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PART I
IT in the Organization

1. Strategic Use of Information Technology in the Digital Economy
2. Information Technologies: Concepts and Management

CHAPTER 1

Strategic Use of Information Technology in the Digital Economy

1.1 Doing Business in the Digital Economy

1.2 Business Pressures, Organizational Responses, and IT Support

1.3 Information Systems: Definitions and Examples

1.4 Information Technology Developments and Trends

1.5 Why Should You Learn About Information Technology?

1.6 Plan of the Book

Minicases:
1. Dartmouth College
2. Wal-Mart

Appendix 1A: Porter's Models

LEARNING OBJECTIVES

After studying this chapter, you will be able to:

1. Describe the characteristics of the digital economy and e-business.
2. Recognize the relationships between business pressures, organizational responses, and information systems.
3. Identify the major pressures in the business environment and describe the major organizational responses to them.
4. Define computer-based information systems and information technology.
5. Describe the role of information technology in supporting the functional areas, public services, and specific industries.
6. List the new technology developments in the areas of generic and networked computing and Web-based systems.
7. Understand the importance of learning about information technology.

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SIEMENS AG IS TRANSFORMING ITSELF INTO AN E-BUSINESS

Various icons are used throughout the book to identify a particular perspective or functional area related to the nearby example. This icon, for example, indicates an international perspective. See page •• in the preface for a listing of all of the icons.

THE PROBLEM

Siemens AG (*siemens.com*) is a German-based 150-year-old diversified and global manufacturer. With 484,000 employees, Siemens does business in 190 countries and has 600 manufacturing and R & D (research and development) facilities in over 50 countries. Its product lines and services are extremely varied, including communication and information, automation and controls, power, transportation, medical equipment, and lighting. Besides its own 13 operating divisions, Siemens AG has interests in other companies like Bosch (household appliances), Framatome (in France's nuclear power industry), and Fujitsu computers.

Facing hundreds of competitors, most of which are in foreign countries, the company had difficulties expanding its business in a fast-changing business environment and was unable to enjoy the profit margin of some of its competitors. A major problem area was the coordination of the internal units of the company. Another one was the collaboration with so many suppliers and customers. In particular, its *supply chain*—the flow of materials from suppliers through manufacturing, distribution, and sales—is very complex. Finally, it was necessary to find ways to contain costs and to increase customer service.

Each chapter opens with an example that illustrates the application of IT in a real-world organization and the relevance of the chapter topics. The format—problem, solution, results—helps model a way to think about business problems.

THE SOLUTION

By the late 1990s the company decided to transform itself into a 100 percent "e-business"—that is, a company that performs various business functions electronically. It would do so by introducing Web-based systems and electronic commerce applications in all of its operations. The reason for such an ambitious goal was the need to solve the problems caused by multiple supply chain operations. Embarking on a four-year plan, the company started the transformation in 1999.

Siemens had decided on a dual approach: It would use its own in-house information systems capabilities where it made sense to do so, but it would also go out-of-house to purchase some systems from major vendors. Siemens strategic goals were to:

- Improve its readiness for extended electronic commerce by standardizing hundreds of business processes across multiple divisions. (For example, the company went from over 300 different process applications to 29.)
- Redesign the information technology infrastructure to enable integration of "best-of-breed" software (software components that best fit the company's needs, each from a different vendor), integrated into an enterprisewide platform.

Besides being able to handle electronic transactions, Siemens also wanted to create an easily accessible central corporate *knowledge base*—a companywide storehouse of proven methodologies (known as "best practices"; see Chapter 10).

Using SAP R/3 systems (see Chapter 7), along with software from i2 Technology and IBM, the company built functional systems that link the enterprise, ensure support functions, and connect with the company's supply chain partners.

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Functions such as taking customer orders, online procuring of materials and components that go into the manufacturing process, collaborating with business partners in developing products, and transporting finished products were integrated across the company, using the Internet as much as possible. Also, the system was designed to provide better customer service to Siemens's business customers.

THE RESULTS

In its 2000 fiscal year, the company saw its online sales and its electronic procurement transactions reach 10 percent of its total sales and purchases, respectively. In 2002, online sales increased by 25 percent, and e-procurement grew 60 percent over its 2000 level.

