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Chapter 1
Information Systems: An Overview

Learning Objectives

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

Detailed Chapter Outline

I. Computers and Information Systems in Daily Life

Organizations use computers and information systems to reduce costs and gain a competitive advantage in the marketplace. Many workers are now telecommuters who perform their jobs at home, and others often use their PDAs (personal digital assistants) to conduct business while on the go. The most common PDA is a smartphone. Smartphones are mobile phones with advanced capabilities, much like a mini PC. They include e-mail and Web-browsing features, and most have a built-in keyboard or an external USB keyboard. Increasingly, tablet computers, such as iPads, are being used as PDAs. These tablets come with apps (small programs) for common applications, and they can improve the user's efficiency.

The Internet is used for all kinds of activities, from shopping to learning to working. The Internet is also used for social purposes. Organizations also use social networking sites to give customers up-to-date information and how-to support via videos. In addition, people use video-sharing sites to watch news, sporting events, and entertainment videos.

Computers and information technology will help the knowledge workers of the future perform

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more effectively and productively, no matter what profession they choose. In addition, these workers will be able to connect to the rest of the world to share information, knowledge, videos, ideas, and almost anything else that can be digitized.

The terms *information systems* and *information technologies* are used interchangeably. Information systems are broader in scope than information technologies, but the two overlap in many areas. Both are used to help organizations be more competitive and to improve their overall efficiency and effectiveness. Information technologies offer many advantages for improving decision making but involve some challenges like security and privacy issues.

In-Class Activity

Ask students to choose a particular organization and find out how they make use of computers and information systems to reduce costs and gain a competitive advantage in the market. Then, have students discuss in class the list of information systems that various organizations use.

Discussion Question

Will online classes substitute the traditional class setting someday? If this happens, what would the advantages and disadvantages be?

II. Computer Literacy and Information Literacy

Computer literacy is skill in using productivity software, such as word processors, spreadsheets, database management systems, and presentation software, as well as having a basic knowledge of hardware and software, the Internet, and collaboration tools and technologies. **Information literacy**, on the other hand, is understanding the role of information in generating and using business intelligence. **Business intelligence (BI)** provides historical, current, and predictive views of business operations and environments and gives organizations a competitive advantage in the marketplace.

In-Class Activity

Ask students to identify an organization that has used business intelligence to gain a competitive advantage in the marketplace. Then, have students discuss their findings in class and determine the best practices.

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Discussion Question

Discuss the importance of computer literacy and information literacy for a knowledge worker to be competitive in the workplace.

III. The Beginning: Transaction-Processing Systems

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

Computers are most beneficial in transaction-processing operations. These operations are repetitive or involve enormous volumes of data. When these systems are automated, human involvement is minimal.

In-Class Activity

Split the class into two groups and have them research examples of how transaction-processing systems (TPSs) are applied to structured tasks such as inventory control and record keeping. Then, have students present and discuss their findings in class.

Discussion Question

Identify the pros and cons of transaction-processing systems. Will the advancement of such systems affect employment opportunities for people in the future?

IV. Management Information Systems

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

The hardware components include input, output, and memory devices and vary depending on the application and the organization. MIS software include commercial programs, software developed in-house, or both. The application or organization determines the type of software

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used. Processes are usually methods for performing a task in an MIS application. The human element includes users, programmers, systems analysts, and other technical personnel.

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

In-Class Activity

Ask each student in the class to choose either the private or the public sector and write a report on how management information system (MIS) is used in that sector. Also, ask them to discuss their key findings in class.

Discussion Question

Identify the three tasks involved in designing an MIS. Discuss a case of an organization that has successfully used MIS to gain a competitive advantage.

V. Major Components of an Information System

In addition to hardware, software, and human elements, an information system includes four major components.

A. Data

The **data** component of an information system is considered the input to the system. The information that users need affects the type of data that is collected and used. Generally, there are two sources of data: external and internal. An information system should collect data from both sources, although organizational objectives and the type of application also determine what sources to use.

Internal data includes sales records, personnel records, and so forth. The following list shows some examples of external data sources:

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

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Typically, data has a time orientation, too. Data can also be collected in different forms, such as aggregated (e.g., subtotals for categories of information) or disaggregated (e.g., itemized lists).

