Technology Guide 1: Hardware

Chapter Outline

TG 1.1 Introduction to Hardware
TG 1.2 Strategic Hardware Issues
TG 1.3 Computer Hierarchy
TG 1.4 Input and Output Technologies
TG 1.5 The Central Processing Unit

Learning Objectives

1. Identify the major hardware components of a computer system.
2. Discuss strategic issues that link hardware design to business strategy.
3. Describe the various types of computers in the computer hierarchy.
4. Differentiate the various types of input and output technologies and their uses.
5. Describe the design and functioning of the central processing unit.

Teaching Tips and Strategies

Computer hardware has become so ubiquitous that some students do not realize that even their smartphones, iPods, and tablet computers contain processors. Even though students have grown up with computers, many students cannot distinguish among the myriad processors and memory options that are available. Students usually think the faster the processor, the better the computer. However, as this guide explains, this is not always the case.

This Technology Guide is designed to help students better understand the computer hardware decisions they make for themselves and, in some cases, will make for their future employers. Many of the design principles presented in this guide apply to most computers. The guide also covers the dynamics of innovation and the costs that can affect personal as well as corporate hardware decisions.

It is sometimes helpful to briefly review the history of computers to make certain that students realize that computers have not always been available to general consumers. I have also found it helpful to go over the basics of the binary and hexadecimal number systems and why they are important to computers. Trivia such as where numbers like 64 and 256 come from and why 1 megabyte is really not 1 million bytes seems to interest the students.

Most students are into game machines such as Xbox, PlayStation 3, and Wii. Ask the class if they remember their first game system. Then, ask what their thoughts are about the playability and graphics of the machine. Proceed to a discussion about the older technology that was involved with those machines compared to today's technology. This discussion will pique

students' interest in how quickly technology changes. It will also make students aware that if game machines do not keep up with technology, they might become obsolete like Atari, Coleco Vision, Intellevision, and Sega Dreamcast. (If you have any older students, ask them if they can remember Pong or Motorola's games from the early 1970s.)

This is a great chapter to demonstrate how computers have changed every aspect of our lives and how businesses communicate on a daily basis.

IT's About Business

There are no case studies in this Technology Guide.

before you go on…

1.   Decisions about hardware focus on what three factors?

Answer: The three factors are: capability (power and appropriateness for the task), speed, and cost.

Level: Easy
Section/Learning Objective: Section TG1.1 /Learning Objective 1
Bloom's Category: Knowledge
AACSB Category: Reflective Thinking

2.   What are the overall trends in hardware?

Answer: The overall trends in hardware have been smaller, faster, cheaper, and more powerful over time. In fact, these trends are so rapid that they make it difficult to know when to purchase (or upgrade) hardware. This difficulty lies in the fact that companies that delay hardware purchases will, more than likely, be able to buy more powerful hardware for the same amount of money in the future.

Level: Easy
Section/Learning Objective: Section TG1.2 /Learning Objective 2
Bloom's Category: Comprehension
AACSB Category: Reflective Thinking

3.   Define hardware and list the major hardware components.

Answer: Hardware refers to the physical equipment used for the input, processing, output, and storage activities of a computer system. It consists of:
•   Central processing unit: (CPU): manipulates the data and controls the tasks performed by the other components.

- Primary storage: internal to the CPU; temporarily stores data and program instructions during processing.
- Secondary storage: external to the CPU; stores data and programs for future use
- Input technologies: accept data and instructions and convert them to a form that the computer can understand.
- Output technologies: present data and information in a form people can understand.
- Communication technologies: provide for the flow of data from external computer networks (e.g., the Internet and intranets) to the CPU, and from the CPU to computer networks.

Level: Easy
Section/Learning Objective: Section TG1.1 /Learning Objective 1
Bloom's Category: Knowledge
AACSB Category: Reflective Thinking

4.   Describe the different types of computers.

Answer: The computer hierarchy beginning the most powerful and ending with the least powerful:
- Supercomputers are the computers with the most processing power. The primary application of supercomputers has been in scientific and military work, but their use is growing rapidly in business as their price decreases. Supercomputers are especially valuable for large simulation models of real-world phenomena, where complex mathematical representations and calculations are required, or for image creation and processing. Example supercomputer applications include weather modeling for better weather prediction, nondestructive weapons testing, aircraft design, and motion picture production. Supercomputers generally operate at 4 to 10 times faster than the next most powerful class, the mainframe.
- Mainframe computers - Large corporations use mainframe computers for centralized data processing and maintaining large databases. Applications that run on a mainframe can be large and complex, allowing for data and information to be shared by thousands of users throughout the organization. Examples of mainframe applications include airline reservation systems, corporate payroll, and student grade calculation and reporting.
- Midrange, ie.so called minicomputers and servers, are relatively small, inexpensive, and compact computers that perform the same function as mainframe computers, but to a more limited extent. Minicomputers are usually designed to accomplish specific tasks such as process control, scientific research, office automation, and engineering applications. IBM is the market leader with its AS/400 series of computers. Servers are smaller midrange computers that are used to support networks.
- Workstations were originally developed for engineers requiring high levels of processing performance. They are typically based on RISC (reduced instruction set computing) architecture and provide both very high-speed calculations and high-resolution graphic displays. These machines have found widespread acceptance with the scientific community and, more recently, within the business community.
- The distinction between workstations and personal computers is rapidly blurring. The latest personal computers have the computing power of recent workstations. Low-end workstations are now indistinguishable from high-end personal computers.

