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.

Chapter Case

MIS CIBC's Digital Transformation and Artificial Itelligence (AI) Integration

Established in 1867, The Canadian Imperial Bank of Commerce (CIBC) has grown to become one of Canada's largest banks, offering a wide range of financial products and services to personal, business, and institutional clients. With a workforce of approximately 48,000 employees, CIBC serves over 14 million clients globally, providing services through its three main business units: Canadian Personal and Business Banking, Canadian Commercial Banking and Wealth Management, and Capital Markets. CIBC as well as many other large financial institutions and organizations, are constantly faced with challenges to enhance operational efficiency, improve customer experience, and stay competitive in a rapidly evolving financial landscape.

CIBC's journey towards digital transformation began with the recognition of several challenges. The bank was grappling with operational inefficiencies due to manual processes and legacy systems, which were slowing down operations and increasing costs. Additionally, clients were demanding more personalized and seamless digital experiences, while the rise of fintech companies and digital banks posed a significant threat to traditional banking models. Managing and leveraging vast amounts of data for decision-making and innovation was also becoming increasingly complex. For example, in 2023, CIBC faced issues with online banking outages and technical glitches that affected customer transactions and access to services. Furthermore, the bank was fined $1.3 million in 2023 for non-compliance with money laundering and terrorist financing measures, highlighting the need for improved risk management and regulatory compliance.

To respond to these challenges, CIBC embarked on a comprehensive digital transformation journey, investing heavily in technology and innovation. In 2024, one of the key initiatives was the development of a custom-built AI platform designed to foster innovation and improve productivity across the organization. This platform leverages generative AI to automate routine tasks, allowing employees to focus on higher-value activities. For instance, the AI platform can summarize documents, generate post-meeting summaries, and draft emails, significantly enhancing efficiency in day-to-day administrative tasks for employees. Additionally, CIBC rolled out GitHub CoPilot for its team of software developers in the IT department, which automates repetitive coding tasks, leading to a 10 to 15 percent boost in productivity among software developers.

Also in 2024, CIBC expanded a Generative AI pilot program. This pilot program evaluates the ethical and responsible utilization of AI within the bank, ensuring that AI applications adhere to CIBC's principles of accountability, transparency, fairness, reliability, privacy, and security. Furthermore, CIBC partnered with Visa to facilitate cross-border remittances through digital wallets,

enhancing convenience for clients. The bank also collaborated with Canadian fintechs to drive digital innovation and supplement in-house development efforts.

Recognizing the importance of talent in driving its digital transformation, CIBC announced in August 2024 that they would be hiring over 200 data and AI professionals to support the development of AI solutions and, this way, maintaining its competitive edge and deliver superior value to its customers.

Central to the concept of digital transformation are informed users. This chapter defines an informed user as someone knowledgeable about information systems (IS) and information technology (IT). As you read this chapter, notice how IS and IT integrate into everyday functions for even the most "nontechnical" company. From the most basic financial transactions to the more advanced AI-assisted tasks—as we just read—are affected by IS and IT.

We conclude this case at the end of the chapter.

Introduction

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 (IT) refers to any computer-based tool that people use to work with information and support an organization's information and information-processing needs.

IT has far-reaching effects on individuals, organizations, and our planet. As illustrated in the chapter case, even basic utilities like water are susceptible to cyberattack because their purification and distribution methods make use of information systems. 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. IT is making our world smaller, enabling more and more people to communicate, collaborate, and compete, thereby leveling the playing field.

The COVID pandemic of 2020 forced people to depend on IT in new ways and demonstrated how far-reaching technology can be. Specifically, IT has come to the forefront of electronic commerce, distance education, and politics. As you will see, throughout this book we draw attention to the numerous ways IT enables us to adapt to life during and after the pandemic.

This text focuses on the successful applications of IT in organizations; that is, how organizations can use IT to make decisions, 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, either you will start your own business or you will 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?

LEARNING OBJECTIVE

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

No doubt, you have noticed that the title of this book is about information systems, not information technology. So, before we proceed, we will differentiate information technology from information systems. As previously defined, **information technology (IT)** refers to any computer-based tool that people use to work with information and support an organization's information and information-processing needs. An **information system (IS)** collects, processes, stores, analyzes, and disseminates information for a specific purpose. While we will discuss IT, the primary purpose of this text is to build your knowledge of the ways that modern organizations make use of IT and IS in their daily operations.

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; you use more information technologies (in the form of digital devices) for more tasks; and you are bombarded with more information than any generation in history. The *MIT Technology Review* refers to you as *Homo Conexus*; that is, a human who is deeply interconnected with other humans through technology. Information technologies are so deeply embedded in your lives that your daily routines would be almost unrecognizable to a college student just 25 years ago.

Essentially, you practice *continuous computing*, surrounded by a movable information network. This network is created by constant communication among the digital devices you carry and wear (e.g., laptops, tablets, smartphones, and wearables); 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 (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, and/or rental car); create your own blog and post your own podcasts and videos to it; create your own page on Instagram, Facebook and LinkedIn; make and upload videos to YouTube and TikTok; take, edit, and share your digital photographs; stream music and movies to your personal libraries; use RSS feeds to create your personal electronic newspaper; text your friends and family throughout your day; send Snaps; order a ride from Uber or Lyft; track the location and arrival time of the next campus bus; 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 the internet or any 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 your entire life, and you feel confident that you can manage any apps that your organization's MIS department installs. Let's look at three reasons why you should learn about IS and IT.

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

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

- 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 aware of potential software problems and be more prepared to avoid them. IT's About Business 1.1 presents a scenario where a simple software glitch shut down gas pumps in New Zealand in 2024. An informed user could have helped to avoid this issue.

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

- 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. In essence, you will enhance the quality of your organization's IT applications with your input.
- 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 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.

IT's About Business 1.1

MIS Informed Users Are an Important Part of System Stability

In February 2024, a leap-year glitch disrupted self-pay gas station pumps across New Zealand, leaving drivers unable to refuel their vehicles. The glitch resulted from a simple software error related to leap year date calculations. The self-pay systems at several stations failed to recognize the date correctly, making it impossible for the gas stations to process payments. This arose because the systems defaulted to an incorrect date on February 29, which occurs only in leap years. Ironically, an uninstalled update was available that would have avoided the glitch.