If an organization has defined its strategic goals, objectives, and critical success factors, then structuring the data component to define what type of data is collected and in what form is usually easy. On the other hand, if there are conflicting goals and objectives or the company is not aware of critical success factors, many problems in data collection can occur, which affects an information system's reliability and effectiveness.

B. Database

A **database**, the heart of an information system, is a collection of all relevant data organized in a series of integrated files. To create, organize, and manage databases, a database management system (DBMS) is used, such as Microsoft Access or FileMaker Pro for home or small-office use. In a large organization, a DBMS such as Oracle or IBM DB2 might be used.

Databases are also important for reducing personnel time needed to gather, process, and interpret data manually. With a computerized database and a DBMS, data can be treated as a common resource that is easy to access and use.

C. Process

The purpose of an information system's **process** component is generating the most useful type of information for making decisions. This component generally includes transaction-processing reports and models for decision analysis that can be built into the system or accessed from external sources.

Users should be able to query an information system and generate a variety of reports. In addition, an information system should be able to grow with the organization so users can redefine and restructure models and incorporate new information into their analyses.

D. Information

Information is the output of an information system which consists of facts that have been analyzed by the process component and are therefore more useful to the MIS user.

The quality of information is determined by its usefulness to users, and its usefulness determines the success of an information system. Information is useful if it enables decision makers to make the right decision in a timely manner. To be useful, information must have

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the following qualities:

- Timeliness
- Integration with other data and information
- Consistency and accuracy
- Relevance

If information lacks any of these qualities, the results are incorrect decisions, misallocation of resources, and overlooked windows of opportunity. Information must provide either a base for users to explore different options or insight into tasks.

Another factor affecting the usefulness of information is the information system's user interface. To be useful, information systems should also produce information in different formats, including graphics, tables, and exception reports, which highlight information that is outside a specified range. Users also need to be able to make use of informal information—such as rumors, unconfirmed reports, and stories—when solving problems. The ultimate goal of an information system is to generate business intelligence (BI).

E. Examples of Information Systems

To better understand the four main components of an information system, take a look at the following two examples.

Example 1: A state university stores all student data in a database. The collected data includes each student's first name, last name, age, gender, major, nationality, and so forth. The process component of the information system performs all sorts of analysis on this data. For example, the university's DBMS has a built-in query capability that can generate the following information:

- How many students are in each major?
- Which major is the fastest growing?
- What is the average age of the student body?
- Among the international students, which country is home to the highest number of students?
- What is the ratio of male to female students in each major?

Many other types of analysis can be done. A forecasting model could be used to generate the estimated number of students for 2020, for instance. In addition, predictions could be made or improved, based on information this system provides. For example, knowing which major is the fastest growing can help with decisions on hiring faculty, and knowing the estimated number of students for 2020 can help with planning facilities.

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Example 2 Teletech, an international textile company, uses a database to store data on products, suppliers, sales personnel, costs, and so forth. The process component of the information system conducts analysis on the data to provide the following information about the preceding month:

- Which salesperson generated the highest sales?
- Which product generated the highest sales? The lowest sales?
- Which region generated the highest sales?

Forecasting models can be used to generate predictions for the next sales period, and these predictions can be broken down by product, region, and salesperson. Based on this information, many decisions could be made, such as allocating the advertising budget to different products and regions.

In-Class Activity

Divide the class into four teams and assign each team a component of an information system (data, database, process, and information). Have each team explain the significance of each component using examples from a real-time organization.

Discussion Question

Distinguish information from data. How is the quality of information determined? List the qualities that determine an information's usefulness.

VI. Using Information Systems and Information Technologies

Information systems are designed to collect data, process the collected data, and deliver timely, relevant, and useful information that can be used for making decisions. To achieve this goal, an information system might use many different **information technologies**.

Computer networks (wired and wireless), database systems, POS systems, and radio-frequency-identification (RFID) tags are just a few examples of information technologies used to support information systems.

A. The Importance of Information Systems

Information is the second most important resource (after the human element) in any organization. Timely, relevant, and accurate information is a critical tool for enhancing a company's competitive position in the marketplace and managing the four Ms of resources:

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manpower, machinery, materials, and money.

To manage these resources, different types of information systems have been developed. A personnel information system (PIS) or human resource information system (HRIS) is designed to provide information that helps decision makers in personnel carry out their tasks more effectively. Web technologies have played a major role in improving the efficiency and effectiveness of HR departments.