As of January 2004, most employees are networked throughout the company. They have direct access to the Internet, and a portal through which employees can access corporate information is in use. This portal offers various workplace aids, including search engines, forms, travel booking, and electronic expense account reporting.

The transformation to an e-business and the managing of change cost Siemens around 1 billion euros. President and CEO Heinrich von Pierer says, "This will make us faster and help us further cut costs. . . . All of this is aimed at meeting today's e-economy goals directly, with the promise of operational economies in return."

Sources: Compiled from Schultz (2002), *aberdeen.com* (accessed September 2002), and *siemens.com* (accessed May 2004).

LESSONS LEARNED FROM THIS CASE

This brief section ties the key points of the opening case to the topics that will be covered in the chapter.

This case illustrates that fierce global competition drives even large corporations to find ways to reduce costs, increase productivity, and improve customer service, which increase competitive advantage. These efforts are best achieved by using Web-based systems, which are the major enablers in the transformation to an *e-business* or *e-company* in the digital economy.

In this chapter we present the characteristics and concepts of the digital economy and how it is changing business processes. In addition, we will describe the extremely competitive business environment in which companies operate today, the business pressures to which they are subject, and what companies are doing to counter these pressures, especially in strategic management. Futhermore, you will learn what makes information technology a necessity in supporting organizations, and what and why any manager in the twenty-first century should know about it.

1.1 DOING BUSINESS IN THE DIGITAL ECONOMY

Conducting business in the digital economy means using Web-based systems on the Internet and other electronic networks to do some form of electronic commerce. First we will consider the concepts of electronic commerce and networked computing and then look at the impact they have made on how companies do business.

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Electronic Commerce and Networked Computing

As described in the opening case, Siemens AG was an established "old-economy" company that has seen the need to transform itself into an **e-business,** a company that performs most of its business functions electronically, in order to enhance its operations and competitiveness (Chapter 12). Its use of Web-based systems to support buying, selling, and customer service exemplifies **electronic commerce** (**EC** or **e-commerce**). In e-commerce (Chapter 4), business transactions are done electronically over the Internet and other computing networks. EC is becoming a very significant global economic element in the twenty-first century (see Evans and Wurster, 2000 and Drucker, 2002).

The infrastructure for EC is **networked computing** (also known as *distributed computing*), which connects computers and other electronic devices via telecommunication networks. Such connections allow users to access information stored in many places and to communicate and collaborate with others, all from their desktop (or even mobile) computers. While some people still use a standalone computer exclusively, or a network confined to one location, the vast majority of people use multiple-location networked computers. These may be connected to the *global networked environment,* known as the **Internet,** or to its counterpart within organizations, called an **intranet.** In addition, some companies link their intranets to those of their business partners over networks called **extranets.** The connection typically is done via wireline systems, but since 2000 more and more communication and collaboration is done via wireless systems.

Networked computing is helping some companies excel and is helping others simply to survive. Broadly, the collection of computing systems used by an organization is termed **information technology (IT),** which is the focus of this book. In the developed countries, almost all medium and large organizations, and many small ones, private or public, in manufacturing, agriculture, or services, use information technologies, including electronic commerce, to support their operations.

Why is this so? The reason is simple: IT has become the major facilitator of business activities in the world today. (See for instance, Dickson and DeSanctis, 2001; Huber, 2004; and Tapscott et al., 2000.) Note that here and throughout the book, in using the term "business" we refer not only to for-profit organizations, but also to not-for-profit public organizations and government agencies, which need to be run like a business. IT is also a catalyst of fundamental changes in the strategic structure, operations, and management of organizations (see Carr, 2001), due to the capabilities shown in Table 1.1. These capabilities, according to Wreden (1997), support the following five business objectives: (1) improving productivity (in 51% of corporations), (2) reducing costs (39%), (3) improving decision making (36%), (4) enhancing customer relationships (33%), and (5) developing new strategic applications (33%). Indeed, IT is creating a transformation in the way business is conducted, facilitating a transition to a digital economy.

