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PART 1

Overview

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01

An Introduction to Information Systems in Organizations

Principles

The value of information is directly linked to how it helps decision makers achieve organizational goals.

Knowing the potential impact of information systems and having the ability to put this knowledge to work can result in a successful personal career, organizations that reach their goals, and a society with a higher quality of life.

System users, business managers, and information systems professionals must work together to build a successful information system.

The use of information systems to add value to organization can also give an organization a competitive advantage.

Cooperation between business managers and IS personnel is the key to unlocking the potential of any new or modified system.

Learning Objectives

- Discuss why it is important to study and understand information systems.
- Describe the characteristics used to evaluate the quality of data.
- Identify the basic types of business information systems and discuss who uses them, how they are used, and what kinds of benefits they deliver.
- Identify the major steps of the systems development process and state the goal of each.
- Identify the value-added processes in the supply chain and describe the role of information systems within them.
- Identify some of the strategies employed to lower costs or improve service.
- Define the term ‘competitive advantage’ and discuss how organizations are using information systems to achieve such an advantage.
- Define the types of roles, functions and careers available in information systems.

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Why Learn About Information Systems in Organizations?

Information systems are used in almost every imaginable profession. Sales representatives use information systems to advertise products, communicate with customers, and analyze sales trends. Managers use them to make major decisions, such as whether to build a manufacturing plant or research a cancer drug. From a small music store to huge multinational companies, businesses of all sizes could not survive without information systems to perform accounting and finance operations. Regardless of your chosen career, you will use information systems to help you achieve goals.

This chapter presents an overview of information systems. The sections on hardware, software, databases, telecommunications, e-commerce and m-commerce, transaction processing and enterprise resource planning, information and decision support, special purpose systems, systems development, and ethical and societal issues are expanded to full chapters in the rest of the book. We will start by exploring the basics of information systems.

1.1 What is an Information System?

People and organizations use information every day. Many retail chains, for example, collect data from their shops to help them stock what customers want and to reduce costs. Businesses use information systems to increase revenues and reduce costs. We use automated teller machines outside banks and access information over the Internet. Information systems usually involve computers, and together, they are constantly changing the way organizations conduct business. Today we live in an information economy. Information itself has value, and commerce often involves the exchange of information rather than tangible goods. Systems based on computers are increasingly being used to create, store, and transfer information. Using information systems, investors make multimillion-euro decisions, financial institutions transfer billions of euros around the world electronically, and manufacturers order supplies and distribute goods faster than ever before. Computers and information systems will continue to change businesses and the way we live. To define an information system, we will start by examining what a system is.

1.1.1 What is a System?

A central concept of this book is that of a **system**. A system is a set of elements or components that interact to accomplish goals. The elements themselves and the relationships among them determine how the system works. Systems have inputs, processing mechanisms, outputs, and feedback (see Figure 1.1). A system processes the input to create the output. For example, consider an automatic car wash. Tangible inputs for the process are a dirty car, water, and various cleaning ingredients. Time, energy, skill, and knowledge also serve as inputs to the system because they are needed to operate it.

system A set of elements or components that interact to accomplish goals.

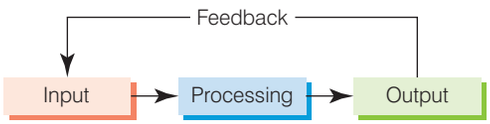

Figure 1.1 Components of a System *A system's four components consists of input, processing, output, and feedback.*

The processing mechanisms consist of first selecting which cleaning option you want (wash only, wash with wax, wash with wax and hand dry, etc.) and communicating that to the operator of the car wash. A feedback mechanism is your assessment of how clean the car is. Liquid sprayers

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shoot clear water, liquid soap, or car wax depending on where your car is in the process and which options you selected. The output is a clean car. As in all systems, independent elements or components (the liquid sprayer, foaming brush, and air dryer) interact to create a clean car.

System performance can be measured in various ways. **Efficiency** is a measure of what is produced divided by what is consumed. For example, the efficiency of a motor is the energy produced (in terms of work done) divided by the energy consumed (in terms of electricity or fuel). Some motors have an efficiency of 50 percent or less because of the energy lost to friction and heat generation.

efficiency A measure of what is produced divided by what is consumed.

Effectiveness is a measure of the extent to which a system achieves its goals. It can be computed by dividing the goals actually achieved by the total of the stated goals. For example, a company might want to achieve a net profit of €100 million for the year with a new information system. Actual profits, however, might only be €85 million for the year. In this case, the effectiveness is 85 percent (85/100 = 85 percent).

effectiveness A measure of the extent to which a system achieves its goals; it can be computed by dividing the goals actually achieved by the total of the stated goals.

Evaluating system performance also calls for using performance standards. A **system performance standard** is a specific objective of the system. For example, a system performance standard for a marketing campaign might be to have each sales representative sell €100 000 of a certain type of product each year (see Figure 1.2a). A system performance standard for a manufacturing process might be to provide no more than 1 percent defective parts (see Figure 1.2b). After

system performance standard A specific objective of the system.

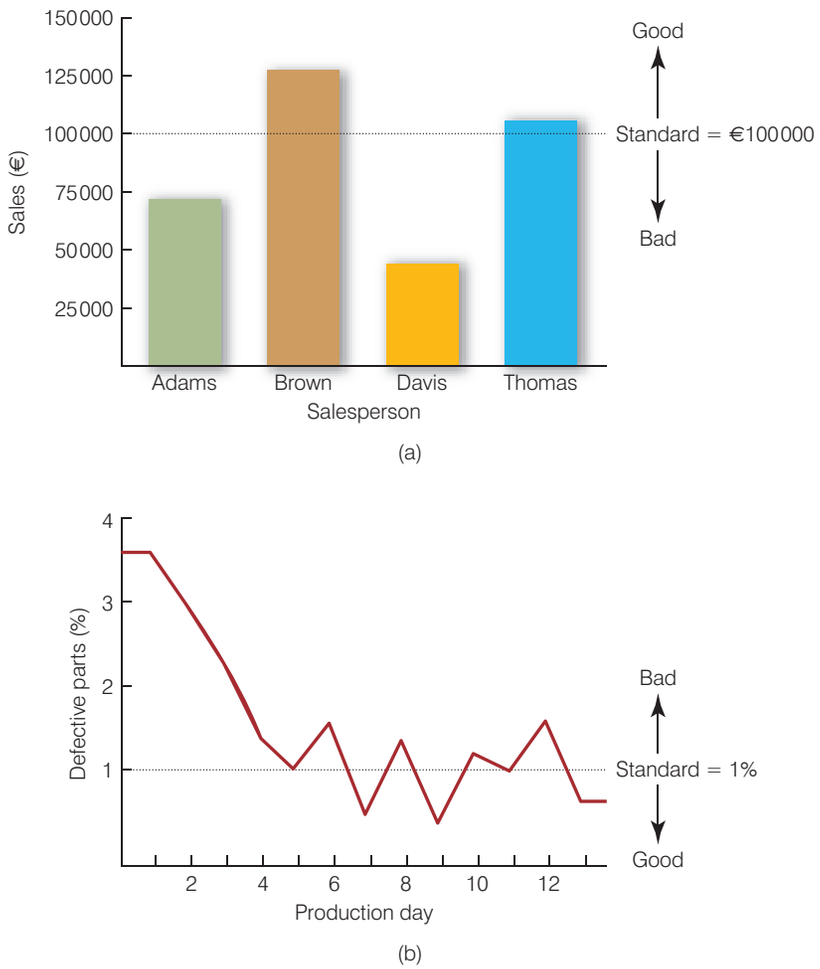

Figure 1.2 System Performance Standards
(a) Sales broken down by sales person
(b) Percentage of defective parts

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standards are established, system performance is measured and compared with the standard. Variances from the standard are determinants of system performance.

1.1.2 What is Information?

Information is a collection of facts. Information can take many forms – text, numbers, images, audio clips, and video clips are all examples. A closely related term is 'data'. The traditional view is that the input into an information system is data. The information system then processes that data, and outputs information. So the difference between data and information is to do with how much processing the collection of facts have undergone. Unfortunately, this distinction is of little practical use, and the two terms can be used interchangeably. As we will see, the output of one information system is the input to another information system, and trying to distinguish between data and information in this situation just leads to confusion – under the traditional view, the 'information' which is output from the first system would turn into 'data' just before it is input into the second system!

1.1.3 What is an Information System?

Now that we have defined the terms 'system' and 'information', we can define an information system: an **information system (IS)** is a set of interrelated components that collect, manipulate, store, and disseminate information and provide a feedback mechanism to meet an objective. It is the feedback mechanism that helps organizations achieve their goals, such as increasing profits or improving customer service.

information system (IS) A set of interrelated components that collect, manipulate, store, and disseminate information and provide a feedback mechanism to meet an objective.

input The activity of gathering and capturing data.

In information systems, **input** is the activity of gathering and capturing data. In producing paycheques, for example, the number of hours every employee works must be collected before the cheques can be calculated or printed. In a university grading system, instructors must submit student grades before a summary of grades for the semester can be compiled and sent to the students.

processing Converting or transforming input into useful outputs.

Processing means converting or transforming this input into useful outputs. Processing can involve making calculations, comparing data and taking alternative actions, and storing data for future use. In a payroll application, the number of hours each employee worked must be converted into net, or take-home, pay. Other inputs often include employee ID number and department. The required processing can first involve multiplying the number of hours worked by the employee's hourly pay rate to get gross pay. If weekly hours worked exceed 35 hours, overtime pay might also be included. Then tax must be deducted along with contributions to health and life insurance or savings plans to get net pay.

After these calculations and comparisons are performed, the results are typically stored. Storage involves keeping data and information available for future use, including output.

output Production of useful information, often in the form of documents and reports.

Output involves producing useful information, usually in the form of documents and reports. Outputs can include paycheques for employees, reports for managers, and information supplied to stockholders, banks, government agencies, and other groups. As we have already said, output from one system can become input for another. For example, output from a system that processes sales orders can be used as input to a customer billing system. Computers typically produce output on printers and display screens. Output can also be handwritten or manually produced reports, although this is not common.

feedback Output that is used to make changes to input or processing activities.

Lastly, **feedback** is information from the system that is used to make changes to input or processing activities. For example, errors or problems might make it necessary to correct input data or change a process. Consider a payroll example. Perhaps the number of hours an employee worked was entered as 400 instead of 40 hours. Fortunately, most information systems check

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to make sure that data falls within certain ranges. For number of hours worked, the range might be from 0 to 100 hours because it is unlikely that an employee would work more than 100 hours in a week. The information system would determine that 400 hours is out of range and provide feedback. The feedback is used to check and correct the input on the number of hours worked to 40.

Feedback is also important for managers and decision makers. For example, a furniture maker could use a computerized feedback system to link its suppliers and plants. The output from an information system might indicate that inventory levels for mahogany and oak are getting low – a potential problem. A manager could use this feedback to decide to order more wood from a supplier. These new inventory orders then become input to the system. In addition to this reactive approach, a computer system can also be proactive – predicting future events to avoid problems. This concept, often called **forecasting**, can be used to estimate future sales and order more inventory before a shortage occurs. Forecasting is also used to predict the strength of hurricanes and possible landing sites, future stock-market values, and who will win a political election.

forecasting Predicting future events.

1.1.4 The Characteristics of Valuable Information

To be valuable to managers and decision makers, information should have some and possibly all of the characteristics described in Table 1.1. Many shipping companies, for example, can determine the exact location of inventory items and packages in their systems, and this information makes them responsive to their customers. In contrast, if an organization's information is not accurate or complete, people can make poor decisions costing thousands, or even millions, of euros. Many claim, for example, that the collapse and bankruptcy of some companies, such as drug companies and energy-trading firms, was a result of inaccurate accounting and reporting

Table 1.1 Characteristics of Valuable Information

Characteristics	Definitions
Accessible	Information should be easily accessible by authorized users so they can obtain it in the right format and at the right time to meet their needs
Accurate	Accurate information is error free. In some cases, inaccurate information is generated because inaccurate data is fed into the transformation process
Complete	Complete information contains all the important facts, but not more facts than are necessary (see the Simple characteristic below)
Economical	Information should also be relatively economical to produce. Decision makers must always balance the value of information with the cost of producing it
Flexible	Flexible information can be used for a variety of purposes. For example, information on how much inventory is on hand for a particular part can be used by a sales representative in closing a sale, by a production manager to determine whether more inventory is needed, and by a financial executive to determine the total value the company has invested in inventory
Relevant	Relevant information is important to the decision maker
Reliable	Reliable information can be depended on. In many cases, the reliability of the information depends on the reliability of the data-collection method. In other instances, reliability depends on the source of the information. A rumor from an unknown source that oil prices might go up might not be reliable (even though it might be useful)

(*continued*)

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Table 1.1 *Continued*

Characteristics	Definitions
Secure	Information should be secure from access by unauthorized users
Simple	Information should be simple, not overly complex. Sophisticated and detailed information might not be needed. In fact, too much information can cause information overload, whereby a decision maker has too much information and is unable to determine what is really important
Timely	Timely information is delivered when it is needed. Knowing last week's weather conditions will not help when trying to decide what coat to wear today
Verifiable	Information should be verifiable. This means that you can check it to make sure it is correct, perhaps by checking many sources for the same information

information, which led investors and employees alike to misjudge the actual state of the company's finances and suffer huge personal losses. As another example, if an inaccurate forecast of future demand indicates that sales will be very high when the opposite is true, an organization can invest millions of euros in a new plant that is not needed. Furthermore, if information is not relevant, not delivered to decision makers in a timely fashion, or too complex to understand, it can be of little value to the organization.

The value of information is directly linked to how it helps decision makers achieve their organization's goals. For example, the value of information might be measured in the time required to make a decision or in increased profits to the company. Consider a market forecast that predicts a high demand for a new product. If you use this information to develop the new product and your company makes an additional profit of €10 000, the value of this information to the company is €10 000 minus the cost of the information.

1.1.5 Manual and Computerized Information Systems

An information system can be manual or computerized. For example, some investment analysts manually draw charts and trend lines to assist them in making investment decisions. Tracking data on stock prices (input) over the last few months or years, these analysts develop patterns on graph paper (processing) that help them determine what stock prices are likely to do in the next few days or weeks (output). Some investors have made millions of euros using manual stock analysis information systems. Of course, today many excellent computerized information systems follow stock indexes and markets and suggest when large blocks of stocks should be purchased or sold to take advantage of market discrepancies.

computer-based information system (CBIS) A single set of hardware, software, databases, telecommunications, people, and procedures that are configured to collect, manipulate, store, and process data into information.

