chapter's opening case and IT's About Business 1.1.

IT's About Business 1.1

A Variety of Digital Transformations

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Wendy's

Fast-food restaurant chain Wendy's (**www.wendys.com**) is undergoing a digital transformation with the goal of putting digital technologies at the center of its customer experience. The company initiated its digital transformation process when it realized that many of its customers, both Millennials and non-Millennials, expect to interact with companies via digital channels. Therefore, Wendy's was going to be judged on the digital experience that it provided for these customers. To implement this transformation, Wendy's created a laboratory called 90 Degree Labs, which it staffed with engineers, customer experience experts, and user experience experts. The lab produces three products: the company website, apps, and self-order kiosks.

Wendy's became one of the first companies to use self-ordering kiosks to control labor costs and deployed this technology in about 4000 (60 percent) of its restaurants by July 2019. Today, stores with the kiosks are seeing higher average checks and higher customer satisfaction scores. As such, the kiosks remain integral to Wendy's strategy to provide a superior digital customer experience.

Wendy's noted that its customers are already familiar with mobile apps and that its kiosks were an intermediate step in providing a mobile digital experience for them. The company believes that once its customers become comfortable using the in-store kiosks, they can transition more easily to ordering via a mobile app.

Utilizing kiosks and mobile apps will enable Wendy's to manage lines, plan kitchen capacity, and order the correct amount of supplies at the right times. Mobile apps also enable customers to get customized orders at the right place and time.

In early 2019, Wendy's announced a $25 million investment in digital initiatives, including new scanning equipment. The scanners will enable employees to scan mobile offers and coupons rather than having to key them in to the point-of-sale system.

POM MKT MIS Professional Golf

Golf is having difficulties as the baby-boomer generation ages and Millennials do not seem to be as interested in the game. In the United States, planners are considering how to manage large tracts of land opened up by closed golf courses. In response, golf is developing what it calls the "connected course" for golf tournaments as a way for golf to broaden its appeal to younger people who are rarely without their computing devices.

First, golf courses must be prepared for the daily technology demands of a modern golf tournament. Each course must support the demands of television broadcasters, the professional tour's own scoring and operational systems, as well as wireless connectivity for spectators.

Preparing courses typically requires laying 6 to 10 miles of fiber in the ground as well as deploying sensors with 5G wireless technology when 5G is ready in 2020. The goal of this technology is for it to generate better insights for staff, players, coaches, business partners, advertisers, and spectators.

The sensors will provide location data that will bring new insights into how spectators move around a course. These data provide tournament sponsors with relevant information on spectator location and movement to increase their potential engagement. For example, spectators could access information relating to a sponsor-operated event or sales concession.

POM MIS The Freight Forwarding Industry

Freight forwarders assist their clients in shipping goods and raw materials by rail, ship, or plane. Significantly, this industry has conducted business the same way for many years. They employ a global network of agents who possess a thorough knowledge of duties, taxes, penalties, and port requirements around the world. In return for a fee from their clients, they negotiate rates with trucking companies, airlines, and ship owners, and they make deals based on large volumes of cargo.

This global business has lagged behind many other industries in adapting to digital transformation. Start-up Freightos (**www.freightos.com**), an online marketplace, is addressing that problem. Freightos allows shippers to book online, receiving bids from multiple freight forwarders within seconds rather than days and often for lower prices than offline alternatives offer.

Another start-up, Windward (**www.wnwd.com**), combines location data with other information about each vessel's size, owner, and other factors to map the paths and behaviors of ships at sea. More than 90 percent of world trade moves by sea. Once cargo is on a ship, however, little information is available regarding the path the ship is taking or the stops it makes. Only in recent years have the largest ships regularly transmitted location data. However, even these ships may stop transmitting and "go dark" at any time.

To analyze the myriad data points coming in from each ship, Windward has constructed artificial intelligence systems using natural language processing to identify unusual or important patterns of behavior. These systems generate maps that might reveal ships meeting mid-ocean to transfer cargo or crossing in and out of a

country's territorial waters in patterns that can be associated with illegal fishing or smuggling. Most of Windward's customers are fishing authorities, coast guards, and navies. However, the company is confident that its information can be valuable to ship owners, cargo owners, and insurance companies as well.

Significantly, Amazon (**www.amazon.com**) is entering the freight forwarding business. For a detailed look at Amazon's efforts in this area, see the closing case in Chapter 11.

MIS America's Cup Yachting

A victory in the America's Cup can go to the team with the best data rather than the best boat. During these head-to-head races, even a small increase in speed can result in a win. Therefore, the more data that teams can gather about the performance of their boats and crews, the better.

To obtain more data, teams are mounting sensors all over the catamarans that record huge amounts of data during a race, from boat speed and wind data to the forces that are stressing the different parts of the boat. In fact, teams can gather as much as 16 gigabytes of data per day.

One team streams its sensor data to a chase boat in real time. The boat design coordinator for the team stays on the chase boat as a Wi-Fi system transmits data from the racing catamaran. In addition to sensors, his team also collects video using GoPro cameras that target various critical parts of the catamaran. The coordinator conducts real-time analysis on the chase boat because he can watch the actual performance of the boat on the water in real time. He later sends the data to headquarters for further analysis. Then analysts at team headquarters virtually replay the race. This analysis helps each crew member enhance his or her performance and also helps engineers build a faster boat by changing the design of its catamaran.

Sources: Compiled from J. Maze, "Wendy's Investing $25M behind Digital Efforts," *Restaurant Business*, February 21, 2019; "Can Digitisation Help Golf Out of Bunker?" *Computer Weekly*, August 7–13, 2018; B. Sozzi, "Wendy's CEO: Future of Fast Food Will Include Kiosks and Fast Pass Drive-Thrus, *The Street*, June 11, 2018; T. Newcomb, "Data Supercharges Billion-Dollar Boats in the World's Fastest Sailing Race," *Wired*, July 8, 2017; A. Bruno, "Technology and Its Impact on the Freight Forwarding Industry," *ICAT Logistics*, June 12, 2017; M. Harvey, "How Data Crunching Was Vitally Important to Britain's America's Cup Team," *The Telegraph*, June 1, 2017; "One Fast Food Chain Is Adding Automated Kiosks to 1,000 of Its Restaurants in 2017," *Futurism*, March 3, 2017; L. Dignan, "Wendy's Cooks Up Digital Transformation Plans with Kiosks, Mobile Apps, Customer Experience Lab," *TechRepublic*, March 1, 2017; "Digital Transformation in the U.S.," *IDC InfoBrief*, January 2017; C. McDonald, "Unilever Puts Digital Transformation in the Hands of IT," *Computer Weekly*, November 2, 2016; N. Byrnes, "This $1 Trillion Industry Is Finally Going Digital," *MIT Technology Review*, October 24, 2016; D. Walter, "Oracle Team USA Credits Data & Analytics for America's Cup Success," *CMS Wire*, September 21, 2016; D. Kline, "Are Robots Taking Over Fast Food Restaurants?" *Newsweek*, September 5, 2016; D. Newman, "Top 10 Trends for Digital Transformation in 2017; *Forbes*, August 30, 2016; M. Castillo, "Technology Could Soon Be Replacing Fast Food Workers," *PSFK.com*, April 21, 2016; and "Wendy's Opens 90 Degree Labs to Fuel Future Technology Innovation," *PRNewswire*, May 26, 2015.

Questions

This case presents digital transformations in four organizations across four industries.

1. **For which organization is digital transformation the most critical? Why? Support your answer.**
2. **For which organization is digital transformation the least critical? Why? Support your answer.**
3. **Would your university be a good candidate for digital transformation? Why or why not? Support your answer.**
4. **If you responded yes, then what types of digital initiatives should your university undertake to transform itself?**

The third reason to learn about Information Systems and IT is that managing the IS function within an organization is no longer the exclusive responsibility of the IS department. Rather, users now play key roles in every step of this process. The overall objective in this text is to provide you with the necessary information to contribute immediately to managing the IS function in your organization. In short, our goal is to help you become a very informed user!

IT Offers Career Opportunities

MIS Because IT is vital to the operation of modern businesses, it offers many employment opportunities. The demand for traditional IT staff—programmers, business analysts, systems analysts, and designers—is substantial. In addition, many well-paid jobs exist in areas such as the Internet and electronic commerce (e-commerce), mobile commerce (m-commerce), network security, telecommunications, and multimedia design.

The IS field includes the people in various organizations who design and build information systems, the people who use those systems, and the people responsible for managing those systems. At the top of the list is the chief information officer (CIO).

The CIO is the executive who is in charge of the IS function. In most modern organizations, the CIO works with the chief executive officer (CEO), the chief financial officer (CFO), and other senior executives. Therefore, he or she actively participates in the organization's strategic planning process. In today's digital environment, the IS function has become increasingly strategic within organizations. As a result, although most CIOs still rise from the IS department, a growing number are coming up through the ranks in the business units (e.g., marketing, finance). Regardless of your major, you could become the CIO of your organization one day. This is another reason to be an informed user of information systems!

TABLE 1.1 Information Technology Jobs

Position	Job Description
Chief Information Officer	Highest-ranking IS manager; responsible for all strategic planning in the organization
IS Director	Manages all systems throughout the organization and the day-to-day operations of the entire IS organization
Information Center Manager	Manages IS services, such as help desks, hot lines, training, and consulting
Applications Development Manager	Coordinates and manages new systems development projects
Project Manager	Manages a particular new systems development project
Systems Analyst	Interfaces between users and programmers; determines information requirements and technical specifications for new applications
Operations Manager	Supervises the day-to-day operations of the data and/or computer center
Programming Manager	Coordinates all application programming efforts
Social Media Manager	Coordinates all social media development efforts and all social media monitoring and response efforts
Business Analyst	Focuses on designing solutions for business problems; interfaces closely with users to demonstrate how IT can be used innovatively
Systems Programmer	Creates the computer code for developing new systems software or maintaining existing systems software
Applications Programmer	Creates the computer code for developing new applications or maintaining existing applications
Emerging Technologies Manager	Forecasts technology trends; evaluates and experiments with new technologies
Network Manager	Coordinates and manages the organization's voice and data networks
Database Administrator	Manages the organization's databases and oversees the use of database-management software
Auditing or Computer Security Manager	Oversees the ethical and legal use of information systems
Webmaster	Manages the organization's website
Web Designer	Creates websites and pages

Table 1.1 provides a list of IT jobs, along with a description of each one. For further details about careers in IT, see **www.linkedin.com**, **www.computerworld.com**, and **www.monster.com**.

Career opportunities in IS are strong and are projected to remain strong over the next 10 years. In fact, *U.S. News & World Report* listed its "100 best jobs of 2018," *Money* listed its "best jobs in America for 2018," and *Forbes* listed its "20 best jobs" for 2018. Let's take a look at these rankings. (Note that the rankings differ because the magazines used different criteria in their research.) As you can see, jobs suited for MIS majors appear in all three lists, many of them quite high. The magazines with their job rankings are as follows:

***U.S. News & World Report* (out of 100)**

#1 Software Developer

#32 Information Security Analyst

#42 Information Technology Manager

#46 Computer Systems Analyst

***Money* (out of 50)**

#2 IT Development Engineer

#8 Mobile Systems Developer

#21 Software Engineer

#26 Database Administrator

***Forbes* (out of 20)**

#2 Software Engineer

#4 IT Solutions Architect

#11 IT Manager

#13 Data Engineer

#14 Front-End Engineer (User Experience Designer)

Not only do IS careers offer strong job growth, but the pay is excellent as well. The Bureau of Labor Statistics, an agency within the Department of Labor that is responsible for tracking and analyzing trends relating to the labor market, notes that the median salary in 2016 for "computer and information systems managers" was approximately $139,220 and predicted that the profession would grow by an average of 12 percent per year through 2026.