A logistics information system (LIS) is designed to reduce the cost of transporting materials while maintaining safe and reliable delivery. A manufacturing information system (MFIS) is used to manage manufacturing resources so companies can reduce manufacturing costs, increase product quality, and make better inventory decisions. MFISs can perform many types of analysis with a high degree of timeliness and accuracy.

The goal of a financial information system (FIS) is to provide information to financial executives in a timely manner. In addition, marketing information systems (MKISs) are used to improve marketing decisions. An effective MKIS should provide timely, accurate, and integrated information about the marketing mix-4Ps: price, promotion, place, and product.

B. Using Information Technologies for a Competitive Advantage

Michael Porter, a professor at Harvard Business School, identified three strategies for successfully competing in the marketplace:

- Overall cost leadership
- Differentiation
- Focus

Information systems can help organizations reduce the cost of products and services and, if designed correctly, they can assist with differentiation and focus strategies. Information technologies can help bottom-line and top-line strategies. The focus of a bottom-line strategy is improving efficiency by reducing overall costs. A top-line strategy focuses on generating new revenue by offering new products and services to customers or increasing revenue by selling existing products and services to new customers.

For differentiation strategies, organizations try to make their products and services different from their competitors. With focus strategies, organizations concentrate on a specific market segment to achieve a cost or differentiation advantage.

Focus and differentiation strategies work only up to a certain point. Customers are often willing to pay more for a unique product or service or one with a specific focus. However,

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cost still plays a major role. If a product or service becomes too expensive, customers might not be willing to purchase it.

C. Porter's Five Forces Model: Understanding the Business Environment

Harvard Business School's Michael Porter created a comprehensive framework called the **Five Forces Model** for analyzing an organization, its position in the marketplace, and how information systems could be used to make the organization more competitive. The five forces are:

- Buyer power
- Supplier power
- Threat of substitute products or services
- Threat of new entrants
- Rivalry among existing competitors

Buyer power is high when customers have many choices and low when they have few choices. Typically, organizations try to limit buyers' choices by offering services that make it difficult for customers to switch, which is essentially using a differentiation strategy. Supplier power is high when customers have fewer options and low when customers have more options. Organizations might use information systems to make their products and services cheaper or to offer more services in order to distinguish themselves from competitors.

The threat of customers choosing substitute products or services is high when many alternatives to an organization's products and services are available. The threat of new entrants into the marketplace is low when duplicating a company's product or service is difficult. Rivalry among existing competitors is high when many competitors occupy the same marketplace position; it is low when there are few competitors.

In-Class Activity

Divide the class into three groups and have each group research one of Michael Porter's three strategies for successfully competing in the marketplace (overall cost leadership, differentiation, and focus). Ask each group to identify an organization that successfully incorporated one or more of the strategies. Then, ask them to present their findings in class.

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Discussion Question

Discuss any four major types of information systems, focusing on the types of data and analysis used in each.

VII. The IT Job Market

During the past decade, the IT job market has been one of the fastest growing segments in the economy, and it continues to be so. Even during the economic downturn, certain segments of the IT job market, such as Web design, infrastructure, and computer and network security, have shown growth compared to the rest of the job market. Broadly speaking, IT jobs fall into the following categories:

- Operations and help desk
- Programming
- Systems design
- Web design and Web hosting
- Network design and maintenance
- Database design and maintenance
- Robotics and artificial intelligence

The educational backgrounds for an IT position can include an AA, BA, BS, MS, or MBA in information systems and related fields. Popular jobs in the information systems field are as follows:

A. CTO/CIO

The top information systems job belongs to either the chief technology officer (CTO) or the chief information officer (CIO). This person oversees long-range planning and keeps an eye on new developments in the field that can affect a company's success.

B. Manager of Information Systems Services

This person is responsible for managing all the hardware, software, and personnel within the information systems department.

C. Systems Analyst

This person is responsible for the design and implementation of information systems. In

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addition to computer knowledge and an information systems background, this position requires a thorough understanding of business systems and functional areas within a business organization.

D. Network Administrator

This person oversees a company's internal and external network systems, designing and implementing network systems that deliver correct information to the right decision maker in a timely manner. Providing network and cybersecurity is part of this position's responsibility.

E. Database Administrator

A database administrator (DBA) is responsible for database design and implementation. Additionally, a database administrator should have knowledge and understanding of data warehouses and data-mining tools.