A **computer-based information system (CBIS)** is a single set of hardware, software, databases, telecommunications, people, and procedures that are configured to collect, manipulate, store, and process data into information. For example, a company's payroll, order entry, or inventory-control system is an example of a CBIS. CBISs can also be embedded into products. Some new cars and home appliances include computer hardware, software, databases, and even telecommunications to control their operations and make them more useful. This is often called 'embedded', 'pervasive', or 'ubiquitous' computing. CBISs have evolved into sophisticated analysis tools.

technology infrastructure All the hardware, software, databases, telecommunications, people, and procedures that are configured to collect, manipulate, store, and process data into information.

The components of a CBIS are illustrated in Figure 1.3. Information technology (IT) refers to hardware, software, databases, and telecommunications. A business's **technology infrastructure** includes all the hardware, software, databases, telecommunications, people, and procedures that are configured

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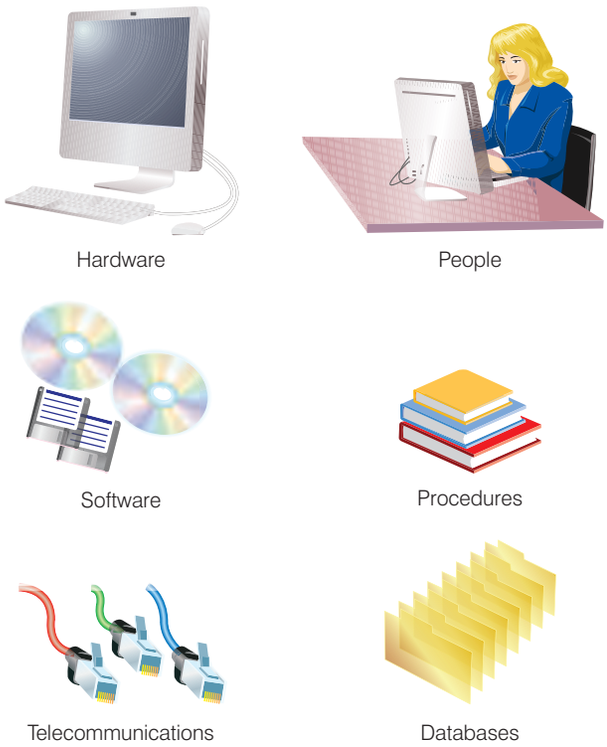

Figure 1.3 The Components of a Computer-Based Information System

to collect, manipulate, store, and process data into information. The technology infrastructure is a set of shared IS resources that form the foundation of each computer-based information system.

Hardware

Hardware consists of computer equipment used to perform input, processing, and output activities. Input devices include keyboards, mice and other pointing devices, automatic scanning devices, and equipment that can read magnetic ink characters. Investment firms often use voice-response technology to allow customers to access their balances and other information with spoken commands. Processing devices include computer chips that contain the central processing unit and main memory. One processor chip, called the 'Bunny Chip' by some, mimics living organisms and can be used by the drug industry to test drugs instead of using animals, such as rats or bunnies.[1] The experimental chip could save millions of euros and months of time in drug research costs. Processor speed is also important. A large IBM computer used by U.S. Livermore National Laboratories to analyze nuclear explosions is possibly the fastest in the world (up to 300 teraflops – 300 trillion operations per second).[2] The super fast computer, called Blue Gene, costs about €29 million.

hardware Any machinery (most of which uses digital circuits) that assists in the input, processing, storage, and output activities of an information system.

The many types of output devices include printers and computer screens. Bond traders, for example, often use an array of six or more computer screens to monitor bond prices and make split-second trades throughout each day. Another type of output device is a printer to print photos from a digital camera. Such printers accept the memory card direct from the camera. There are also many special-purpose hardware devices. Computerized event data recorders (EDRs) are now being placed into vehicles (Figure 1.4). Like an airplane's black box, EDRs record a vehicle's speed, possible engine problems, a driver's performance, and more. The technology is being used to monitor vehicle operation, determine the cause of accidents, and investigate whether truck drivers are taking required breaks.

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Figure 1.4
Computerized Dashboard
Computerized event data recorders record a vehicle's speed, possible engine problems, driver's performance, and more.

SOURCE: Istock.

Software

Software consists of the computer programs that govern the operation of the computer. These programs allow a computer to process payroll, send bills to customers, and provide managers with information to increase profits, reduce costs, and provide better customer service. With software, people can work anytime at any place. Software, along with manufacturing tools, for example, can be used to fabricate parts almost anywhere in the world.[3] Software called 'Fab Lab', controls tools, such as cutters, milling machines, and other devices. A Fab Lab system, which costs about €15 000, has been used to make radio frequency tags to track animals in Norway, engine parts to allow tractors to run on processed castor beans in India, and many other fabrication applications.

software The computer programs that govern the operation of the computer.

The two types of software are system software, such as Microsoft Windows XP, which controls basic computer operations, including start-up and printing; and applications software, such as Microsoft Office, which allows you to accomplish specific tasks, including word processing and drawing charts. Sophisticated application software, such as Adobe Creative Suite, can be used to design, develop, print, and place professional-quality advertising, brochures, posters, prints, and videos on the Internet.

Databases

A **database** is an organized collection of facts and information, typically consisting of two or more related data files. An organization's database can contain information on customers, employees, inventory, competitors' sales, online purchases, and much more. Most managers and executives consider a database to be one of the most valuable parts of a computer-based information system. One California real estate development company uses databases to search for homes that are undervalued and purchase them at bargain prices.[4] It uses the database to analyze crime statistics, prices, local weather reports, school districts, and more to find homes whose values are likely to increase. The database has helped the company realize an average 50 percent return on investment. Increasingly, organizations are placing important databases on the Internet, which makes them accessible to many, including unauthorized users.

database An organized collection of information.

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Telecommunications, Networks, and the Internet

Telecommunication is the electronic transmission of signals for communications, which enables organizations to carry out their processes and tasks through computer networks. Large restaurant chains, for example, can use telecommunications systems and satellites to link hundreds of restaurants to plants and headquarters to speed credit card authorization and report sales and payroll data. **Networks** connect computers and equipment in a building, around the country, or around the world to enable electronic communication. Investment firms can use wireless networks to connect thousands of investors with brokers or traders. Many hotels use wireless telecommunications to allow guests to connect to the Internet, retrieve voice messages, and exchange e-mail without plugging their computers or mobile devices into a phone socket. Wireless transmission also allows drones, such as Boeing's Scan Eagle, to fly using a remote control system and monitor buildings and other areas.

telecommunications The electronic transmission of signals for communications; enables organizations to carry out their processes and tasks through effective computer networks.

network Computers and equipment that are connected in a building, around the country, or around the world to enable electronic communications.

The **Internet** is the world's largest computer network, actually consisting of thousands of interconnected networks, all freely exchanging information. Research firms, colleges, universities, schools, and businesses are just a few examples of organizations using the Internet. People use the Internet to research information, buy and sell products and services, make travel arrangements, conduct banking, and download music and videos, among other activities. After downloading music, you can use audio software to change a song's tempo, create mixes of your favourite tunes, and modify sound tracks to suit your personal taste. You can even mix two or more songs simultaneously, which is called 'mashing'. You can also use many of today's mobile phones to connect to the Internet from around the world and at high speeds.[5] This not only speeds communications, but allows you to conduct business electronically. Some airline companies are providing Internet service on their flights so that travellers can send and receive e-mail, check investments, and browse the Internet. Internet users can create blogs (weblogs) to store and share their thoughts and ideas with others around the world.[6] You can also record and store TV programs on computers or special viewing devices and watch them later.[7] Often called 'place shifting', this technology allows you to record TV programs at home and watch them at a different place when it's convenient.

Internet The world's largest computer network, actually consisting of thousands of interconnected networks, all freely exchanging information.

The World Wide Web (WWW), or the Web, is a network of links on the Internet to documents containing text, graphics, video, and sound. Information about the documents and access to them are controlled and provided by tens of thousands of special computers called 'web servers'. The Web is one of many services available over the Internet and provides access to many hundreds of millions of documents.

The technology used to create the Internet is also being applied within companies and organizations to create **intranets**, which allow people within an organization to exchange information and work on projects. One company, for example, uses an intranet to connect its 200 global operating companies and 20 000 employees. An **extranet** is a network based on web technologies that allows selected outsiders, such as business partners and customers, to access authorized resources of a company's intranet. Companies can move all or most of their business activities to an extranet site for corporate customers. Many people use extranets every day without realizing it – to track shipped goods, order products from their suppliers, or access customer assistance from other companies. If you log on to the FedEx site (www.fedex.com) to check the status of a package, for example, you are using an extranet.

intranet An internal company network built using Internet and World Wide Web standards and products that allows people within an organization to exchange information and work on projects.

extranet A network based on web technologies that allows selected outsiders, such as business partners, suppliers, or customers, to access authorized resources of a company's intranet.

People

People are the most important element in most computer-based information systems. The people involved include users of the system and information systems personnel, including all the people who manage, run, program, and maintain the system.

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Procedures

Procedures include the strategies, policies, methods, and rules for using the CBIS, including the operation, maintenance, and security of the computer. For example, some procedures describe when each program should be run. Others describe who can access facts in the database, or what to do if a disaster, such as a fire, earthquake, or hurricane, renders the CBIS unusable. Good procedures can help companies take advantage of new opportunities and avoid potential disasters. Poorly developed and inadequately implemented procedures, however, can cause people to waste their time on useless rules or result in inadequate responses to disasters, such as hurricanes or tornadoes.

procedures The strategies, policies, methods, and rules for using a CBIS.

1.2 Business Information Systems

The most common types of information systems used in business organizations are those designed for electronic and mobile commerce, transaction processing, management information, and decision support. In addition, some organizations employ special-purpose systems, such as virtual reality, that not every organization uses. Together, these systems help employees in organizations accomplish routine and special tasks – from recording sales, processing

Information Systems @ Work

Speeding Up Insurance Claims with New Information Systems

Insurance companies employ claims adjusters to visit property damaged by disaster, analyze the damage, and estimate the value required to repair the property. Each estimate can take considerable time and effort. Adjusters might visit four or five properties in the morning and afternoon, then return to the office where they review notes taken at each property, consult reference charts to calculate repair costs, fill out paper forms, and enter data into the corporate information system. A cheque is then issued from the insurance company to the victim of the disaster. Multiply the complexity of this process by the thousands of claims that an insurance company processes each year, and the result is a lot of paperwork, wasted time, and mistakes.

The executives at Gore Mutual Insurance of Cambridge, Ontario, Canada, wanted to streamline the claims adjustment process, making it more effective and efficient by applying new information systems. They partnered with a start-up software company named Symbility to create a state-of-the-art solution. The goal of the new system was to process claims onsite during the damage inspection. Gore Mutual wanted to eliminate paper notes that adjusters carried back to the office for processing. Even processing on a notebook PC in a van onsite wasn't efficient enough. Symbility turned to tablet and handheld PCs with handwriting recognition to provide the ideal solution. Tablet and handheld PCs allow users to enter data by writing on the touch screen with a stylus.

Symbility designed pen-based software to run on Windows tablet PCs and handheld PCs. Adjusters can now take notes, sketch floor plans and diagrams, even transfer digital photos from mobile phones. All forms and reference charts are accessible and easy to manipulate. The adjuster's PC is connected over a wireless network to a special information service provided by Symbility that supports all the calculations, data manipulation, and processing required to adjust claims. For a claims adjuster, it's like holding the power of the corporate server in their hand.

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Gore Mutual found that the tablet PC solution let adjusters spend more time meeting with customers in the field. Estimates were calculated quickly and accurately. Symbility estimates that the system results in claims being settled up to six times faster and more accurately.

The pen-based solution was such a hit that Symbility now supports claim processing for many insurance companies at around $20 per claim. In this way, Symbility plays the role of an application service provider (ASP). ASPs design and maintain software and systems and lease the use of the software to businesses. This benefits businesses in a number of ways. The business can focus on its primary goals rather than worrying about developing and maintaining the technology components of an information system. Because the ASP's primary purpose is to develop the best systems possible, the quality of the service is typically higher than if the business developed its own system.

As with most good information systems, the end result of the Symbility solution was a huge reduction of tedious procedures for claims adjusters and fewer opportunities for human error. More importantly, the system frees claim adjusters to do what they do best: evaluate damage and help people continue with their lives.

Considering recent devastation by hurricanes, mudslides, forest fires, and other natural disasters, the speed with which claims are processed affects more than an insurance company's bottom line. In catastrophic events, insurance companies are hard pressed to process claims efficiently. Imagine a technology that allows a company to process 6000 claims in the amount of time that it typically processes 1000. Such a system could mean the difference between life and death for homeless survivors. Symbility's pen-based claims processing system does just that.

Questions

1. Explain how the information system components hardware, software, databases, telecommunications, people, and procedures combine to provide a solution for insurance claims adjusters.
2. What benefits did Gore Mutual enjoy by working with Symbility rather than going it on their own?
3. What technologies used in this system are more readily available today than they were five years ago? How long might it be before this system becomes outdated?
4. What other professions would benefit from a pen-based wireless system like Symbility's?

SOURCES: John Cox, 'Insurance adjusters use pen-based GUI and wireless', *Network World,* October 5, 2005, www.techworld.com. 'Symbility Solutions to Demonstrate the Power of "Insurance Mobility"', *PRNewswire,* January 17, 2006, http://biz.yahoo.com/prnews/060117/nytu128.html?.v=41. Symbility website, accessed February 22, 2006, www.symbilitysolutions.com.

payrolls, and supporting decisions in various departments, to examining alternatives for large-scale projects and opportunities. Although these systems are discussed in separate sections in this chapter and explained in more detail later, they are often integrated in one product and delivered by the same software package. For example, some enterprise resource planning packages process transactions, deliver information, and support decisions (see Figure 1.5).