In addition, LinkedIn analyzed thousands of profiles of members who graduated between 2015 and 2017. LinkedIn collected salary information using the LinkedIn Salary tool. It discovered that of the 15 highest-paying entry-level jobs, 8 were in the technology industry. These jobs include the following:

Job	Median Starting Salary
#2 Data Scientist	$93,500
#3 Hardware Engineer	$90,000
#4 Software Engineer	$80,000
#6 Technology Analyst	$76,000
#9 Consulting Analyst	$75,000
#10 Management Consultant	$74,300
#11 Security Engineer	$74,200
#14 User Experience Designer	$72,000

Managing Information Resources

Managing information systems in modern organizations is a difficult, complex task. Several factors contribute to this complexity. First, information systems have enormous strategic value to organizations. Firms rely on them so heavily that, in some cases, when these systems are not working (even for a short time), the firm cannot function. (This situation is called "being hostage to information systems.") Second, information systems are very expensive to acquire, operate, and maintain.

A third factor contributing to the difficulty in managing information systems is the evolution of the management information systems (MIS) function within the organization. When businesses first began to use computers in the early 1950s, the MIS department "owned" the only computing resource in the organization, the mainframe. At that time, end users did not interact directly with the mainframe.

MIS In contrast, in the modern organization, computers are located in all departments, and almost all employees use computers in their work. This situation, known as *end user computing*, has led to a partnership between the MIS department and the end users. The MIS department now acts as more of a consultant to end users, viewing them as customers. In fact, the main function of the MIS department is to use IT to solve end users' business problems.

MIS As a result of these developments, the responsibility for managing information resources is now divided between the MIS department and the end users. This arrangement raises several important questions: Which resources are managed by whom? What is the role of the MIS department, its structure, and its place within the organization? What is the appropriate relationship between the MIS department and the end users? Regardless of who is doing what, it is essential that the MIS department and the end users work in close cooperation.

There is no standard way to divide responsibility for developing and maintaining information resources between the MIS department and the end users. Instead, that division depends on several factors: the size and nature of the organization, the amount and type of IT resources, the organization's attitudes toward computing, the attitudes of top management toward computing, the maturity level of the technology, the amount and nature of outsourced IT work, and even the countries in which the company operates. Generally speaking, the MIS department

TABLE 1.2 The Changing Role of the Information Systems Department

Traditional Functions of the MIS Department
Managing systems development and systems project management
• As an end user, you will have critical input into the systems development process. You will learn about systems development in Chapter 13.
Managing computer operations, including the computer center
Staffing, training, and developing IS skills
Providing technical services
Infrastructure planning, development, and control
• As an end user, you will provide critical input about the IS infrastructure needs of your department.
New (Consultative) Functions of the MIS Department
Initiating and designing specific strategic information systems
• As an end user, your information needs will often mandate the development of new strategic information systems.
You will decide which strategic systems you need (because you know your business needs and requirements better than the MIS department does), and you will provide input into developing these systems.
Incorporating the Internet and electronic commerce into the business
• As an end user, you will be primarily responsible for effectively using the Internet and electronic commerce in your business. You will work with the MIS department to accomplish these tasks.
Managing system integration, including the Internet, intranets, and extranets
• As an end user, your business needs will determine how you want to use the Internet, your corporate intranets, and extranets to accomplish your goals. You will be primarily responsible for advising the MIS department on the most effective use of the Internet, your corporate intranets, and extranets.
Educating the non-MIS managers about IT
• Your department will be primarily responsible for advising the MIS department on how best to educate and train your employees about IT.
Educating the MIS staff about the business
• Communications between the MIS department and business units is a two-way street. You will be responsible for educating the MIS staff on your business, its needs and requirements, and its goals.
Partnering with business unit executives
• Essentially, you will be in a partnership with the MIS department. You will be responsible for seeing that this partnership is one "between equals" and ensuring its success.
Managing outsourcing
• Outsourcing is driven by business needs. Therefore, the outsourcing decision resided largely with the business units (i.e., with you). The MIS department, working closely with you, will advise you on technical issues, such as communications bandwidth and security.
Proactively using business and technical knowledge to see innovative ideas about using IT
• Your business needs will often drive innovative ideas about how to effectively use information systems to accomplish your goals. The best way to bring these innovative uses of IS to life is to partner closely with your MIS department. Such close partnerships have amazing synergies!
Creating business alliances with business partners
• The needs of your business unit will drive these alliances, typically along your supply chain. Again, your MIS department will act as your adviser on various issues, including hardware and software compatibility, implementing extranets, communications, and security.

is responsible for corporate-level and shared resources, and the end users are responsible for departmental resources. **Table 1.2** identifies both the traditional functions and various new, consultative functions of the MIS department.

So, where do the end users come in? Take a close look at Table 1.2. Under the traditional MIS functions, you will see two functions for which you provide vital input: managing systems development and infrastructure planning. Under the consultative MIS functions, in contrast, you exercise the primary responsibility for each function, while the MIS department acts as your adviser.

Before you go on . . .

1. Rate yourself as an informed user. (Be honest; this isn't a test!)
2. Explain the benefits of being an informed user of information systems.
3. Discuss the various career opportunities offered in the IT field.

1.2 Overview of Computer-Based Information Systems

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Apply the Concept activities are available in the Appendix and in *WileyPLUS*.

Organizations refer to their management information system's functional area by several names, including the MIS Department, the Information Systems (IS) Department, the Information Technology (IT) Department, and the Information Services Department. Regardless of the name, however, this functional area deals with the planning for—and the development, management, and use of—information technology tools to help people perform all the tasks related to information processing and management. Recall that information technology relates to any computer-based tool that people use to work with information and to support the information and information-processing needs of an organization.

As previously stated, an information system collects, processes, stores, analyzes, and disseminates information for a specific purpose. The purpose of information systems has been defined as getting the right information to the right people, at the right time, in the right amount, and in the right format. Because information systems are intended to supply useful information, we need to differentiate between information and two closely related terms: data and knowledge (see **Figure 1.2**).

Data items refer to an elementary description of things, events, activities, and transactions that are recorded, classified, and stored but are not organized to convey any specific meaning. Data items can be numbers, letters, figures, sounds, and images. Examples of data items are collections of numbers (e.g., 3.11, 2.96, 3.95, 1.99, 2.08) and characters (e.g., B, A, C, A, B, D, F, C).

Information refers to data that have been organized so that they have meaning and value to the recipient. For example, a grade-point average (GPA) by itself is data, but a student's name coupled with his or her GPA is information. The recipient interprets the meaning and draws conclusions and implications from the information. Consider the examples of data

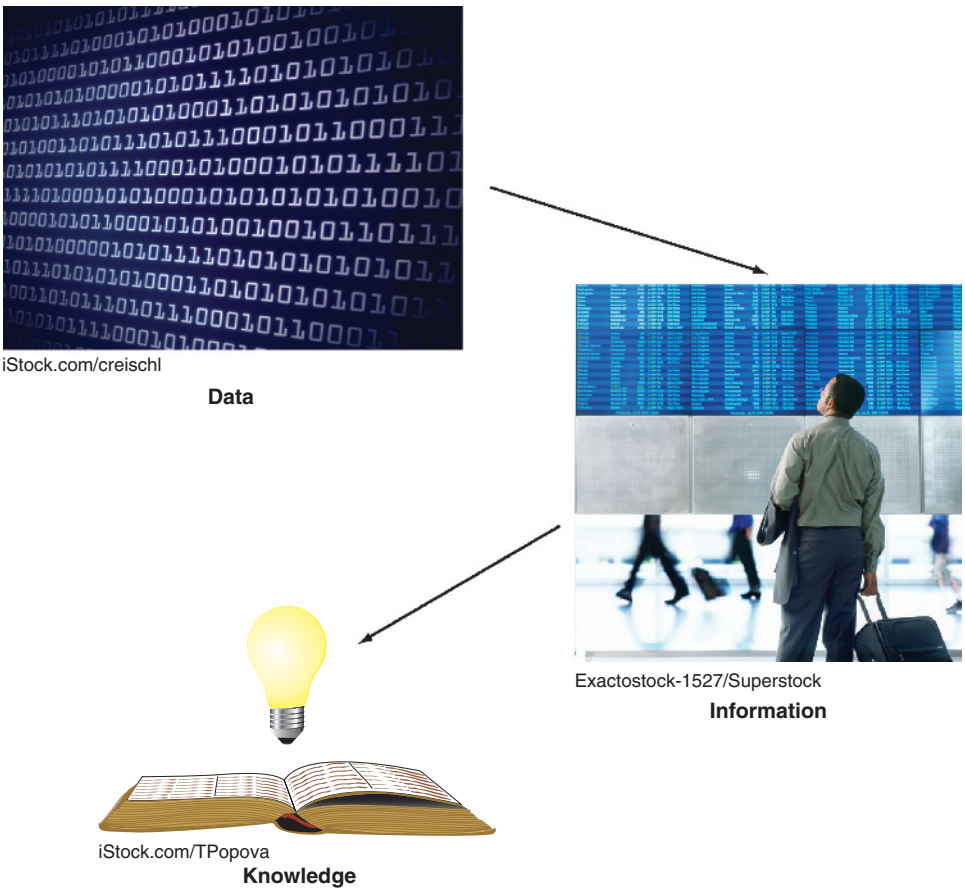

FIGURE 1.2 **Data, information, and knowledge.**

provided in the preceding paragraph. Within the context of a university, the numbers could be GPAs, and the letters could be grades in an Introduction to MIS class.

Knowledge consists of data and/or information that have been organized and processed to convey understanding, experience, accumulated learning, and expertise as they apply to a current business problem. For example, suppose that a company recruiting at your school has found over time that students with GPAs over 3.0 have experienced the greatest success in its management program. Based on this accumulated knowledge, that company may decide to interview only those students with GPAs over 3.0. This example presents an example of knowledge because the company utilizes information—GPAs—to address a business problem—hiring successful employees. As you can see from this example, organizational knowledge, which reflects the experience and expertise of many people, has great value to all employees.

Consider this example:

Data	Information	Knowledge
[No context]	[University context]	
3.16	3.16 + John Jones = GPA	* Job prospects
2.92	2.92 + Sue Smith = GPA	* Graduate school prospects
1.39	1.39 + Kyle Owens = GPA	* Scholarship prospects
3.95	3.95 + Tom Elias = GPA	
Data	**Information**	**Knowledge**
[No context]	[Professional baseball pitcher context]	
3.16	3.16 + Ken Rice = ERA	
2.92	2.92 + Ed Dyas = ERA	* Keep pitcher, trade pitcher, or send pitcher to minor leagues
1.39	1.39 + Hugh Carr = ERA	* Salary/contract negotiations
3.95	3.95 + Nick Ford = ERA	

GPA = Grade-point average (higher is better)

ERA = Earned run average (lower is better); ERA is the number of runs per nine innings that a pitcher surrenders.

You see that the same data items, with no context, can mean entirely different things in different contexts.

Now that you have a clearer understanding of data, information, and knowledge, let's shift our focus to computer-based information systems. As you have seen, these systems process data into information and knowledge that you can use.

A **computer-based information system (CBIS)** is an information system that uses computer technology to perform some or all of its intended tasks. Although not all information systems are computerized, today most are. For this reason, the term *information system* is typically used synonymously with *computer-based information system*. The basic components of a CBIS are listed below. The first four are called **information technology components**. **Figure 1.3** illustrates how these four components interact to form a CBIS:

- **Hardware** consists of devices such as the processor, monitor, keyboard, and printer. Together, these devices accept, process, and display data and information.
- **Software** is a program or collection of programs that enable the hardware to process data.
- A **database** is a collection of related files or tables containing data.
- A **network** is a connecting system (wireline or wireless) that enables multiple computers to share resources.

- **Procedures** are the instructions for combining the above components to process information and generate the desired output.
- People use the hardware and software, interface with it, or utilize its output.