- – Microcomputers (also called micros, personal computers, or PCs) are the smallest and least expensive category of general-purpose computers. They can be subdivided into three classifications based on their size: desktops, laptops and notebooks, network computers, and palmtops.
- – Desktop PCs are the typical, familiar microcomputer system that has become a standard tool for business and, increasingly, the home. It is usually modular in design, with separate but connected monitor, keyboard, and CPU.
- – Laptop and notebook computers are small, easily transportable, lightweight microcomputers that fit easily into a briefcase. Notebooks and laptops are designed to be as convenient and easy to transport as possible.
- A netbook is a very small, lightweight, portable computer that is energy efficient and relatively inexpensive. Netbooks are generally optimized for Internet-based services such as Web browsing and emailing.
- A tablet computer, or simply tablet, is a complete computer contained entirely in a flat touch screen that users operate via a stylus, a digital pen, or their fingertip instead of a keyboard or mouse

Level: Medium
Section/Learning Objective: Section TG1.3 /Learning Objective 3
Bloom's Category: Comprehension
AACSB Category: Reflective Thinking

5.   Distinguish between human data-input devices and source-data automation.

Answer: Human data-input devices allow people to communicate with the computer. Some of these devices are very common, such as the keyboard and the mouse. Others, such as the touch screen, stylus, trackball, joystick, and microphone, are used for somewhat more specialized purposes.

The objective of source-data automation is to input data with minimal human intervention. These technologies speed up data collection, reduce errors, and can gather data at the source of a transaction or other event. Common devices in source-data automation are automated teller machines (ATMs), point-of-sale (POS) terminals, bar code scanners, and optical mark readers. Voice recognition systems (VRS) are an emerging source-data automation tool used in conjunction with microphones to input speech into computers. Finally, sensors collect data from the environment and input them into a computer system. Examples include heating, ventilating and air-conditioning (HVAC) control sensors in building automation systems, and the myriad types of sensors built into a modern aircraft.

Level: Medium
Section/Learning Objective: Section TG1.4 /Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Analytic

6.   Briefly describe how a microprocessor functions.

Answer: A microprocessor fundamentally accepts inputs, stores them until needed, at which point they are retrieved and processed and the output is stored and delivered somewhere.

Level: Easy
Section/Learning Objective: Section TG1.5 /Learning Objective 5
Bloom's Category: Knowledge
AACSB Category: Reflective Thinking

7. Distinguish between primary storage and secondary storage.

Answer: Primary storage.
- RAM holds a program and small accounts of data for processing and is volatile.
- Registers have the least capacity, storing instructions and data for a short time before processing.
- Cache memory is a type of high-speed memory that enables the computer to temporarily store blocks of data that are used often so the processor can access them more rapidly.
- ROM is a type of chip where certain critical instructions are safeguarded and is not volatile.

Secondary storage.
- Magnetic media (such as hard disks, floppy disks or tape)
- Optical media - read by a laser, slower than magnetic drives, but are less fragile

Primary storage is faster, but more costly and has a smaller capacity than secondary storage.

Level: Medium
Section/Learning Objective: Section TG1.1 /Learning Objective 6
Bloom's Category: Analysis
AACSB Category: Analytic

Discussion Questions

1. What factors affect the speed of a microprocessor?

Answer: The speed is commonly measured by the number of instructions the chip processes per second – machine instructions cycles per second, or MIPS. This number depends on the following four factors:
- The preset speed of the clock that times all chip activities, measured in megahertz (MHz). The faster the clock speed the faster the chip (a 500 MHz chip is half as slow as a 1.0 GHz chip).
- The word length, which is the number of bits (0s and 1s) that can be processed at any time. Today's chips are designed to handle 32-bit or 64-bit word length. The larger the word length, the faster the chip.
- The bus width. The wider the bus (the physical avenues down which the data and information travel as electrical impulses), the more data can be moved and the faster the processing. Buses are measured in microns (millionths of a meter).

- The physical design of the chip. Generally, a greater number of transistors and shorter line width (distance between transistors) give faster processing speeds.

Level: Medium
Section/Learning Objective: Section TG1.5 /Learning Objective 5
Bloom's Category: Synthesis
AACSB Category: Analytic

2. If you were the chief information officer (CIO) of a firm, what factors would you consider when selecting secondary storage media for your company's records (files)?

Answer: Factors a CIO might consider when selecting secondary storage media for company records:
- Cost per byte of storage
- Amount of storage capacity required
- Archival storage requirements
- Back up considerations
- Retrieval speed
- Portability and cross platform support

Level: Medium
Section/Learning Objective: Section TG1.5 /Learning Objective 5
Bloom's Category: Synthesis
AACSB Category: Analytic

3. Given that Moore's Law has proven itself over the past two decades, speculate on what chip capabilities will be in 10 years in the future. What might your desktop PC be able to do?

Answer: The brightest prospects for desktop computers in 10 years are in multimedia systems design. While sound, video, and animation are still most important for educational and game software, multimedia PCs has already begun to suffice business applications as well. The cost of videoconferencing has plummeted while its quality has improved. Film clips and animations are enhancing tutorials and training materials. Shared documents with voice digitized photographs, or 3-D graphics are beginning to make the rounds on the company network. The next generation Internet initiative will deliver a highly graphical Web, for good or ill, will be more commonplace as bad coffee in today's office.

Level: Hard
Section/Learning Objective: Section TG1.5 /Learning Objective 5
Bloom's Category: Synthesis
AACSB Category: Analytic

4. If you were the chief information officer (CIO) of a firm, how would you explain the workings, benefits, and limitations of thin clients as opposed to using fat clients?