Technology Solution

To address the problem, the affected gas station operators and their technology partners deployed the software update. This response required the technology teams, who had to develop, test, and roll out the patch across all affected stations, to act quickly. The situation demonstrated the importance of maintaining robust and adaptable information systems that can handle rare but foreseeable events such as leap years.

The immediate outcome of the glitch was significant disruption to both customers and businesses. Drivers were frustrated because they could not pay at the stations. This problem led to long queues and delays as they sought alternative refuelling options.

For the gas stations, this glitch resulted in a temporary loss of revenue and damaged customer trust, particularly regarding the reliability of their payment systems.

Outcomes

In the long term, the incident prompted a broader review of the IS used by gas stations across New Zealand. It became clear that many systems were outdated and lacked the necessary updates to manage simple issues, such as date-related events. As a result, there was a push for gas station personnel to maintain and update these systems on a regular basis, emphasizing proactive measures to prevent similar incidents in the future.

Conclusion

This case exemplifies the importance of understanding and maintaining IS. This incident illustrates how a seemingly small software error can have far-reaching effects, disrupting customer service and causing business financial losses. It highlights the need for businesses to invest in robust, adaptable, and regularly updated information systems to avoid unexpected problems and maintain smooth operations.

Sources are provided at the end of the textbook.

Questions

1. **How might a more robust quality control system have prevented the leap-year glitch?**
2. **What stands out about the far-reaching effect of a simple software malfunction?**
3. **How might informed users of technology help to avoid future interruptions of this kind?**

The second reason to learn about IS 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. According to a 2024 Gartner report, 91 percent of companies surveyed had a digital transformation strategy in place or were working on such a strategy, and 87 percent were prioritizing digital transformation.

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:

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.

- Big Data (see Chapter 5)
- Business Analytics (see Chapter 12)
- Broadband internet access (see Chapter 6)
- Mobile Computing (see Chapter 8)
- The Internet of Things (see Chapter 8)
- Social Computing (see Chapter 9)
- Agile Systems Development methods (see Chapter 13)
- Cloud Computing (see Technology Guide 3)
- Artificial Intelligence (see Chapter 14)

The third reason to learn about IS 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 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 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.indeed.com**, and **www.monster.ca**.

Career opportunities in IS are strong and are projected to remain strong over the next 10 years. As an example, LinkedIn publishes several lists of in-demand jobs, three of which feature 20 Canadian roles, including several jobs in IS. In fact, most jobs in business would require some basic level of IS skills. The job rankings are as follows:

LinkedIn Jobs on the Rise in Canada (2024)

#9 Cyber Security Analyst

#12 Sales Development Representative

#20 Data Management Analyst

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 Centre Manager	Manages IS services such as help desks, hotlines, 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 centre
Programming Manager	Coordinates all applications 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

LinkedIn Jobs with the Fastest-Growing Demand Worldwide (2024)

#2 Information technology consultant
#3 Finance officer
#4 Accounting associate
#5 Information technology analyst
#6 Software engineer
#7 Supply chain analyst
#8 Financial services associate

LinkedIn Most In-Demand Jobs Worldwide (2024)

#1 Software engineer
#2 Salesperson
#4 Project manager
#5 Account manager
#6 Customer service representative
#8 Sales manager
#9 Accountant

Not only do IS careers offer strong job opportunities, but the pay is excellent as well. For example, Indeed (**www.ca.indeed.com**), released a list of the 15 highest paying jobs in Canada in 2023. Five of those jobs are directly related to information systems and information technology. Similarly, LinkedIn also releases the list of 15 high-paying business jobs you can pursue, many of which require IS and IT skills.

Indeed 15 Highest Paying Jobs in Canada (2023)

Job Title	Annual Average Salary (CAD)
#9 Software engineer manager	$136,038
#10 Director of information technology	$126,924
#11 Software architect	$116,842
#12 Enterprise architect	$123,125
#15 Data scientist	$ 96,641

LinkedIn 15 Highest Paying Business Jobs You Can Pursue (2024)

Job Title	Annual Average Salary (USD)
#1 E-commerce specialist	$ 52,760
#2 Business systems analyst	$ 80,714
#3 Human resources manager	$ 78,664
#4 Project manager	$ 81,409
#5 Business advisor	$ 69,935
#6 Business intelligence analyst	$ 78,486
#7 Investment banker	$ 77,808
#8 Portfolio manager	$ 83,509
#9 Internal auditor	$ 82,810
#10 Sales manager	$ 76,442

Job Title	Annual Average Salary (USD)
#11 Payroll manager	$ 86,500
#12 Economist	$ 91,943
#13 Transport manager	$ 80,818
#14 Corporate controller	$105,130
#15 Market analyst	$ 68,665

Further, a 2024 Gartner report of more than 400 CFOs and CEOs indicated that technology spending will remain strong, even if the economy does not. The survey found that technology is the second-highest-rated priority following organizational growth. This is great news for students looking for strong job opportunities.

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 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 advisor.

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 centre
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 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 • Communication 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 resides 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 advisor on various issues, including hardware and software compatibility, implementing extranets, communications, and security.

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

LEARNING OBJECTIVE

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

Organizations refer to their management information systems 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 support the information and information-processing needs of an organization.

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

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 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 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