Figure 1.4 illustrates how these components are integrated to form the wide variety of information systems found within an organization. Starting at the bottom of the figure, you see that the IT components of hardware, software, networks (wireline and wireless), and databases form the **information technology platform**. IT personnel use these components to develop information systems, oversee security and risk, and manage data. These activities

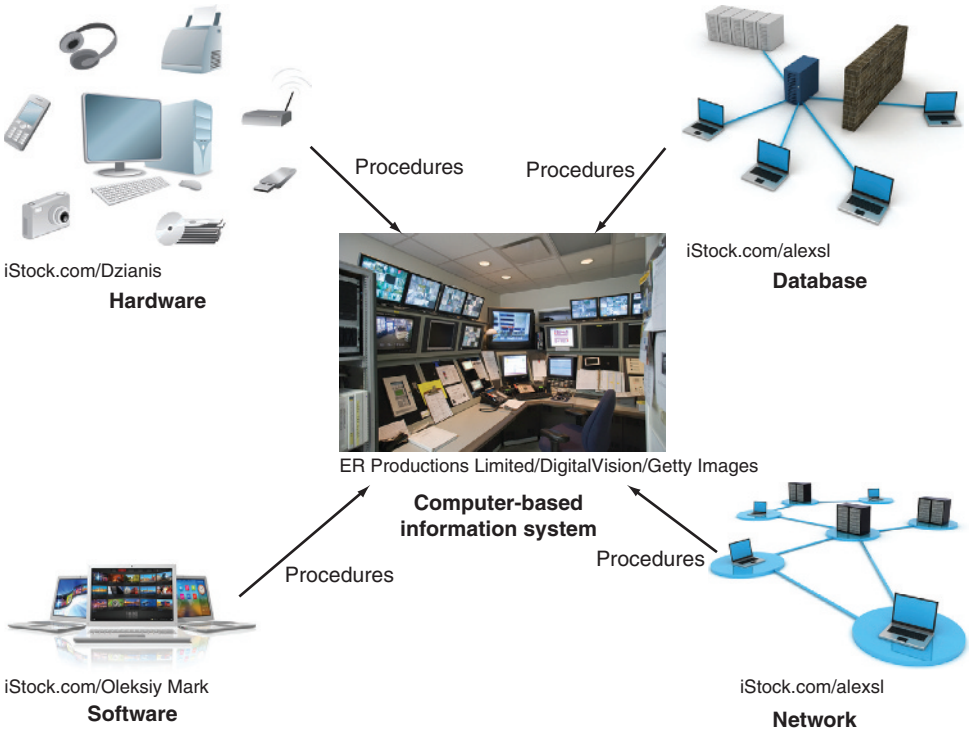

FIGURE 1.3 **Computer-based information systems consist of hardware, software, databases, networks, procedures, and people.**

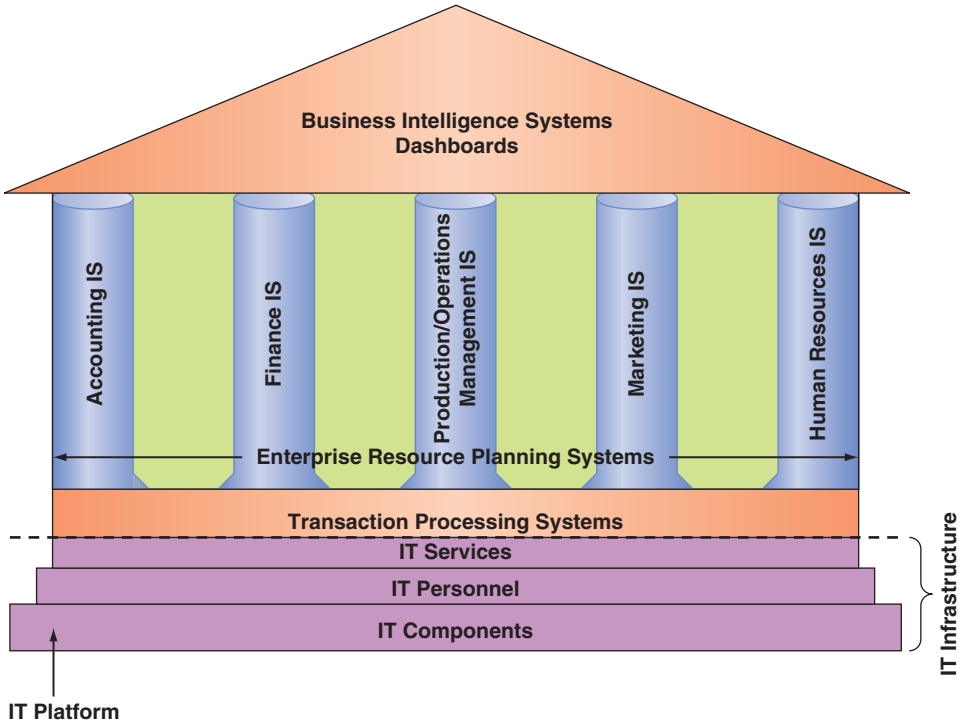

FIGURE 1.4 **Information technology inside your organization.**

TABLE 1.3 Major Capabilities of Information Systems

Perform high-speed, high-volume numerical computations.
Provide fast, accurate communication and collaboration within and among organizations.
Store huge amounts of information in an easy-to-access yet small space.
Allow quick and inexpensive access to vast amounts of information worldwide.
Analyze and interpret vast amounts of data quickly and efficiently.
Automate both semiautomatic business processes and manual tasks.

cumulatively are called **information technology services**. The IT components plus IT services make up the organization's **information technology infrastructure**. At the top of the pyramid are the various organizational information systems.

Computer-based information systems have many capabilities. **Table 1.3** summarizes the most important ones.

Information systems perform these various tasks via a wide spectrum of applications. An **application** (or **app**) is a computer program designed to support a specific task or business process. (A synonymous term is **application program**.) Each functional area or department within a business organization uses dozens of application programs. For example, the human resources department sometimes uses one application for screening job applicants and another for monitoring employee turnover. The collection of application programs in a single department is usually referred to as a **functional area information system** (also known as a **departmental information system**). For example, the collection of application programs in the human resources area is called the human resources information system (HRIS). There are collections of application programs—that is, departmental information systems—in the other functional areas as well, such as accounting, finance, marketing, and production/operations.

The importance of information systems cannot be understated. In fact, a 2016 report from the Software Alliance shows that information systems added more than *$1 trillion of value* to the U.S. gross domestic product.

Types of Computer-Based Information Systems

Modern organizations employ many different types of information systems. Figure 1.4 illustrates the different types of information systems that function *within* a single organization, and **Figure 1.5** shows the different types of information systems that function *among* multiple organizations. You will study transaction processing systems, management information systems, and enterprise resource planning systems in Chapter 10. You will learn about customer relationship management (CRM) systems in Chapter 11 and supply chain management (SCM) systems in Chapter 11.

In the next section, you will learn about the numerous and diverse types of information systems employed by modern organizations. You will also read about the types of support these systems provide.

Breadth of Support of Information Systems.

Certain information systems support parts of organizations, others support entire organizations, and still others support groups of organizations. This section addresses all of these systems.

Recall that each department or functional area within an organization has its own collection of application programs, or information systems. These functional area information systems (FAISs) are the supporting pillars for the information systems located at the top of Figure 1.4, namely, business intelligence systems and dashboards. As the name suggests, each FAIS supports a particular functional area within the organization. Examples are

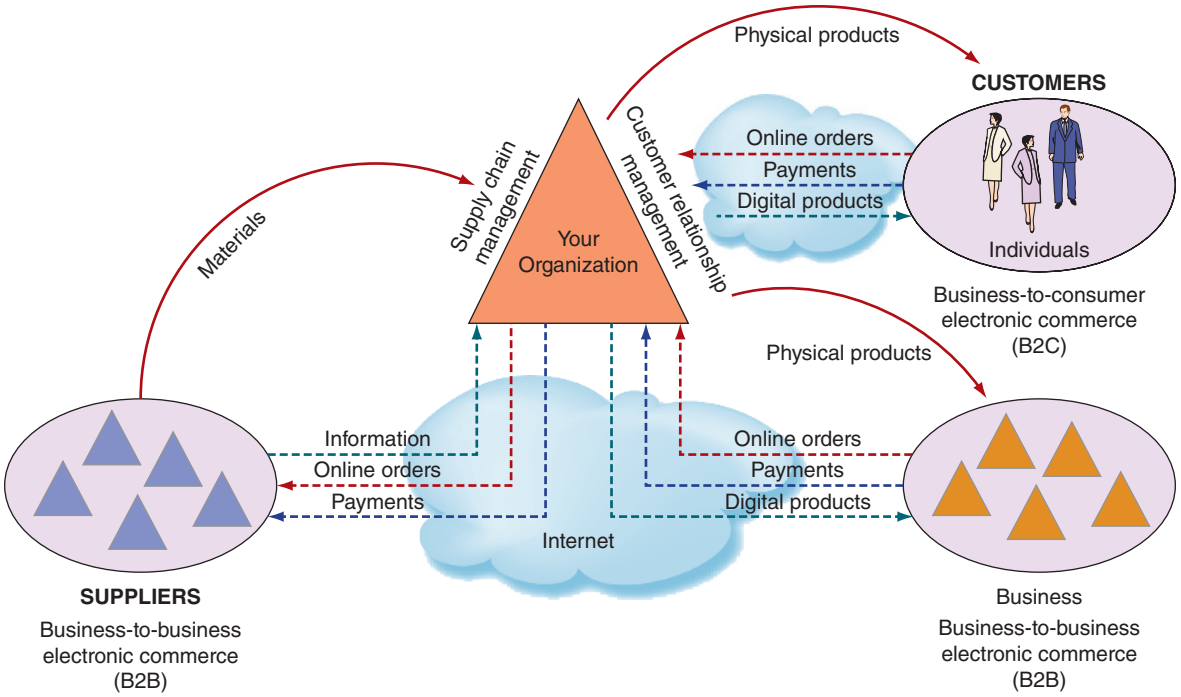

FIGURE 1.5 **Information systems that function among multiple organizations.**

accounting IS, finance IS, production/operations management (POM) IS, marketing IS, and human resources IS.

ACCT FIN Consider these examples of IT systems in the various functional areas of an organization. In finance and accounting, managers use IT systems to forecast revenues and business activity, to determine the best sources and uses of funds, and to perform audits to ensure that the organization is fundamentally sound and that all financial reports and documents are accurate.

MKT In sales and marketing, managers use information technology to perform the following functions:

- *Product analysis:* Developing new goods and services.
- *Site analysis:* Determining the best location for production and distribution facilities.
- *Promotion analysis:* Identifying the best advertising channels.
- *Price analysis:* Setting product prices to obtain the highest total revenues.

POM Marketing managers also use IT to manage their relationships with their customers. In *manufacturing*, managers use IT to process customer orders, develop production schedules, control inventory levels, and monitor product quality. They also use IT to design and manufacture products. These processes are called *computer-assisted design (CAD)* and *computer-assisted manufacturing (CAM)*.

HRM Managers in *human resources* use IT to manage the recruiting process, analyze and screen job applicants, and hire new employees. They also employ IT to help employees manage their careers, to administer performance tests to employees, and to monitor employee productivity. Finally, they rely on IT to manage compensation and benefits packages.

Two information systems that support the entire organization, **enterprise resource planning (ERP) systems** and transaction processing systems, are designed to correct a lack of communication among the functional area Information Systems. For this reason, Figure 1.4 shows ERP systems spanning the FAISs. ERP systems were an important innovation because organizations often developed the various functional area Information Systems as stand-alone systems that did not communicate effectively (if at all) with one another. ERP systems resolve this problem by tightly integrating the functional area Information Systems via a common database. In

doing so, they enhance communications among the functional areas of an organization. For this reason, experts credit ERP systems with greatly increasing organizational productivity.

