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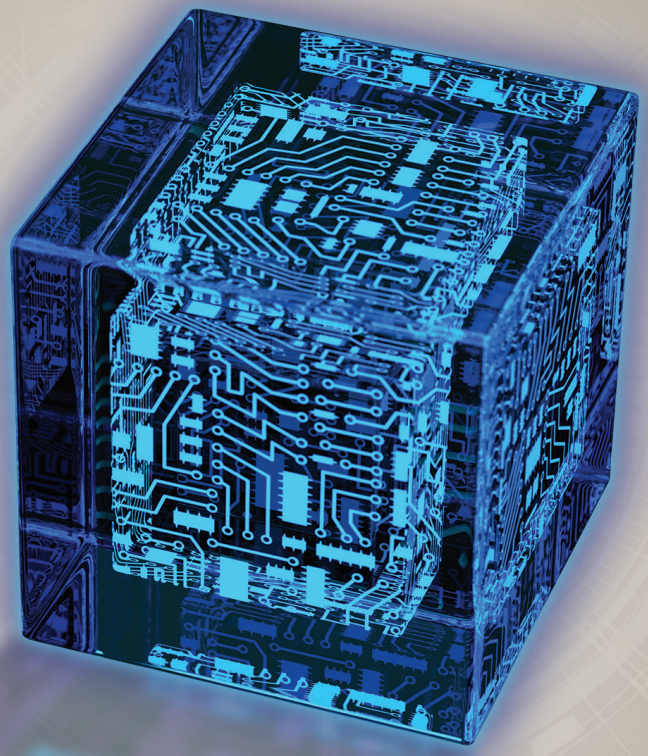

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To so many fine memories of my mother, Ashraf, my father, Mohammad, and my brother, Mohsen, for their uncompromising belief in the power of education. —Hossein Bidgoli

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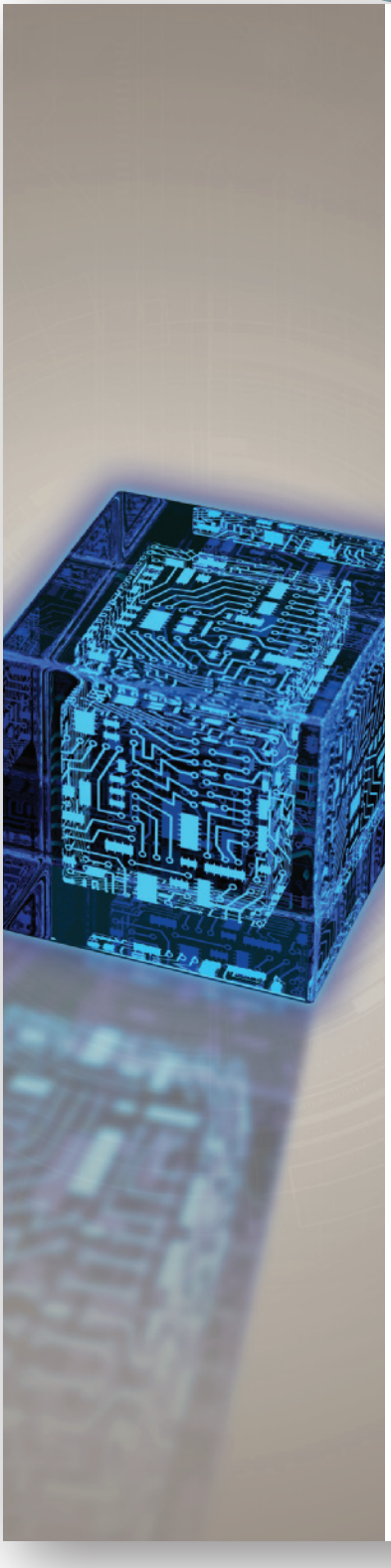

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PART 1

1 | Information Systems: An Overview

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

- **1-1** Discuss common applications of computers and information systems.
- **1-2** Explain the differences between computer literacy and information literacy.
- **1-3** Define transaction-processing systems.
- **1-4** Define management information systems.
- **1-5** Describe the four major components of an information system.
- **1-6** Discuss the differences between data and information.
- **1-7** Explain the importance and applications of information systems in functional areas of a business.
- **1-8** Discuss how information technologies are used to gain a competitive advantage.
- **1-9** Explain the Five Forces Model and strategies for gaining a competitive advantage.
- **1-10** Review the IT job market.
- **1-11** Summarize the future outlook of information systems.