Answer: CIOs can focus on the total cost of ownership (TCO) aspect of thin client versus fat client. Thin client based systems are not only less expensive to buy than standard personal computers, but they accrue additional cost benefits over the life of the computer. Savings can be achieved with thin clients through minimizing technical support, less training for users and less frequent replacement. It is good to have a choice for client computing and it is unlikely that thin clients will make today's fat client obsolete. There are scenarios were both client systems work best.

Level: Medium
Section/Learning Objective: Section TG1.2 /Learning Objective 2
Bloom's Category: Synthesis
AACSB Category: Analytic

5.   Where might you find embedded computers at home, at school, and/or at work?

Answer:
•   Embedded computers for improved healthcare. Applications based on remote diagnosis of vital health signs.
•   Embedded computers and sensors for monitoring all aspects relating to home security, comfort and control.
•   Embedded computers to deliver emergency signals from homes to monitoring stations.

Level: Easy
Section/Learning Objective: Section TG1.2 /Learning Objective 2
Bloom's Category: Comprehension
AACSB Category: Reflective Thinking

6. What does this statement mean: "Hardware is useless without software."

Answer: Basically, a computer (hardware) does not have any capabilities without the operating system and application software to utilize the capabilities of the hardware.

Level: Easy
Section/Learning Objective: Section TG1.2 /Learning Objective 2
Bloom's Category: Comprehension
AACSB Category: Reflective Thinking

Problem Solving Activities

1.   Access the websites of the major chip manufacturers—for example, Intel (*www.intel.com*), Motorola (*www.motorola.com*), and Advanced Micro Devices (*www.amd.com*)—and obtain the latest information on new and planned chips. Compare performance and costs across these vendors. Ensure to take a close look at the various multicore chips.

Answer: Students should research and report their findings.

Level: Medium
Section/Learning Objective: Section TG1.5 /Learning Objective 5
Bloom's Category: Analysis
AACSB Category: Analytic

2.   Access "The Journey Inside" on Intel's website at
     http://www.intel.com/content/www/us/en/education/k12/the-journey-inside.html. Prepare a
     presentation of each step in the machine instruction cycle.

Answer: Students should research and report their findings.

Level: Medium
Section/Learning Objective: Section TG1.5 /Learning Objective 5
Bloom's Category: Analysis
AACSB Category: Analytic

Chapter Glossary

arithmetic logic unit (ALU) Portion of the CPU that performs the mathematical calculations and makes logical comparisons.

augmented reality A live, direct or indirect, view of a physical, real-world environment whose elements are enhanced by computer-generated sensory input such as sound, video, graphics, or GPS data.

bit Short for *binary digit* (0s and 1s), the only data that a CPU can process.

byte An 8-bit string of data, needed to represent any one alphanumeric character or simple mathematical operation.

cache memory A type of high-speed memory that enables the computer to temporarily store blocks of data that are used more often and that a processor can access more rapidly than main memory (RAM).

central processing unit (CPU) Hardware

that performs the actual computation or "number crunching" inside any computer.

control unit Portion of the CPU that controls the flow of information.

fat clients Computers that offer full functionality without having to connect to a network.

flash memory devices Nonvolatile electronic storage devices that are compact, are portable, require little power, and contain no moving parts.

gesture recognition An input method that interprets human gestures, in an attempt for computers to begin to understand human body language.

magnetic disks (or hard drives or fixed disk drives) A form of secondary storage on a magnetized disk divided into tracks and sectors that provide addresses for various pieces of data.

magnetic tape A secondary storage medium on a large open reel or in a smaller cartridge or cassette.

microprocessor The CPU, made up of millions of transistors embedded in a circuit on a silicon wafer or chip.

Moore's law Prediction by Gordon Moore, an Intel cofounder, that microprocessor complexity would double approximately every two years.

multimedia technology Computer-based integration of text, sound, still images, animation, and digitized full-motion video.

optical storage devices A form of secondary storage in which a laser reads the surface of a reflective plastic platter.

primary storage (also called main memory) High-speed storage located directly on the motherboard that stores data to be processed by the CPU, instructions telling the CPU how to process the data, and operating system programs.

random access memory (RAM) The part of primary storage that holds a software program and small amounts of data when they are brought from secondary storage.

read-only memory (ROM) Type of primary storage where certain critical instructions are safeguarded; the storage is nonvolatile and retains the instructions when the power to the computer is turned off.

registers High-speed storage areas in the CPU that store very small amounts of data and instructions for short periods.

secondary storage Technology that can store very large amounts of data for extended periods.

sequential access Data access in which the computer system must run through data in sequence to locate a particular piece.

server Computers that support networks, enabling users to share files, software, and other network devices.

solid-state drives (SSDs) Data storage devices that serve the same purpose as a hard drive and store data in memory chips.

thin client A computer that does not offer the full functionality of a fat client.

thumb drive Storage device that fits into the USB port of a personal computer and is used for portable storage.

Chapter 1: Introduction to Information Systems

Chapter Outline

1.1 Why Should I Study Information Systems?
1.2 Overview of Computer-Based Information Systems
1.3 How Does IT Affect Organizations?
1.4 Importance of Information Systems to Society

Learning Objectives

1. Identify the reasons why being an informed user of information systems is important in today's world.
2. Describe the various types of computer-based information systems in an organization.
3. Discuss ways in which information technology can affect managers and non-managerial workers.
4. Identify positive and negative societal effects of the increased use of information technology.