A **transaction processing system (TPS)** supports the monitoring, collection, storage, and processing of data from the organization's basic business transactions, each of which generates data. When you are checking out at Walmart, for example, a transaction occurs each time the cashier swipes an item across the bar code reader. Significantly, within an organization, different functions or departments can define a transaction differently. In accounting, for example, a transaction is anything that changes a firm's chart of accounts. The information system definition of a transaction is broader: A transaction is anything that changes the firm's database. The chart of accounts is only part of the firm's database. Consider a scenario in which a student transfers from one section of an Introduction to MIS course to another section. This move would be a transaction to the university's information system but not to the university's accounting department (the tuition would not change).

The TPS collects data continuously, typically in *real time*—that is, as soon as the data are generated—and it provides the input data for the corporate databases. TPSs are considered critical to the success of any enterprise because they support core operations. Significantly, nearly all ERP systems are also TPSs, but not all TPSs are ERP systems. In fact, modern ERP systems incorporate many functions that previously were handled by the organization's functional area information systems. You study both TPSs and ERP systems in detail in Chapter 10.

ERP systems and TPSs function primarily within a single organization. Information systems that connect two or more organizations are referred to as **interorganizational information systems (IOSs)**. IOSs support many interorganizational operations, of which *supply chain management* is the best known. An organization's **supply chain** is the flow of materials, information, money, and services from suppliers of raw materials through factories and warehouses to the end customers.

Note that the supply chain in Figure 1.5 shows physical flows, information flows, and financial flows. Digitizable products are those that can be represented in electronic form, such as music and software. Information flows, financial flows, and digitizable products go through the Internet, whereas physical products are shipped. For example, when you order a computer from **www.dell.com**, your information goes to Dell via the Internet. When your transaction is completed (i.e., your credit card is approved and your order is processed), Dell ships your computer to you. (We discuss supply chains in more detail in Chapter 11.)

Electronic commerce (e-commerce) systems are another type of interorganizational information system. These systems enable organizations to conduct transactions, called business-to-business (B2B) electronic commerce, and customers to conduct transactions with businesses, called business-to-consumer (B2C) electronic commerce. Figure 1.5 illustrates B2B and B2C electronic commerce. Electronic commerce systems are so important that we discuss them in detail in Chapter 7, with additional examples interspersed throughout the text. IT's About Business 1.2 shows how information systems have enabled Opendoor to grow rapidly via e-commerce.

Support for Organizational Employees. So far, you have concentrated on information systems that support specific functional areas and operations. Now you will learn about information systems that typically support particular employees within the organization.

Clerical workers, who support managers at all levels of the organization, include bookkeepers, secretaries, electronic file clerks, and insurance claim processors. *Lower-level managers* handle the day-to-day operations of the organization, making routine decisions such as assigning tasks to employees and placing purchase orders. *Middle managers* make tactical decisions, which deal with activities such as short-term planning, organizing, and control.

Knowledge workers are professional employees such as financial and marketing analysts, engineers, lawyers, and accountants. All knowledge workers are experts in a particular subject area. They create information and knowledge that they integrate into the business. Knowledge workers, in turn, act as advisers to middle managers and executives. Finally, *executives* make decisions that deal with situations that can significantly change the manner in which business

IT's About Business 1.2

Opendoor Buys Homes for Cash

MIS MKT

The $1.4 trillion real estate market for traditional single-family homes has operated with few changes for decades. Now, start-up company Opendoor (**www.opendoor.com**), based in Phoenix, Arizona, is changing that market.

In 2014, Opendoor was founded on the idea that sellers will value the certainty of a sale over getting the absolute highest price; that is, Opendoor believes people will be willing to sell their homes for less in return for a less burdensome process with favorable timing. Furthermore, Opendoor's services should be particularly valuable during periods when home sales are slow. The company purchases only single-family homes, built after 1960, in the $125,000 to $500,000 range. Their goal is to sell quickly, thereby keeping holding costs to a minimum.

Opendoor's vision is to offer one-stop shopping for real estate transactions, allowing home buyers to obtain a mortgage and even customize their new homes. If Opendoor were to capture only 1 percent of the more than 5 million real estate transactions that take place annually in the United States, at an average price of $250,000, then the company's revenue would exceed $1 billion.

The Opendoor process begins when potential sellers complete an online form that collects extensive information regarding their home and its location. The company then uses a proprietary algorithm to determine which price to offer these individuals. The algorithm takes into account thousands of variables, including the home's square footage and number of bedrooms and bathrooms; its proximity to golf courses, parks, and freeways; its curb appeal (how the house looks from the street) and interior condition; whether the kitchen countertops are quartz, marble, or granite; whether the kitchen appliances are stainless steel; and many others. The company performs sophisticated analyses on these data. For example, most houses in Phoenix have swimming pools, which an appraiser might simply value at $10,000. In contrast, Opendoor has found that a nice pool in an affluent neighborhood could be worth $20,000, while a small pool in a less desirable neighborhood could be worth only $2,000.

After a seller accepts Opendoor's proposed price, the company sends inspectors to assess the home's condition and confirm the details provided by the seller. The company then prepares to close, for cash, from 3 to 60 days later, on a date selected by the seller.

Opendoor takes a service fee of 6 percent, similar to the standard real estate commission, plus an additional fee that varies based on the company's estimate of the riskiness of the transaction. This process brings the total charge for a sale to an average of 8 percent. If Opendoor believes that a particular home will be more difficult to sell or that market conditions are less favorable, then it may charge up to 6 percent for the risk, raising the total fee to 12 percent.

Opendoor typically borrows 90 percent of the purchase price. Once the company owns the home, it makes any necessary repairs and puts the home on the market at a slight markup. Potential buyers can view the home on their own timetable, using a key code to gain entry to the house. Buyers receive a 30-day guarantee that Opendoor will buy the property back if they are not satisfied. Opendoor also provides a two-year warranty on each home's electrical system and major appliances.

Opendoor takes no fees or commissions from buyers. As a result, if the company's pricing algorithm is correct, then it keeps the additional revenue from the markup. However, if the algorithm is wrong and the price falls to below what the company paid, then Opendoor can lose money on the transaction.

Some critics note that Opendoor's model has not been tested by a recession or a market crash. Opendoor responds that it can simply charge sellers higher fees to cover its risk. Also, home owners who need to sell would likely be willing to pay more for Opendoor's service in a down market than they would when prices are rising and selling is easy.

Opendoor claims that when it makes an offer to serious sellers, which it defines as people who plan to sell within six months, the offer is accepted one-third of the time. It further claims that their homes receive three times as many visits as traditional listings, primarily because prospective buyers do not have to make an appointment to view them.

After it opened in December 2014, Opendoor took less than two years to capture 2 percent of the Phoenix market. By mid-2019, the company had entered 20 markets and was purchasing approximately $2.5 billion in homes on an annual basis.

In March 2019, Opendoor raised $300 million in its latest round of financing, valuing the start-up at approximately $3.8 billion. With these funds, Opendoor planned to expand to 50 markets by the end of 2020. The company also noted that more than 800,000 people toured Opendoor homes in 2018.

Opendoor's success is attracting competition. For example, competitors such as Knock (**www.knock.com**) and OfferPad (**www.offerpad.com**) utilize similar business models and are raising capital.

However, this type of business is difficult to start because it requires both a viable pricing model and access to a large amount of capital. In fact, Opendoor faces substantial risks. For example, if home sellers know more about their properties than Opendoor does, then the company will be vulnerable. For example, a home owner might not disclose a plumbing problem that Opendoor inspectors missed. In addition, certain variables might be difficult to quantify. For example, are the schools in the neighborhood of questionable quality? Are potential zoning readjustments being considered for properties close by? Another risk is that home owners may not want to rely on a service that does not pay them top dollar. Further, Opendoor might not be able to sell as quickly as it would like or for the desired price.

Sources: Compiled from I. Lunden, "Opendoor Raises $300M on a $3.8B Valuation for Its Home Marketplace," *TechCrunch*, March 20, 2019; M. Lynley, "Opendoor Raises $325M to Make Buying and Selling Homes a Near-Instant Process," *TechCrunch*, June 13, 2018; M. Dickey, "Uber's Head of Finance Is Heading to Opendoor," *TechCrunch*, June 9, 2017; F. Manjoo, "The Rise of the Fat Start-Up," *New York Times*, May 24, 2017; M. Delprete, "Opendoor, Knock, and OfferPad: Growth in New Markets," *Inman*, April 10, 2017; M. Newlands, "Investing in Single-Family Homes Has Never Been Easier, Says This Oakland Startup," *Forbes*, January 10, 2017; A. Feldman, "Home Shopping Networkers," *Forbes*, December 20,

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Questions

1. **Provide two examples of how Opendoor uses information technology to support its business model.**
2. **How might Opendoor further use information technology to counter competitors who attempt to emulate the company's business model? Support your answer.**

is conducted. Examples of executive decisions are introducing a new product line, acquiring other businesses, and relocating operations to a foreign country.

Functional area information systems summarize data and prepare reports, primarily for middle managers but sometimes for lower-level managers as well. Because these reports typically concern a specific functional area, report generators (RPGs) are an important type of functional area IS.

Business analytics (BA) systems (also known as **business intelligence [BI] systems**) provide computer-based support for complex, nonroutine decisions, primarily for middle managers and knowledge workers. (They also support lower-level managers but to a lesser extent.) These systems are typically used with a data warehouse, and they enable users to perform their own data analysis. You learn about BA systems in Chapter 12.

Expert systems (ESs) attempt to duplicate the work of human experts by applying reasoning capabilities, knowledge, and expertise within a specific domain. They have become valuable in many application areas, primarily but not exclusively areas involving decision making. For example, navigation systems use rules to select routes, but we do not typically think of these systems as expert systems. Significantly, expert systems can operate as stand-alone systems or be embedded in other applications. We examine ESs in greater detail in Technology Guide 4.

Dashboards (or **digital dashboards**) are a special form of IS that support all managers of the organization. They provide rapid access to timely information and direct access to structured information in the form of reports. Dashboards that are tailored to the information needs of executives are called *executive dashboards*. Chapter 12 provides a thorough discussion of dashboards.

Table 1.4 provides an overview of the different types of information systems used by organizations.

TABLE 1.4 Types of Organizational Information Systems

Type of System	Function	Example
Transaction processing system	Processes transaction data from terminal.	Walmart checkout point-of-sale business events
Enterprise resource planning	Integrates all functional areas of the organization.	Oracle, SAP system
Functional area IS	Supports the activities within specific functional area.	System for processing payroll
Decision support system	Provides access to data and analysis tools.	"What-if" analysis of changes in budget
Expert system	Mimics human expert in a particular area and makes decisions.	Credit card approval analysis
Dashboards	Present structured, summarized information about aspects of business important to executives.	Status of sales by product
Supply chain management system	Manages flows of products, services, and information among organizations.	Walmart Retail Link system connecting suppliers to Walmart
Electronic commerce system	Enables transactions among organizations and between organizations and customers.	**www.dell.com**

Before you go on . . .

1. What is a computer-based information system?
2. Describe the components of computer-based information systems.
3. What is an application program?
4. Explain how information systems provide support for knowledge workers.
5. As we move up the organization's hierarchy from clerical workers to executives, how does the type of support provided by information systems change?

1.3 How Does IT Impact Organizations?

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Apply the Concept activities are available in the Appendix and in *WileyPLUS*.