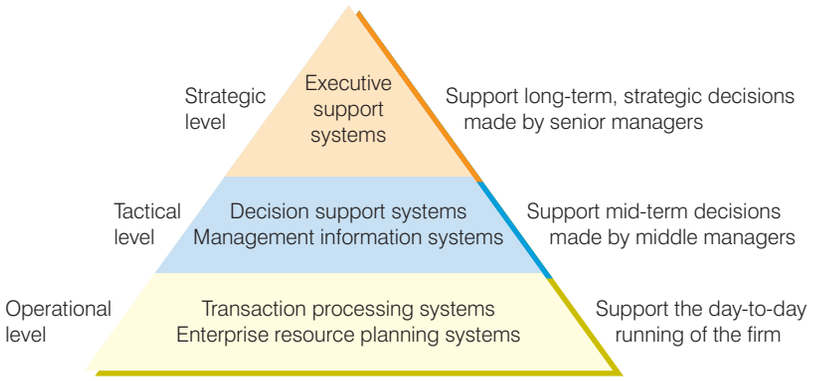

Figure 1.5 Business Information Systems

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1.2.1 Electronic and Mobile Commerce

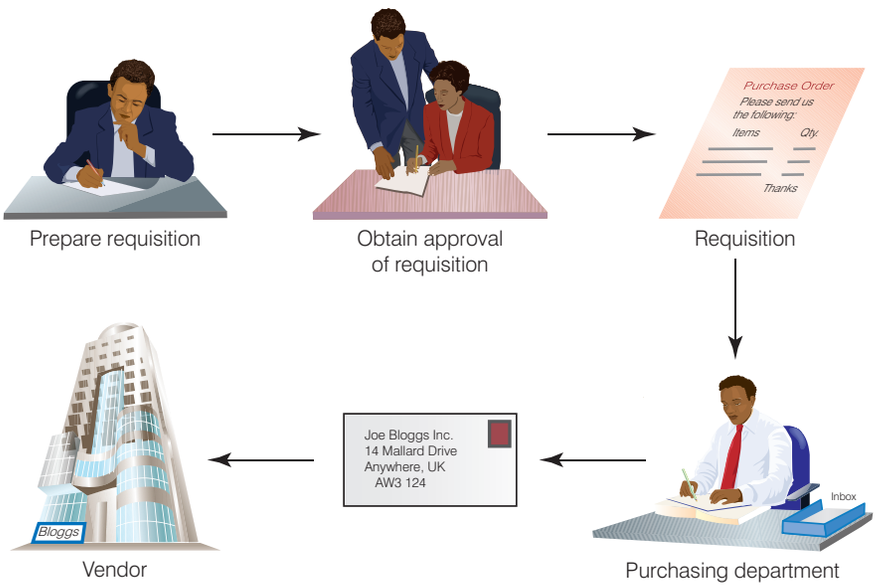
E-commerce involves any business transaction executed electronically between companies (business-to-business, 'B2B'), companies and consumers (business-to-consumer, 'B2C'), consumers and other consumers (consumer-to-consumer, 'C2C'), business and the public sector, and consumers and the public sector. You might assume that e-commerce is reserved mainly for consumers visiting websites for online shopping, but web shopping is only a small part of the e-commerce picture; the major volume of e-commerce – and its fastest growing segment – is business-to-business (B2B) transactions that make purchasing easier for corporations. This growth is being stimulated by increased Internet access, growing user confidence, better payment systems, and rapidly improving Internet and web security. E-commerce also offers opportunities for small businesses to market and sell at a low cost worldwide, allowing them to enter the global market. **Mobile commerce (m-commerce)** refers to transactions conducted anywhere, anytime. M-commerce relies on wireless communications that managers and corporations use to place orders and conduct business with handheld computers, portable phones, laptop computers connected to a network, and other mobile devices.

e-commerce Any business transaction executed electronically between companies (business-to-business), companies and consumers (business-to-consumer), consumers and other consumers (consumer-to-consumer), business and the public sector, and consumers and the public sector.

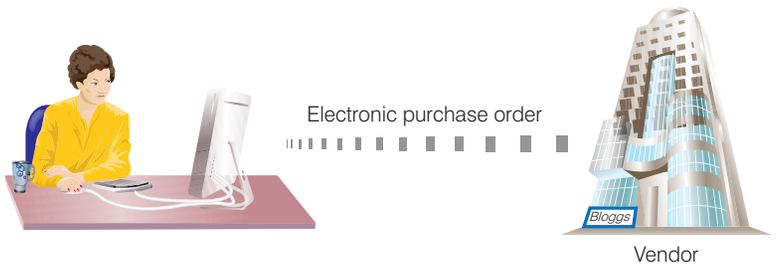
mobile commerce (m-commerce) Conducting business transactions electronically using mobile devices such as smartphones.

E-commerce offers many advantages for streamlining work activities. Figure 1.6 provides a brief example of how e-commerce can simplify the process of purchasing new office furniture

Figure 1.6
E-Commerce Greatly Simplifies Purchasing



Traditional process for placing a purchase order



E-commerce process for placing a purchase order

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from an office-supply company. In the manual system, a corporate office worker must get approval for a purchase that exceeds a certain amount. That request goes to the purchasing department, which generates a formal purchase order to procure the goods from the approved vendor. Business-to-business e-commerce automates the entire process. Employees go directly to the supplier's website, find the item in a catalogue, and order what they need at a price set by their company. If approval is required, the approver is notified automatically. As the use of e-commerce systems grows, companies are phasing out their traditional systems. The resulting growth of e-commerce is creating many new business opportunities.

E-commerce can enhance a company's stock prices and market value. Today, several e-commerce firms have teamed up with more traditional brick-and-mortar businesses to draw from each other's strengths. For example, e-commerce customers can order products on a website and pick them up at a nearby store.

In addition to e-commerce, business information systems use telecommunications and the Internet to perform many related tasks. Electronic procurement (e-procurement), for example, involves using information systems and the Internet to acquire parts and supplies. **Electronic business (e-business)** goes beyond e-commerce and e-procurement by using information systems and the Internet to perform all business-related tasks and functions, such as accounting, finance, marketing, manufacturing, and human resource activities. E-business also includes working with customers, suppliers, strategic partners, and stakeholders. Compared with traditional business strategy, e-business strategy is flexible and adaptable.

electronic business (e-business) Using information systems and the Internet to perform all business-related tasks and functions.

1.2.2 Enterprise Systems: Transaction Processing Systems and Enterprise Resource Planning

Transaction Processing Systems

Since the 1950s, computers have been used to perform common business applications. Many of these early systems were designed to reduce costs by automating routine, labour-intensive business transactions. A **transaction** is any business-related exchange, such as payments to employees, sales to customers, or payments to suppliers. Thus, processing business transactions was the first computer application developed for most organizations. A **transaction processing system (TPS)** is an organized collection of people, procedures, software, databases, and devices used to record completed business transactions. If you understand a transaction processing system, you understand basic business operations and functions.

transaction Any business-related exchange, such as payments to employees, sales to customers, and payments to suppliers.

transaction processing system (TPS) An organized collection of people, procedures, software, databases, and devices used to record completed business transactions.

Enterprise systems help organizations perform and integrate important tasks, such as paying employees and suppliers, controlling inventory, sending out invoices, and ordering supplies. In the past, companies accomplished these tasks using traditional transaction processing systems. Today, they are increasingly being performed by enterprise resource planning systems. For example, Whirlpool Corporation, the large appliance maker, used enterprise resource planning to reduce inventory levels by 20 percent and cut about 5 percent from its freight and warehousing costs by providing managers with information about inventory levels and costs.[8] The new system may have also helped the company increase its revenues by about €0.7 billion.

One of the first business systems to be computerized was the payroll system. The primary inputs for a payroll TPS are the number of employee hours worked during the week and the pay rate. The primary output consists of paycheques. Early payroll systems produced employee paycheques and related reports required by tax authorities. Other routine applications include sales ordering, customer billing and customer relationship management, and inventory control. Some car companies, for example, use their TPSs to buy billions of euros of needed parts each

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year through websites. Because these systems handle and process daily business exchanges, or transactions, they are all classified as TPSs.

Enterprise Resource Planning

An **enterprise resource planning (ERP) system** is a set of integrated programs that manages the vital business operations for an entire multi-site, global organization. An ERP system can replace many applications with one unified set of programs, making the system easier to use and more effective.

enterprise resource planning (ERP) system A set of integrated programs capable of managing a company's vital business operations for an entire multi-site, global organization.

Although the scope of an ERP system might vary from company to company, most ERP systems provide integrated software to support manufacturing and finance. In such an environment, a forecast is prepared that estimates customer demand for several weeks. The ERP system checks what is already available in finished product inventory to meet the projected demand. Manufacturing must then produce inventory to eliminate any shortfalls. In developing the production schedule, the ERP system checks the raw materials and packing-materials inventories and determines what needs to be ordered to meet the schedule. Most ERP systems also have a purchasing subsystem that orders the needed items. In addition to these core business processes, some ERP systems can support functions such as human resources, sales, and distribution. The primary benefits of implementing an ERP system include easing adoption of improved work processes and increasing access to timely data for decision making (see Figure 1.7).

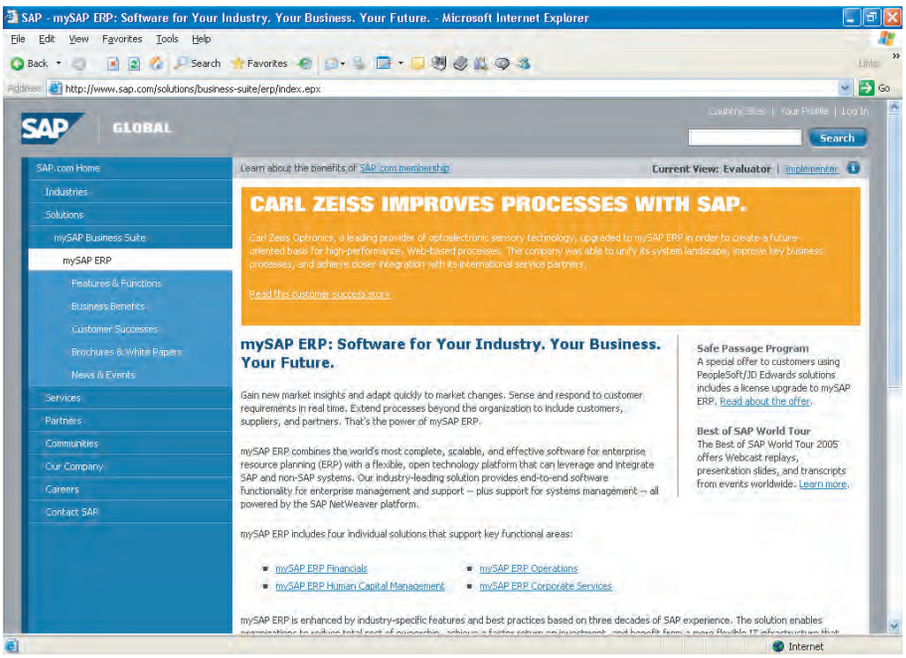

Figure 1.7 **SAP** *SAP AG, a German software company, is one of the leading suppliers of ERP software. The company employs more than 34 000 people in more than 50 countries.*

1.2.3 Information and Decision Support Systems

The benefits provided by an effective TPS are tangible and justify their associated costs in computing equipment, computer programs, and specialized personnel and supplies. A TPS can speed business activities and reduce clerical costs. Although early accounting and financial TPSs were already valuable, companies soon realized that they could use the data stored in these systems to help managers make better decisions, whether in human resource management, marketing, or administration. Satisfying the needs of managers and decision makers continues to be a major factor in developing information systems.

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Management Information Systems

A **management information system (MIS)** is an organized collection of people, procedures, software, databases, and devices that provides routine information to managers and decision makers. An MIS focuses on operational efficiency. Marketing, production, finance, and other functional areas are supported by MISs and linked through a common database. MISs typically provide standard reports generated with data and information from the TPS, meaning the output of a TPS is the input to a MIS. Producing a report that describes inventory that should be ordered is an example of an MIS.

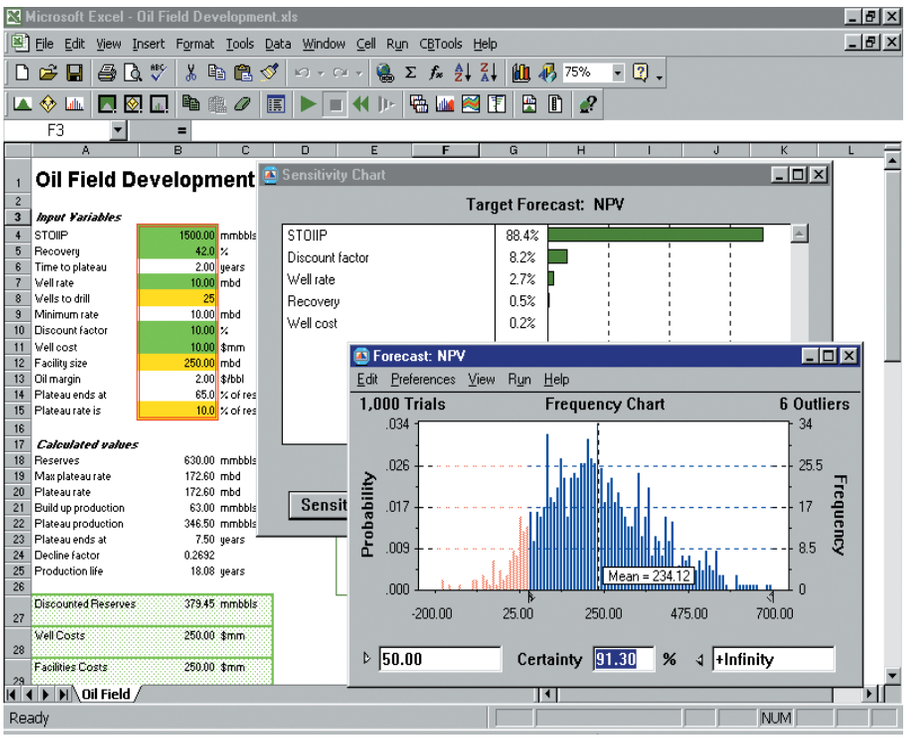
management information system (MIS) An organized collection of people, procedures, software, databases, and devices that provides routine information to managers and decision makers.

MISs were first developed in the 1960s and typically use information systems to produce managerial reports. In many cases, these early reports were produced periodically – daily, weekly, monthly, or yearly. Because of their value to managers, MISs have proliferated throughout the management ranks. For instance, the total payroll summary report produced initially for an accounting manager might also be useful to a production manager to help monitor and control labour and job costs.

Decision Support Systems

By the 1980s, dramatic improvements in technology resulted in information systems that were less expensive but more powerful than earlier systems. People at all levels of organizations began using personal computers to do a variety of tasks; they were no longer solely dependent on the IS department for all their information needs. People quickly recognized that computer systems could support additional decision-making activities. A **decision support system (DSS)** is an organized collection of people, procedures, software, databases, and devices that support problem-specific decision making (see Figure 1.8). The focus of a DSS is on making

decision support system (DSS) An organized collection of people, procedures, software, databases, and devices used to support problem-specific decision making.



SOURCE: Crystal Ball screenshot courtesy of Decisioneering, Inc.