Teaching Tips and Strategies

Most of today's college students use information in ways that were not dreamed of just a few years ago. However, because most students have grown up with information technology, they normally do not think about the whys and wherefores that underlie it.

It is therefore important for students to step back and learn the basic terms that define the foundation of Management Information Systems (MIS). Unfortunately, some of them will find this task boring or even complain they already know it all.

Because most students use technology in their everyday lives, they often fail to see the importance of MIS and how it relates to them. In order to involve students in the class, it is vital to let them know what is in it for them. This step should be taken early in the course to engage the students from the beginning. You may want to find each student's major and explain how MIS knowledge can enhance their course of study and their chosen career. Knowing each student's major and career goals will help you tailor examples, classroom assignments, and discussions to the students' individual interests. Point out the "What's In IT for Me" end-of-chapter section so that students know there are links to each major for each chapter.

Explaining how MIS has affected businesses as well as workers helps to get students interested in this class. It also helps them to appreciate the relevance of the history of how computers have evolved and how MIS and DSS applications have made managerial decision making easier and more reliable.

The importance of computer technology is underscored by examples of how companies save money by using email as an alternative to the postal service. Students should be introduced to the concept that IT must be paired with business processes to harness its potential. IT is important to business leaders all over the world. In Canada, immigration lawyers use an online system to assess potential salaries for different types of job (*http://www.canadavisa.com/canada-salary-wizard.html*). Students should be encouraged to become familiar with this website. Salary statistics for IT related jobs in Canada can be obtained from *http://www.itworldcanada.com/salarycalculator/* because salary information seems to attract students' attention, especially if they realize that if they are more technology savvy, then they will likely make more money.

Case 1.1: SAMS Chaos

1. Itemize the tasks that were likely underestimated by the Ontario Ministry of Community and Social Services during the development and implementation phases of the SAMS project. Why might these tasks have been underestimated?

Answer: Interpreting "underestimated" as "inadequately performed", it is reasonable to conclude that SAMS problems quite likely began in the early phases of the project (Chapter 13), (and took their root in existing poor IT governance (Chapter 2) and control practices (Chapter 4) within the ministry/provincial government). So, in addition to identifying the obvious task of testing, students should be encouraged to describe steps from other phases:

- Testing – to ensure the system does what it is expected to do by the developers and the users, and that it is doing it correctly
- In Systems investigation – what do we really need, new or revised software, or better procedures/adherence to procedures (to ensure that data processing is complete, accurate and authorized – i.e., better controls around use of existing system). Are our problems really the fault of the system or the system alone?
- Ensuring real, ongoing user involvement in all stages of the SAMS project
- In systems analysis – more complete, clear description of user/business requirements, TO BE DETERMINED BEFORE making any decision about whether to modify or replace the existing system, and especially before requesting quotes from software vendors.
- In assessing the quotes - careful and thorough assessment of each vendor's software in meeting the ministry's detailed business requirements, as well as each vendor's reputation, reliability, service and support.
- In implementation:
  - careful planning and detailed testing of data conversion to ensure that integrity of master data is maintained;
  - choice of an appropriate conversion strategy, (such as pilot or phased), to reduce the risk of the kind of chaos that occurred at the ministry;
  - staff training for implementation tasks and for ongoing operations with the new system.

Level: Medium
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Application
AACSB Category: Reflective Thinking

2.　Is it possible for the ministry to do its work without computer systems? Why or why not?

Answer: While it is possible, it is not realistic to operate manually today. This is a province-wide system, serving 900,000 citizen-clients with varying needs at any time. The system supports complicated processes, involving multiple government programs and regulations that influence eligibility, payments and services. Client data needs to be maintained and used to assess and document eligibility, calculate payments, and prepare required forms and letters. Clearly, accuracy, timeliness and security are critically important to this system and IT can best provide the means of satisfying all these requirements.

Level: Hard
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Evaluation
AACSB Category: Technology
AACSB Category: Reflective Thinking

Case 1.2: Are Drones ready to deploy?

1.　What are the advantages of commercial drones (in general)?

Answer: The advantages of commercial drones include many applications. They are more cost effective in applications where traditional airplanes or helicopters might have been used in the past. Drones could access areas or provide views that were not available to users in the past. Drone use was also opened to those where could not afford traditional aircraft. Companies will develop new applications for the use of drones as their design and capabilities evolve.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Technology

2.　What are the disadvantages of commercial drones (in general)?

Answer: The more sophisticated drone models require specialized training to operate them. Due to their advanced capabilities, there is the potential for them to interfere with safe operation of commercial and private aircraft. In the U.S., the FAA is considering requiring the licensing of commercial drone pilots. (Auburn University was the first university in the U.S. to receive FAA approval for a program to train commercial drone pilots.)

As the use of drones expands to other venues/applications, such as camera platforms over crowds at concerts or athletic events, issues such as liability issues in the case of a crash, will have to be considered.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4

Bloom's Category: Analysis
AACSB Category: Technology

3. Do you think the advantages outweigh the disadvantages, or vice versa? Support your answer.

Answer: Based on current aviation industry literature, the advantages of the use of drones far exceed the disadvantages. In addition, the expanding use of drones will open up new job and business opportunities. (Your students should expand on this.)

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Technology

4. Search the Internet for a drone manufacturer near you. How much do they charge and what types of drones do they produce?

Answer: In August 2016, I found a Mississauga, Ontario based manufacturer, Aeromao, *(http://aeromao.com)*, producing commercial drones, "destined for image acquisition for mapping and surveying applications", with three models priced from USD $9600 to $16,000, plus available upgrades for increased accuracy. Marketing material indicated that the drones meet FAA and Transport Canada standards, are individually tested and delivered ready to use, with no assembly or setup required and support documentation available on request.