Throughout this text, you will encounter numerous examples of how IT affects various types of organizations. These examples will make you aware of just how important IT actually is to organizations. In fact, for the vast majority of organizations, if their information systems fail, then they cease operations until the problems are found and fixed. Consider the following examples:

- In April 2018, an unsuccessful migration to a new software platform at TSB Bank (**www.tsb.co.uk**) in the United Kingdom caused major disruptions for weeks, angered the bank's 5 million customers, and led to the resignation of its CEO.
- In May 2018, a software problem at Australian telecommunications company Telstra (**www.telstra.com.au**) caused outages of its 3G and 4G wireless services nationwide for millions of its customers
- In July 2018, German supermarket company Lidl (**www.lidl.com**) stopped using a three-year-old merchandise management system after spending more than %565 million on it.

This section provides an overview of the impact of IT on modern organizations. As you read this section, you will learn how IT will affect you as well.

IT Impacts Entire Industries

As of mid-2019, the technology required to transform industries through software had been developed and integrated and could be delivered globally. In addition, software tools and Internet-based services enabled companies in many industries to launch new software-powered start-ups without investing in new infrastructure or training new employees. For example, in 2000, operating a basic Internet application cost businesses approximately $150,000 per month. In mid-2018, operating that same application in Amazon's cloud (see cloud computing in Technology Guide 3) cost less than $1,000 per month.

In essence, software is impacting every industry, and every organization must prepare for these impacts. Let's examine a few examples of software disruption across several industries. Many of these examples focus on two scenarios: (1) industries where software disrupted the previous market-leading companies and (2) industries where a new company (or companies) used software to achieve a competitive advantage.

The Book Industry. The largest book publisher and bookseller in the United States is Amazon, a software company. Amazon's core capability is its software engine, which can sell virtually anything online without building or maintaining any retail stores. Now, even books themselves have become software products, known as electronic (or digital) books, or eBooks. In 2018, physical books accounted for approximately $5 billion (83 percent of total book sales) and electronic books accounted for approximately $1 billion (16 percent of total book sales). (Interestingly, according to the 2018 Academic Student Ebook Experience Survey, 74 percent of respondents said that they preferred print books when reading for pleasure. Further more, 68 percent said that they preferred print books for assigned readings.)

Consider the Borders bookstore chain. In 2001, Borders agreed to hand over its online business to Amazon because it was convinced that online book sales were nonstrategic and unimportant. Ten years later, Borders filed for bankruptcy.

The Music Industry. Total U.S. album sales peaked at 785 million in 2000, which was the year after Napster was created. Napster was a service that allowed anyone with a computer and a reasonably fast Web connection to download and trade music for free. From 2000 to 2018, the major music labels (companies) worked diligently to eliminate illegal downloading and sharing. Despite these efforts, however, album sales continued to decline. The result was that the music labels earned about $8 billion less in annual retail sales in 2018 than they did in 2000. In addition, prior to 1999 six major music labels dominated the industry. By 2015, a series of mergers had reduced that number to the "Big Three": Warner Music Group (**www.wmg.com**), Universal Music (**www.universalmusic.com**), and Sony BMG (**www. sonybmg.com**).

These dramatic changes in the music industry resulted from the emergence of digital music-streaming technologies over the Internet. Two digital-streaming business models emerged: (1) Internet radio companies such as Pandora (**www.pandora.com**) that allow subscribers to passively listen to music that is customized for their tastes and (2) interactive companies such as Spotify (**www.spotify.com**) and Apple's iTunes (**www.apple.com/itunes**) that allow users to pick songs. Internet radio companies can operate under a government-mandated license that dictates how much they have to pay to recording artists. In contrast, interactive companies must make deals with labels and music publishers in order to license music for legal use in the United States.

Responding to these disruptions, the Big Three music labels have been buying stakes in digital entertainment start-ups, such as established streaming services Spotify (**www.spotify.com**) and Pandora (**www.pandora.com**). The labels buy stakes very cheaply, after which they often give themselves the right to buy larger amounts at deep discounts to market at a later date. The labels have purchased parts of start-ups such as choose-your-own-adventure music video seller Eko (**www.helloeko.com**), song-recognition company Shazam (**www.shazam.com**), and SoundCloud (**www.soundcloud.com**). Industry analysts estimate that the three labels have amassed positions in digital music start-ups valued at $3 billion.

The Video Industry. Blockbuster—which rented and sold videos and ancillary products through its chain of stores—was the industry leader until it was disrupted by a software company, Netflix (**www.netflix.com**). By the first quarter of 2018, Netflix had the largest subscriber base of any video service, with 125 million subscribers. Meanwhile, Blockbuster declared bankruptcy in February 2011 and was acquired by satellite television provider Dish Network (**www.dish.com**) a month later. In July, 2019 the last Blockbuster store in the world, located in Bend, Oregon, was still open.

MIS The Software Industry. Incumbent software companies such as Oracle and Microsoft are increasingly threatened by software-as-a-service (SaaS) products—for example, Salesforce (**www.salesforce.com**) and Android, an open-source operating system. (We discuss operating systems in Technology Guide 2 and SaaS in Technology Guide 3.)

The Videogame Industry. Today, the fastest-growing entertainment companies are video game makers—again, software. Examples are Zynga (**www.zynga.com**), the creator of FarmVille; Rovio (**www.rovio.com**), the maker of Angry Birds; and Minecraft (**www.minecraft.net**), now owned by Microsoft (**www.microsoft.com**).

The Photography Industry. Software disrupted this industry years ago. Today it is virtually impossible to buy a mobile phone that does not include a software-powered camera. In addition, people can upload photos automatically to the Internet for permanent archiving and global sharing. Leading photography companies include Shutterfly (**www.shutterfly.com**), Snapfish (**www.snapfish.com**), Flickr (**www.flickr.com**), and Instagram (**www.instagram.com**). Meanwhile, Kodak, the longtime market leader—whose name was almost synonymous with cameras—declared bankruptcy in January 2012.

MKT The Marketing Industry. Today's largest direct marketing companies include Facebook (**www.facebook.com**), Google (**www.google.com**), and Amazon (**www.amazon.com**). All of these companies are using software to disrupt the retail marketing industry.

HRM The Recruiting Industry. LinkedIn (**www.linkedin.com**) is disrupting the traditional job recruiting industry. For the first time, employees and job searchers can maintain their resumes on a publicly accessible website that interested parties can search in real time.

FIN The Financial Services Industry. Software has transformed the financial services industry. Practically every financial transaction—for example, buying and selling stocks—is now performed by software. Also, many of the leading innovators in financial services are software companies. For example, Square (**www.squareup.com**) allows anyone to accept credit card payments with a mobile phone.

The Motion Picture Industry. The process of making feature-length computer-generated films has become incredibly IT intensive. Studios require state-of-the-art information technologies, including massive numbers of servers, sophisticated software, and an enormous amount of storage (all described in Technology Guide 1).

Consider DreamWorks Animation (**www.dreamworksanimation.com**), a motion picture studio that creates animated feature films, television programs, and online virtual worlds. For a single motion picture, the studio manages more than 500,000 files and 300 terabytes (a terabyte is 1 trillion bytes) of data, and it uses about 80 million central processing unit (CPU; described in Technology Guide 1) hours. As DreamWorks executives state, "In reality, our product is data that looks like a movie. We are a digital manufacturing company."

Software is also disrupting industries that operate primarily in the physical world. Consider these examples:

- *The Automobile Industry:* In modern cars, software is responsible for running the engines, controlling safety features, entertaining passengers, guiding drivers to their destinations, and connecting the car to mobile, satellite, and GPS networks. Other software functions include Wi-Fi receivers, which turn your car into a mobile hot spot; software, which helps maximize fuel efficiency; and ultrasonic sensors, which enable some models to parallel-park automatically.

  The next step is to network all vehicles together, a necessary step toward the next major breakthrough: self-driving or driverless cars. Google, Tesla (**www.tesla.com**), Apple and, all major automobile companies are now developing driverless vehicles.
- *The Agriculture Industry:* Agriculture is increasingly powered by software, including satellite analysis of soils linked to per-acre seed-selection software algorithms. In addition, precision agriculture makes use of automated, driverless tractors controlled by global positioning systems (GPS) and software. (Precision agriculture is an approach to farm management that uses information technology to ensure that crops receive exactly what they need [e.g., water, fertilizer, and pesticides] for optimum health and productivity.)
- *The Fashion Industry:* Women have long "borrowed" special-occasion dresses from department stores, buying them and then returning them after wearing them for one evening. Now, Rent the Runway (**www.renttherunway.com**) has redefined the fashion business, making expensive clothing available to more women than ever before. The firm is also disrupting traditional physical retailers. After all, why buy a dress when you can rent one for a very low price? Some department stores feel so threatened by Rent the Runway that they have reportedly told vendors that they will remove floor merchandise if it ever shows up on that company's website.
- *The Legal Profession:* Today, electronic discovery (e-discovery) software applications can analyze documents in a fraction of the time that human lawyers would take, at a fraction of the cost. For example, Blackstone Discovery (**www.blackstonediscovery.com**) helped one company analyze 1.5 million documents for less than $100,000. That company estimated that the process would have cost $1.5 million had it been performed by lawyers.

Law firms are now beginning to use a new artificial intelligence software package called ROSS (**www.rossintelligence.com**). For example, law firm BakerHostetler has hired ROSS to serve as a legal researcher in bankruptcy cases.

IT Reduces the Number of Middle Managers

HRM IT makes managers more productive, and it increases the number of employees who can report to a single manager. Thus, IT ultimately decreases the number of managers and experts. Therefore, it is reasonable to assume that in the coming years, organizations will have fewer managerial levels and fewer staff and line managers. If this trend materializes, promotional opportunities will decrease, making promotions much more competitive. Bottom line: Pay attention in school!

IT Changes the Manager's Job

One of the most important tasks of managers is making decisions. A major consequence of IT has been to change the manner in which managers make their decisions. In this way, IT ultimately has changed managers' jobs.

IT often provides managers with near-real-time information, meaning that managers have less time to make decisions, making their jobs even more stressful. Fortunately, IT also provides many tools—for example, business analytics applications such as dashboards, search engines, and intranets—to help managers handle the volumes of information they must deal with on an ongoing basis.

So far in this section, we have been focusing on managers in general. Now, let's focus on you. Due to advances in IT, you will increasingly supervise employees and teams who are geographically dispersed. Employees can work from anywhere at any time, and teams can consist of employees who are literally dispersed throughout the world. Information technologies such as telepresence systems (discussed in Chapter 6) can help you manage these employees even though you do not often see them face-to-face. For these employees, electronic or "remote" supervision will become the norm. Remote supervision places greater emphasis on completed work and less emphasis on personal contacts and office politics. You will have to reassure your employees that they are valued members of the organization, thereby diminishing any feelings they might have of being isolated and "out of the loop."

Will IT Eliminate Jobs?

One major concern of every employee, part-time or full-time, is job security. Relentless cost-cutting measures in modern organizations often lead to large-scale layoffs. Put simply, organizations are responding to today's highly competitive environment by doing more with less. Regardless of your position, then, you consistently will have to add value to your organization and to make certain that your superiors are aware of this value.

Many companies have responded to difficult economic times, increased global competition, demands for customization, and increased consumer sophistication by increasing their investments in IT. In fact, as computers continue to advance in terms of intelligence and capabilities, the competitive advantage of replacing people with machines is increasing rapidly. This process frequently leads to layoffs. At the same time, however, IT creates entirely new categories of jobs, such as electronic medical record keeping and nanotechnology.

IT Impacts Employees at Work

Many people have experienced a loss of identity because of computerization. They feel like "just another number" because computers reduce or eliminate the human element present in noncomputerized systems.

The Internet threatens to exert an even more isolating influence than have computers and television. Encouraging people to work and shop from their living rooms could produce some unfortunate psychological effects, such as depression and loneliness.

HRM **IT Impacts Employees' Health and Safety.** Although computers and information systems are generally regarded as agents of "progress," they can adversely affect individuals' health and safety. To illustrate this point, we consider two issues associated with IT: job stress and long-term use of the keyboard.