After you finish this chapter, go to **PAGE 21** for the **STUDY TOOLS**

This chapter starts with an overview of common uses for computers and information systems, explains the difference between computer literacy and information literacy, and then reviews transaction-processing systems as one of the earliest applications of information systems. Next, the chapter discusses the components of a management information system (MIS), including data, databases, processes, and information, and then delves into how information systems relate to information technologies. This chapter also covers the roles and applications of information systems and explains the Five Forces Model used to develop strategies for gaining a competitive advantage. Finally, the chapter reviews the IT job market and touches on the future of information systems.

Organizations use computers and information systems to reduce costs and gain a competitive advantage in the marketplace.

1-1 COMPUTERS AND INFORMATION SYSTEMS IN DAILY LIFE

Organizations use computers and information systems to reduce costs and gain a competitive advantage in the marketplace. Throughout this book, you will study many information system applications. For now, you will look at some common applications used in daily life.

Computers and information systems are all around you. As a student, you use computers and office suite software and might take online classes. Computers are often used to grade your exam answers and generate detailed reports comparing the performance of each student in your class. Computers and information systems also calculate grades and grade point averages (GPAs) and can deliver this information to you.

Computers and information systems are commonly used in grocery and retail stores as well. For example, a point-of-sale (POS) system speeds up service by reading the universal product codes (UPCs) on items in your shopping cart (see Exhibit 1.1). This same system also manages store inventory, and some information systems can even reorder stock automatically. Banks, too, use computers and

Exhibit 1.1
A point-of-sale system

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information systems for generating your monthly statement, running ATM machines, and for many other banking activities.

Many workers are now telecommuters who perform their jobs at home, and others often use their personal digital assistants (PDAs) to conduct business while on the go. The most common PDA is a smartphone (such as an iPhone, Galaxy, Droid, or a BlackBerry). A typical PDA includes a calendar, address book, and task-listing programs; more advanced PDAs often allow for wireless connection to the Internet and have built-in MP3 players. Smartphones are mobile phones with advanced capabilities, much like a mini-PC. They include e-mail and Web-browsing features, and most have a built-in keyboard or an external USB keyboard (see Exhibit 1.2). Increasingly, tablet computers, such as iPads, are being used as PDAs. These tablets come with apps (small programs) for common applications, and they can improve the user's efficiency. The information box "Smartphones Everywhere and for Everything" highlights several popular applications of smartphones.

The Internet is used for all kinds of activities, from shopping to learning to working. Search engines and broadband communication bring information to your desktop in seconds. The Internet is also used for social purposes. With social networking sites—such as Facebook, Twitter, Google+, LinkedIn, and Foursquare—you can connect

Exhibit 1.2
Examples of smartphones

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Smartphones Everywhere and for Everything

With the growing number of apps available for both iPhones and Android phones, individuals and businesses are using their smartphones as a productivity tool and as an intelligent assistant for all sorts of activities. Here are few popular examples.

Group texting app GroupMe is used for sending a message to a group of employees or customers. The Samsung iPolis app, a video camera security system, is used to remotely watch the video that monitors the location of a business or home. Apps are available to pay bills, update a company's Web site, market and advertise a product or service, reach out to customers, and keep in touch with employees from anywhere. Some businesses give out the Google Voice phone number to customers so that they can text an order. Google's calendar is used to coordinate events, and Instagram is used to post photos of new merchandise.[1]

According to Massimo Marinucci, the owner and president of The Wine Connection, a $20-million business with six employees, the iPhone does nearly everything for business that a desktop used to do. Using their iPhones, employees check inventory, view sales for the day, run reports, print, change prices, and change inventory quantities. The new POS app allows customers to buy immediately as soon as a new wine becomes available.[2]

Starwood Hotels & Resorts Worldwide, Inc., plans to offer customers of two of its hotels in Harlem, NY, and Cupertino, CA, a virtual key. Guests can bypass the crowded check-in desk and enter their rooms using their smartphones. Guests receive a message on Starwood's app that will unlock their rooms with a tap or twist of their smartphones, using Bluetooth technology. Marriott International, Inc., also does mobile check-ins at some of their hotels. Loyalty program customers can check in via their smartphones and then go to a separate check-in desk to pick up a key.[3]

with friends, family, and colleagues online and meet people with similar interests and hobbies. Twitter (*www.twitter.com*), for example, is a social networking and short-message service. Users can send and receive brief text updates, called Tweets. These posts are displayed on one's profile page, and other users can sign up to have them delivered to their in-boxes. As an example, the author of this textbook sends daily Tweets that consist of links to current articles about information systems applications, new developments, breaking news, IT jobs, and case examples. You can read these Tweets in Twitter, Facebook, or LinkedIn.