Level: Easy
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Comprehension
AACSB Category: Technology

IT's About Business 1.1 Grab Your Food Faster with Grabb

1. Use Table 1.1 to consider all the different roles that individual developers of apps need to play when creating, running, and marketing their product. Describe three of these jobs in detail.

Answer: At a minimum, the student needs to consider (identify??) roles specifically related to application systems development and operation, including Applications Development, Project, Programming and Systems Managers, System and Business Analysts, and Applications Programmer. If the student is considering innovative applications to run on the Web, they may also need to include roles such as Emerging Technologies, Network and Computer Security Managers, Webmaster, Web Designer, and perhaps Database Administrator if DBMS is to be an integral part of the application software package. In addition to all these IT roles, the student would need to consider the roles involved in marketing the application and in managing the business. The three jobs to be described in detail would be best if chosen from among the key IT roles associated with a particular type of application the student has in mind.

Level: Medium
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Analysis
AACSB Category: Analytic
AACSB Category: Technology
AACSB Category: Reflective Thinking

2. Search your city and those in your province for restaurant-related or pickup apps. Compare and contrast them. Which one would you use? Why?

Answer: Answers will vary. Look in student answers for clear, relevant criteria on which they choose their favoured app. An interesting discussion that might evolve from reviewing this question with the students is in recognizing that those customer-favoured apps, which likely offer flexibility, convenience and ease of use, may also involve the use of sophisticated or complex technology in their development. Without recognizing and making use of the power of IT, businesses may miss their opportunity for gaining competitive advantage or even staying in the game.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Comprehension
AACSB Category: Technology

3. How would the IT department of a large organization such as Just Eats differ from a start-up such as Grabb?

Answer: Just Eats, started in 2000, now running multiple websites around the world would have a much larger IT department than that of the start-up, downtown Toronto based Grabb. Just Eats' IT department would likely have a formal IT reporting structure, supporting decentralized operations geared to its major market locations. Grabb may still be a one-man operation or it may be a small, informal team of IT technical specialists, working at one location or virtually, possibly from their homes, likely under the management of the company founder, Daswani.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Comprehension
AACSB Category: Communication
AACSB Category: Technology

IT's About Business 1.2 Warby Parker

1. Provide two examples of how Warby Parker uses information technology to support its business model.

Answer: Warby Parker uses information technology:

- To maintain an online presence where their potential customers can make selections and place orders
- Offers a way for customers to upload photos to virtually try on frames.

Level: Easy
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Comprehension
AACSB Category: Technology

2. How might Warby Parker further use information technology to counter major competitors who want to emulate Warby's business model? Support your answer.

Answer: To counter competitors trying to emulate their business model, Warby Parker might:
- develop an application where customers can design their own frames from available parts.
- develop an exchange/upgrade program.
Students may have other suggestions.

Level: Medium
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Application
AACSB Category: Technology

IT's About Business 1.3 Saving Money and Time Using Additive Manufacturing

1. Research online the different materials that can be used by 3D printers. Which industries could use these materials and how?

Answer: A broad array of materials can be used, based on the many additive processes and technologies now available. Raw materials include not only paper, polymers and metals, but also edible materials, rubbers, clays, thermoplastics and plastic film, metal foils, powders and alloys, ceramic materials and powders and more.
Students could discuss use in many industries, but answers need to reflect an understanding that:
- 3D printing is not appropriate for use in high volume manufacturing. It is best in small volume production (e.g., artisanal jewellery making), prototypes/samples or mold making from which dies may be cast for more conventional manufacturing;
- 3D printers can be very expensive (ranging from hundreds to thousands of dollars in price), so their use must merit their cost. Some examples of appropriate and innovative uses are to create needed tools or medical instruments in remote locations or outer space.

Level: Hard
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Evaluation
AACSB Category: Technology
AACSB Category: Reflective Thinking

2. Discuss the possible reactions of a small manufacturing business owner to the use of 3D printing to help the company print samples for production.

Answer: The small business owner's reaction could vary, depending on whether he/she is an informed user if IT. Shock and rejection might be a response from an owner with little IT knowledge and no 3D printing knowledge. However, a better informed and open-minded owner might react positively to the prospect of saving time and resources to produce realistic samples, which might easily justify the cost of a printer.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Analytic
AACSB Category: Technology

3. Search Amazon for the current availability and price of 3D printers. Which printers do you think would be suitable for a small manufacturing business employing 20 people? What about a large manufacturing company with 5,000 employees—which printers would it purchase?

Answer: Answers will vary. Amazon's Prices for Industrial and Scientific 3D printers ranged from less than $300 to more than $6000 US. However, suitability to business size is not necessarily determined by the price, but rather by the function that it will perform. Students' interpretations of the question will impact their answers.

Level: Hard
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Evaluation
AACSB Category: Technology
AACSB Category: Reflective Thinking

IT's About Business 1.4 Apricot Forest Helps China's Physicians

1. Explain how Apricot Forest's apps will help improve the relationship between physicians and patients in China.

Answer: Apricot Forest's apps provide a means for the doctors to maintain patient records and for their patients to contact their doctor using MedClip. The patients previously could not directly contact their doctors. It also enables the doctors to have access to patient records via a mobile app if there are treating them in a patient's home.