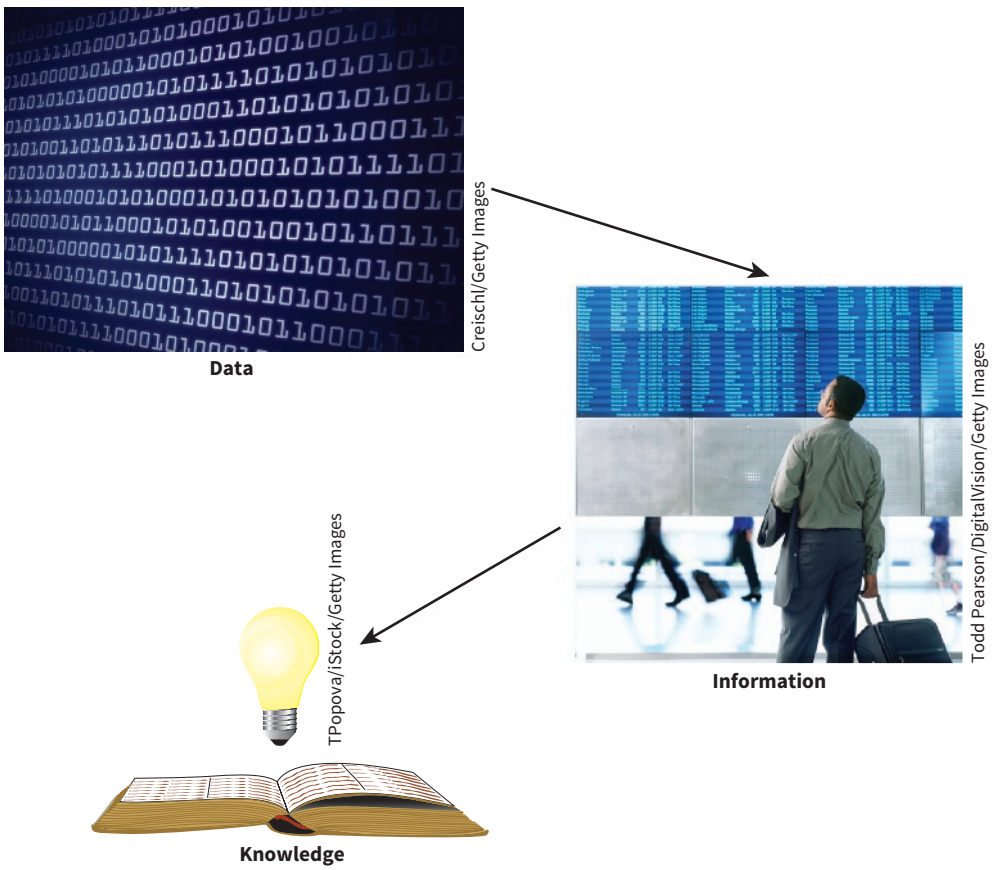

FIGURE 1.2 Data, information, and knowledge.

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

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

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 grade point averages 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 is 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.

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.

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 + Corey Kluber = ERA	
2.92	2.92 + Chris Sale = ERA	* Keep pitcher, trade pitcher, or send pitcher to minor leagues
1.39	1.39 + Clayton Kershaw = ERA	* Salary/contract negotiations
3.95	3.95 + Shane Bieber = 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 have entirely different meanings 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 computer-based information systems are listed below. The first four are called

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

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

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

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

database A collection of related files or tables containing data.

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.

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.

information technology infrastructure IT components plus IT services.

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

departmental/functional area information systems IS that support a particular functional area within the organization.

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 cumulatively are called **information technology services**. The IT components plus IT services comprise 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 (also 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 instance, 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 **departmental information system** (also known as a **functional area information system (FAIS)**). For example, the collection of application programs in

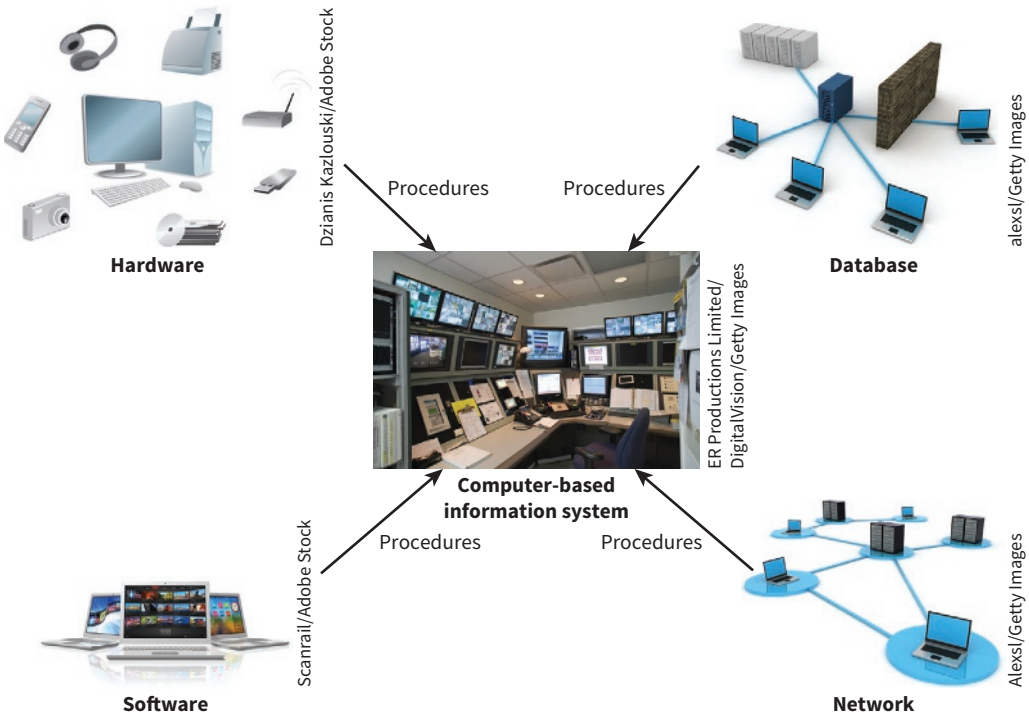

FIGURE 1.3 **Computer-based information systems consist of hardware, software, databases, networks, procedures, and people.**