Figure 1.8 DSS

Decisioneering provides decision support software called Crystal Ball, which helps business people of all types assess risks and make forecasts. Shown here is the Standard Edition being used for oil field development.

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effective decisions. Whereas an MIS helps an organization 'do things right', a DSS helps a manager 'do the right thing'.

In addition to assisting in all aspects of problem-specific decision making, a DSS can support customers by rapidly responding to their phone and e-mail enquiries. A DSS goes beyond a traditional MIS by providing immediate assistance in solving problems. Many of these problems are unique and complex, and information is often difficult to obtain. For instance, an car manufacturer might try to determine the layout for its new manufacturing facility. Traditional MISs are seldom used to solve these types of problems; a DSS can help by suggesting alternatives and assisting in final decision making.

Decision support systems are used when the problem is complex and the information needed to make the best decision is difficult to obtain and use. So a DSS also involves managerial judgment and perspective. Managers often play an active role in developing and implementing the DSS. A DSS recognizes that different managerial styles and decision types require different systems. For example, two production managers in the same position trying to solve the same problem might require different information and support. The overall emphasis is to support, rather than replace, managerial decision making.

The essential elements of a DSS include a collection of models used to support a decision maker or user (model base), a collection of facts and information to assist in decision making (database), and systems and procedures (dialogue manager or user interface) that help decision makers and other users interact with the DSS. Software is often used to manage the database – the database management system (DBMS) – and the model base – the model management system (MMS).

In addition to DSSs for managers, group decision support systems and executive support systems use the same approach to support groups and executives.[9] A group decision support system, also called a group support system, includes the DSS elements just described and software, called groupware, to help groups make effective decisions. An executive support system, also called an executive information system, helps top-level managers, including a firm's president, vice presidents, and members of the board of directors, make better decisions. An executive support system can assist with strategic planning, top-level organizing and staffing, strategic control, and crisis management.

1.2.4 Knowledge Management, Artificial Intelligence, Expert Systems, and Virtual Reality

In addition to TPSs, MISs, and DSSs, organizations often rely on specialized systems. Many use knowledge management systems (KMSs), an organized collection of people, procedures, software, databases, and devices to create, store, share, and use the organization's knowledge and experience. According to a survey of CEOs, firms that use KMSs are more likely to innovate and perform better.[10]

In addition to knowledge management, companies use other types of specialized systems. The Nissan Motor Company, for example, has developed a specialized system for their vehicles called 'Lane Departure Prevention' that nudges a car back into the correct lane if it veers off course.[11] The system uses cameras and computers to adjust braking to get the vehicle back on course. The system switches off when the driver uses turn signals to change lanes. Other specialized systems are based on the notion of **artificial intelligence (AI)**, in which the computer system takes on the characteristics of human intelligence. The field of artificial intelligence includes several subfields (see Figure 1.9). Some people predict that in the future, we will have nanobots, small molecular-sized robots, travelling throughout our bodies and in our bloodstream, keeping us healthy.[12] Other nanobots will be embedded in products and services, making our lives easier and creating new business opportunities.

artificial intelligence (AI) The ability of computer systems to mimic or duplicate the functions or characteristics of the human brain or intelligence.

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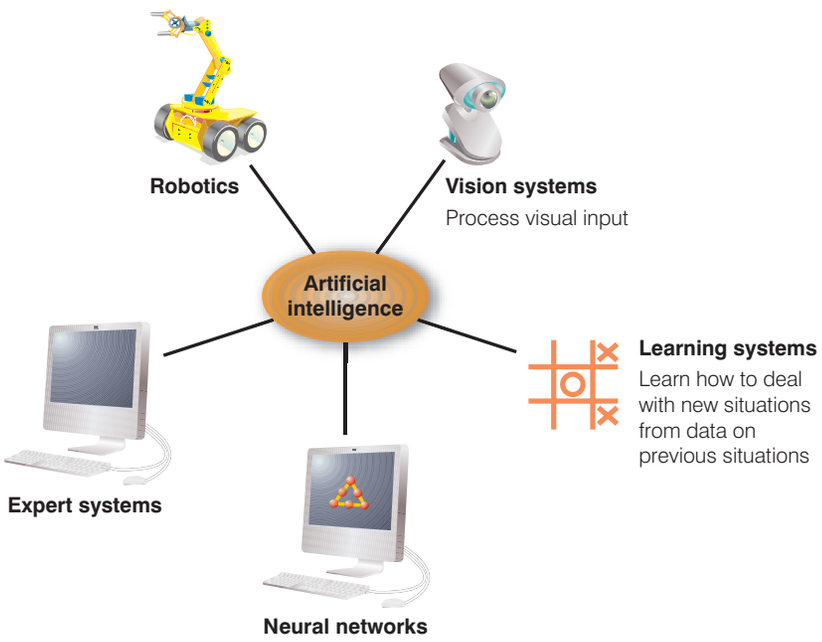

Figure 1.9 The Major Elements of Artificial Intelligence

Artificial Intelligence

Robotics is an area of artificial intelligence in which machines take over complex, dangerous, routine, or boring tasks, such as welding car frames or assembling computer systems and components. Vision systems allow robots and other devices to 'see', store, and process visual images. Natural language processing involves computers understanding and acting on verbal or written commands in English, Spanish, or other human languages. Learning systems allow computers to learn from past mistakes or experiences, such as playing games or making business decisions, and neural networks is a branch of AI that allows computers to recognize and act on patterns or trends. Some successful stock, options, and futures traders use neural networks to spot trends and make them more profitable with their investments.

Expert Systems

Expert systems give the computer the ability to make suggestions and act like an expert in a particular field. It can help the novice user perform at the level of an expert. The unique value of expert systems is that they allow organizations to capture and use the wisdom of experts and specialists. Therefore, years of experience and specific skills are not completely lost when a human expert dies, retires, or leaves for another job. Expert systems can be applied to almost any field or discipline. They have been used to monitor nuclear reactors, perform medical diagnoses, locate possible repair problems, design and configure IS components, perform credit evaluations, and develop marketing plans for a new product or new investment strategy. The collection of data, rules, procedures, and relationships that must be followed to achieve value or the proper outcome is contained in the expert system's **knowledge base**.

expert system A system that gives a computer the ability to make suggestions and act like an expert in a particular field.

knowledge base A component of an expert system that stores all relevant information, data, rules, cases, and relationships used by the expert system.

Virtual Reality

Virtual reality is the simulation of a real or imagined environment that can be experienced visually in three dimensions. Originally, virtual reality referred to immersive virtual reality, which means the user becomes fully immersed in an artificial, computer-generated 3D world. The virtual world is presented in full

virtual reality The simulation of a real or imagined environment that can be experienced visually in three dimensions.

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scale and relates properly to the human size. It can represent any 3D setting, real or abstract, such as a building, an archaeological excavation site, the human anatomy, a sculpture, or a crime scene reconstruction. Virtual worlds can be animated, interactive, and shared. Through immersion, the user can gain a deeper understanding of the virtual world's behaviour and functionality. Virtual reality can also refer to applications that are not fully immersive, such as mouse-controlled navigation through a 3D environment on a graphics monitor, stereo viewing from the monitor via stereo glasses, stereo projection systems, and others.

A variety of input devices, such as head-mounted displays (see Figure 1.10), data gloves, joysticks, and handheld wands, allow the user to navigate through a virtual environment and to interact with virtual objects. Directional sound, tactile and force feedback devices, voice recognition, and other technologies enrich the immersive experience. Because several people can share and interact in the same environment, virtual reality can be a powerful medium for communication, entertainment, and learning.

SOURCE: Frank Chmura/Alamy.

Figure 1.10 A Head-Mounted Display *The head-mounted display (HMD) was the first device to provide the wearer with an immersive experience. A typical HMD houses two miniature display screens and an optical system that channels the images from the screens to the eyes, thereby presenting a stereo view of a virtual world. A motion tracker continuously measures the position and orientation of the user's head and allows the image-generating computer to adjust the scene representation to the current view. As a result, the viewer can look around and walk through the surrounding virtual environment.*

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It is difficult to predict where information systems and technology will be in 10 to 20 years. It seems, however, that we are just beginning to discover the full range of their usefulness. Technology has been improving and expanding at an increasing rate; dramatic growth and change are expected for years to come. Without question, a knowledge of the effective use of information systems will be critical for managers both now and in the long term. But how are these information systems created?

1.3 Systems Development

Systems development is the activity of creating or modifying business systems. Systems development projects can range from small to very large in fields as diverse as stock analysis and video game development. People inside a company can develop systems, or companies can use outsourcing, hiring an outside company to perform some or all of a systems development project. Outsourcing allows a company to focus on what it does best and delegate other functions to companies with expertise in systems development. Outsourcing, however, is not the best alternative for all companies.

systems development The activity of creating or modifying existing business systems.

Developing information systems to meet business needs is highly complex and difficult – so much so that it is common for IS projects to overrun budgets and exceed scheduled completion dates. Her Majesty's Revenue and Customs (HMRC), which collects taxes in the UK, settled out of court with an outsourcing company to recover funds lost due to a tax-related mistake caused by a failed systems development project.[13] The failed project overpaid about €2.5 billion to some families with children or taxpayers in a low-income tax bracket. One strategy for improving the results of a systems development project is to divide it into several steps, each with a well-defined goal and set of tasks to accomplish (see Figure 1.11). These steps are summarized next.

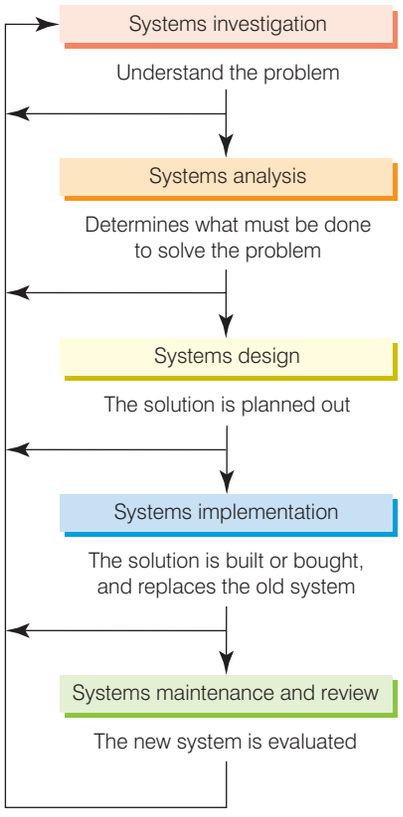

Figure 1.11 An Overview of Systems Development

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1.3.1 Systems Investigation and Analysis

The first two steps of systems development are systems investigation and analysis. The goal of the systems investigation is to gain a clear understanding of the problem to be solved or opportunity to be addressed. A cruise line company, for example, might launch a systems investigation to determine whether a development project is feasible to automate purchasing at ports around the world. After an organization understands the problem, the next question is, 'Is the problem worth solving?'. Given that organizations have limited resources – people and money – this question deserves careful consideration. If the decision is to continue with the solution, the next step, systems analysis, defines the problems and opportunities of the existing system. During systems investigation and analysis, as well as design maintenance and review, discussed next, the project must have the complete support of top-level managers and focus on developing systems that achieve business goals.[14]

1.3.2 Systems Design, Implementation, and Maintenance and Review

Systems design determines how the new system will work to meet the business needs defined during systems analysis. Systems implementation involves creating or acquiring the various system components (hardware, software, databases, etc.) defined in the design step, assembling them, and putting the new system into operation. The purpose of systems maintenance and review is to check and modify the system so that it continues to meet changing business needs.

1.4 Organizations and Information Systems

An **organization** is a formal collection of people and other resources established to accomplish a set of goals. The primary goal of a for-profit organization is to maximize shareholder value, often measured by the price of the company stock. Non-profit organizations include social groups, religious groups, universities, charities and other organizations that do not have profit as their goal.

organization A formal collection of people and other resources established to accomplish a set of goals.

An organization is a system, which, as you will recall from Chapter 1, means that it has inputs, processing mechanisms, outputs, and feedback. Resources such as materials, people, and money serve as inputs to the organizational system from the environment, go through a transformation mechanism, and then are produced as outputs to the environment. The outputs from the transformation mechanism are usually goods or services, which are of higher relative value than the inputs alone. Through adding value or worth, organizations attempt to achieve their goals.

How does the organizational system increase the value of resources? In the transformation mechanism, subsystems contain processes that help turn inputs into goods or services of increasing value. These processes increase the relative worth of the combined inputs on their way to becoming final outputs. Consider a car maker. Its inputs are the staff it has hired, the assembly equipment it has bought, raw materials such as metal and plastic and pre-assembled components such car radios. The processing that it does is turning the materials into finished vehicles, which are the output. The finished product is worth more than the cost of the components. This amount is the value that has been added.

value chain A series (chain) of activities that includes inbound logistics, warehouse and storage, production, finished product storage, outbound logistics, marketing and sales, and customer service.

The **value chain**, popularized by Michael Porter in his book, *Competitive Strategy*,[15] is a useful tool for analyzing where and how this value gets added. The value chain is a series (chain) of activities that includes inbound logistics,

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warehouse and storage, production, finished product storage, outbound logistics, marketing and sales, and customer service. The value chain of a manufacturing company is shown in Figure 1.12.

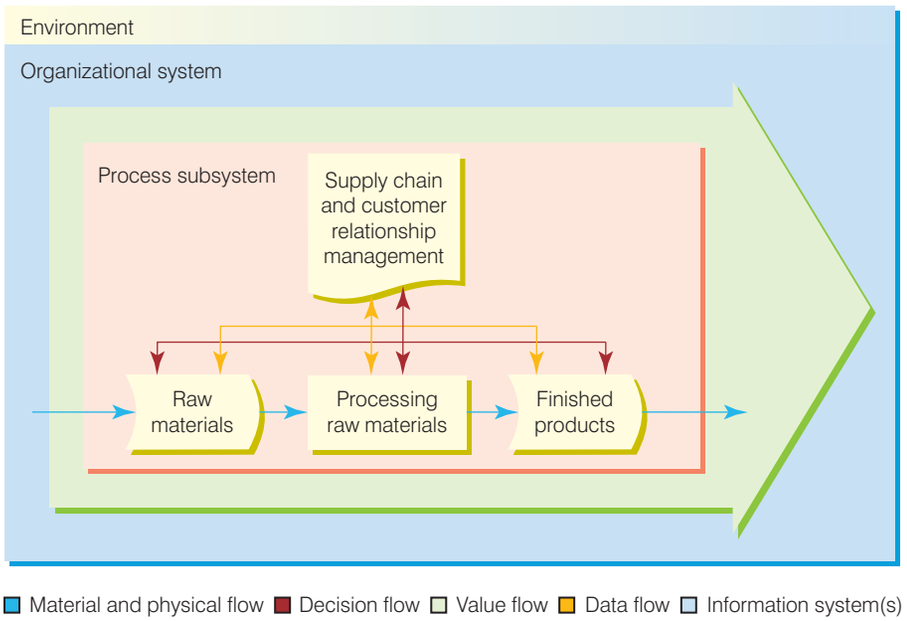

Figure 1.12 The Value Chain of a Manufacturing Company *Managing raw materials, inbound logistics, and warehouse and storage facilities is called 'upstream management', and managing finished product storage, outbound logistics, marketing and sales, and customer service is called 'downstream management'.*

Analyzing value chains when developing information systems often results in efficient transaction processing systems (explained fully in a later chapter), an expanding market, and the sharing of information.[16] The value chain is used to examine what happens to raw material to add value to them before the finished product is sold to customers. Information systems can be focused on those activities that add the most value. The value chain can also reveal linkages between different activites (say marketing and production) which can be exploited using IS (to increase communication between the two for instance).