Level: Easy
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Comprehension
AACSB Category: Technology

2.   Explain how Apricot Forest's apps will help improve overall health care in China.

Answer: Apricot Forest can aggregate and analyze the data the doctors enter into MedClips. This information can be supplied to companies for market research, design, and for the marketing of medical products. Overall, the company's tools provide China's doctors with more information about their patients.

Level: Easy
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Comprehension
AACSB Category: Technology

3.   Discuss potential disadvantages of Apricot Forest's apps to patients.

Answer: Potential disadvantages to patients include Apricot Forest selling information about them to researchers, and marketing companies. Another disadvantage is that because the apps include advertisements, marketing companies could possibly track patient/doctor clicks and target marketing towards them. They could also potentially use patient information entered by the doctor for marketing purposes.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Application
AACSB Category: Technology

4.   Discuss potential disadvantages of Apricot Forest's apps to physicians.

Answer: Potential disadvantages to doctors possibly include government health agencies using Apricot Forest apps to track the quality of service the doctor is provided their patients. Another disadvantage is that because the apps include advertisements, marketing companies could possibly track patient/doctor clicks and target marketing towards them. They could also potentially use patient information entered by the doctor for marketing purposes.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Application
AACSB Category: Technology

before you go on…

Section 1.1

1.   Rate yourself as an informed user. (Be honest; this isn't a test!)

Answer: You will receive all types of answers to this question. Some will think they have a

higher level of technology knowledge than they actually do.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Knowledge
AACSB Category: Technology

2.   Explain the benefits of being an informed user of information systems.

Answer: Informed users tend to get more value from whatever technologies they use. You will enjoy many benefits from being an informed user of IT. First, 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 operating "behind" your screen. Second, you will be in a position to enhance the quality of your organization's IT applications with your input. Third, even as a new graduate, you will quickly be in a position to recommend — and perhaps help select — the IT applications that your organization will use. Fourth, being an informed user will enable you to keep abreast of both new information technologies and rapid developments in existing technologies. Remaining "on top of things" will help you to anticipate the impacts that "new and improved" technologies will have on your organization and to make recommendations on the adoption and use of these technologies. Finally, you will understand how IT can be used to improve your organization's performance and teamwork as well as your own productivity.

Level: Medium
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Comprehension
AACSB Category: Technology

3.   Discuss the various career opportunities offered in the IT field.

Answer: Career opportunities in IS are strong and are projected to remain strong over the next ten years. In fact, when Money Magazine's Best Jobs in America (http://money.cnn.com/pf/best-jobs/2015/list/index.html) listed the "top jobs" in America in 2015, 11 of the top 40 jobs related directly to information technology. These jobs (with their ranks) are:
(1) Software Architect: 10-year growth projection: 23% Median pay: $124,000
(2) Video Game Designer: (19% / $79,900)
(8) Database Designer: (23% / $88,300)
(9) Information Assurance Analyst: (37% / 96,400)
(14) User Experience Designer: (18% / $89,300)
(17) IT Program Manager: (15% / $122,000)
(27) Health Information Management Director (23% / $81,900)
(32) Software Quality Assurance Manager (15% / $110,000)
(38) IT Security Consultant: (37% / $110,000)
(39) Telecommunications Network Engineer: (15% / $90,500)
(40) Technical Consultant: (23% / $101,000)

Have your students check the site (*http://money.cnn.com/pf/best-jobs/2015/list/index.html*) for the current year.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Knowledge
AACSB Category: Technology

Section 1.2

1.   What is a computer-based information system?

Answer: 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."

Level: Easy
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Knowledge
AACSB Category: Technology

2.   Describe the components of computer-based information systems.

Answer:
●   Hardware is a device such as the processor, monitor, keyboard, and printer. Together, these devices accept data and information, process them, and display them.
●   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 permits different computers to share resources.
●   Procedures are the set of instructions about how to combine the above components in order to process information and generate the desired output.
●   People are those individuals who use the hardware and software, interface with it, or utilize its output.

Level: Medium
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Knowledge
AACSB Category: Technology

3.   What is an application program?

Answer: An application (or app) is a computer program designed to support a specific task or business process.

Level: Easy
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Knowledge
AACSB Category: Technology

4.   Explain how information systems provide support for knowledge workers.

Answer: Knowledge workers make decisions about situations that can significantly change the manner in which business is done. Information systems provide the databases, communications, and applications which allow them to store critical data used in analysis and tactical decision making.

Level: Easy
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Comprehension
AACSB Category: Technology

5.   As we move up the organization's hierarchy from clerical workers to executives, how does the type of support provided by information systems change?

Answer: At the lower organizational levels, systems are used primarily to automate routine tasks. Moving up in the organization, systems are used to analyze information for decision making purposes.

Level: Easy
Section/Learning Objective: Section 1.2 /Learning Objective 2
Bloom's Category: Comprehension
AACSB Category: Technology

Section 1.3

1.   Why should employees in all functional areas become knowledgeable about IT?

Answer: Information systems are important for several reasons, regardless of the employee's functional area of responsibility. (1) IT facilitates the organizational activities and processes of today's businesses. (2) Most jobs students will go to after graduating will require some knowledge of information technology. (3) Employees' that are able to use information technology will be able to give themselves an important advantage over their peers in the workplace. (4) Students will find that information systems will make their job easier and more efficient.

Level: Medium
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Comprehension
AACSB Category: Technology

2.   Describe how IT might change the manager's job.

Answer: IT often provides managers with near real-time information, meaning that managers have less time to make decisions, making their jobs even more stressful

Level: Easy
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Comprehension
AACSB Category: Technology

3.   Discuss several ways in which IT affects employees at work.

Answer: 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 that was present in non-computerized systems.