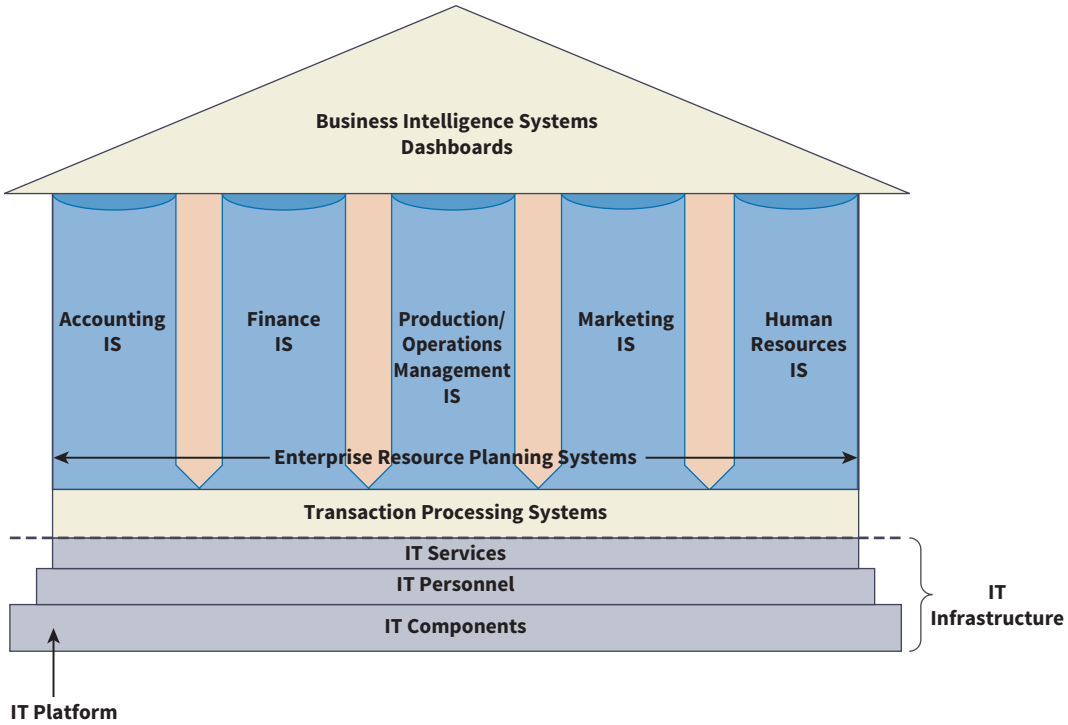

FIGURE 1.4 **Information technology inside your organization.**

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

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, recent reports show that information systems added more than US $*1 trillion of value* to the United States gross domestic product (GDP) and about CAD $73 billion to Canada's GDP in 2024.

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.

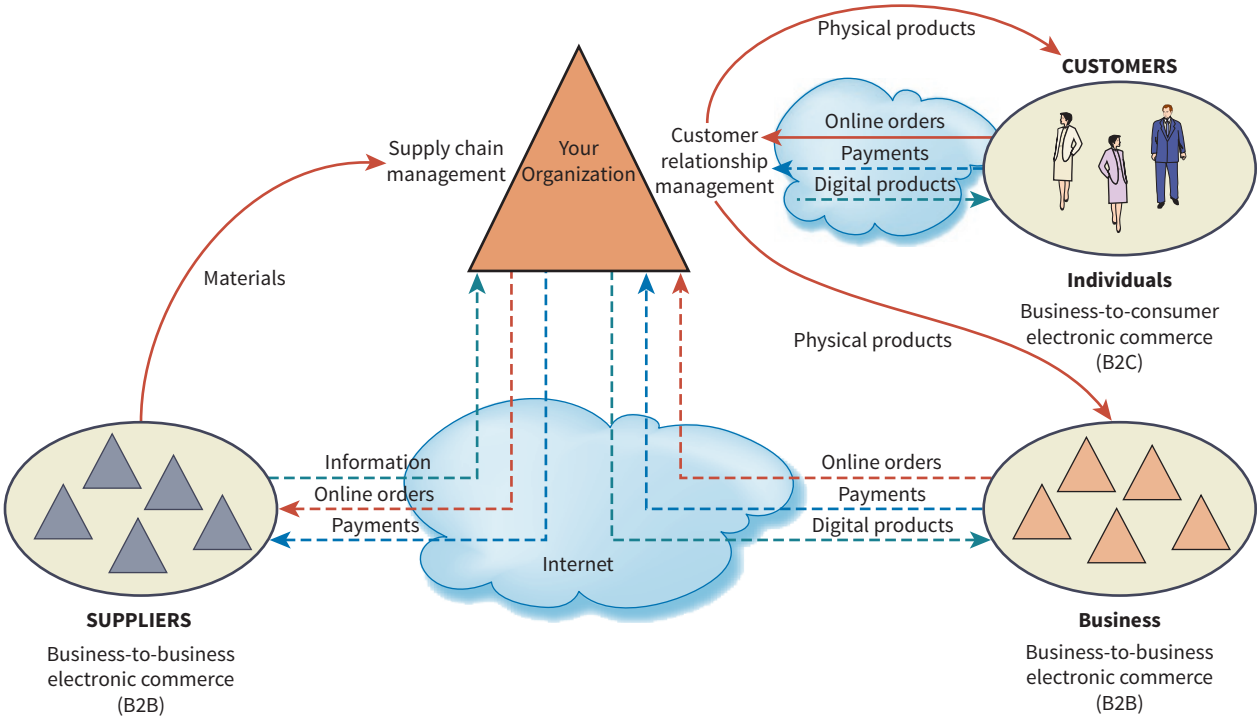

FIGURE 1.5 **Information systems that function among multiple organizations.**

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 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 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

Marketing managers also use IT to manage their relationships with their customers.

POM 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 IS. For this reason, Figure 1.4 shows ERP systems spanning the FAIS. ERP systems were an important innovation because organizations often developed the various functional area IS 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 IS 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.

enterprise resource planning (ERP) systems Information systems that take a business process view of the overall organization to integrate the planning, management, and use of all of an organization's resources, employing a common software platform and database.

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).

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

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.

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

supply chain 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.

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.

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

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.

subject area. They create information and knowledge, which they integrate into the business. Knowledge workers, in turn, act as advisors to middle managers and executives. Finally, *executives* make decisions that deal with situations that can significantly change the manner in which business 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 See **business intelligence systems**.

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

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

dashboard A business analytics presentation tool that provides rapid access to timely information and direct access to management reports.

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 will learn about BA systems in Chapter 12.

Expert systems (ES) 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 ES in greater detail in Chapter 14.

Dashboards (also called **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 dash*boards. Chapter 12 provides a thorough discussion of dashboards.

Table 1.4 provides an overview of the different types of information systems used by organizations. IT's About Business 1.2 presents several examples of these information systems at Lululemon Athletica.