Organizations also use social networking sites to give customers up-to-date information and how-to support via videos. These sites can reduce organizations' costs by providing an inexpensive medium for targeting a large customer base.

In addition, people use video-sharing sites to watch news, sporting events, and entertainment videos. One of the most popular sites is YouTube (*www.youtube.com*). You can upload and share video clips via Web sites, mobile devices, blogs, and e-mails. Users upload most of the content on YouTube, although media corporations such as CBS, BBC, Sony Music Group, the Sundance Channel, and others also provide content. Anyone can watch videos on YouTube, but you must register to upload videos. (This book has a YouTube channel on which you can watch many practical videos related to information systems.) Businesses are increasingly using YouTube to

> In the 21st century, knowledge workers need two types of knowledge to be competitive in the workplace: computer literacy and information literacy.

A New Era of Marketing: YouTube

Companies use newspapers, magazines, TV shows, and search engines to promote their products, services, and brands. YouTube is a popular video-sharing service that can be used as a marketing tool. The videos on YouTube are very well indexed and organized. They are categorized and sorted by "channels." The channels range from film and animation to sports, short movies, and video blogging. Individual YouTube users have used this marketing tool to share videos and stories. One popular application is watching how-to videos for repairing cars, home appliances, and so forth. Corporations can also take advantage of this popular platform. YouTube represents a great opportunity for marketers to reach consumers who are searching for information about a brand or related products and services. The service can also be used as a direct marketing tool. The following are examples of corporations that are using YouTube to promote their products and services:

Quiksilver—This manufacturer of apparel and accessories, including the Roxy brand, frequently posts new videos of its products, continually renewing its Web presence.

Ford Models—Since 2006, it has uploaded over 554 videos promoting its brand.

University of Phoenix Online—This site has hundreds of video testimonials, reviews, and documentaries that promote the university's degree programs.

The Home Depot—Free content, including practical knowledge and money-saving tips for home improvements may be found at this site.

Nikefootball—Nike maintains several distinct YouTube channels that cater to specific audiences. Consumers can find content that is relevant to their needs without having to sift through everything.[4,5]

However, there are some challenges in using YouTube as an advertising medium. In 2017, several companies, including Starbucks, Pepsi, AT&T, Verizon, Johnson & Johnson, Volkswagen, and Walmart pulled YouTube ads after ads were placed on racist videos or alongside unpleasant videos. Alphabet, the parent company of YouTube, has taken steps to fix this problem by involving more people in reviewing videos and developing more-sophisticated algorithms to instruct its computers to eliminate this problem.[6]

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promote their products and services. See the information box "A New Era of Marketing: YouTube," which highlights a few such companies.

So what do all these examples mean to you? Computers and information technology will help the knowledge workers of the future perform more effectively and productively, no matter what profession they choose. In addition, these workers will be able to connect to the rest of the world to share information, knowledge, videos, ideas, and almost anything else that can be digitized. Throughout this book, these opportunities, as well as the power of computers and information systems, are explored.

As you read, keep in mind that the terms *information systems* and *information technologies* are used interchangeably. Information systems are broader in scope than information technologies, but the two overlap in many areas. Both are used to help organizations be more competitive and to improve their overall efficiency and effectiveness. Information technologies offer many advantages for improving decision making but involve some challenges, too, such as security and privacy issues. The information box "Social Networking and the Vulnerability of Personal Information" describes one of the potential challenges.

Social Networking and the Vulnerability of Personal Information

The popularity of social networking sites such as Facebook, Twitter, Google+, Snapchat, and Foursquare is on the rise. As of November 1, 2017, Facebook had 2.07 billion monthly active users, and the number is increasing on a daily basis.[7] But so is the potential risk. According to an InfoWorld study, over half of all users of social networks in this country are putting themselves at risk by posting information that could be misused by cybercriminals. Many social networkers post their full birth dates, their home addresses, photos of themselves and their families, and the times when they will be away from home. This information could be used by cybercriminals for malicious purposes. According to the report, 9 percent of the 2,000 people who participated in the study had experienced some kind of computer-related trouble, such as malware infections, scams, identity theft, or harassment. To reduce risk and improve the privacy of your personal information, the study offers several tips:[8]

- Always use the privacy controls o□ered by the social networking sites.
- Use long passwords (eight characters or longer) that mix uppercase and lowercase letters with numbers and symbols.
- Do not post a phone number or a full address.
- Do not post children's names, even in photo tags or captions.
- Do not be specific when posting information about vacations or business trips.