What Is the Digital Economy?

The **digital economy** refers to an economy that is based on digital technologies, including digital communication networks (the Internet, intranets, and private *value-added networks* or VANs), computers, software, and other related information technologies. The digital economy is also sometimes called the *Internet economy,* the *new economy,* or the *Web economy* (see Brynolfsson et al., 2003 and Liebowitz, 2002).

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TABLE 1.1 Major Capabilities of Information Systems

- Perform high-speed, high-volume, numerical computations.
- Provide fast, accurate, and inexpensive communication within and between organizations.
- Store huge amounts of information in an easy-to-access, yet small space.
- Allow quick and inexpensive access to vast amounts of information, worldwide.
- Enable communication and collaboration anywhere, any time.
- Increase the effectiveness and efficiency of people working in groups in one place or in several locations.
- Vividly present information that challenges the human mind.
- Facilitate work in hazardous environments.
- Automate both semiautomatic business processes and manually done tasks.
- Facilitate interpretation of vast amounts of data.
- Facilitate global trade.
- Can be wireless, thus supporting unique applications anywhere.
- Accomplish all of the above much less expensively than when done manually.

In this new economy, digital networking and communication infrastructures provide a global platform over which people and organizations devise strategies, interact, communicate, collaborate, and search for information. This platform includes, for example, the following, according to Choi and Whinston (2000):

- A vast array of digitizable products—databases, news and information, books, magazines, TV and radio programming, movies, electronic games, musical CDs, and software—which are delivered over the digital infrastructure any time, anywhere in the world
- Consumers and firms conducting financial transactions digitally—through digital currencies or financial tokens carried via networked computers and mobile devices
- Physical goods such as home appliances and automobiles, which are equipped with microprocessors and networking capabilities

The following icon is used throughout the book to indicate that additional related resources are available at the book's Web site, *www.wiley.com/college/turban.*

The term *digital economy* also refers to the convergence of computing and communication technologies on the Internet and other networks, and the resulting flow of information and technology that is stimulating e-commerce and vast organizational change. This convergence enables all types of information (data, audio, video, etc.) to be stored, processed, and transmitted over networks to many destinations worldwide. The digital economy has helped create an economic revolution, which was evidenced by unprecedented economic performance and the longest period of uninterrupted economic expansion in history from 1991 until 2000. (See Online File W1.1 for some statistics related to the "digital revolution.")

OPPORTUNITIES FOR ENTREPRENEURS. The new digital economy is providing unparalleled opportunities for thousands of entrepreneurs, some of them in their teens, to apply EC business models to many business areas. As we will see throughout the book, many of these initiatives were started by one or two individuals. Others were started by large corporations. These startup companies

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IT at Work 1.1
DIAMONDS FOREVER—ONLINE

The gems market is a global one with thousands of traders buying and selling about $40 billion worth of gems each year. This age-old business is very inefficient in terms of pricing: Several layers of intermediaries can jack up the price of a gem 1,000 percent between wholesale and final retail prices.

Chanthaburi, Thailand, is one of the world's leading centers for processing gems, and that is where Don Kogen landed, at the age of 15, to search for his fortune. And indeed, he found it there. After failing to become a gem cutter, Kogen moved into gem sorting, and soon he learned to speak Thai. After three years of observing how gem traders haggle over stones, he decided to try the business himself. Having only a small amount of "seed" money, Kogen started by purchasing low-grade gems from sellers who arrived early in the morning and selling them for a small profit to dealers from India and Pakistan who usually arrived late in the day. Using advertising, he reached the U.S. gem market and soon had 800 potential overseas customers. Using faxes, he shortened the order time, which resulted in decreasing the entire time from order to delivery. These various business methods enabled him to grow his mail-order business to $250,000 per year by 1997.

In 1998, Kogen decided to use the Internet. Within a month, he established a Web site *thaigem.com* and sold his first gem online. By 2001, the revenue reached $4.3 million, growing to $9.8 million in 2002. Online sales account for 85 percent of the company's revenue. The buyers are mostly jewelry dealers or retailers such as Wal-Mart or QVC. Kogen buys raw or refined gems from all over the world, some online, trying to cater to the demands of his customers.