The value chain is just as important (although it can be a little more difficult to apply to) to companies that don't manufacture products, but provide services, such as tax preparers and legal firms. By adding a significant amount of value to their products and services, companies ensure success.

Supply chain management (SCM) and customer relationship management (CRM) are two key parts of managing the value chain. SCM helps determine what supplies are required for the value chain, what quantities are needed to meet customer demand, how the supplies should be processed (manufactured) into finished goods and services, and how the shipment of supplies and products to customers should be scheduled, monitored, and controlled.[17] For example, in the car manufacturing company mentioned on page 22, SCM can identify key suppliers and parts, negotiate with vendors for the best prices and support, make sure that all supplies and parts are available to manufacture cars, and send finished products to dealerships around the country when they are needed. Increasingly, SCM is accomplished using the Internet and electronic marketplaces (e-marketplaces).[18] When an organization has many suppliers, it can use business-to-business exchanges such as eBay Business (http://business.ebay.co.uk) to negotiate good prices and service.

CRM programs help a company manage all aspects of customer encounters, including marketing and advertising, sales, customer service after the sale, and help retain loyal customers. CRM can assist a company with collecting data on customers, contacting customers, informing them about new products, and actively selling products to existing and new customers. Often, CRM

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software uses a variety of information sources, including sales from retail stores, surveys, e-mail, and Internet browsing habits, to compile comprehensive customer profiles. CRM systems can also collect customer feedback which can be used to design new products and services. Tesco, the UK's largest retail operation, encourages its customers to use its Clubcard, which allows it to collect information on customer transactions. It uses this information to provide outstanding customer service and deliver loyalty rewards and perks to valued customers[19] (see Figure 1.13). In return customers are rewarded with discounts on Tesco products, holidays, and other deals.

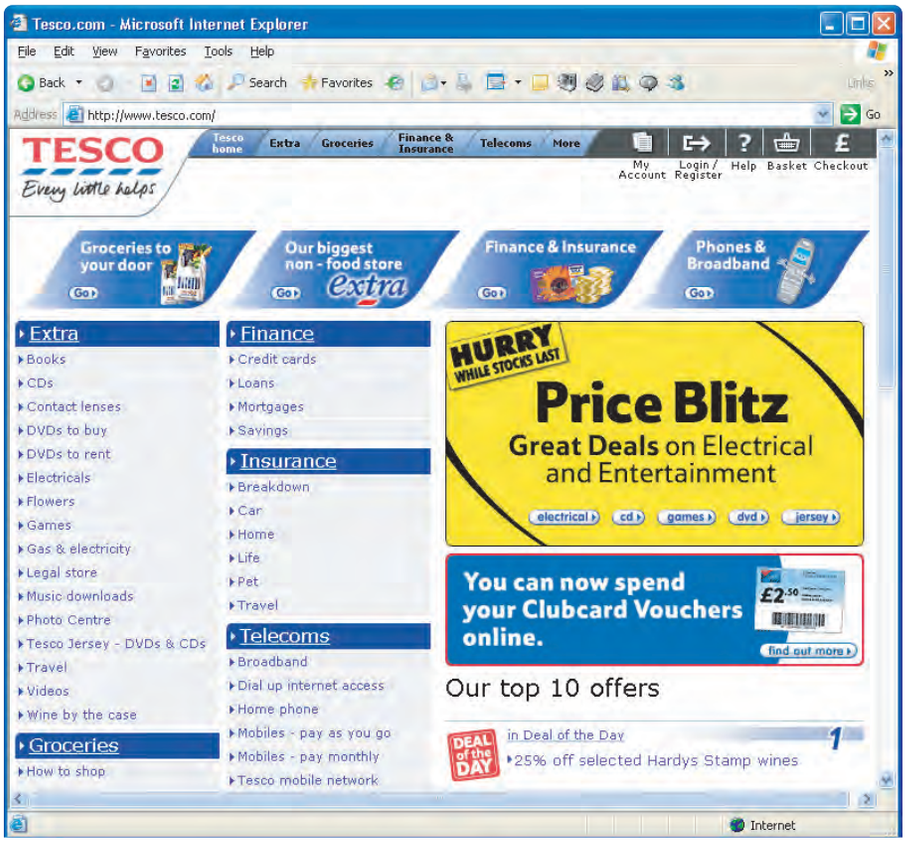

Figure 1.13 **Tesco Website** *Tesco uses its website to help with customer relationship management.*

What role does an information system play in these processes? A traditional view of information systems holds that organizations use them to control and monitor processes and ensure effectiveness and efficiency. Under this view, the output from a company's information systems is used to make changes to company processes. These changes could involve using different raw materials (inputs), designing new assembly-line procedures (product transformation), or developing new products and services (outputs). Here, the information system is external to the process and serves to monitor or control it.

A more contemporary view however, holds that information systems are often so intimately involved that they are part of the process itself. From this perspective, the information system plays an integral role in the process, whether providing input, aiding product transformation, or producing output. Consider a phone directory business that creates phone books for international businesses. A customer requests a phone directory listing all steel suppliers in Western Europe. Using its information system, the directory business can sort files to find the suppliers' names and phone numbers and organize them into an alphabetical list. The information system itself is an a inseparable part of this process. It does not just monitor the process externally but works as part of the process to transform raw data into a product. In

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this example, the information system turns input (names and phone numbers) into a sellable output (a phone directory). The same system might also provide the input (the files storing the data) and output (printed pages for the directory).

This latter view provides a new perspective on how and why businesses can use information systems. Rather than attempting to understand information systems independently of the organization, we must consider the potential role of information systems within the process itself, often leading to the discovery of new and better ways to accomplish the process.

1.4.1 Organizational Change

Most organizations are constantly undergoing change, both minor and major. The need for **organizational change** can be caused by internal factors, such as those initiated by employees at all levels, or external factors, such as activities wrought by competitors, stockholders, new laws, community regulations, natural occurrences (such as hurricanes), and general economic conditions. In the 1990s, the Internet caused massive changes in the way millions of organizations did business.

organizational change The responses that are necessary so that for-profit and non-profit organizations can plan for, implement, and handle change.

Change can be sustaining or disruptive. Sustaining change such as new or cheaper production equipment can help an organization improve its operation. For example, many factories are now able to use robots because prices for robots are falling and their useful lifetime is increasing, leading to a big market in second-hand robots.[20]

Disruptive change, on the other hand, often harms an organization's performance or even puts it out of business. In general, disruptive technologies might not originally have good performance, low cost, or even strong demand. Over time, however, they often replace existing technologies. They can cause good, stable companies to fail when they don't change or adopt the new technology. VoIP telephone technology is currently disrupting the business models of established companies such as BT (http://www.bt.com) who, in response, are moving toward providing broadband Internet connections as their main product.

Ethical and Societal Issues

Royal Mail Collects Vehicle Telemetry

Royal Mail collects and delivers letters and packages throughout the U.K. Every working day it collects items from 113000 post boxes, 14300 Post Office branches and from some 87000 businesses. These pass through 70 mail centres, 8 regional distribution centres and 3000 delivery offices. A fleet of around 30000 vans and lorries (and 33000 bicycles) are used to deliver them to their final destination, six days a week.

This fleet is costly to maintain and Royal Mail is keen to determine if it can reduce the number of vehicles required. A decision was taken to pilot a scheme to try to improve vehicle usage, reduce costs, and improve quality of service. The pilot was performed with a few hundred vans and involved installing a system in each to record vehicle telemetry. The system consisted of sensors inside each vehicle along with an aerial for data transmission, and analysis tools to examine the data collected. This data included vehicle location recorded every five minutes, when engines were started and stopped, fuel consumption, amount of acceleration and deceleration, and driver operating hours. The pilot study ran for 14 weeks.

*(**continued**)*

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The data was analyzed to minimize vehicle downtime, maximize vehicle usage, manage fuel consumption, manage accidents, and, interestingly, effect a cultural change in the way that vehicle assets were treated.

Prior to the pilot, Royal Mail carefully agreed a set of terms of reference with the Communication Workers Union (CWU), the body that represents postal workers. The CWU were understandably concerned that the data collected should not be used for purposes other than those stated in the agreed terms. Workers may have been worried about having to answer for taking an unusual route one day, perhaps because an accident blocked a road. The system records the new route, but is unable to record the accident that caused the change. Perhaps by the time the data is analyzed the driver will have forgotten the reason for going a different way. Royal Mail will have to overcome concerns such as these if it is to roll the system out to all of its vehicles. In fact, a pilot scheme is a very good way of identifying such concerns.

Questions

1 How much say should employees have in the data that their employer collects about them? Should Royal Mail drivers be worried about downsizing? If the aim of this system was to rightsize the Royal Mail fleet, should employees be told this?

2 Suggest some ways in which the data collected could be analyzed to achieve an increase in the quality of service Royal Mail provides.

3 Even if no workers union existed, why would it still be a good idea for managers to consult employees about the planned introduction of a system such as this?

4 In response to suggestions about installing tracking devices on vehicles (or even people) many respond by saying 'Big Brother is watching you'. What do you think they mean by this, and how would you allay their fears? Maybe you agree with them – explain why.

SOURCES: Royal Mail (website), http://www.royalmail.com/; Communication Workers Union (website), http://www.cwu.org; Vehicle Telemetry Project Terms and Conditions, working document 09-09-05 (website), http://www.cwu.org/ uploads/documents/outdoor%20Vehicle%20Telemetry%20TOR.doc.

1.4.2 User Satisfaction and Technology Acceptance

To be effective, reengineering and continuous improvement efforts must result in satisfied users and be accepted and used throughout the organization. You can determine the actual usage of an information system by the amount of technology diffusion and infusion.

technology diffusion A measure of how widely technology is spread throughout the organization.

Technology diffusion is a measure of how widely technology is spread throughout an organization. An organization in which computers and information systems are located in most departments and areas has a high level of technology diffusion. Some online merchants, such as BT (http://www.bt.com), have a high diffusion and use computer systems to perform most of their business functions, including marketing, purchasing, and billing.

technology infusion The extent to which technology is deeply integrated into an area or department.

Technology infusion, on the other hand, is the extent to which technology permeates an area or department. In other words, it is a measure of how deeply embedded technology is in an area of the organization. Some architectural firms, for example, use computers in all aspects of designing a building from drafting to final blueprints. The design area, thus, has a high level of infusion. Of course, a firm can have a high level of infusion in one part of its operations and a low level of diffusion overall. The architectural firm might use computers in all aspects of design (high infusion in the design area), but not to perform other business functions, including billing, purchasing, and marketing (low diffusion). Diffusion and infusion often depend on the technology available now and in the future, the size and type of the organization, and the environmental factors that include the competition, government regulations, suppliers, and so on. This is often called the 'technology, organization, and environment' (TOE) framework.[21]

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An active research area in IS involves identifying why people accept and use one system, but dislike and therefore don't use, another. One early model, the Technology Acceptance Model (TAM), shows that people will use a system is it is easy to use and useful to them. This in itself is unhelpful to IS developers, however TAM has been the basis for an large body of research that is ongoing, and which hopes to produce more practical results.

Although an organization might have a high level of diffusion and infusion, with computers throughout the organization, this does not necessarily mean that information systems are being used to their full potential.

1.5 Competitive Advantage

A **competitive advantage** is the ability of a firm to outperform its industry, that is, to earn a higher rate of profit than the industry norm[22] and can result from higher-quality products, better customer service, and lower costs. Establishing and maintaining a competitive advantage is complex. An organization often uses its information system to help it do this. Ultimately, it is not how much a company spends on information systems but how it makes and manages investments in technology. Companies can spend less and get more value.

competitive advantage The ability of a firm to outperform its industry, that is, to earn a higher rate of profit than the industry norm.

1.5.1 Factors that Lead Firms to Seek Competitive Advantage

A number of factors can lead a company to seek to attain a competitive advantage. Michael Porter, a prominent management theorist, suggested a simple but widely accepted model of the competitive forces in an industry, also called the **five-forces model**. A strong force can put a business at a disadvantage and lead it to invest in technology that can weaken it. The five forces are: (1) the rivalry among existing competitors, (2) the threat of new entrants, (3) the threat of substitute products and services, (4) the bargaining power of buyers, and (5) the bargaining power of suppliers. The more these forces combine in any instance, the more likely firms will seek competitive advantage and the more dramatic the results of such an advantage will be.

five-forces model A widely accepted model that identifies five key factors that can lead to attainment of competitive advantage, including (1) the rivalry among existing competitors, (2) the threat of new entrants, (3) the threat of substitute products and services, (4) the bargaining power of buyers, and (5) the bargaining power of suppliers.

Given the five market forces just mentioned, Porter and others have proposed a number of strategies to attain competitive advantage, including cost leadership, differentiation, niche strategy, altering the industry structure, creating new products and services, and improving existing product lines and services.[23] In some cases, one of these strategies becomes dominant. For example, with a cost leadership strategy, cost can be the key consideration, at the expense of other factors if need be.

Cost Leadership

The intent of a cost leadership strategy is to deliver the lowest possible products and services. In the U.K., supermarket Asda has used this strategy for years. Cost leadership is often achieved by reducing the costs of raw materials through aggressive negotiations with suppliers, becoming more efficient with production and manufacturing processes, and reducing warehousing and shipping costs. Some companies use outsourcing to cut costs when making products or completing services.

Differentiation

The intent of differentiation as a strategy is to deliver different products and services. This strategy can involve producing a variety of products, giving customers more choices, or delivering

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higher-quality products and services. Many car companies make different models that use the same basic parts and components, giving customers more options. Other car companies attempt to increase perceived quality and safety to differentiate their products. Some consumers are willing to pay higher prices for vehicles that differentiate on higher quality or better safety.