1-2 COMPUTER LITERACY AND INFORMATION LITERACY

In the 21st century, knowledge workers need two types of knowledge to be competitive in the workplace: computer literacy and information literacy. **Computer literacy** is skill in using productivity software, such as word processors, spreadsheets, database management systems, and presentation software, as well as having a basic knowledge of hardware and software, the Internet, and collaboration tools and technologies. **Information literacy**, on the other hand, is understanding the role of information in generating and using business intelligence. **Business intelligence (BI)** is more than just information. It provides historical, current, and predictive views of business operations and environments and gives organizations a competitive advantage in the marketplace. (BI is discussed in more detail in Chapter 3.) To summarize, knowledge workers should know the following:

- Internal and external sources of data
- How data is collected
- Why data is collected
- What type of data should be collected
- How data is converted to information and eventually to business intelligence
- How data should be indexed and updated
- How data and information should be used to gain a competitive advantage

1-3 THE BEGINNING: TRANSACTION-PROCESSING SYSTEMS

For the past 60 years, **transaction-processing systems (TPSs)** have been applied to structured tasks such as record keeping, simple clerical operations, and inventory control. Payroll, for example, was one of the first applications to be automated. TPSs focus on data collection and processing, and they have provided enormous reductions in costs.

Computers are most beneficial in transaction-processing operations. These operations are repetitive, such as printing numerous checks, or involve enormous volumes of data, such as inventory control in a multinational textile company. When these systems are automated, human involvement is minimal. For example, in an automated payroll system, there is little need for managerial judgment in the task of printing and sending checks, which reduces personnel costs.

Transaction processing systems have come a long way. For example, the first ATM opened for business in 1969 with some very basic features. Similar to other information technologies, ATMs have gone through major changes and improvements.[9] In 2014, JPMorgan Chase introduced electronic banking kiosks (EBKs). Using these kiosks customers can withdraw cash in a variety of denominations ($10, $20, …). These machines also allow customers to cash a check and receive exact change.[10] Customers can be identified using biometric features such as a fingerprint or iris scanners.[11]

The cardless ATM is one of the recent technologies deployed by some banks in order to attract younger customers. An app provided by the bank is used to withdraw cash. The customers set the amount using the app and receive a code on his/her smartphone which is scanned by the bank's ATM when the customer gets there. The ATM dispenses the cash and sends a receipt over the phone, or it can be printed at the ATM.[12]

According to the Chicago-based BMO Harris Bank, mobile withdrawal reduces fraud and also increases efficiency, as a mobile cash transaction takes 15 seconds compared to 45 seconds for a card-based withdrawal.[13]

JPMorgan Chase says upcoming ATM features will include cash withdrawals by tapping smartphones to the ATM, the technology similar to Apple Pay; withdrawals of up to $3,000 on some ATMs; and allowing customers to make their credit card and mortgage payments at the ATM.[14]

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Information literacy is understanding the role of information in generating and using business intelligence.

Business intelligence (BI) provides historical, current, and predictive views of business operations and environments and gives organizations a competitive advantage in the marketplace.

Transaction-processing systems (TPSs) focus on data collection and processing; the major reason for using them is cost reduction.

Information Technologies at Domino's Pizza

In 1960, Domino's Pizza opened its first store. Today, there are nearly 12,000 stores, half of them outside the United States. In 2007, Domino's started online and mobile ordering. Today, customers can order online at *www.dominos.com* or they can use apps for the iPhone, Android, or Kindle Fire.[15] This allows them to customize their pizzas with any combination of ingredients, enhancing their sense of participation while also saving Domino's the labor costs associated with phone orders. After placing the order, the customer can track it all the way to when it is sent out for delivery, keeping an eye on an estimated delivery time.

In 2012, Domino's surpassed $1 billion in annual sales through its Web site, proving that electronic sales will continue to play a large role in the company's success.[16]

At Domino's, online ordering seamlessly accomplishes multiple objectives without the customer even taking notice. First, it creates the feeling among customers that they are an active part of the pizza-making process. Second, it results in greater efficiency at the various stores because employees do not have to spend as much time taking orders. They merely need to prepare the orders, which appear in an instant order queue, with all the customers' specifications.

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Domino's now has the ability to store its online orders in its database. This data can then be used for many purposes, including target marketing and deciding which pizzas to offer in the future. The company is also actively using social media, including Facebook and Twitter, to promote its products and gather customers' opinions.