Thaigem's competitive edge is low prices. The proximity to gem-processing factories and the low labor cost enable Kogen to offer prices significantly lower than his online competitors (such as Tiffany's at *tiffany.com*). Kogen makes only 20 to 25 percent profit, much less than other dealers make. To make the business even more competitive, Kogen caters even to small buyers. Payments are made safely, securely, and conveniently using either PayPal or Escrow.com. Delivery to any place is made via Federal Express, at $15 per shipment.

Dissatisfied customers can return merchandise within 30 days, no questions asked. No jewel is guaranteed, but Kogen's name is trusted by over 68,000 potential customers worldwide. Kogen enjoys a solid reputation on the Web. For example, he uses eBay to auction gems as an additional selling channel. Customers' comments on eBay are 99 percent positive versus 1 percent negative. In fact, Thaigem.com is further expanding its customer-service program. The company has implemented a 24-hour "Live Support" chat service, Monday through Friday, further augmenting this service with the addition of a 1-800 (toll-free) number for U.S. customers. This "Live Support" chat software allows Thaigem.com to track the movement of customers and know exactly what products or content pages customers are viewing.

Sources: Compiled from *thaigem.com* (April 2004) and from Mevedoth (2002).

For Further Exploration: Go to *blackstartrading.com* and compare the two sites; which one do you think is better? What kinds of business and revenue models were used? Were they effective? How is competitive advantage gained in this case?

"IT at Work" boxes spotlight innovations and technologies used by real organizations to solve business problems.
"Integrating IT" icons highlight examples of IT applications in major functional areas of business, in government, and in public services. The codes used in these turquoise-colored icons are:
ACC—accounting
POM—production/operations management
MKT—marketing
HRM—human resources management
FIN—finance
GOV—government and
SVC—other public services

not only sold products, but many also provided support services ranging from computer infrastructure to electronic payments. Known as *dot-coms*, these companies saw an opportunity to do global business electronically. An interesting example is entrepreneur Don Kogen and his Thaigem.com business, described in *IT at Work 1.1*.

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The New vs. the Old: Illustrative Examples

The changes brought by the digital economy are indeed significant. Computer-based information systems of all kinds have been enhancing business competitiveness and creating strategic advantage on their own or in conjunction with e-commerce applications (see Carr, 2001; Basu and Muylle, 2003; and Li et al., 2003). In a study conducted by Lederer et al. (1998), companies ranked the number-one benefit of Web-based systems as "enhancing competitiveness or creating strategic advantage." Let's look at a few examples that illustrate differences between doing business in the new economy and the old one.

EXAMPLE #1: PAYING FOR GOODS: THE CHECKOUT EXPERIENCE. It sometimes takes more time to check out than to shop, which can be a really frustrating experience.

Old Economy. In the "old-old" economy, when you visited stores that sold any type of retail product (e.g., groceries, office supplies), you placed your items in a shopping cart and proceeded to checkout. At the checkout counter, you stood in line while a clerk punched in the price of each item on a manual adding machine. After the clerk added up all your items, you paid for them in cash. Note that in this situation no information was gathered about the item itself, other than the price.

Using the next generation of checkout technology, you take your items to a clerk, who swipes (sometimes twice or more) the barcode of each item over a "reader." The reader captures data on the price and description of each item and automatically enters that data into the organization's database. You receive an itemized account of your purchases and the total price.

New Economy. In the new economy, you take your items to a self-service kiosk, where you swipe the barcode of each item over a reader. After you have swiped all of your items, the kiosk gives you directions about how to pay (cash, credit card, or debit card). You still may have to wait if there are lines to get to the self-service kiosk; often, other shoppers need help to learn the technology. But, your checkout time is much faster.

In the coming generation of checkout technology, all items will have wireless radio frequency identification (RFID) tags (see Chapters 2 and 5) either attached to or embedded in them. After you have finished shopping, you will simply walk your cart with all its items through a device similar to an airport security scanner. This device will "read" the wireless signals from each item, generate an itemized account of all your purchases, total up the price, and debit your debit card or credit card (after recognizing your face or fingerprint), all in a few seconds. You will not wait in line at all, but will walk almost directly from the store to your car.