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 a 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**
Customer Relationship Management	Manage relational details so customers receive excellent service regardless of the agent providing the service	**www.salesforce.com**
Knowledge Management	Retain and share knowledge gained by experts.	Not losing organizational knowledge with attrition or retirement
Artificial Intelligence systems	Constant learning based on data analysis to uncover previously unknown or undiscovered trends used in future predictions	Customer Service Chatbots, Human Resources Recruiting, Marketing shopping predictions

IT's About Business 1.2

MIS Lululemon Athletica Leverages Technology to Succeed

Lululemon Athletica, headquartered in Vancouver, BC, is a Canadian athletic apparel brand with more than 490 stores worldwide. Founded in 1998 by Chip Wilson, Lululemon initially focused on yoga apparel for women. Over the years, the company expanded its product line to include a wide range of athletic and lifestyle apparel.

By March 2020, Lululemon had already established a strong online presence through its e-commerce website. The company had also invested in RFID technology, which provided accurate real-time store inventory visibility. This enabled Lululemon to offer customers the option to buy online and pick up in-store (BOPIS). Additionally, Lululemon introduced a new mobile point-of-sale system, allowing transactions such as gift card purchases, returns, and exchanges to be conducted just outside the store.

Beyond these advancements, Lululemon utilizes other advanced information systems to support its operations. For instance, the company has implemented Oracle Cloud Enterprise Performance Management (EPM) to enhance its financial planning and analysis. This system allows Lululemon to create various financial scenarios, simulate long-term strategies, and stress-test financial models. The strategic modeling capabilities in Oracle Cloud EPM help Lululemon adapt to changing market conditions and improve its financial forecasting.

Lululemon also leverages data intelligence through its partnership with AgilOne, a CRM and data intelligence company. AgilOne's technology integrates customer data from digital and physical channels, providing a comprehensive view of customer behaviour. This enables Lululemon to deliver highly personalized customer experiences and improve engagement. The data intelligence platform helps Lululemon understand customer preferences, optimize marketing efforts, and enhance overall customer relationships.

As Lululemon continued to grow, it began leveraging artificial intelligence (AI) to enhance various aspects of its business operations. One of the primary areas where Lululemon uses AI is in personalized shopping experiences. By analyzing customer data, preferences, and behaviours, AI algorithms provide tailored product recommendations, improving customer satisfaction and engagement. This personalization extends to AI-powered search functionalities on their website, which refine customer queries and offer more relevant suggestions.

In addition to enhancing customer experience, Lululemon employs AI for supply chain optimization. AI helps in inventory management by predicting demand and optimizing stock levels, ensuring that popular items are always available while minimizing overstock. This efficiency extends to merchandise planning and store clustering, where AI analyzes sales data to optimize product placement and store layouts. By leveraging predictive analytics, Lululemon can forecast demand patterns, reducing lead times and enhancing overall supply chain efficiency.

Lululemon also integrates AI into product development. Generative AI tools assist designers in creating new products more efficiently, reducing the time and resources needed for development. This innovative approach allows Lululemon to stay ahead in the competitive market by quickly responding to trends and customer preferences. AI aids in every stage of the product lifecycle, from ideation to production, ensuring that the products meet customer expectations and market demands.

Furthermore, AI enhances customer service through the use of chatbots and virtual assistants. These AI-powered tools handle routine inquiries, provide instant support, and free up human agents to focus on more complex issues. This not only improves response times but also ensures a consistent and high-quality customer service experience. AI-driven sentiment analysis and social media monitoring help Lululemon gauge customer reactions to its products and identify untapped markets.

Overall, Lululemon's strategic use of RFID technology, Oracle Cloud EPM, data intelligence, and AI across personalized shopping, supply chain management, product development, and customer service demonstrates its commitment to leveraging technology to drive innovation and operational efficiency. By integrating these advanced information systems into various aspects of its business, Lululemon not only enhances customer experience but also ensures that it remains competitive in the ever-evolving retail landscape.

Sources are provided at the end of the textbook.

Questions

1. **Using Table 1.4 can you identify the different information systems that Lululemon is using?**
2. **Do a brief search on the internet to search for additional information systems Lululemon may have adopted more recently.**
3. **Match for each type of information system identified in the case with the group of employees at Lululemon that it supports (clerical staff, knowledge workers, management).**

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? What examples can you provide?
4. How do knowledge workers utilize information systems in their day-to-day jobs?
5. As we move up the organization's hierarchy from clerical workers to executives, are information systems more important in some areas than others?

1.3 How Does IT Impact Organizations?

LEARNING OBJECTIVE

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

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 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 example.

On July 19, 2024, Crowdstrike (**www.crowdstrike.com**), a cybersecurity company that specializes in the protection of endpoints (laptops, tablets, smartphones, etc.), pushed out an update that created massive problems around the world. The faulty update crashed systems—many of which were businesses—and rendered them unable to complete daily transactions. One industry in particular that was severely impacted was the airline industry. Within hours, airlines had to cancel more than 2,000 flights until they were able to repair the damaged servers. This example highlights how important IS are for today's modern business functions.

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-2022, 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 startups without investing in new infrastructure or training new employees. For example, in 2000, operating a basic internet application cost businesses approximately US $150,000 per month. By mid-2022, operating that same application in Amazon's cloud could cost as little as US $100 per month, depending on the amount of data traffic to and from the website. (We discuss cloud computing in Technology Guide 3.)

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 As of mid-2025, one of the largest booksellers in Canada and the United States was 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 e-books. In 2020, physical books accounted for approximately 81 percent of total book sales, and electronic books accounted for approximately 19 percent of total book sales. Keep in mind that electronic book sales increased from 0 percent in 1994 when Amazon was founded to 19 percent 26 years later.

The Music Industry Dramatic changes in the music industry resulted from the emergence of digital music-streaming. Platforms such as Spotify (**www.spotify.com**), Apple Music (**www.apple.com/apple-music/**), Amazon Music (**www.amazon.ca/music**), and YouTube Music (**www.music.youtube.com**), which generally charge somewhere between CAD $11 to $14 per month for unlimited access to millions of songs. Even though the record

labels receive only about 0.3-0.5 cents each time a song is streamed, these small amounts are significant. In 2023, the global record industry reported revenues of US $28.6 billion (up from US $20.2 billion in 2019), with streaming generating US $16.3 billion (up from US $11.4 billion in 2019).