An increase in an employee's workload and/or responsibilities can trigger *job stress*. Although computerization has benefited organizations by increasing productivity, it also has created an ever-expanding workload for some employees. Some workers feel overwhelmed and have become increasingly anxious about their job performance. These feelings of stress and anxiety can actually diminish rather than improve workers' productivity while jeopardizing their physical and mental health. Management can help alleviate these problems by providing training, redistributing the workload among workers, and hiring more workers.

On a more specific level, the long-term use of keyboards can lead to *repetitive strain injuries* such as backaches and muscle tension in the wrists and fingers. *Carpal tunnel syndrome* is a particularly painful form of repetitive strain injury that affects the wrists and hands.

Designers are aware of the potential problems associated with the prolonged use of computers. To address these problems, they continually attempt to design a better computing environment. The science of designing machines and work settings that minimize injury and illness is called *ergonomics*. The goal of ergonomics is to create an environment that is safe, well lit, and comfortable. Examples of ergonomically designed products are antiglare screens that alleviate problems of fatigued or damaged eyesight and chairs that contour the human body to decrease backaches. **Figure 1.6** displays some sample ergonomic products.

Media Bakery

Media Bakery

Media Bakery

Media Bakery

FIGURE 1.6 **Ergonomic products protect computer users.**

IT Provides Opportunities for People with Disabilities. Computers can create new employment opportunities for people with disabilities by integrating speech-recognition and vision-recognition capabilities. For example, individuals who cannot type can use a voice-operated keyboard, and individuals who cannot travel can work at home.

Going further, adaptive equipment for computers enables people with disabilities to perform tasks they normally would not be able to do. For example, the Web and graphical user interfaces (GUIs; e.g., Windows) can be difficult for people with impaired vision to use. To address this problem, manufacturers have added audible screen tips and voice interfaces, which essentially restore the functionality of computers to the way it was before GUIs become standard.

Other devices help improve the quality of life in more mundane but useful ways for people with disabilities. Examples are a two-way writing telephone, a robotic page turner, a hair brusher, and a hospital-bedside video trip to the zoo or the museum. Several organizations specialize in IT designed for people with disabilities.

Before you go on . . .

1. Why should employees in all functional areas become knowledgeable about IT?
2. Describe how IT might change the manager's job.
3. Discuss several ways in which IT impacts employees at work.

1.4 Importance of Information Systems to Society

Author Lecture Videos are available exclusively in *WileyPLUS*.
Apply the Concept activities are available in the Appendix and in *WileyPLUS*.

This section explains in greater detail why IT is important to society as a whole. Other examples of the impact of IT on society appear throughout the text.

IT Affects Our Quality of Life

IT has significant implications for our quality of life. The workplace can be expanded from the traditional 9-to-5 job at a central location to 24 hours a day at any location. IT can provide employees with flexibility that can significantly improve the quality of leisure time, even if it doesn't increase the total amount of leisure time.

From the opposite perspective, however, IT also can place employees on "constant call," which means they are never truly away from the office, even when they are on vacation. In fact, surveys reveal that the majority of respondents take their laptops and smartphones on their vacations, and 100 percent take their cell phones. Going further, the majority of respondents did some work while vacationing, and almost all of them checked their e-mail regularly.

The Robot Revolution Is Here Now

Once restricted largely to science fiction, robots that can perform practical tasks are now a reality. Around the world, autonomous devices have become increasingly common on factory floors, in hospital corridors, and in farm fields. These devices are called cobots (from *collaborative robot*). A *cobot* is a robot intended to physical interact with humans in a shared workspace. Let's look at two examples.

MKT POM **LoweBots.** In August 2016, Lowe's began to deploy Lowebots, which are multilingual, autonomous customer assistance robots. Lowebots help customers find their

way around the store and get the items they need. Lowebots also travel around the store and ask customers simple questions to discover what they are looking for. The robots provide directions and maps to products and share specialty knowledge with customers. The Lowebots also monitor inventory so the store knows what items need to be restocked.

Drones. A *drone* is an unmanned aerial vehicle (UAV) that either is controlled by pilots from the ground or autonomously follows a preprogrammed mission. Commercial drones function in a variety of business purposes, in contrast to drones used by hobbyists for recreational purposes.

Uber is using drones in an interesting way. The company is so successful in Mexico City that it feels comfortable using drones to tease drivers who are stuck in gridlocked traffic. One drone carried an ad saying, "Driving by yourself?" The idea was to guilt the driver into carpooling with UberPOOL.

Drones are being employed in many different ways. Two different uses are in the wine-making industry and in law enforcement. IT's About Business 1.3 discusses both applications.

IT's About Business 1.3

Diverse Uses for Drones

POM California Wineries

Wine industry analysts have predicted that, as a result of global warming, by 2050 many regions in Europe, including much of Italy and parts of southern France, could become unsuitable for wine grapes. The analysts also suggested that California wine production could decrease by 70 percent by that year.

In fact, California experienced a severe drought from 2012-2019, with warmer nights and drying aquifers (huge areas of underground water). As a result, the state's wineries are employing a variety of both technological and nontechnological methods to improve water utilization.

In the past, experienced winemakers had to physically inspect the vines and grapes. Today, wineries launch drones and deploy sensors to map areas of vines with GPS coordinates, and they proceed directly to those vines that exhibit problems. Specifically, drones equipped with sensors detect moisture by evaluating the colors of the vegetation. The wrong color can indicate nutritional deficiencies in the crops or irrigation leaks.

Drones can also examine plant growth, detect areas under stress from disease or lack of water, and help assess when pickers should have the next load of grapes ready to send to the winery. Normalized difference vegetation index (NDVI) maps, which highlight areas of high and low vegetation density, provide visual information on how to improve uniformity of growth within a vineyard and when to harvest vineyard areas for optimal grape quality.

POM Law Enforcement Agencies

In July 2019, approximately 350 U.S. agencies were using drones as part of their law enforcement activities. In fact, there has been a dramatic 500 percent increase in law enforcement drone use since 2016. These are the most common uses for drones in these agencies:

- Search and rescue
- Traffic collision reconstructions
- Active shooter scenarios
- Crime scene analysis
- General surveillance

Remotely controlled drones often arrive on crime scenes before officers in cars. Drones allow police officers to survey a scene prior to their physical arrival, enabling them to track a suspect's movements if one has been identified. Drones are more effective monitoring tools than fixed security cameras and more cost effective to operate than helicopters with onboard cameras. Let's look at a few examples of law enforcement agencies using drones:

- The use of a single, quadcopter drone in the city of Ensenada, Mexico, helped to reduce overall crime by some 10 percent, including a 30 percent decrease in burglaries. DJI's Inspire I quadcopter helped police officers in the city make over 500 arrests in four months.
- In the United Kingdom, Devon, Cornwall, and Dorset police officers teamed up in 2017 to launch a drone unit for assistance with missing person searches, gathering images from crime scenes and major traffic accidents, and taking part in coastal and woodland searches to fight wildlife crime.
- Police officers in the Bordeaux area of southwestern France are using drones to catch drivers violating traffic laws. The drones are much cheaper than helicopter surveillance that the police sometimes use to catch traffic offenders. Drone surveillance does have one limitation. While drones can reveal dangerous driving, such as cars zigzagging through traffic for example, they are not suitable for detecting speeding.
- Looking ahead, Amazon has filed a patent for tiny drones that would be useful for a number of tasks. For example, Amazon envisages these drones traveling with law enforcement officers to assist them in their work. In this capacity, the drones could record video, meaning that they could replace the dashboard cameras in many police cars. Specifically, the drones

could hover just above or behind officers, take photos of license plates and drivers, and then feed that data back to the police department for facial recognition. In a chase of two people, an officer could direct a drone to follow one person while he or she follows the other.

There are, however, many opponents of the use of drones by law enforcement agencies. For example, the city of Seattle, Washington, donated their drones to the city of Los Angeles because Seattle citizens objected so strongly to their deployment.

Public unease with law enforcement drones is occurring at the same time as overwhelming support for the use of police body cameras. This discrepancy raises the question of who or what can surveil and record a city's citizens and under what investigative circumstances.

Sources: Compiled from J. Stewart, "A Single Drone Helped Mexican Police Drop Crime 10 Percent," *Wired*, June 11, 2018; G. Manaugh, "Drone Cops Take Flight in Los Angeles," *The Atlantic*, June 8, 2018; "Like It or Not, Camera-Equipped Police Drones Will Soon Patrol the Skies," *Digital Trends*, June 6, 2018; M. Uleski, "How Unmanned Aerial Systems Can Assist Police Pursuits," *PoliceOne.com*, March 19, 2018; G. Friese, "Research: Drone Video Effective in Identifying Multiple Vehicle Collision Hazards," *PoliceOne.com*, March 14, 2018; V. Masters, "How a Washington PD Is Leveraging Drone Technology to Serve Citizens," *PoliceOne.com*, February 22, 2018; J. Laurenson, "France Is Using Drones to Catch Dangerous Drivers," *Marketplace.org*, November 13, 2017; M. Margaritoff, "Drones in Law Enforcement: How, Where, and When They're Used," *The Drive*, October 13, 2017; "'Drone Unit' for British Police Brings Crime Fighting to the Skies," *Digital Trends*, July 15, 2017; A. Nixon, "Best Drones for Agriculture 2017," *bestoneforthejob.com*, May 4, 2017; A. King, "Technology: The Future of Agriculture," *Nature*, April 27, 2017; T. Jennings, "Farming Drones: The Future of Agriculture?" *CropLife*, April 7, 2017; A. Glaser, "Police Departments Are Using Drones to Find and Chase Down Suspects," *Recode*, April 6, 2017; T. Sparapani, "How Big Data and Tech Will Improve Agriculture, from Farm to Table," *Forbes*, March 23, 2017; "Technology That Will Change Agriculture in 2017," *Food and Farm Discussion Lab*, March 22, 2017; T. Logan, "Drone Mapping in Agriculture on the Rise," ABC News, March 6, 2017; D. Gelles, "Falcons, Drones, Data: A Winery Battles Climate Change," *New York Times*, January 5, 2017; C. Daileda, "Amazon Wants Its Tiny Drones to Ride with Police," *Mashable*, November 2, 2016; and B. Vyenielo, "High-Tech Sustainability: Wineries Turn to High-Tech Solutions for Sustainable Business," *Vineyard & Winery Management*, September–October 2016.

Questions

1. **Compare and contrast the nontechnological and technological methods that wineries are using to combat global warming.**
2. **What other uses for drones would you suggest to wineries?**
3. **Describe other applications for drones in law enforcement.**
4. **Describe potential problems that drone use by law enforcement agencies could cause for citizens.**

Autonomous Vehicles. When you think about autonomous vehicles, consider these statistics:

- Human error accounts for more than 90 percent of automobile accidents.
- Each year, more than 6 million vehicle accidents are reported to law enforcement.
- Each year, approximately 35,000 Americans and 1.25 million people worldwide die in automobile accidents.
- With mobile devices providing a distraction, U.S. highway fatalities increased 8 percent in 2016, the largest increase in 50 years.
- The average car in the United States is used two hours per day, which is only 8 percent of the time.

These statistics offer compelling reasons for autonomous vehicles, and the development of these vehicles is proceeding rapidly. Leading autonomous vehicle companies are Waymo (**www.waymo.com**), GM Cruise (**www.getcruise.com**), and Ford Autonomous (**www.ford.com**).

There is some bad news, however. Several fatalities have been reported with Tesla automobiles on full autopilot (self-driving mode). Whether these deaths were caused by the automobiles is under investigation.

It probably will be a long time before we see robots making decisions by themselves, handling unfamiliar situations, and interacting with people. Nevertheless, robots are extremely helpful in various environments, particularly those that are repetitive, harsh, or dangerous to humans.