An ethical issue here is what happens to the tags. If they are not removed after you pay, it is theoretically possible for someone to track your whereabouts, which many consider an invasion of privacy. But removing these tags costs money and takes time, an added burden to retailers. Pending legislation in Massachusetts is attempting to force retailers to remove the tags. Pending legislation in California tries to limit the information placed on RFIDs to ensure privacy.

EXAMPLE #2: CROSSING INTERNATIONAL BORDERS. Assume you are traveling to another country, say Australia. Your plane lands after a long flight, but before you can make your way to your lodgings, you must first go through immigration.

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Old Economy. You wait in line to be processed by the immigration officers. The inspectors are slow, and some are new and need help from time to time. Processing certain people takes several minutes. You are tired, upset, and stressed. You may wait 10 minutes, 20 minutes, or even close to an hour.

New Economy. You submit your passport and it is scanned. At the same time, a photo of your face is taken. A computer compares that picture with the picture in the passport and with one in a database. In 10 seconds you are through immigration and on your way out of the airport. The world's first system of this kind was initiated in Australia in 2003. In some countries (e.g., Israel), an image of your fingerprints is taken and compared to a stored image. Again, in seconds you are on your way. These systems use a technology called *biometrics* (see Chapter 15) that not only expedites processing but also increases security by eliminating the entry of people with false passports.

EXAMPLE #3: SUPPLYING COMMERCIAL PHOTOS. Thousands of companies around the globe provide photos of their products to retailers who advertise products in newspapers, in paper catalogs, or online. The new economy has changed the process by which these photos are supplied.

Old Economy. In the old economy, the retailer sends the manufacturer a request for a picture of the item to be advertised, say a Sony TV set. Sony then sends to a designated ad agency, by courier, alternative pictures that the agency can use. The agency selects a picture, designs the ad, gets an approval from the retailer and sends the picture by courier to the printer. There it is rephotographed and entered into production for the catalog. (An improvement introduced several years ago allows the ad agency to send the picture to a scanning house. There, a digital image is made, and that image is moved to the printer.) Both the retailer and the ad agency may be involved in a quality check at various times, slowing the process. The cycle time per picture can be four to six weeks. The total processing cost per picture is about $80.

New Economy. Orbis Inc., a very small Australian company, changed the above old-economy linear supply chain to a hub-like supply chain, as shown in Figure 1.1. In the new process, the manufacturer (e.g., Sony) sends many

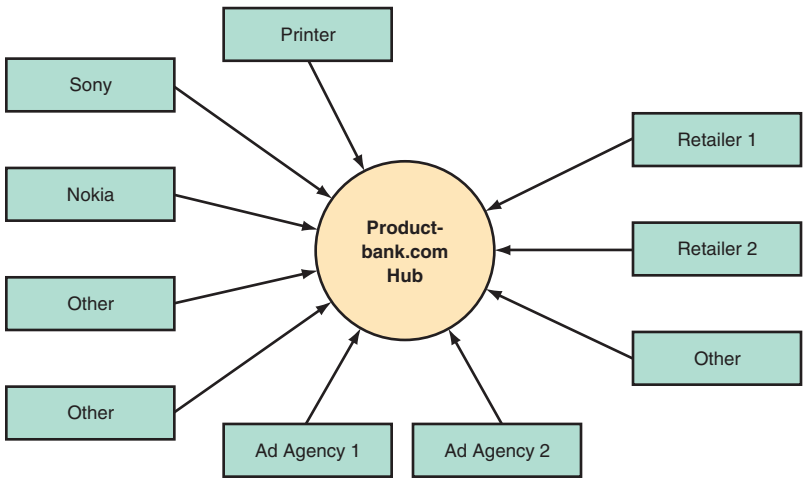

FIGURE 1.1 Changing a linear supply chain to a hub.