The Video Industry Prior to 2007, 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, 2020, Netflix had the largest global subscriber base of any video service, with 167 million subscribers. Meanwhile, Blockbuster declared bankruptcy in February 2011 and was acquired by satellite television provider Dish Network (**www.dish.com**) a month later. By 2025 Netflix had an estimated 9 million subscribers followed by Amazon Prime with 7.5 million and Disney+ with 5.5 million subscribers.

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 Video Game 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 Sports Industry Professional sports leverage information systems in numerous ways to enhance performance, improve fan engagement, and optimize operations. Teams utilize advanced data analytics platforms to track player performance, health metrics, and game statistics in real time. Wearable technologies and sensors provide critical insights on player movement, fatigue, and injury risks, helping teams make informed decisions regarding training and strategy. Additionally, mobile apps and social media integration enhance the fan experience by providing real-time updates, ticketing systems, and interactive experiences like fantasy sports. These systems also support team management in scouting, contract negotiations, and even marketing efforts. The result is a more data-driven approach to sports management. IT's About Business 1.3 presents a story of how artificial intelligence, or AI, is helping to enhance player safety in the National Football League (NFL).

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 Instagram (**www.instagram.com**), Shutterfly (**www.shutterfly.com**), Snapfish (**www.snapfish.com**), and Flickr (**www.flickr.com**). Meanwhile, Kodak, the longtime market leader—whose name was almost synonymous with cameras—declared bankruptcy in January 2012.

MKT **The Marketing Industry** Some of 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 résumés on a publicly accessible website that interested parties can search in real time. Additionally, many companies are turning to recruitment automation through companies like Recruiter Flow (**www.recruiterflow.com**) to automate and expedite the applicant's experience.

IT's About Business 1.3

MIS AI and NFL Safety

One compelling example of this transformation is the application of artificial intelligence (AI) in professional sports. AI refers to the use of technology to complete tasks that normally require human intelligence. A prominent example is the National Football League (NFL), which is employing AI to enhance player safety. Other professional sports leagues, including the National Basketball Association (NBA) and the National Hockey League (NHL), are exploring similar technologies to enhance their safety protocols.

The NFL adopted AI technology in response to the longstanding issue of player injuries, particularly concussions and Chronic Traumatic Encephalopathy (CTE). Concussions occur when the head receives a sudden impact or jolt that causes the brain to move rapidly in the skull. CTE is a condition caused by repeated blows to the head, whether the blow causes a concussion or not. Given the physical nature of professional football, these head impacts are common. AI assists teams in analyzing vast amounts of data collected from games, practices, and medical records to predict and prevent injuries.

One of the primary ways NFL teams utilize AI is to analyze video footage from games and practices. High-resolution cameras capture every movement on the field, and AI systems process this footage live to identify anomalies that could indicate potential injury risks. AI can analyze the speed and angle of impacts during tackles, providing insights into which collisions are more likely to result in concussions. This information is crucial for coaches, medical staff, and league officials, who can use it to make informed decisions about player safety protocols and training practices.

The league also employs AI to inform rule changes. For instance, it has instituted stricter penalties for helmet-to-helmet hits, mandated improved helmet technology, and updated concussion protocols. In 2024, players who experience a potential concussion-causing impact are evaluated by an Unaffiliated Neurotrauma consultant (UNC) during the game and cleared by an Independent Neurological Consultant (INC) before returning to the game. These penalty changes have led to a significant decrease in concussions and the independent analysis has helped manage the recovery from this serious injury.

In addition to video analysis, AI is also used to track players' physical conditions over time. Wearable technology collects data on players' heart rates, movement patterns, and neurological responses. AI systems monitor these data for signs of fatigue, stress, and other factors that could lead to injury. Early identification helps teams to take preventative measures, such as adjusting practice intensity and providing additional medical care, that reduce the likelihood of serious injuries.

Outcomes

Integrating AI into the NFL games and practices has led to several positive outcomes for players and the league in general. Most notably, the number of concussions and other severe injuries has declined significantly. According to the NFL's annual injury data, the 2023 season saw a 10 percent decrease in concussions compared to previous years. Many experts attribute this decline to AI-driven safety protocols. This improvement not only enhances player well-being, it also reduces the long-term health risks associated with CTE.

Furthermore, AI has led to a more data-driven approach to player management and game strategy. Coaches and medical staff now have access to detailed insights about each player's condition. They utilize this information to create more personalized training regimens and make more informed health-related decisions during games.

The NFL's integration of AI illustrates how IS can enhance safety in other high-risk industries. For example, AI can analyze accident data in the automotive sector, leading to the development of safer vehicles and advanced driver-assistance systems. Similarly, in healthcare, AI can identify disease patterns, accelerate drug discovery, and optimize patient care. The applications are virtually limitless.

Conclusion

The impact of information systems on society is profound, particularly in how they enhance safety and efficiency across various sectors. The NFL's use of AI to improve player safety is a compelling example of how advanced technologies can address longstanding challenges innovatively. As AI continues to evolve and its applications expand, its potential to contribute positively to society will only grow. Whether in sports, healthcare, or other industries, integrating information systems will continue to shape the future, making our world safer, more efficient, and better informed.

Sources are provided at the end of the textbook.

Questions

1. **How has AI informed rules and penalties in the NFL?**
2. **How is AI used to inform coaches and trainers about players' physical condition?**
3. **How might the NFL's use of AI help other industries avoid accidents?**

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. In fact, an entirely new name has been given to the merging of technology and financial services, FinTech (Financial Technologies). Also, many of the leading innovators in financial services are software companies. See our discussion of FinTech in Chapter 7.

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.dreamworks.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 engine, controlling safety features, entertaining passengers, guiding drivers (and in some cases, responsible for fully autonomous driving) 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: driverless cars. Waymo (**www.waymo.com**), Tesla (**www.tesla.com**), Chevrolet (**www.chevrolet.com**), Ford (**www.ford.com**), and many other 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—for example, 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, UnitedLex (**www.unitedlex.com**) helped one company analyze 1.5 million documents for less than US $100,000. That company estimated that the process would have cost US $1.5 million had it been performed by lawyers.

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. It is reasonable to assume, therefore, that in 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 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.

HRM 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. In fact, the average Canadian worker spends approximately seven hours per day in front of some type of screen (consider laptops, tablets, smartphones, computers, and televisions). Let's 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.