Niche Strategy

A niche strategy will deliver to only a small, niche market. Porsche, for example, doesn't produce inexpensive estate cars or saloons. It makes high-performance sports cars and four-wheel drives. Rolex only makes high-quality, expensive watches. It doesn't make inexpensive, plastic watches that can be purchased for €20 or less.

Altering the Industry Structure

Changing the industry to become more favourable to the company or organization is another strategy companies use. The introduction of low-fare airline carriers, such as EasyJet, has forever changed the airline industry, making it difficult for traditional airlines to make high profit margins. To fight back, airlines such as British Airways cut their flight prices and started to emphasize their strengths over low-cost airlines in their advertising. These include landing in central airports rather than airports many miles out of the city they supposedly serve, and extra staff and resources to cope if there is a fault with an aircraft, or adverse weather grounds all planes. Creating **strategic alliances** can also alter the industry structure. A strategic alliance, also called a 'strategic partnership', is an agreement between two or more companies that involves the joint production and distribution of goods and services.

strategic alliance (strategic partnership) An agreement between two or more companies that involves the joint production and distribution of goods and services.

Creating New Products and Services

Some companies introduce new products and services periodically or frequently as part of their strategy. This strategy can help a firm gain a competitive advantage, especially in the computer industry and other high-tech businesses. If an organization does not introduce new products and services every few months, the company can quickly stagnate, lose market share, and decline. Companies that stay on top are constantly developing new products and services.

Improving Existing Product Lines and Service

Making real or perceived improvements to existing product lines and services is another strategy. Manufacturers of household products are always advertising 'new and improved' products. In some cases, the improvements are more perceived than real refinements; usually, only minor changes are made to the existing product, such as reducing the amount of sugar in a breakfast cereal. Some mail order companies are improving their service by using Radio Frequency Identification (RFID) tags to identify and track the location of their products as they are shipped from one location to another. Customers and managers can instantly locate products as they are shipped from suppliers to the company, to warehouses, and finally to customers.

Other potentially successful strategies include being the first to market, offering customized products and services, and hiring talented staff, the assumption being that the best people will determine the best products and services to deliver to the market and the best approach to deliver these products and services. Companies can also combine one or more of these strategies.

1.6 Evaluating IS

Once an information system has been implemented, management will want to assess how successful it has been in achieving its goals. Often this is a difficult thing to do, and many businesses do not attempt to take anything more than an informal approach to evaluation.[24] Business can use measurements of productivity, return on investment (ROI), net present value,

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and other measures of performance to evaluate the contributions their information systems make to their businesses.

1.6.1 Productivity

Developing information systems that measure and control productivity is a key element for most organizations. **Productivity** is a measure of the output achieved divided by the input required. A higher level of output for a given level of input means greater productivity; a lower level of output for a given level of input means lower productivity. The numbers assigned to productivity levels are not always based on labour hours – productivity can be based on factors such as the amount of raw materials used, resulting quality, or time to produce the goods or service. The value of the productivity number is not as significant as how it compares with other time periods, settings, and organizations.

productivity A measure of the output achieved divided by the input required. Productivity = (Output / Input) × 100%.

After a basic level of productivity is measured, an information system can monitor and compare it over time to see whether productivity is increasing. Then a company can take corrective action if productivity drops below certain levels. In addition to measuring productivity, an information system can be used within a process to significantly increase productivity. Thus, improved productivity can result in faster customer response, lower costs, and increased customer satisfaction.

In the late 1980s and early 1990s, overall productivity did not seem to improve as a company increased its investments in information systems. Often called the productivity paradox, this situation troubled many economists who were expecting to see dramatic productivity gains. In the early 2000s, however, productivity again seemed on the rise.

1.6.2 Return on Investment and the Value of Information Systems

One measure of IS value is **return on investment (ROI)**. This measure investigates the additional profits or benefits that are generated as a percentage of the investment in IS technology. A small business that generates an additional profit of €20 000 for the year as a result of an investment of €100 000 for additional computer equipment and software would have a return on investment of 20 percent (€20 000/€100 000). In many cases, however, it can be difficult to accurately measure ROI.[25]

return on investment (ROI) One measure of IS value that investigates the additional profits or benefits that are generated as a percentage of the investment in IS technology.

Earnings Growth

Another measure of IS value is the increase in profit, or earnings growth, it brings. For instance, a mail-order company might install an order-processing system that generates a 7 percent earnings growth compared with the previous year.

Market Share

Market share is the percentage of sales that a product or service has in relation to the total market. If installing a new online catalogue increases sales, it might help a company increase its market share by 20 percent.

Customer Awareness and Satisfaction

Although customer satisfaction can be difficult to quantify, about half of today's best global companies measure the performance of their information systems based on feedback from internal and external users. Some companies use surveys and questionnaires to determine whether the IS investment has increased customer awareness and satisfaction.

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Total Cost of Ownership

Another way to measure the value of information systems was developed by the Gartner Group and is called the **total cost of ownership (TCO)**. This approach breaks total costs into areas such as the cost to acquire the technology, technical support, administrative costs, and end-user operations. Other costs in TCO include retooling and training costs. TCO can help to develop a more accurate estimate of the total costs for systems that range from desktop computers to large mainframe systems. Market research groups often use TCO to compare products and services.

total cost of ownership (TCO)
The measurement of the total cost of owning computer equipment, including desktop computers, networks, and large computers.

Return on investment, earnings growth, market share, customer satisfaction, and TCO are only a few measures that companies use to plan for and maximize the value of their IS investments. Regardless of the difficulties, organizations must attempt to evaluate the contributions that information systems make to assess their progress and plan for the future. Information technology and personnel are too important to leave to chance.

Risk

In addition to the return-on-investment measures of a new or modified information system, managers should also consider the risks of designing, developing, and implementing these systems. Information systems can sometimes be costly failures. Some companies, for example, have attempted to implement ERP systems and failed, costing them millions of dollars. In other cases, e-commerce applications have been implemented with little success. The costs of development and implementation can be greater than the returns from the new system.

1.7 Careers in Information Systems

Realizing the benefits of any information system requires competent and motivated IS personnel, and many companies offer excellent job opportunities. Professionals with careers in information systems typically work in an IS department as web developers, computer programmers, systems analysts, database developers and administrators, computer operators, technical support or in other positions. In addition to technical skills, they need skills in written and verbal communication, an understanding of organizations and the way they operate, and the ability to work with people and in groups. Today, many good information, business, and computer science schools require these business and communications skills of their graduates.

In general, IS professionals are charged with maintaining the broadest perspective on organizational goals. Most medium to large organizations manage information resources through an IS department. In smaller businesses, one or more people might manage information resources, with support from outsourced services. As shown in Figure 1.14, the IS department has three primary responsibilities: operations, systems development, and support.

1.7.1 Operations

People in the operations component of a typical IS department work with information systems in corporate or business unit computer facilities. They tend to focus more on the efficiency of IS functions rather than their effectiveness.

System operators primarily run and maintain IS equipment, and are typically trained at technical schools or through on-the-job experience. They are responsible for starting, stopping, and correctly operating mainframe systems, networks, back-up drives, disk devices, printers, and so on. Other operations include scheduling, hardware maintenance, and preparing input and output. Data-entry operators convert data into a form the computer system can use. They can use terminals or other devices to enter business transactions, such as sales orders and payroll

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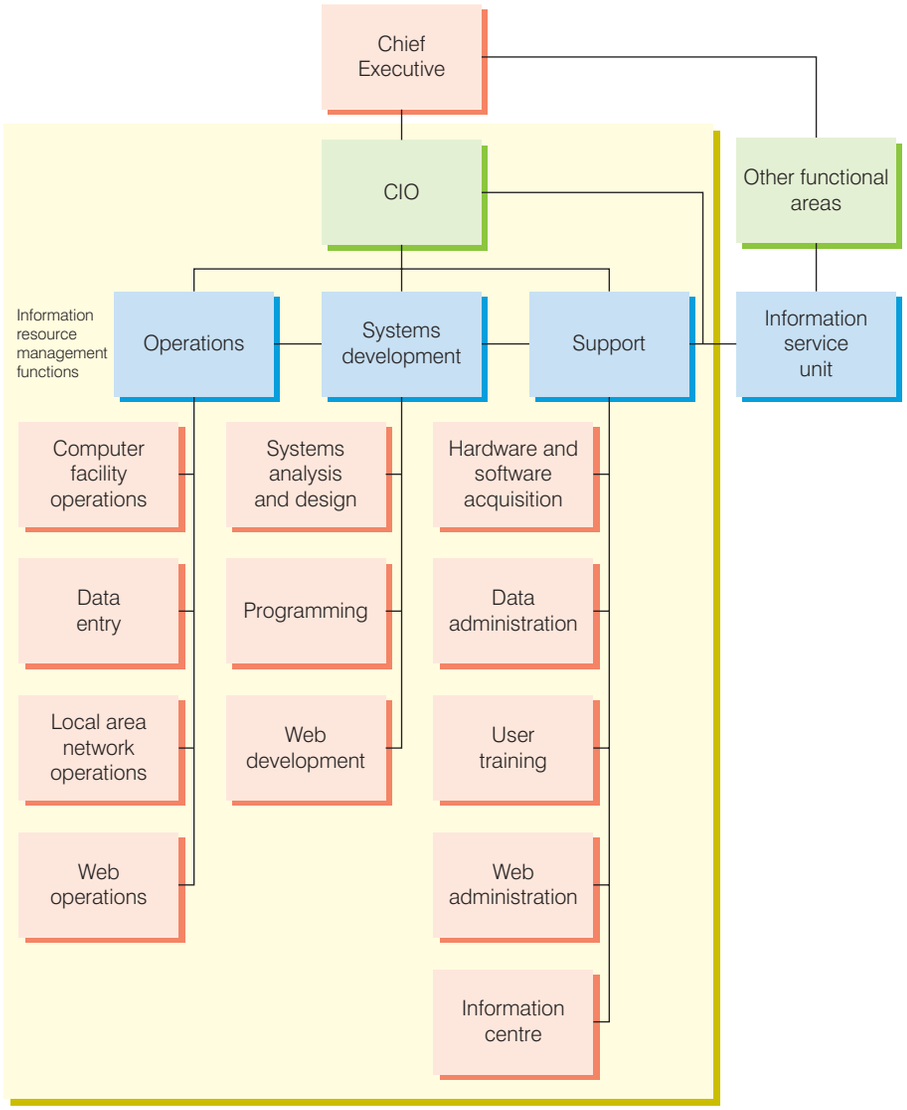

Figure 1.14 The IS Department

data. Increasingly, data entry is being automated – captured at the source of the transaction rather than entered later. In addition, companies might have local area network (LAN) and web operators who run the local network and any websites the company has.

1.7.2 Systems Development

The systems development component of a typical IS department focuses on specific development projects and ongoing maintenance and review. Systems analysts and programmers, for example, address these concerns to achieve and maintain IS effectiveness. The role of a systems analyst is multifaceted. Systems analysts help users determine what outputs they need from the system and construct plans for developing the necessary programs that produce these outputs. Systems analysts then work with one or more programmers to make sure that the appropriate programs are purchased, modified from existing programs, or developed. A computer programmer uses the plans the systems analyst created to develop or adapt one or more computer programs that produce the desired outputs.

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With the dramatic increase in the use of the Internet, intranets, and extranets, many companies have web or Internet developers who create effective and attractive websites for customers, internal personnel, suppliers, stockholders, and others who have a business relationship with the company.

1.7.3 Support

The support component of a typical IS department provides user assistance in hardware and software acquisition and use, data administration, user training and assistance, and web administration. In many cases, support is delivered through an information centre.

Because IS hardware and software are costly, a specialized support group often manages computer hardware and software acquisitions. This group sets guidelines and standards for the rest of the organization to follow in making purchases. It must gain and maintain an understanding of available technology and develop good relationships with vendors.

A database administrator focuses on planning, policies, and procedures regarding the use of corporate data and information. For example, database administrators develop and disseminate information about the organization's databases for developers of IS applications. In addition, the database administrator monitors and controls database use.

User training is a key to get the most from any information system, and the support area ensures that appropriate training is available. Training can be provided by internal staff or from external sources. For example, internal support staff can train managers and employees in the best way to enter sales orders, to receive computerized inventory reports, and to submit expense reports electronically. Companies also hire outside firms to help train users in other areas, including the use of word processing, spreadsheets, and database programs.

Web administration is another key area for support staff. With the increased use of the Internet, web administrators are sometimes asked to regulate and monitor Internet use by employees and managers to make sure that it is authorized and appropriate. Web administrators also maintain the organization's website to keep it accurate and current, which can require substantial resources.

The support component typically operates the helpdesk. A helpdesk provides users with assistance, training, application development, documentation, equipment selection and setup, standards, technical assistance, and troubleshooting.

1.7.4 Information Service Units

An information service unit is basically a miniature IS department attached and directly reporting to a functional area in a large organization. Notice the information service unit shown in Figure 1.14. Even though this unit is usually staffed by IS professionals, the project assignments and the resources necessary to accomplish these projects are provided by the functional area to which it reports. Depending on the policies of the organization, the salaries of IS professionals staffing the information service unit might be budgeted to either the IS department or the functional area.

1.7.5 Typical IS Titles and Functions

The organizational chart shown in Figure 1.14 is a simplified model of an IS department in a typical medium or large organization. Many organizations have even larger departments, with increasingly specialized positions such as librarian or quality assurance manager. Smaller firms often combine the roles shown in Figure 1.14 into fewer formal positions.

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The Chief Information Officer

The role of the chief information officer (CIO) is to employ an IS department's equipment and personnel to help the organization attain its goals. The CIO is a senior manager concerned with the overall needs of the organization, and sets organization-wide policies, and plans, manages, and acquires information systems. Some of the CIO's top concerns include integrating IS operations with business strategies, keeping up with the rapid pace of technology, and defining and assessing the value of systems development projects. The high level of the CIO position reflects that information is one of the organization's most important resources. A CIO works with other high-level officers of an organization, including the finance director and the executive officer, in managing and controlling total corporate resources. CIOs must also work closely with advisory committees, stressing effectiveness and teamwork and viewing information systems as an integral part of the organization's business processes – not an adjunct to the organization. Thus, CIOs need both technical and business skills.

LAN Administrator

Local area network (LAN) administrators set up and manage the network hardware, software, and security processes. They manage the addition of new users, software, and devices to the network. They also isolate and fix operations problems. LAN administrators are in high demand and often solve both technical and non-technical problems.

local area network (LAN) A computer network that connects computer systems and devices within a small area, such as an office, home, or several floors in a building.