IT Impacts Health Care

IT has brought about major improvements in health care delivery. Medical personnel use IT to make better and faster diagnoses and to monitor critically ill patients more accurately. IT

also has streamlined the process of researching and developing new drugs. Expert systems now help doctors diagnose diseases, and machine vision is enhancing the work of radiologists. Surgeons use virtual reality to plan complex surgeries. They also employ surgical robots to perform long-distance surgery. Finally, doctors discuss complex medical cases via videoconferencing. New computer simulations re-create the sense of touch, allowing doctors in training to perform virtual procedures without risking harm to an actual patient.

Information technology can be applied to improve the efficiency and effectiveness of health care. For example, consider IBM Watson (**www.ibm.com/watson**), an IT system that uses natural language processing and machine learning (discussed in Technology Guide 4) to reveal insights from vast collections of data. We take a closer look at Watson in the next section.

Among the thousands of other health care applications, administrative systems are critically important. These systems perform functions ranging from detecting insurance fraud to creating nursing schedules to performing financial and marketing management.

The Internet contains vast amounts of useful medical information. Despite the fact that this information exists on the Internet, physicians caution against self-diagnosis. Rather, people should use diagnostic information obtained from Google and medical websites such as WebMD (**www.webmd.com**) only to ask questions of their physicians.

The Emergence of Cognitive Computing: IBM Watson

MIS IBM (**www.ibm.com**) developed Watson specifically to answer questions on the quiz show *Jeopardy!* In February 2011, Watson competed on *Jeopardy!* against former winners Brad Rutter and Ken Jennings. Watson won the game series and received the first prize of $1 million. (In *Jeopardy!* the host reads the answer, and the contestants must then provide the correct question.)

Watson is an application of advanced natural language processing, information retrieval, knowledge representation and reasoning, and machine learning technologies to the field of answering open-domain (general) questions. IBM has labeled the type of processing demonstrated by Watson as *cognitive computing*. Four primary capabilities distinguish Watson as a cognitive system:

- The ability to understand human language, with all of its nuance and ambiguity
- The ability to learn and absorb information
- The ability to formulate hypotheses
- The ability to understand the context of a question

By mid-2019, thousands of firms in at least 20 industries were using Watson in a variety of applications. Let's consider some of them here.

- *Medicine:* Although some health data are structured—for example, blood pressure readings and cholesterol counts—the vast majority are unstructured. These data include textbooks, medical journals, patient records, and nurse and physician notes. In fact, modern medicine entails so much unstructured data that their rapid growth has surpassed the ability of health care practitioners to keep up. IBM emphasizes that Watson is *not* intended to replace doctors. Rather, its purpose is to assist them in avoiding medical errors and fine-tuning their medical diagnoses.

  By mid-2010, Watson had digested millions of medical and scientific articles as well as information about thousands of clinical trials collected from **www.clinicaltrials.gov**, the federal government's public database. The system can read—and remember—patient histories, monitor the latest drug trials, examine the potency of new therapies, and closely follow state-of-the-art guidelines that help doctors choose the best treatments. Watson can also analyze images such as MRIs. To exploit these capabilities, two top-ranked hospitals are collaborating with Watson in the field of oncology (cancer care): Memorial Sloan Kettering (**www.mskcc.org**) and the Mayo Clinic (**www.mayoclinic.org**).

- MKT *Customer Service:* The Watson Engagement Advisor is designed to help customer representatives assist consumers with deeper insights more quickly than was previously possible. Engagement Advisor's "Ask Watson" feature can quickly address customers' questions, offer feedback to guide their purchase decisions, and troubleshoot their problems. Companies employing the Advisor include USAA (**www.usaa.com**), Genesys (**www.genesys.com**), DBS Bank of Singapore (**www.dbs.com.sg**), and many others.
- FIN *Financial Services:* Many financial organizations have integrated Watson into their business processes. As one example, Citigroup (**www.citigroup.com**) employs Watson to analyze financial, regulatory, economic, and social data across financial exchanges, currencies, and funds to help simplify and improve the bank's digital interactions with its customers.
- *Travel Services:* Terry Jones, founder of Travelocity (**www.travelocity.com**) and Kayak (**www.kayak.com**), has launched WayBlazer (**www.wayblazer.ai**), a new travel company powered by Watson. Watson engages and advises users through a natural language interface to help create the best travel experience.

Other Interesting Applications:

- ACCT Tax preparation firm H&R Block (**www.hrblock.com**) is using IBM Watson to assist the firm's clients with their taxes. Clients interact with Watson via natural language processing, answering questions from Watson pertinent to their tax returns. H&R Block hopes that by feeding Watson this tax return data (along with answers provided by human tax preparers), the company can improve the performance of all of their tax preparers. In essence, Watson will act as a central repository for tax experts' knowledge. The company asserts that they are not using Watson to replace human workers.
- POM BNSF Railway (**www.bnsf.com**) is using Watson to help detect faulty sections in the company's 32,500 miles of track before they break.
- Repsol (**www.repsol.com**), a global energy company, is using Watson to improve its strategic decision making in crucial areas such as optimizing oil reservoir production and discovering new oil fields.
- Edge Up Sports teamed with Watson to bring analytical capabilities to fantasy football. The company's app can analyze the vast amounts of available data about football and its players, thereby enabling fantasy league players to make better decisions.
- General Motors began rolling out smarter vehicles in 2017 with its new cognitive mobility platform OnStar Go, powered by Watson. OnStar Go is capable of identifying information about the car and its surroundings. For example, OnStar Go will immediately call the driver when air bags are deployed. If the system does not receive an immediate answer, it will call 911 and direct first responders to the car's location.
- The 2017 Wimbledon tennis tournament introduced a voice-activated digital assistant named "Fred," powered by Watson. Fred helped attendees find their way around the All England Lawn Tennis Club and informed them as to who was playing on Centre Court. Fred also compiled highlight videos of the matches.

Before you go on . . .

1. What are some of the quality-of-life improvements made possible by IT? Has IT had any negative effects on our quality of life? If so, explain and provide examples.
2. Describe the robotic revolution and consider its implications for humans. How do you think robotics will affect your life in the future?
3. Explain how IT has improved health care practices. Has the application of IT to health care created any problems or challenges?

What's in IT for me?

In Section 1.2, we discussed how IT supports each of the functional areas of the organization. Here we examine the MIS function.

MIS For the MIS Major

The MIS function directly supports all other functional areas in an organization; that is, the MIS function is responsible for providing the information that each functional area needs in order to make decisions. The overall objective of MIS personnel is to help users improve performance and solve business problems using IT. To accomplish this objective, MIS personnel must understand both the information requirements and the technology associated with each functional area. Given their position, however, they must think "business needs" first and "technology" second.

Summary

1.1 Identify the reasons why being an informed user of information systems is important in today's world.

The benefits of being an informed user of IT include the following:

- You will benefit more from your organization's IT applications because you will understand what is "behind" those applications.
- You will be able to provide input into your organization's IT applications, thus improving the quality of those applications.
- You will quickly be in a position to recommend or to participate in the selection of IT applications that your organization will use.
- You will be able to keep up with rapid developments in existing information technologies as well as the introduction of new technologies.
- You will understand the potential impacts that "new and improved" technologies will have on your organization. Consequently, you will be qualified to make recommendations concerning their adoption and use.
- You will play a key role in managing the information systems in your organization.
- You will be in a position to use IT if you decide to start your own business.

1.2 Describe the various types of computer-based information systems in an organization.

- Transaction processing systems (TPSs) support the monitoring, collection, storage, and processing of data from the organization's basic business transactions, each of which generates data.
- Functional area information systems (FAISs) support a particular functional area within the organization.
- Interorganizational information systems (IOSs) support many interorganizational operations, of which supply chain management is the best known.
- Enterprise resource planning (ERP) systems correct a lack of communication among the FAISs by tightly integrating the functional area Information Systems via a common database.
- Electronic commerce (e-commerce) systems enable organizations to conduct transactions with other organizations (called business-to-business [B2B] electronic commerce) and with customers (called business-to-consumer [B2C] electronic commerce).
- Business analytics (BA) systems provide computer-based support for complex, nonroutine decisions, primarily for middle managers and knowledge workers.
- Expert systems (ESs) attempt to duplicate the work of human experts by applying reasoning capabilities, knowledge, and expertise within a specific domain.

1.3 Discuss ways in which information technology can affect managers and nonmanagerial workers.

Potential IT impacts on managers:

- IT may reduce the number of middle managers.
- IT will provide managers with real-time or near-real-time information, meaning that managers will have less time to make decisions.
- IT will increase the likelihood that managers will have to supervise geographically dispersed employees and teams.

Potential IT impacts on nonmanagerial workers:

- IT may eliminate jobs.
- IT may cause employees to experience a loss of identity.
- IT can cause job stress and physical problems, such as repetitive stress injury.

1.4 List positive and negative societal effects of the increased use of information technology.

Positive societal effects:

- IT can provide opportunities for people with disabilities.
- IT can provide people with flexibility in their work (e.g., work from anywhere, anytime).
- Robots will take over mundane chores.
- IT will enable improvements in health care.

Negative societal effects:

- IT can cause health problems for individuals.
- IT can place employees on constant call.
- IT can potentially misinform patients about their health problems.

Chapter Glossary

application (or app) A computer program designed to support a specific task or business process.

business analytics (BA) systems Systems that provide computer-based support for complex, nonroutine decisions, primarily for middle managers and knowledge workers.

business intelligence (BI) systems See **business analytics (BA) systems**.

computer-based information system (CBIS) An information system that uses computer technology to perform some or all of its intended tasks.

dashboards (or digital dashboards) A special form of IS that supports all managers of the organization by providing rapid access to timely information and direct access to structured information in the form of reports.

data items An elementary description of things, events, activities, and transactions that are recorded, classified, and stored but are not organized to convey any specific meaning.

database A collection of related files or tables containing data.

digital transformation The business strategy that leverages IT to dramatically improve employee, customer, and business partner relationships; support continuous improvement in business operations and business processes; and develop new business models and businesses.

electronic commerce (e-commerce) systems A type of interorganizational information system that enables organizations to conduct transactions, called business-to-business (B2B) electronic commerce, and customers to conduct transactions with businesses, called business-to-consumer (B2C) electronic commerce.

enterprise resource planning (ERP) systems Information systems that correct a lack of communication among the functional area Information Systems by tightly integrating the functional area Information Systems via a common database.

expert systems (ESs) An attempt to duplicate the work of human experts by applying reasoning capabilities, knowledge, and expertise within a specific domain.

functional area information systems (FAISs) (departmental information system) Information Systems that support a particular functional area within the organization.

hardware A device such as a processor, monitor, keyboard, or printer. Together, these devices accept, process, and display data and information.

information Data that have been organized so that they have meaning and value to the recipient.

information system (IS) A system that collects, processes, stores, analyzes, and disseminates information for a specific purpose.

information technology (IT) Any computer-based tool that people use to work with information and support the information and information-processing needs of an organization.

information technology components Hardware, software, databases, and networks.

information technology infrastructure IT components plus IT services.

information technology platform The name given to the combination of the IT components of hardware, software, networks (wireline and wireless), and databases.

information technology services Activities performed by IT personnel using IT components, specifically, developing information systems, overseeing security and risk, and managing data.

informed user A person who is knowledgeable about information systems and information technology.

interorganizational information systems (IOSs) Information systems that connect two or more organizations.

knowledge Data and/or information that have been organized and processed to convey understanding, experience, accumulated learning, and expertise as they apply to a current problem or activity.

knowledge workers Professional employees such as financial and marketing analysts, engineers, lawyers, and accountants who are experts in a particular subject area and who create information and knowledge, which they integrate into the business.

network A connecting system (wireline or wireless) that enables multiple computers to share resources.

procedures The set of instructions for combining hardware, software, database, and network components in order to process information and generate the desired output.

software A program or collection of programs that enable the hardware to process data.

supply chain The flow of materials, information, money, and services from suppliers of raw materials through factories and warehouses to the end customers.

transaction processing system (TPS) A system that supports the monitoring, collection, storage, and processing of data from the organization's basic business transactions, each of which generates data.