HRM 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

Andrey Popov/Adobe Stock

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

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 became 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 all employees be knowledgeable about IT?
2. Describe how IT has changed and how AI might further change a manager's job.
3. Discuss several ways in which IT impacts employees at work.

1.4 Importance of Information Systems to Society

LEARNING OBJECTIVE

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

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 nine-to-five 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. Online meetings are now a fixture in our business life. These meetings have many advantages (easier to share documents, less travel, time savings). However, there are also many disadvantages when they are not coordinated properly.

While IT does bring significant improvements to quality of life, 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. Boundaries are more important than ever because IT has made it easy to blur those lines.

The Robot Revolution Is Now Here

Once restricted largely to science fiction, robots that can perform practical tasks are now a reality. Two major types of robot are industrial robots and collaborative robots, or cobots.

An *industrial robot* is an automated, programmable machine used in manufacturing operations. Applications for industrial robots include welding, painting, assembly, disassembly, packaging and labelling, palletizing, and many others. *Collaborative robots*, or *cobots*, are machines designed to be used in collaborative applications where there are interactions with humans within a shared space. Applications for cobots include providing information in public spaces, transporting materials and products within a building, inspection of goods, patrolling perimeters, securing facilities, and many others. Now let's look at the differences between the two types.

POM **Industrial Robots Versus Cobots** Cobots are designed to work alongside human employees, while industrial robots perform work in place of those employees. A cobot can assist employees with work that may be too dangerous, strenuous, or tedious for them to accomplish on their own. This assistance can create a safer, more efficient workplace without eliminating factory jobs. In contrast, industrial robots are used to automate the manufacturing process almost entirely without human help on the manufacturing floor. This process can free employees for more meaningful tasks that are less mundane and less prone to repetitive motion injuries.

Cobots are also more easily programmable than industrial robots because they are capable of "learning" on the job. A factory worker can re-program a cobot simply by moving the cobot's arms along a desired path. At that point, the cobot will "remember" the new movement and be able to repeat it on its own. Industrial robots cannot be so easily reprogrammed and require an engineer to write new software for any changes in the process that the robot is to perform.

Industrial robots are designed for heavy manufacturing, while cobots are designed for light manufacturing. Industrial robots require safety cages to keep humans out of the workspace, while cobots are safe enough to function around people and do not require the same type of safety infrastructure that industrial robots require. Last but certainly not least, industrial robots are much more expensive (US $100,000 to $150,000) than cobots (US $35,000 to $50,000).

Cobots have become increasingly common on factory floors, in hospital corridors, and in farm fields. Amazon Robotics is an excellent example of cobots in a distribution centre.

Traditionally, companies moved goods around their distribution centres with human-operated conveyors or with human-operated machines such as forklifts. That is, orders would enter the distribution centre and humans would locate, pick, and pack the items for shipment.

Amazon Robotics, formerly Kiva Systems, reversed the process with cobots. In the new approach, the company stores items on portable storage units. When an order enters the company database, software locates the closest cobot to the item and directs it to retrieve that item. The cobots navigate around the distribution centre by following bar code stickers on the floor. Each cobot has sensors that read the bar codes and prevent collisions. When the cobot reaches the correct storage unit, it slides underneath it and lifts it off the ground through a corkscrew action. The cobot then carries the storage units to a human operator who picks the item(s).

The bottom line with this system is that, rather than humans going to the items, the cobots bring the items to the humans. The system is much more efficient and accurate than the traditional one.

Drones A *drone* is an unmanned aerial vehicle (UAV) (a flying robot, if you will) 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.

An interesting use of drones is in the fight against deforestation. A good example of this process is in Yangon, Myanmar, where Dendra Systems (**www.dendra.io**) is working with a non-profit organization called Worldview International Foundation (**www.wif.foundation**) to plant mangrove saplings.

Drones first fly over the area to be planted, map it, and collect data about the topography and soil conditions. Dendra integrates these data with satellite data of the area and determines the best locations to plant seeds. Once the company analyzes the data, drones fire biodegradable pods filled with germinated seeds and nutrients into the ground at the preselected locations. Over the next months, drones fly over the planted areas and monitor how the mangroves are growing.

Autonomous Vehicles An autonomous, or self-driving, car (essentially a robot car) is a vehicle that is capable of sensing its environment and moving safely to its destination with little or no human input. 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.
- In 2024, a total of 2,045 Canadians and 1.2 million people worldwide died in road accidents.

These statistics offer compelling reasons for autonomous vehicles, and the development of these vehicles is proceeding rapidly. Leading autonomous vehicle companies are Tesla (**www.tesla.com**), Waymo (**www.waymo.com**), GM Autonomous Driving (**www.gm.com/innovation/autonomous-driving**), and Ford BlueCruise (**www.ford.com/technology/bluecruise**).

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.

The Emergence of Cognitive Computing and AI: IBM Watsonx

MIS IBM Watsonx (**www.ibm.com/watsonx**) is a suite of enterprise-ready artificial intelligence services, applications, and software tools. Watson integrates advanced natural language processing, information retrieval, knowledge representation and reasoning, and machine learning technologies to answer open-domain (general) questions. IBM has labelled the type of processing demonstrated by Watsonx as *cognitive computing,* and the company specifically promotes its capabilities in the area of AI. By mid-2024, IBM reported that more than 150 organizations were utilizing Watsonx in industries as diverse as mining (Goldcorp) and banking (TD Bank).

IT Impacts Healthcare

IT has brought about major improvements in healthcare delivery. Medical personnel use IT to make better and faster diagnoses and to monitor critically ill patients more accurately. IT has also 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, a system known as *telemedicine*. New computer simulations re-create the sense of touch, which enables doctors-in-training to perform virtual procedures without risking harm to an actual patient.

One form of IT that is critically important to healthcare is administrative systems. These systems perform functions ranging from detecting insurance fraud to creating nursing schedules to performing financial and marketing management.

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 healthcare practitioners to keep up. IBM emphasizes that Watson is *not* intended to replace healthcare professionals. Rather, its purpose is to help them avoid errors and fine-tune their diagnoses. For example, Hamilton Health Sciences in Ontario uses IBM Watson to analyze patient data to predict critical health events, helping healthcare providers take timely actions to improve patient outcomes.