Internet Careers

These careers are in the areas of web operations, web development, and web administration. As with other areas in IS, many top-level administrative jobs are related to the Internet. These career opportunities are found in both traditional companies and those that specialise in the Internet.

Internet jobs within a traditional company include Internet strategists and administrators, Internet systems developers, Internet programmers, and Internet or website operators.

Systems Developers

Systems developers design and write software. Typically developers will be graduates with degrees in technical subjects such as computer science, mathematics or engineering. However, many big employers have graduate recruitment schemes where degree subject is less important than an ability to learn. On such schemes, graduates are taught the skills they need. The skills needed by developers include the ability to design solutions to problems and communicate these solutions to other developers and to users, and the technical skill to create these solutions. Software development can be extremely challenging and exciting.

Often, systems developers are employed to create software to support business goals, such as develop the organization's transaction processing system. Alternatively, systems developers may work in a software house, where the software they write is the product the organization sells. One of the fastest growing areas of software development is the games industry, with many universities now offering degrees in games development.

1.8 Global Challenges in Information Systems

Changes in society as a result of increased international trade and cultural exchange, often called globalization, have always had a big impact on organizations and their information systems. In his book *The World Is Flat,* Thomas Friedman describes three eras of globalization (see Table 1.2).[26] According to Friedman, we have progressed from the globalization of countries to the globalization of multinational corporations and individuals. Today, people in remote

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Table 1.2 Eras of Globalization

Era	Dates	Characterized by
Globalization 1	Late 1400–1800	Countries with the power to explore and influence the world
Globalization 2	1800–2000	Multinational corporations that have plants, warehouses, and offices around the world
Globalization 3	2000–today	Individuals from around the world who can compete and influence other people, corporations, and countries by using the Internet and powerful technology tools

areas can use the Internet to compete with, and contribute to, other people, the largest corporations, and entire countries. These workers are empowered by high-speed Internet access, making the world seem smaller and effectively levelling the global playing field. In the Globalization 3 era, designing a new airplane or computer can be separated into smaller subtasks and then completed by a person or small group that can do the best job. These workers can be located in India, China, Russia, Europe, and other areas of the world. The subtasks can then be combined or reassembled into the complete design. This approach can be used to prepare tax returns, diagnose a patient's medical condition, fix a broken computer, and many other tasks.

Today's information systems have led to greater globalization. High-speed Internet access and networks that can connect individuals and organizations around the world create more international opportunities. Global markets have expanded. People and companies can get products and services from around the world, instead of around the corner or across town. These opportunities, however, introduce numerous obstacles and issues, including challenges involving culture, language, and many others.

- *Cultural challenges:* Countries and regional areas have their own cultures and customs that can significantly affect individuals and organizations involved in global trade.
- *Language challenges:* Language differences can make it difficult to translate exact meanings from one language to another.
- *Time and distance challenges:* Time and distance issues can be difficult to overcome for individuals and organizations involved with global trade in remote locations. Large time differences make it difficult to talk to people on the other side of the world. With long distance, it can take days to get a product, a critical part, or a piece of equipment from one location to another location.
- *Infrastructure challenges:* High-quality electricity and water might not be available in certain parts of the world. Telephone services, Internet connections, and skilled employees might be expensive or not readily available.
- *Currency challenges:* The value of different currencies can vary significantly over time, making international trade more difficult and complex.
- *Product and service challenges:* Traditional products that are physical or tangible, such as a car or bicycle, can be difficult to deliver to the global market. However, electronic products (e-products) and electronic services (e-services) can be delivered to customers electronically, over the phone, networks, through the Internet, or other electronic means. Software, music, books, manuals, and help and advice can all be delivered over the Internet.
- *Technology transfer issues:* Most governments don't allow certain military-related equipment and systems to be sold to some countries. Even so, some believe that foreign

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companies are stealing the intellectual property, trade secrets, copyrighted materials, and counterfeiting products and services.[27]

- *National laws:* Every country have a set of laws that must be obeyed by citizens and organizations operating in the country. These laws can deal with a variety of issues, including trade secrets, patents, copyrights, protection of personal or financial data, privacy, and much more. Laws restricting how data enters or exits a country are often called 'trans-border data-flow laws'. Keeping track of these laws and incorporating them into the procedures and computer systems of multinational and trans-national organizations can be very difficult and time consuming, requiring expert legal advice.
- *Trade agreements:* Countries often enter into trade agreements with each other. The EU has trade agreements among its members.[28] The North American Free Trade Agreement (NAFTA) and the Central American Free Trade Agreement (CAFTA) are other examples.[29] Others include the Australia–United States Free Trade Agreement and agreements between Bolivia and Mexico, Canada and Costa Rica, Canada and Israel, Chile and Korea, Mexico and Japan, the U.S. and Jordan, and many others.[30]

Summary

The value of information is directly linked to how it helps decision makers achieve the organizational goals. Information systems are used in almost every imaginable career area. Regardless of your chosen career, you will find that information systems are indispensable tools to help you achieve your goals. Learning about information systems can help you get your first job, earn promotions, and advance your career.

Information is a collection of facts. To be valuable, information must have several characteristics: It should be accurate, complete, economical to produce, flexible, reliable, relevant, simple to understand, timely, verifiable, accessible, and secure. The value of information is directly linked to how it helps people achieve their organization's goals.

Knowing the potential impact of information systems and having the ability to put this knowledge to work can result in a successful personal career, organizations that reach their goals, and a society with a higher quality of life. Information systems are sets of interrelated elements that collect (input), manipulate and store (process), and disseminate (output) data and information. Input is the activity of capturing and gathering new data, processing involves converting or transforming data into useful outputs, and output involves producing useful information. Feedback is the output that is used to make adjustments or changes to input or processing activities.

The components of a computer-based information system (CBIS) include hardware, software, databases, telecommunications and the Internet, people, and procedures. The types of CBISs that organizations use can be classified into: (1) e-commerce and m-commerce, TPS and ERP systems, (2) MIS and DSS, and (3) specialized business information systems. The key to understanding these types of systems begins with learning their fundamentals.

E-commerce involves any business transaction executed electronically between parties such as companies (business to business), companies and consumers (business to consumer), business and the public sector, and consumers and the public sector. The major volume of e-commerce and its fastest-growing segment is business-to-business transactions that make purchasing easier for big corporations. E-commerce also offers opportunities for small businesses to market and sell at a low cost worldwide, thus allowing them to enter the global market right from start-up. M-commerce involves 'anytime, anywhere' computing that relies on wireless networks and systems.

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1

The most fundamental system is the transaction processing system (TPS). A transaction is any business-related exchange. The TPS handles the large volume of business transactions that occur daily within an organization. An enterprise resource planning (ERP) system is a set of integrated programs that can manage the vital business operations for an entire multi-site, global organization. A management information system (MIS) uses the information from a TPS to generate information useful for management decision making.

A decision support system (DSS) is an organized collection of people, procedures, databases, and devices that help make problem-specific decisions. A DSS differs from an MIS in the support given to users, the emphasis on decisions, the development and approach, and the system components, speed, and output.

Specialized business information systems include knowledge management, artificial intelligence, expert, and virtual reality systems. Knowledge management systems are organized collections of people, procedures, software, databases, and devices used to create, store, share, and use the organization's knowledge and experience. Artificial intelligence (AI) includes a wide range of systems in which the computer takes on the characteristics of human intelligence. Robotics is an area of artificial intelligence in which machines perform complex, dangerous, routine, or boring tasks, such as welding car frames or assembling computer systems and components. Vision systems allow robots and other devices to have 'sight' and to store and process visual images. Natural language processing involves computers interpreting and acting on verbal or written commands in English, Spanish, or other human languages. Learning systems let computers learn from past mistakes or experiences, such as playing games or making business decisions, while neural networks is a branch of artificial intelligence that allows computers to recognize and act on patterns or trends. An expert system (ES) is designed to act as an expert consultant to a user who is seeking advice about a specific situation. Originally, the term 'virtual reality' referred to immersive virtual reality, in which the user becomes fully immersed in an artificial, computer-generated 3D world. Virtual reality can also refer to applications that are not fully immersive, such as mouse-controlled navigation through a 3D environment on a graphics monitor, stereo viewing from the monitor via stereo glasses, stereo projection systems, and others.

System users, business managers, and information systems professionals must work together to build a successful information system. Systems development involves creating or modifying existing business systems. The major steps of this process and their goals include systems investigation (gain a clear understanding of what the problem is), systems analysis (define what the system must do to solve the problem), systems design (determine exactly how the system will work to meet the business needs), systems implementation (create or acquire the various system components defined in the design step), and systems maintenance and review (maintain and then modify the system so that it continues to meet changing business needs).

The use of information systems to add value to the organization can also give an organization a competitive advantage. An organization is a formal collection of people and various other resources established to accomplish a set of goals. The primary goal of a for-profit organization is to maximise shareholder value. Nonprofit organizations include social groups, religious groups, universities, and other organizations that do not have profit as the primary goal. Organizations are systems with inputs, transformation mechanisms, and outputs.

Value-added processes increase the relative worth of the combined inputs on their way to becoming final outputs of the organization. The value chain is a series (chain) of activities that includes (1) inbound logistics, (2) warehouse and storage, (3) production, (4) finished product storage, (5) outbound logistics, (6) marketing and sales, and (7) customer service.

Supply chain management (SCM) helps determine what supplies are required, what quantities are needed to meet customer demand, how the supplies are to be processed (manufactured) into finished goods and services, and how the shipment of supplies and products to customers is to be scheduled, monitored, and controlled. Customer relationship management (CRM) programs help a company manage all aspects of customer encounters, including marketing and advertising, sales, customer service after the sale, and programs to help keep and retain loyal customers. CRM can help a company collect customer data, contact customers, educate customers on new products, and actively sell products to existing and new customers.

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Organizations use information systems to support organizational goals. Because information systems typically are designed to improve productivity, methods for measuring the system's impact on productivity should be devised. In the late 1980s and early 1990s, overall productivity did not seem to increase with increases in investments in information systems. Often called the *productivity paradox,* this situation troubled many economists who were expecting to see dramatic productivity gains. In the early 2000s, however, productivity again seemed on the rise.

Organizational change is an important internal issues that affects most organizations. Organizational change deals with how for-profit and nonprofit organizations plan for, implement, and handle change. Change can be caused be internal or external factors. Many European countries, for example, adopted the euro, a single European currency, which changed how financial companies do business and how they use their information systems.

User satisfaction with a computer system and the information it generates often depends on the quality of the system and the resulting information. A quality information system is usually flexible, efficient, accessible, and timely. The extent to which technology is used throughout an organization is a function of technology diffusion, infusion and acceptance. Technology diffusion is a measure of how widely technology is in place throughout an organization. Technology infusion is the extent to which technology permeates an area or department. The technology acceptance model (TAM) investigates factors, such as the perceived usefulness of the technology, ease of the use of the technology, the quality of the information system, and the degree to which the organization supports the use of the information system, to predict IS usage and performance.

Competitive advantage is usually embodied in either a product or service that has the most added value to consumers and that is unavailable from the competition or in an internal system that delivers benefits to a firm not enjoyed by its competition. The five-forces model covers factors that lead firms to seek competitive advantage: rivalry among existing competitors, the threat of new market entrants, the threat of substitute products and services, the bargaining power of buyers, and the bargaining power of suppliers. Three strategies to address these factors and to attain competitive advantage include altering the industry structure, creating new products and services, and improving existing product lines and services.

The ability of an information system to provide or maintain competitive advantage should also be determined. Several strategies for achieving competitive advantage include enhancing existing products or services or developing new ones, as well as changing the existing industry or creating a new one.

Developing information systems that measure and control productivity is a key element for most organizations. A useful measure of the value of an IS project is return on investment (ROI). This measure investigates the additional profits or benefits that are generated as a percentage of the investment in IS technology. Total cost of ownership (TCO) can also be a useful measure.

Cooperation between business managers and IS personnel is the key to unlocking the potential of any new or modified system. Information systems personnel typically work in an IS department. The chief information officer (CIO) employs an IS department's equipment and personnel to help the organization attain its goals. Systems analysts help users determine what outputs they need from the system and construct the plans needed to develop the necessary programs that produce these outputs. Systems analysts then work with one or more system developers to make sure that the appropriate programs are purchased, modified from existing programs, or developed. The major responsibility of a computer programmer is to use the plans developed by the systems analyst to build or adapt one or more computer programs that produce the desired outputs.

Computer operators are responsible for starting, stopping, and correctly operating mainframe systems, networks, tape drives, disk devices, printers, and so on. LAN administrators set up and manage the network hardware, software, and security processes. Trained personnel are also needed to set up and manage a company's Internet site, including Internet strategists, Internet systems developers, Internet programmers, and website operators. Information systems personnel can also support other functional departments or areas.

In addition to technical skills, IS personnel need skills in written and verbal communication, an understanding of organizations and the way they operate, and the ability to work with people (users). In general, IS personnel are charged with maintaining the broadest enterprise-wide perspective.

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1 Self-Assessment Test

1 A(n) _____ is a set of interrelated components that collect, manipulate, and disseminate data and information and provide a feedback mechanism to meet an objective.

2 A(n) _____ consists of hardware, software, databases, telecommunications, people, and procedures.

3 Computer programs that govern the operation of a computer system are called _____.
a. feedback
b. feedforward
c. software
d. transaction processing systems

4 What is an organized collection of people, procedures, software, databases, and devices used to create, store, share, and use the organization's experience and knowledge?
a. TPS (transaction processing system)
b. MIS (management information system)
c. DSS (decision support system)
d. KMS (knowledge management system)

5 What determines how a new system will work to meet the business needs defined during systems investigation?
a. systems implementation
b. systems review
c. systems development
d. systems design

6 _____ involves anytime, anywhere commerce that uses wireless communications.

7 _____ involves contracting with outside professional services to meet specific business needs.

8 _____ change can help an organization improve raw materials supply, the production process, and the products and services offered by the organization.

9 Technology infusion is a measure of how widely technology is spread throughout an organization. True or False?

10 Who is involved in helping users determine what outputs they need and constructing the plans needed to produce these outputs?
a. CIO
b. applications programmer
c. systems programmer
d. systems analyst

11 The systems development component of a typical IS department focuses on specific development projects and ongoing maintenance and review. True or false?