In 2014, Domino's began allowing customers to order pizza using a voice app called "Dom," powered by Nuance Communications. It enables users of iOS and Android devices to place orders using their voices.

Twitter is now a part of the ordering system at Domino's. As of 2015, U.S. customers can order pizza by tweeting a pizza emoji.[17]

Starting in 2016 customers were able to order Domino's Pizza from a Facebook Messenger bot.[18] Also, in 2016, Domino's Pizza began testing a delivery robot called DRU in New Zealand.[19] And the pizza company also announced plans to beat Amazon and Google to delivery by drones.[20]

In 2017, Domino's tested self-driving pizza delivery in a joint project with Ford in a specially equipped Ford Fusion that comes with both self-driving technology and an oven.[21]

However, there are some security risks associated with using ATMs. ATM skimming is a worldwide problem costing more than $2 billion a year in fraudulent charges. Skimmers, by using a card the size of a credit card installed inside the ATM or on the top of the machine, are able to record PIN numbers and other financial information of the users. This could happen when you swiped your card at the ATM or even at a gas station. Skimmers have been stealing financial information from cards with magnetic strips, as chip-based cards are more difficult to steal from. To protect your financial information while using an ATM, follow these steps[22]:

- Check your bank statements regularly. Usually, if you report fraudulent charges within two days your bank will reimburse you for anything over $50.
- Watch for signs that the ATM of a gas pump may have been tampered with. This could be done by physically touching the machine or checking on Bluetooth for unusual Wi-Fi networks.
- Cover your pin number when entering it.

A **management information system (MIS)** is an organized integration of hardware and software technologies, data, processes, and human elements designed to produce timely, integrated, relevant, accurate, and useful information for decision-making purposes.

1-4 MANAGEMENT INFORMATION SYSTEMS

A **management information system (MIS)** is an organized integration of hardware and software technologies, data, processes, and human elements designed to produce timely, integrated, relevant, accurate, and useful information for decision-making purposes.

The hardware components, which are discussed in more detail in Chapter 2, include input, output, and memory devices and vary depending on the application and the organization. MIS software, also covered

If an organization has defined its strategic goals, objectives, and critical success factors, then structuring the data component to define what type of data is collected and in what form is usually easy.

in Chapter 2, can include commercial programs, software developed in-house, or both. The application or organization determines the type of software used. Processes are usually methods for performing a task in an MIS application. The human element includes users, programmers, systems analysts, and other technical personnel. This book emphasizes users of MISs.

In designing an MIS, the first task is to clearly define the system's objectives. Second, data must be collected and analyzed. Finally, information must be provided in a useful format for decision-making purposes.

Many MIS applications are used in both the private and public sectors. For example, an MIS for inventory control provides data (such as how much of each product is on hand), what items have been ordered, and what items are back-ordered. Another MIS might forecast sales volume for the next fiscal period. This type of system uses recent historical data and mathematical or statistical models to generate the most accurate forecast, and sales managers can use this information for planning purposes. In the public sector, an MIS for a police department, for example, could provide information such as crime statistics, crime forecasts, and allocation of police units. Management can examine these statistics to spot increases and decreases in crime rates or types of crimes and analyze this data to determine future deployment of law enforcement personnel.

As you will see in this book, many organizations use information systems to gain a competitive advantage. The information box on Domino's Pizza describes one example of this. (*Note*: MISs are often referred to as just *information systems*, and these terms are used interchangeably in this book.)

1-5 MAJOR COMPONENTS OF AN INFORMATION SYSTEM

In addition to hardware, software, and human elements, an information system includes four major components, which are discussed in the following sections: data, a database, a process, and information (see Exhibit 1.3).[23]

Exhibit 1.3
Major components of an information system

1-5a Data

The **data** component of an information system is considered the input to the system. The information that users need affects the type of data that is collected and used. Generally, there are two sources of data: external and internal. An information system should collect data from both sources, although organizational objectives and the type of application also determine what sources to use. Internal data includes sales records, personnel records, and so forth. The following list shows some examples of external data sources:

- Customers, competitors, and suppliers
- Government agencies and financial institutions
- Labor and population statistics
- Economic conditions

Typically, data has a time orientation, too. For example, past data is collected for performance reports, and current data is collected for operational reports. In addition, future data is predicted for budgets or cash flow reports. Data can also be collected in different forms, such as aggregated (e.g., subtotals for categories of information) or disaggregated (e.g., itemized lists). An organization might want disaggregated data to analyze sales by product, territory, or salesperson. Aggregated data can be useful for reporting overall performance during

Data consists of raw facts and is a component of an information system.