Before you go on…

1. What are some of the quality-of-life improvements made possible by information systems? Have information systems had any negative effects on your quality of life? If so, then explain and provide examples.
2. Describe the robotic revolution, and consider its implications for humans. How do robots affect your life now, and how do you think robotics will affect your life in the future?
3. Explain how IS have improved healthcare practices. Has the application of technology to healthcare created any problems or challenges? If so, then explain and provide examples.

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.

- 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 better employ 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 (TPS) 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 (FAIS) support a particular functional area within the organization.
- Interorganizational information systems (IOS) 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 FAIS by tightly integrating the functional area IS 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 intelligence (BI) 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 healthcare.

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.

Key Terms

application (also app) 12
business analytics (BA) systems 16
business intelligence (BI) systems 16
computer-based information system (CBIS) 11
dashboard 16
digital dashboard 16
data items 10
database 12
departmental information system 12
digital transformation 5
electronic commerce (e-commerce) systems 15
enterprise resource planning (ERP) systems 15
expert systems (ES) 16
functional area information systems (FAIS) 12
hardware 12
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information technology components 12
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interorganizational information systems (IOSs) 15
knowledge 11
knowledge workers 15
network 12
procedures 12
software 12
supply chain 15
transaction processing system (TPS) 15

Discussion Questions

1. Would your university be a good candidate for digital transformation? Why or why not? Support your answer.

2. If you responded yes, then what types of digital initiatives should your university undertake to transform itself?

3. 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.

4. 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.

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

6. 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.

7. 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?

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

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

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

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

12. 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.

Problem-Solving Activities

1. Visit some websites that offer employment opportunities in IT. Prominent examples are: **www.linkedin.com**, **www.indeed.ca**, **www.dice.com**, **www.monster.ca**, **www.collegerecruiter.com**, **www.simplyhired.ca**, and **www.jobbank.gc.ca**. Compare IT salaries to salaries offered to personnel in accounting, marketing, finance, operations, and human resources. For other information on IT salaries, check *Computerworld*'s annual salary survey.

2. Explore the role of the CIO in today's business world. Access **www.cio.com** and search through the resources listed under careers. What opportunities are available if you were graduating today?

3. Go to **www.canadapost.ca**.

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 25 cm × 50 cm × 38 cm box, weighing 18 kg, from your hometown to Montreal, Quebec (or to Vancouver, British Columbia, if you live in or near Montreal). Compare the fastest delivery against the least cost. How long did this process take? Look into the business services offered by Canada Post. How do they make this process easier for business customers?

4. Surf the internet for information about the federal government department Public Safety Canada. Examine the available information and comment on the role of information technologies in the department.

5. Access **www.irobot.ca**, and investigate the company's products. Write a brief report analyzing and discussing the impact of these robots on society.

Chapter Case Conclusion

Outcomes of Digital Transformation and AI Integration at CIBC

The implementation of these IT solutions yielded significant positive outcomes for CIBC. The automation of routine tasks and the integration of AI tools led to increased productivity and reduced operational costs. For example, the use of GitHub CoPilot resulted in a 10 to 15 percent boost in developer productivity. AI-powered chatbots and virtual assistants enhanced customer support by providing instant responses to common inquiries, leading to better client experiences. The partnership with Visa also made cross-border remittances more convenient for clients.

CIBC's innovative pilot program was recognized with the Best Gen-AI Initiative technology award at The Digital Banker's 2024 Global Transaction Banking Innovation Awards. Additionally, CIBC Caribbean won the 2024 Eastern Caribbean Currency Union (ECCU) Bank of the Year Award for Technological Innovation.

CIBC's digital transformation efforts also may have had a notable impact on its financial performance. The CIBC's overall revenue rose 10 percent and adjusted earnings grew 12 percent to CAD $7.3 billion. Similarly, the bank shares hit an all-time high of $94.2 in December 2024.

By leveraging AI and digital technologies, CIBC was able to stay ahead of the competition and position itself as a leader in the banking industry.

Lessons Learned

CIBC's journey through digital transformation and AI integration offers several valuable lessons:

1. Embrace Innovation and Technology
CIBC's proactive approach to adopting IT, such as AI and generative AI, highlights the importance of embracing innovation. By investing in a custom-built AI platform and tools like GitHub CoPilot, CIBC was able to automate routine tasks, enhance productivity, and foster a culture of innovation.

2. Address Operational Inefficiencies
The case of CIBC underscores the need to identify and address operational inefficiencies. Manual processes and legacy systems can hinder productivity and increase costs. By leveraging AI and digital technologies, CIBC was able to streamline operations, reduce costs, and improve overall efficiency.

3. Invest in Talent and Skills
Recognizing the critical role of talent in driving digital transformation, CIBC's strategic hiring of over 200 data and AI professionals highlights the importance of investing in skilled personnel. Building a robust talent pool with expertise in emerging technologies is essential for developing and implementing innovative solutions. Organizations should focus on attracting, retaining, and upskilling their workforce to support their digital initiatives.

4. Ensure Ethical and Responsible AI Use

CIBC's commitment to ethical AI principles, such as accountability, transparency, fairness, reliability, privacy, and security, underscores the importance of responsible AI use. Organizations should establish guidelines and oversight mechanisms to ensure that AI applications are used ethically and responsibly.

In conclusion, CIBC's digital transformation and AI integration demonstrate the critical importance of information systems in addressing operational inefficiencies and prioritizing customer experience. By investing in IT, such as AI and generative AI, CIBC was able to enhance productivity, reduce costs, and improve client satisfaction. This case study highlights the necessity of understanding information systems and developing IT skills, as these are foundational to using technology effectively in any organization. Mastery of information systems enables the efficient management of data and ensures that AI and other information systems can be implemented successfully to meet business objectives.

Sources are provided at the end of the textbook.

Questions

1. **How did CIBC leverage AI and generative AI to improve operational efficiency and productivity?**
2. **In what ways did CIBC enhance customer experience through its digital transformation initiatives?**
3. **Why is it important for a bank to adhere to ethical and responsible AI principles, and how did they ensure this?**
4. **How important do you think are IT skills for a co-op or entry level job at a banking institution such as CIBC? Do a search of three jobs you would be interested and report to your class.**
5. **Society relies heavily on computer-based IS. To what degree should people understand the IS they are using, such as, digital banking from your bank? Who do you think should be responsible for this level of education?**