F. Computer Programmer

A computer programmer writes computer programs or software segments that allow the information system to perform a specific task. There are many computer languages available, and each one requires a specific knowledge suitable for a specific application. Because of the popularity of smartphones and mobile devices, many programmers are now developing apps for iOS and Android devices.

G. Webmaster

A webmaster designs and maintains the organization's Web site. In recent years, new IT-related jobs have been created that appear to also be in high demand. These jobs include:

- Social media/online-community manager
- Social media architect
- Telework manager or coordinator
- Search engine optimization specialist
- Business architect
- Data scientist
- Mobile technology expert
- Enterprise mobile developer
- Cloud architect

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In-Class Activity

Split the class into five groups and ask each group to choose a particular job in the information systems field. Then, ask each team to identify a unique role or feature about that job and present it to the class.

Discussion Question

With the advancement in technology, will different jobs in the information systems field be combined (merged) to form one job? Elucidate.

VIII. Outlook for the Future

By examining various factors related to designing, implementing, and using information systems, some of the following predictions can be made:

- Hardware and software costs will continue to decline, so processing information will be less expensive. These cost savings should make information systems affordable for any organization, regardless of its size and financial status.
- The computer literacy of typical information system users will improve, as computer basics are taught more in elementary schools.
- Networking technology will improve, so connecting computers will be easier, and sending information from one location to another will be faster. Compatibility issues between networks will become more manageable, and integrating voice, data, and images on the same transmission medium will improve communication quality and information delivery.
- Internet growth will continue, which will put small and large organizations on the same footing, regardless of their financial status. Internet growth will also make e-collaboration easier, despite geographical distances.

Some of the major computing trends that are already underway and should continue into the future are outlined below:

- Ubiquitous computing: Computing devices everywhere with different sizes and power and accessed through multiple formats such as voice, touch, and gesture.
- 3D printing: Creating a physical object from a 3D digital model for individuals use and businesses. This could significantly bring down manufacturing costs.
- Pervasive analytics: Building and integrating analytics capabilities into all everyday business activities.

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- Cloud computing: Growth in cloud computing for multiple applications and multiple users.
- Security: The importance of computer and network security will increase, and more attention will be given to application self-protection.

In-Class Activity

Prior to explaining this section to the students, ask them to identify at least five major computing trends that are already underway and would continue into the future.

Discussion Question

In light of the predictions surrounding the future of information systems, how do you think the role of humans is going to evolve at the workplace?

Key Terms

Computer literacy is skill in using productivity software, such as word processors, spreadsheets, database management systems, and presentation software, as well as having a basic knowledge of hardware and software, the Internet, and collaboration tools and technologies.

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

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

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

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

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

A **database** is a collection of all relevant data organized in a series of integrated files.

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The **process** component of an information system generates the most useful type of information for decision making, including transaction-processing reports and models for decision analysis.

Information consists of facts that have been analyzed by the process component and is an output of an information system.

Information technologies support information systems and use the Internet, computer networks, database systems, POS systems, and radio-frequency-identification (RFID) tags. (P.11)

Michael Porter's **Five Forces Model** analyzes an organization, its position in the marketplace, and how information systems could be used to make it more competitive. The five forces include buyer power, supplier power, threat of substitute products or services, threat of new entrants, and rivalry among existing competitors.

End of Chapter Solutions

Reviews and Discussions

What are two applications of computers and information systems at Domino's Pizza?

Answer—

- Domino's allows customers to order pizza using a voice app called "Dom," powered by Nuance Communications.
- Domino's customers can order pizza by tweeting a pizza emoji.

1. Is the knowledge of Office such as world processing and Excel computer literacy or information literacy? Discuss

Answer—

Computer literacy. It is skill in using productivity software, such as word processors, spreadsheets, database management systems, and presentation software, as well as having a basic knowledge of hardware and software, the Internet, and collaboration tools and technologies.

2. What are the four main components of an information system?

Answer—

Data, a database, a process, and information.

3. What are two applications of computers and information systems at the Home Depot?

Answer—

- A high-speed network connecting its stores throughout the United States and Canada.
- It uses a data warehousing application to analyze variables affecting its success—customers, competitors, products, and so forth.