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

They can adversely affect individuals' health and safety. To illustrate this point, we consider two issues associated with IT: job stress and long-term use of the keyboard.

Computers can create new employment opportunities for people with disabilities by integrating speech- and vision-recognition capabilities.

Level: Easy
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Application
AACSB Category: Technology

Section 1.4

1.   What are some of the quality-of-life improvements made possible by IT? Has IT any negative effects on our quality of life? If so, explain and provide examples.

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

However, IT can also place employees on "constant call" where they are never truly away from the office, even when they are on vacation.

Level: Easy
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Application

AACSB Category: Technology

2.   Describe the robotic revolution and consider its implications for humans.

Answer: In fact, "cyberpooches," "nursebots," and other mechanical beings may be our companions before we know it. Around the world, quasi-autonomous devices have become increasingly common on factory floors, in hospital corridors, and in farm fields. In our homes, iRobot (*www.irobot.com*) produces the Roomba to vacuum our floors, the Scooba to wash our floors, the Dirt Dog to sweep our garages, the Verro to clean our pools, and the Looj to clean our gutters.

We also have to look at advances made in building robotic devices to replace hands, legs, and arms.

To do some tasks, companies have started to replace human-workers with robotic workers.

Level: Easy
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Application
AACSB Category: Technology

3.   Explain how IT has improved health care practices.

Answer: Medical personnel use IT to make better and faster diagnoses and to monitor critically ill patients more accurately. IT also has streamlined the process of researching and developing new drugs. Expert systems now help doctors diagnose diseases, and machine vision is enhancing the work of radiologists. Surgeons use virtual reality to plan complex surgeries. They have also used a surgical robot to perform long-distance surgery by controlling the robot's movements. Finally, doctors discuss complex medical cases via videoconferencing. New computer simulations recreate the sense of touch, allowing doctors-in-training to perform virtual procedures without risking harm to an actual patient.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Application
AACSB Category: Technology

Discussion Questions

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

Answer: Answers will vary. Encourage student to go beyond simplistic approaches that merely indicate use of the internet to search for ideas and help with business planning and financing. They could include specific websites and apps they might use, online businesses they might

research, software they could use to keep records of their research results, as well as software that they could use for business planning and financing, or online courses they might take to learn how to do some of these things for themselves.

Level: Medium
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Application
AACSB Category: Technology

2. Your university wants to recruit high-quality high school students from your province. 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.

Answer:
    Grade 12 grades, AP course grades - potential for success in university courses
    Location – some students may want to stay close to home
    Other factors that may be unique to your school or to faculties or programs at your school

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Comprehension
AACSB Category: Technology

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

Answer: Yes. Students will have different responses based on their personal experiences and possibly their majors.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Comprehension
AACSB Category: Technology

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

Answer: This discussion should touch on email and Instant Messaging and their impact on a 24/7/365 business environment. If you are teaching an online class or the students are familiar with the concept, discuss how being available has changed the way you are interacting with students. Applications such as Facebook, Google+, and Twitter should also be considered in the overall discussion given that businesses have embraced these as marketing tools.

Level: Medium

Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Application
AACSB Category: Technology

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

Answer: Potentially reducing or eliminating some non-skilled repetitive production line jobs.

Level: Easy
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Comprehension
AACSB Category: Technology

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

Answer: Discuss the issue of reliability of the sources of information and danger of self-diagnosis. Also discuss problems related to non-tested "miracle cures" and possible negative interactions with medications a patient may be taking for other conditions.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Application
AACSB Category: Technology

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

Answer: Most of your students have grown up using technology and will not remember a time when it was not around. Open the discussion by asking how many students have Facebook (FB) and/or Google+ profiles. Ask them how they kept up with their friends before FB? Then open the discussion as to how they use Facebook/Google+, how often the access their account, how many "friends" they have and do they block any, how often they post? If any students have hundreds of friends in FB, ask why and do they consider it a problem (why or why not?) Ask how many of the students have smartphones? Ask of and how often they use text messaging on the including and for what? Do they maintain an electronic calendar to remind them of events (including birthdays and doctor appointments). This questions has a number of possibilities.

Level: Medium
Section/Learning Objective: Section 1.4/Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Technology

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

Answer: Hopefully this course will in the end provide an answer to the question. However the basis of the answer is to help the employee understand what is going on around them within the business and industry so that they might be able to make knowledge-based decisions on ways technology can be used to strategically support or enhance the business process.

Level: Easy
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Application
AACSB Category: Technology

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

Answer: In order to stay competitive, organizations should look to new advances in the use of information technology. This impacts employees in many ways.

In the case of social media, the automation of the employment process by the HR department and, in a growing number of cases, the use of social media to find and track employees. Employees need to understand social media so they can use it effectively.

Another example is the use of social media for the marketing of the organization's products or services. While some companies still advertise on search sites such as Google and Yahoo, they are now using sites as Facebook and Twitter for this.

Another area is data analytics. This is very important area for many companies. Employees not only need to understand data analysis, but how to collect, store and manage massive amounts of data.

Have your students research other examples.

Level: Medium
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Analysis
AACSB Category: Technology

10. Given the information technology is affecting every industry, what does this mean for students attending a business college or university? Provide specific examples to support your answer.

Answer: New technologies are being announced or release almost every day. In addition, researchers are discovering or developing new ways to use old technologies. Finally, old applications are being updated to utilize these advancements. What this means for business students is technologies that used or learned about as freshman may no longer be around or even replaced by the time that they graduate.