Discussion Questions

1. Describe a business that you would like to start. Discuss how information technology could (a) help you find and research an idea for a business, (b) help you formulate your business plan, and (c) help you finance your business.

2. Your university wants to recruit high-quality high school students from your state. Provide examples of (a) the data that your recruiters would gather in this process, (b) the information that your recruiters would process from these data, and (c) the types of knowledge that your recruiters would infer from this information.

3. Can the terms *data*, *information*, and *knowledge* have different meanings for different people? Support your answer with examples.

4. Information technology makes it possible to "never be out of touch." Discuss the pros and cons of always being available to your employers and clients (regardless of where you are or what you are doing).

5. Robots have the positive impact of being able to relieve humans from working in dangerous conditions. What are some negative impacts of robots in the workplace?

6. Is it possible to endanger yourself by accessing too much medical information on the Web? Why or why not? Support your answer.

7. Describe other potential impacts of IT on societies as a whole.

8. What are the major reasons why it is important for employees in all functional areas to become familiar with IT?

9. Given that information technology is impacting every industry, what does this mean for a company's employees? Provide specific examples to support your answer.

10. Given that information technology is impacting every industry, what does this mean for students attending a college of business? Provide specific examples to support your answer.

11. Is the vast amount of medical information on the Web a good thing? Answer from the standpoint of a patient and from the standpoint of a physician.

Problem-Solving Activities

1. Visit some websites that offer employment opportunities in IT. Prominent examples include the following: **www.dice.com**, **www.monster.com**, **www.collegerecruiter.com**, **www.careerbuilder.com**, **www.job.com**, **www.career.com**, **www.simplyhired.com**, and **www.true-career.com**. Compare the IT salaries to salaries offered to accountants, marketing personnel, financial personnel, operations personnel, and human resources personnel. For other information on IT salaries, check *Computerworld*'s annual salary survey.

2. Enter the website of UPS (**www.ups.com**).

a. Find out what information is available to customers before they send a package.

b. Find out about the "package tracking" system.

c. Compute the cost of delivering a 10" × 20" × 15" box, weighing 40 pounds, from your hometown to Long Beach, California (or to Lansing, Michigan, if you live in or near Long Beach). Compare the fastest delivery against the lowest cost. How long did this process take? Look into the business services offered by UPS. How do they make this process easier when you are a business customer?

3. Surf the Internet for information about the Department of Homeland Security (DHS). Examine the available information and comment on the role of information technologies in the department.

4. Access **www.irobot.com** and investigate the company's Education and Research Robots. Surf the Web for other companies that manufacture robots and compare their products with those of iRobot.

Closing Case

POM MIS John Deere Becomes a Technology Company, and It Is Not All Good News

Farming is highly land and labor intensive. In the past, farmers managed all the plants in a field approximately the same way. To do this, they had to assume that all plants in a field were at the same growth stage, all were in the same health, and all needed the same nutrients.

Today, farmers are able to treat individual plants using precision agriculture. Precision agriculture is a farm management approach that uses a number of technologies, including global positioning systems (GPS; see Chapter 8), sensors (see Chapter 8), robotics, drones, autonomous vehicles, artificial intelligence, and computer vision (these last five technologies are discussed in Technology Guide 4) to increase efficiency and ensure profitability while protecting the environment. Communications among these technologies will be improved with fifth-generation (5G) wireless technology, expected to be widely deployed by 2020.

Founded in 1837, John Deere (**www.deere.com**) is the largest agricultural equipment manufacturer in the world with 2018 global revenues of $37 billion. Deere is changing its business model by undergoing digital transformation. In the past, Deere generated revenue one time, with each sale. Today, Deere embeds the precision agriculture technologies noted above into its equipment. With these technologies, machines communicate with each other, with the farmer, and with external services, such as satellite mapping and image generation. The machines also generate data that Deere can help the farmer analyze. As a result, Deere can provide additional services after each sale, creating more continuous revenue flows from each customer.

The company began its transformation in 1999 with the acquisition of NavCom Technology for its GPS system. Consequently, Deere began embedding GPS receivers into its large farm equipment, such as tractors and combines, thereby turning the machines into nodes on the Internet of Things (see Chapter 8). The GPS receivers allowed the machines to steer themselves, enabling them to steer more accurate paths within fields with less overlap. As a result, farmers could work longer with less fatigue.

Deere then connected its machines into the company's own cloud computing platform, called the John Deere Operations Center (see Technology Guide 3). Through Deere's Center, farmers can monitor and operate machinery, check the health of crops, and monitor environmental conditions. Deere's platform can gather and analyze data from onboard sensors to offer predictive maintenance on machines, thereby reducing the possibility of expensive downtime on the machines (see Chapter 12).

By July 2018, Deere had more than 70 business partners that could access Deere's platform to help farmers analyze their data.

These companies provide satellite imagery, drone integration, visualization, and other tools to which farmers can apply their data. The companies range from smaller drone start-ups, such as Precision Hawk (**www.precisionhawk.com**) and Green Aero Tech (**www.greenaerotech.com**), to giants, such as Monsanto (**www.monsanto.com**), Syngenta (**www.syngenta.com**), and DuPont (**www.dupont.com**). As part of its continuing effort to change the strategy of Deere beyond acquiring technology companies, Deere opened up its own innovation lab in San Francisco in 2017.

In September 2017, Deere purchased Blue River Technology (**www.bluerivertechnology.com**), a developer of crop-spraying robots that utilize computer vision and machine learning to differentiate between weeds and crops so that farmers spray herbicides only on weeds. Because the robot can target weeds with squirts of herbicide the size of a postage stamp, it can reduce the amount of herbicide that farmers use by some 90 percent. Blue River is also developing a robot (called LettuceBot) for precision lettuce thinning and a drone imaging system that collects data from fields.

A Negative Consequence of John Deere's Digital Transformation

Unfortunately, Deere's transformation has led to a serious, negative consequence. The company is making it difficult for consumers and independent repair shops to repair today's equipment, which operates on copyright-protected software.

As a result, farmers who buy Deere tractors cannot repair their equipment themselves. Instead, they must work with company-approved technicians who may take time to arrive and can be expensive. For example, Deere charges $230, plus $130 per hour for a technician to come to a farm and plug a USB connector between the tractor and the technician's computer to authorize the repair and any needed parts. Essentially, Deere sells their tractors to farmers and uses software to control every aspect of the tractors' use after the sale.

Consequently, many farmers are supporting "right-to-repair" legislation. Such bills, which have been proposed in 19 states, would allow owners to repair their equipment themselves without voiding warranties or agreements and require equipment manufacturers such as Deere to offer the diagnostic tools, manuals, and other supplies that farmers need to fix their own machines. As expected, Deere opposes the right-to-repair legislation.

Interestingly, Apple also opposes the right-to-repair legislation. Apple argues that the bills could result in poor repair work or make consumers vulnerable to hackers. Right-to-repair advocates say that Apple, which offers iPhone repair services at every Apple store, wants to maintain control of its share of the approximately $4 billion smartphone repair business.

The Deere controversy had its beginning in the debate over jailbreaking iPhones and other high-tech devices. The legal question underlying this controversy centers on the Digital Millennium Copyright Act (DMCA).

The DMCA is a U.S. copyright law that criminalizes production and dissemination of technology, devices, or services intended to circumvent measures that control access to copyrighted works and also criminalizes the act of circumventing an access control. The DMCA was originally meant to stop people from pirating music and movies but has arguably been taken advantage of by companies selling a wide variety of devices containing software.

After the passage of the DMCA, regulators considered whether there should be exceptions to the law. In such cases, consumers might have the right to circumvent technical protection measures (TPMs) intended to protect intellectual property and protect the rights of intellectual property holders. The U.S. Copyright Office subsequently exempted 27 classes of intellectual property from TPMs. Class 21 covers a variety of types of motor vehicles, including mechanized farm equipment.

Deere pointed out that the Class 21 exemption is for the equipment owners themselves but prevents owners from transferring the right to modify software "to third parties, such as repair shops or hackers." Deere argued further that the manufacturer needed to control access to their equipment's software to ensure machine functionality, safety, and emissions compliance and to preserve product warranties.

After the Class 21 exemption, Deere began requiring its customers to sign an updated End User Licensing Agreement (EULA) that restricted their ability to repair or modify their equipment, in essence requiring them to use Deere-certified diagnostic and repair software. Despite the Class 21 exemption, farmers say that Deere still keeps tight control over how its customers service their equipment. In fact, Deere locks the Engine Control Module reading function, which forces farmers to use its services. Violation of the EULA would be considered a breach of contract, meaning that Deere would have to sue its own customers if it wants to enforce the EULA.

Farmers note that this problem poses a threat to their livelihood if their tractor breaks at an inopportune time. One farmer stated that he does not have time to wait for a dealership employee to come to his farm and repair his tractor, particularly at harvest time. The farmer went on to say that most all repairs on new equipment require software downloads. Ultimately, farmers fear that Deere could remotely shut down a tractor and there would be nothing that they could do about it.

The controversy has led to a growing market where farmers and independent repair shops can buy unlicensed alternative software and associated diagnostic equipment on invitation-only, paid online forums. Much of the software comes from Ukraine. The software being traded on various forums includes the following:

- John Deere Service Advisor: A diagnostic program used by Deere technicians that recalibrates tractors and can diagnose broken parts.
- John Deere Payload files: These files specifically program certain parts of the tractor. For example, the files can customize and fine-tune the performance of the chassis, engine, and cab.
- John Deere Electronic Data Link drivers: This software allows a computer to communicate with a tractor.
- Also for sale on the forums are license key generators, speed-limit modifiers, and cables that allow farmers to connect a tractor to a computer. Demonstrations of all this software in operation can be found on YouTube.

Sources: Compiled from A. Minter, "U.S. Farmers Are Being Bled by the Tractor Monopoly," *Bloomberg.com*, April 23, 2019 D. Swinhoe, "How Tractor Seller John Deere Became a Technology Company," *IDG Connect*, June 5, 2018; D. Newman, "Top Six Digital Transformation Trends in Agriculture," *Forbes*, May 14, 2018; N. Gagliordi, "How 5G Will Impact the Future of Farming and John Deere's Digital Transformation," *ZDNet*, February 2, 2018; T. Simonite, "Why John Deere Just Spent $305 Million on a Lettuce-Farming Robot," *Wired*, September 6, 2017; M. Lev-Ram, "John Deere Is Paying $305 Million for This Silicon Valley Company," *Fortune*, September 6, 2017; J. Hightower, "John Deere Is Against the Right to Repair Its Equipment," *AlterNet*, August 1, 2017; J. Roberts, "One Controversial Thing Tractors and iPhones Have in Common," *Fortune*, June 29, 2017; A. Fitzpatrick, "Hand Me That Wrench: Farmers and Apple Fight over the Toolbox," *Time*, June 22, 2017; A. Ebrahimzadeh, "Will Farmers or 3rd Party Repair Shops Sue John Deere for Allegedly Contractually

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Questions

1. Describe how Deere's digital transformation changed its business model.
2. Describe the various applications that Deere employed in its digital transformation.
3. Discuss why Deere's digital transformation is "not all good news."

Look ahead to Chapter 3 for the next three questions:

4. Discuss the ethicality and the legality of John Deere's end-user licensing agreement that it requires its customers to sign.
5. Discuss the ethicality and the legality of John Deere customers who use unlicensed repair shops to repair their equipment using hacked software.
6. The fundamental tenets of ethics include responsibility, accountability, and liability. Discuss each of these tenets as it applies to John Deere's actions toward its customers.