4. What are three features or capabilities of a modern ATM?

   Answer—

   - Cash withdraw simply by tapping smartphones to the ATM, same technology similar to Apple Pay.
   - Withdrawals of up to $3,000 on some ATMs
   - Allowing customers to make their credit card and mortgage payments at the ATM.

5. What are Michael Porter's three strategies for successfully competing in the marketplace?

Answer—

- Overall cost leadership
- Differentiation
- Focus

6. What are two responsibilities of a data scientist?

Answer—

- Identifying the problem that an organization is facing.
- Identifying and collecting data sets and variables.

7. What are three examples of computing trends that are already underway?

Answer—

- Ubiquitous computing: Computing devices everywhere with different sizes and power and accessed through multiple formats such as voice, touch, and gesture (discussed in Chapter 2).
- The Internet of things (IoT) and the Internet of everything (IoE): Connected devices through the Web that will be used by businesses and individuals for increasing productivity and cost savings (discussed in Chapter 7).

Projects

1. Identify three applications of information systems at the college or the university that you are attending. Write a one-page paper that describes these three applications, and provide an example of the type of decisions that are being improved by each application.

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Answer—

Answers will vary. Online registration, online learning systems, and transcript preparations are just a few examples.

2. Grocery chains have been using information technologies for several decades. After reading the information presented in this chapter and other sources, write a one-page paper that describes three such technologies.

Answer—

Answers will vary. Point-of-sale (POS) systems, radio-frequency-identification (RFID) tags, and automated inventory systems are just a few examples..

3. RFID tags are being increasingly used by companies such as Macy's, Walmart, and Home Depot. Identify an additional company that uses RFIDs and write a one-page paper that describes the company's specific application of RFIDs.

Answer—

Answers will vary.

4. After reading the information presented in this chapter and other sources, write a one-page paper that describes the ways two different companies use Michael Porter's three strategies. How are information systems assisting these companies in implementing each strategy?

Answer—

Answers will vary.

5. After reading the information presented in this chapter and other sources, write a one-page paper that supports the claim that, in the future, computer criminals will become more sophisticated and that protecting personal information will become more difficult.

Answer—

Answers will vary.

6. Banks are promoting online banking to a broad range of customers. After reading the information presented in this chapter and other sources, write a one-page paper that lists three advantages and three disadvantages of online banking. Why are some customers reluctant to use online banking?

Answer—

Answers will vary.

Three advantages

- Accessing customer service by e-mail around the clock
- Viewing current and old transactions
- Online mortgage applications

Three disadvantages

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- Security issues
- Privacy issues
- Access issues

Are You Ready to Move On?

1. A point-of-sale (POS) system slows down service by reading the universal product codes (UPCs) on items in your shopping cart. True or False?

   Answer—

   False

2. Organizations use social networking sites to give customers up-to-date information and how-to support via videos. True or False?

   Answer—

   True

3. A logistics information system (LIS) is designed to reduce the cost of transporting materials while maintaining safe and reliable delivery. True or False?

   Answer—

   True

4. One of the following components of an information system is responsible for converting data to information?

a. Data

b. Information

c. Process

d. Database

   Answer—

   C

5. All of the following are among decisions supported by a PIS/HRIS except:

a. Choosing the best job candidate

b. Scheduling and assigning employees

c. Ordering decisions

d. Predicting the organization's future personnel needs

   Answer—

   C

6. All of the following information technology tools are being used in the marketing filed except:

a. Logistic optimization

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b. Business analytics

c. E-mail marketing

d. Search engine marketing

Answer—

A

Case Study 1-1

1. Is technology alone enough to ensure high-quality customer service?

Answer—
Answers will vary. A brief answer is no.

2. What are Federal Express's estimated annual savings from using information technology?

Answer—
Answers will vary.

3. What are a couple of examples of information technologies used by Federal Express?

Answer—
Answers will vary. The following are few examples:

- A comprehensive Web site, www.FedEx.com, where it assists customers and reduces costs
- Ship Manager
- Uses customer relationship management software called Clarify for improving customer service

Case Study 1-2

1. According to this case study, what is an upcoming key technology that will be used in retail stores to improve customer service?

Answer—
Mobile technology.

2. What is the name of the device used by Ahold USA's Stop & Shop retail stores?

Answer—

Scan It.

3. What will be the role of smartphones in the future of shopping?

Answer—
Answers will vary. Most experts believe that smartphones will be used as a device for paying for products and services among other things.