Examples of this include how businesses have embraced the use of social media, such as Facebook, since 2013. How hiring departments have embraced the use of social media sites such as LinkedIn to find applicants and use sites such as Facebook as part of their background checks.

Another example is the use of mobile apps. Up until around 2014, students had to use a computer to write research papers using a text processer such as MS-Word or Apple's Pages. Mobile apps are now available so students can now use their tables or smartphones (if they really want to).

There are smartphone apps, such as for graphing calculators that are just powerful as a standalone calculator.

Have your students research other examples.

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Technology

11. Refer to the study at Princess Alexandra Hospital (in the "Improvements in Health Care" section). How do you feel about the study's finding that Google searches find the correct diagnosis in 57 percent of the cases? Are you impressed with these results? Why or why not? What are the implications of this study for self diagnosis?

Answer: Ask if the students consider 57 percent a good or bad success rate? Why or why not? What are some of the implications of a false positive diagnosis? False negative?

Level: Easy
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Analysis
AACSB Category: Technology

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

Answer:
Patient   Good: provides the patient with information that they can discuss with the doctor. Provides the patient more information and possibly options not mentioned by physician.

Bad: provides some erroneous or false information which might be misinterpreted by the patient, possibly wasting the physician's time or causing a misdiagnosis done by the patient themselves.

Physician   Good: provides current trends assisting to diagnosis and treatments. Collaboration with other physicians. If patient records are available online, can view test results that were done at other locations.

Bad: patient records security issues

Level: Medium
Section/Learning Objective: Section 1.4 /Learning Objective 4
Bloom's Category: Analysis
AACSB Category: Technology

Problem Solving Activities

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

Answer: Students will provide comparisons about IT positions (suggest classifications – analyst, developers, support) and salary ranges using the sites listed.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Analysis
AACSB Category: Technology

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

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

Answer: The site provides a detailed interface to interact with the company and information about its multitude of services.

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

Answer: Visit *http://www.ups.com/content/us/en/resources/track/check/index.html?WT.svl=Footer* to get information about the tracking system and its policies.

    c. Calculate the cost of delivering a 25 cm x 50 cm x 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 UPS. How does the company make this process easier when you are a business customer?

Answer: Cost can vary from ~ $200 for overnight to $42 for slowest option.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Knowledge
AACSB Category: Technology

3.   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.

Answer: Students will discuss their findings after searching the Internet.

Level: Easy
Section/Learning Objective: Section 1.3 /Learning Objective 3
Bloom's Category: Knowledge
AACSB Category: Technology

4.   Access *www.irobot.com* and investigate the company's education and research robots by
     checking the iRobot STEM section on the site. Surf the Web for other companies that
     manufacture robots, and compare their products with those of iRobot.

Answer: Students will discuss their findings after searching the site.

Level: Easy
Section/Learning Objective: Section 1.1 /Learning Objective 1
Bloom's Category: Knowledge
AACSB Category: Technology

Team Assignments

1. a. Create an online group for studying IT or a part of it you are interested in. Each member of
        the group must have a Yahoo email account (free). Go to Yahoo!: Groups
        (*http://groups.yahoo.com*) and at the bottom see a section titled "Create Your Own Group."

   Step 1:   Click on "Start a Group Now."
   Step 2:   Select a category that best describes your group (use the Search Group Categories,
              or use Browse Group Categories tool). You must find a category.
   Step 3:   Describe the purposes of the group and give it a name.
   Step 4:   Set up an email address for sending messages to all group members.
   Step 5:   Each member must join the group (select a "profile"); click on "Join this Group."
   Step 6:   Go to Word Verification Section; follow the instructions.
   Step 7:   Finish by clicking "Continue."
   Step 8:   Select a group moderator. Conduct a discussion online of at least two topics of
              interest to the group.
   Step 9:   Arrange for messages from the members to reach the moderator at least once a week.
   Step 10:   Find a similar group (use Yahoo!'s "Find a Group" and make a connection). Write
              a report for your instructor.

b. Now follow the same steps for Google Groups.

c. Compare Yahoo Groups and Google Groups.

Answer: Students will come up their report based on comparing their experiences at the two sites.

2. Review the Wall Street Journal, Toronto Star, Globe and Mail, Canadian Business (*http://www.canadianbusiness.com/*), and local newspapers for the last three months to find stories about the use of web-based technologies in organizations. Each group will prepare a report describing five applications. The reports should emphasize the role of the Web and its benefit to the organizations. Focus on issues described in this chapter, such as productivity, competitive strategies, and globalization. Present and discuss your work.

Answer: Students will come up their report based on their selected articles.

Chapter Glossary

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

business intelligence system A system that provides computer-based support for complex, non-routine decisions, primarily for middle managers and knowledge workers.

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

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

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

database A collection of related files or

tables containing data.

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

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

ergonomics The science of adapting machines and work environments to people; it focuses on creating an environment that is safe, well lit, and comfortable.

expert system A system that attempts to duplicate the work of human experts by applying reasoning capabilities, knowledge, and expertise within a specific domain.

functional area information system A system that supports a particular functional

area within the organization.

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

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

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

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

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

information technology infrastructure IT components plus IT services.

information technology platform Formed by the IT components of hardware, software, networks (wireline and wireless), and databases.

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

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

interorganizational information systems Information systems that connect two or more organizations.

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

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

network A connecting system (wireline or wireless) that permits different computers to share resources.

office automation system Software that supports the daily work activities of individuals and groups, such as software for creating documents and preparing emails

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

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

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

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