12 The _____ is typically in charge of the IS department or area in a company.

Review Questions

1 What is an information system? Explain some of the ways in which information systems are changing our lives.

2 Define the term 'system'. Give several examples.

3 What are the components of any information system?

4 What is a computer-based information system? What are its components?

5 Identify three functions of a transaction processing system.

6 What is the difference between an intranet and an extranet?

7 What is m-commerce? Describe how it can be used.

8 Identify three elements of artificial intelligence.

9 Identify the steps in the systems development process and state the goal of each.

10 What is the value chain?

11 What is the difference between technology infusion and technology diffusion?

12 What is downsizing? How is it different from outsourcing?

13 What are some general strategies employed by organizations to achieve competitive advantage?

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14 What are several common justifications for implementing an information system?

15 What is on-demand computing? What two advantages does it offer to a company?

16 What is the role of a systems developer? What is the role of a programmer? Are they different, and if so, how?

Discussion Questions

1 Describe how information systems are used in your college or university.

2 Explain using examples the difference between e-commerce and m-commerce.

3 What is the difference between an MIS and a DSS?

4 You have decided to open an Internet site to buy and sell used music CDs to other students. Describe the value chain for your new business.

5 How might you measure user satisfaction with a registration program at a college or university? What are the important features that would make students and faculty satisfied with the system?

6 There are many ways to evaluate the effectiveness of an information system. Discuss two methods and describe when one method would be preferred over another method.

7 A company has a prototype that it classes in the applications portfolio as potential strategic. If they develop it and it turns out to be strategic, is there any way they can sustain the advantage it brought? Or will it be destined to be copied by competitors which will erode its advantage?

Web Exercises

1 Throughout this book, you will see how the Internet provides a vast amount of information to individuals and organizations. We will stress the World Wide Web, or simply the Web, which is an important part of the Internet. Most large universities and organizations have an address on the Internet, called a website or home page.

   The address of the website for this publisher is www.cengage.co.uk/stair. You can gain access to the Internet through a browser, such as Microsoft Internet Explorer or Safari. Using an Internet browser, go to the Cengage Learning website. Try to obtain information on this book. You might be asked to develop a report or send an e-mail message to your instructor about what you found.

2 Go to an Internet search engine, such as www.google.co.uk, and search for information about knowledge management. Write a brief report that summarizes what you found and the companies that provide knowledge management products.

3 Using the Internet, search for information on the use of information systems in a company or organization that interests you. How does the organization use technology to help accomplish its goals?

4 This book emphasizes the importance of information. You can get information from the Internet by going to a specific address, such as www.ibm.com, the home page of the IBM corporation, or a search engine such as www.google.co.uk.

   Using Google, search for information about a company or topic discussed in Chapters 1 or 2. You might be asked to develop a report or send an e-mail message to your instructor about what you find.

5 Use the Internet to search for information about user satisfaction. You can use a search engine or a database at your college or university. Write a brief report describing what you find.

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Case One

Shroff International Travel Care Opens Door to Philippines

In many markets, large superstores are seriously threatening the livelihood of small local business owners. This is true online as well. How can a local travel agency compete with Travelocity, Expedia, and Priceline? One answer lies in finding your unique niche.

Shroff International Travel Care, Incorporated (SITCI) found its niche. SITCI is a small travel agency with two offices in and near Manila in the Philippines. SITCI prides itself on its extensive knowledge of travel in the region, and its high level of customer satisfaction. SITCI believes that it can provide customers with better deals, more effective service, and more options than the big online travel companies.

SITCI recently decided to automate their reservations system through a web-based service. 'If you take a look at the reservations process in the travel industry, most of them are excellent candidates for automation,' states Arjun Shroff, CEO and managing director of the company. Taking the business online provides several advantages: (1) Shroff can present travel options to customers in a more organized manner to be viewed anytime, (2) the website provides self-service for customers to book their own flights, hotels, and ground transportation, and (3) the website transforms the business from a local entity to a global entity.

The website (www.airlinecenter.info) provides deals and information on tour packages, resorts and hotels, visa applications, airline reservations, embassy listings, and limousine services. Airline reservations are provided through the Amadeus global travel distribution system. Amadeus is a global provider of IT applications designed for the travel and tourism industry. Amadeus also provides the transaction processing system that allows customers to pay for flights and accommodations through SITCI's website.

The new system has freed up time for SITCI travel agents to work on the more complicated reservations and ticketing work. 'Information technology allows our agency to enhance our product and service offerings, provide better and modern service to our existing customers, and even reach out to new customers. You simply cannot do without IT today,' Shroff said.

Mr. Shroff takes his national responsibilities seriously and believes that taking his business online will help move the country forward. 'We have to be very creative and innovative in attracting tourists to the Philippines; sincerity in dealings, continuous presence in all local and international travel trade-related shows will keep the country on the go,' Mr. Shroff said. Arjun Shroff trained with the International Air Transport Associations and Universal Federation of Travel Agents Association (IATA/UFTA) in Switzerland and has spent 29 years in the travel industry in various countries.

Questions

1. Tour the www.airlinecenter.info website. Who do you think this website is primarily designed to assist – local customers or global customers? Do you think SITCI have the right customer in mind? Explain your answer.
2. How does www.airlinecenter.info empower SITCI travel agents to provide better personal service to customers?
3. How might SITCI further develop its website to provide unique services to the global market that could not be provided by the big online companies?
4. If you were planning a trip to tour the Philippines, who would you rather work with, Expedia.co.uk or SITCI? Explain your answer.

SOURCES: Jenalyn Rubio, 'Local travel company invests in online reservation system', *Computerworld Philippines,* February 23, 2006, www.itnetcentral.com/computerworld/default.asp. Shroff International Travel Care Incorporated (SITCI) website, February 23, 2006, www.airlinecenter.info.

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Case Two

Discovery Communications Digs Out of Mountains of Documents

Discovery Communications, Inc. (DCI) is the leading global real-world media and entertainment company. DCI presents real-world content through documentaries and television programs over the Discovery Channel and many other network brands in 160 countries and 35 languages. DCI's unique brand of programming has been combining education with entertainment since 1985.

Like all global corporations, DCI works hard to distribute mission-critical information and materials to its 5000-person global workforce. Unknown to most television viewers, each program produced involves a significant amount of legal and strategic paperwork; on average, this amounts to a six-inch stack of production documents for every program. The paperwork assists DCI in maintaining production lifecycles and articulating the legal rights of ownership. Creating and accessing these documents was a cumbersome and tedious chore for DCI personnel. The documents were stored at various locations, which made searches for documents time consuming. Once located, it was difficult to tell if the document was current and up to date. DCI needed a system that would allow employees at any location to access up-to-date production documents for its programs without any time delay.

This type of business problem falls under the information system heading of 'knowledge management'. Knowledge management, or KM, is a term used to identify systems that collect, transfer, secure, and manage knowledge in terms of resources, documents, and people skills within an organization. Successful knowledge management systems help an organization make the best use of that knowledge. DCI required a special type of KM system that focused on document management. Fortunately for them, KM is popular in industry today and many companies were eager to provide a solution for DCI's problem.

DCI worked with Carefree Technologies (an IBM partner company acquired by Integro, Inc.) for their document management system. Carefree Technologies turned to IBM's Lotus Domino Document Manager system, a document management solution that would centralize and streamline the process of document creation, filing, management, and retrieval. Carefree Technologies and DCI agreed on IBM's WebSphere Portal as the primary user interface for the document management system. As the name implies, WebSphere would act as a web-based interface to the database of documents and allow Carefree Technology's development team to customize the system for DCI's needs. A portal is an application that provides access to a commonly used information system and communication tools from one central interface, typically a web page.

Carefree Technology's developers found it easy to merge the document management system with other portal services such as news, information, and communications tools. The final product goes beyond the original hopes and expectations for the system. The portal helps employees track and manage the television production process and easily find the documents they need. In addition, employees can use links to external websites and a news service from LexisNexis to keep abreast of the latest trends in the television industry. Through the integration and customization of IBM's systems, Carefree Technologies and DCI's IT staff have enhanced its portal by integrating it with other business tools, instant messaging, and web conferencing to further enhance productivity levels.

Questions

1. What companies were involved in developing DCI's new system? What role did each company play in the development process?
2. What is the purpose of a corporate portal? What convenience does DCI's new portal provide for its employees?
3. Why do you think knowledge management is so popular today? What advantages can it provide a company?
4. What were the most important steps in organizing the millions of documents in DCI's systems? Why?

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1

Questions for Web Case

See the web site for this book to read the Innocent Drinks case for this chapter. Following are questions concerning this Web case.

Innocent Drinks Stays in Touch

Questions

1. How might Innocent use technology to help maintain its five ethics?
2. Explain some ways technology could help Innocent stay in touch with fruit growers.
3. Why do you think executive support so important in technology development? Could a project go ahead without it? What would such a project look like?
4. Do you think the 'Innocent Family' is a good idea? Explain your answer.

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World Views Case

High Performance Computing in South Africa: Computing in Support of African Development

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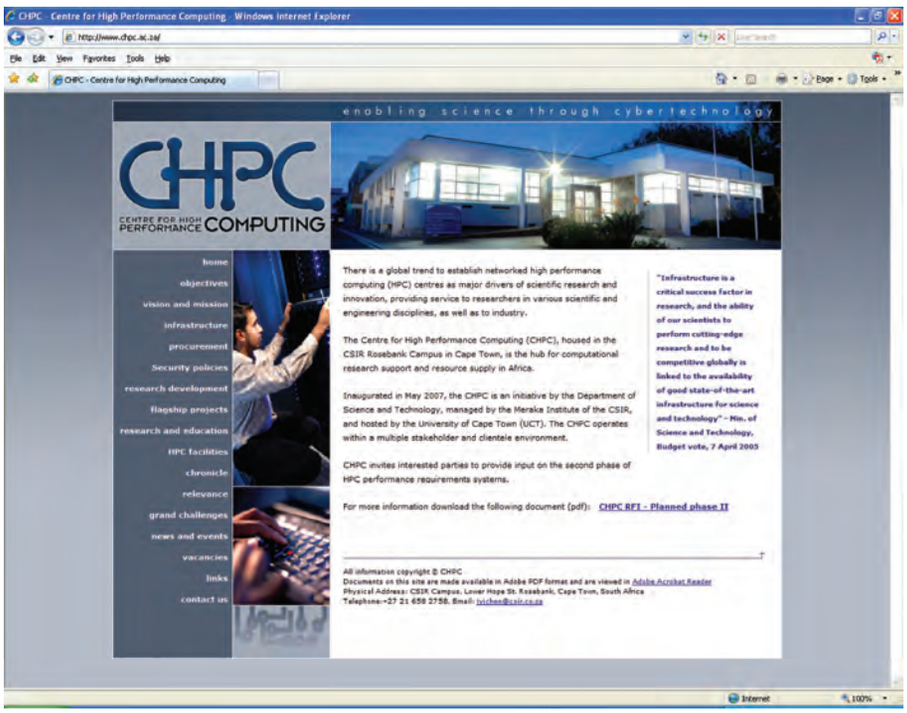
South Africa is currently in the process of expanding its scientific research and innovation base with a direct link to social and economic development. Part of this process was the recognition that an Information and Communications Technology (ICT) strategy was needed. Two major enabling domains were highlighted and these were Computational Science and High Performance Computing. Major examples in this regard are Biotechnology, particularly with reference to research into the major infectious diseases such as HIV/AIDS and tuberculosis, advanced manufacturing technology, technologies to utilise and protect our natural resources and ensure food security (e.g., climate systems analysis and disaster forecasting), and technology for poverty reduction (e.g., behavioural modelling in social research; financial management; HPC in SMEs). Funding for three years (2006–2008) has been secured for the high performance computing initiative. In addition, parallel investment in a South African National Research Network (SANReN), intended to provide high bandwidth connectivity for South African researchers, has been planned.

In his 2002 State of the Nation address, President Thabo Mbeki of South Africa singled out Information and Communication Technology (ICT) as *'a critical and pervasive element in economic development,'* and recommended the establishment of an *'ICT University.'* This led to the establishment of the Meraka Institute of which The Centre for High Performance Computing (CHPC) is a component.

These developments within South Africa are aligned with initiatives to stimulate research, development and technology across the African continent. A 'Plan for Collective Action' was adopted by



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African Ministers of Science and Technology in Dakar in November 2005, in a meeting organized jointly by New Partnership for Africa's Development (Nepad) and the African Union (AU). It highlights initiatives and projects that are crucial to enabling Africa to mobilize and strengthen its capacities to engage effectively in scientific and technological development.

The three conceptual pillars of the 'Plan for Collective Action' are capacity building, knowledge production, and technological innovation. The Plan has twelve sub-programmes based on specific content areas, one of which is Information and Communications Technology. The ICT sub-programme will aim at establishing a continental research network on ICTs. It will bring together leading universities and research centres to design and implement projects that generate software to use with African content. Its specific goals will be to:

- stimulate technical change and innovation in ICTs
- build skills in local software research and development; and
- build knowledge of Open Source Software and promote its application in education, health and conduct of science.

However, one drawback at the moment is the exorbitant price of bandwidth on the African continent.

Funding, at this stage largely from the government, has been secured for the establishment of the central physical facility together with the appointment of scientific and technical staff by mid-2006. Cooperation with similar facilities in developing countries such as Brazil and India are seen as essential to the success of the South African project, given this country's largely developing economy. Currently discussions have been held with colleagues in India with a view to establishing a relationship similar to that envisaged with those colleagues in Brazil.

A key objective will be that of identifying projects that will be supported through the CHPC. These projects will be identified and selected on the basis of national importance and also those which are deemed to be appropriate for location in the CHPC. In the future we will see the use of computers become critical to problems as diverse as drug design to combat diseases malaria and HIV/AIDS through the development of models for predicting drought and preventing crop failures. High performance computing is now being positioned at the centre of innovative technologies. The impact of design through scientific computing on economies driven by innovation will be significant.

The creation of a national Centre for High Performance Computing will permit South African scientists and engineers to be active at the cutting edge of their respective research disciplines within a vibrant intellectual atmosphere. The benefits of the linkage between research and innovation that is enabled through the CHPC will be felt not only in university laboratories but throughout the wider South African economy. The building of a critical mass in state-of-the-art high-performance computing equipment as well as high-level scientific computing expertise in an intellectual common space will be central to achieving the goal of making the African Renaissance a reality.

Questions

1. How important is a national ICT strategy for South Africa? Justify your answer.
2. What benefits could be accrued by the South African population by implementing such a strategy?
3. As a Programme Director of the CHPC in charge of research and development what general criteria would you apply when selecting a proposed project?
4. Given the recognised need for the ICT strategy what areas do you think require the most immediate funding in order that the strategy becomes successful?

SOURCE: Adam, R., de la Rey, C., Naidoo, K., Reddy, D. "High Performance Computing in South Africa: Computing in Support of African Development," *CTWatch Quarterly,* Volume 2, Number 1, Feb 2006.

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