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digitized pictures to Orbis (at *productbank.com.au*), and Orbis organizes the pictures in a database. When a retailer needs a picture, it enters the database and selects a picture, or several alternatives. The ID number of the chosen picture is e-mailed to the ad agency. The agency enters the database, views the digitized pictures, and works on them. Then, after the client's approval, either the final digitized pictures are e-mailed to the printer, or the printer is told to pick them up from the database. The entire process takes less than a week at a cost of about $50 per picture.

EXAMPLE #4: PAYING FOR TRANSPORTATION IN NEW YORK CITY. Millions of people all over the world take public transportation. Metal tokens were the preferred solution in some major cities for generations.

Old Economy. For over 50 years, New Yorkers have used tokens to pay for transportation on buses and subways. The tokens save time and are liked by travelers. However, it costs $6 million a year to manufacture replacement tokens and to collect the tokens out of turnstiles and fare boxes ("NYC Transit Tokens. . . ," 2003). New York City needs this money badly for other services.

New Economy. The new-economy solution has been to switch to MetroCards. By 2002, only 9 percent of all commuters were still using tokens. Despite the fact that they have to occasionally swipe the MetroCard through the card reader several times, travelers generally like the new cards. (A new generation of contactless cards does not have this problem.) MetroCards are offered at discounts, which riders like. Other cities have made the transition to electronic cards as well. Chicago's transit moved to cards in 1999, replacing the century-old tokens. Washington, D.C., Paris, and London also use transit cards. In Hong Kong, millions use a contactless card not only for transportation but also to pay for telephone, Internet access, food in vending machines, and much more.

EXAMPLE #5: IMPROVING THE LAUNDRY EXPERIENCE FOR COLLEGE STUDENTS. Millions of college students use dorm laundry facilities worldwide. What is their experience?

Old Economy. You run to the laundry room only to find out that all machines are taken. You wait for a machine, and when you finally get one, you realize that you are short on coins. After using the dollar changer, you are set to go, but you do not remember what your mother instructed you to do with the dirty shirts. However, you put everything in to the washer, start it, and hope for the best. Rather than hang around the laundry room, you go away to study, and when you come back you find that someone took out your clean stuff and placed it on the dirty counter. You transfer the laundry to the dryer, and go back to study some more. This time you come back before the dryer is finished, so you must wait, wasting time again.

New Economy. Dryers and washers in your college are hooked to the Web. You punch a code into your cell phone or sign in at *esuds.net*, and you can check for availability of laundry machines. Furthermore, you can pay with your student ID or with a credit card, and you will receive e-mail alerts when your wash and dry cycles are complete. Once in the laundry room, you activate this system by swiping your student ID card (or key in a PIN number). The system automatically injects premeasured amounts of detergent and fabric softener, at the right cycle time.

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The machine owners benefit too: They can monitor machine performance, arrange for some maintenance, eliminate vandalism (no cash in the machines), and enjoy higher utilization (more students use the campus machines). Sound great? If you do not have it on your campus yet, it will come soon.

EXAMPLE #6: THE POWER OF E-COMMERCE. The power of e-commerce is demonstrated in the following three examples:

Every year, Warren Buffett, the most famous U.S. stock investor and investment guru, invites eight people to lunch with him. The eight pay big money for the pleasure. The money is donated to San Francisco's needy people. In the past, Buffett charged $30,000 per person. In 2003, Buffett placed the invitation in an online auction. Bidders pushed the price from $30,000 to over $200,000.

Initial public offerings (IPOs) of equity securities (stocks) can make their buyers rich, since on the first day of trading prices can go up considerably, frequently over 100 percent. Initial stock allocations typically have been offered for sale to stockbrokers and to some interest groups (e.g., mutual funds and pension funds). In 2004, Google.com went public with its IPO by conducting a Dutch auction on the Internet (see Chapter 4). Using this method for its stock offering, the company collected much more money and the shares were distributed in a fair manner.

Chris Moneymaker won $2.5 million in May 2003 in the World Series of Poker. Chris, a 27-year-old, had never before sat down at a poker tournament table. Yet, he cleaned out many skilled professionals. How did he do it? Although Chris had never sat in a room with players, he had played extensively online, where the game is much faster, but the money is just as real. (Interested? See Wayner, 2003 and *playwinningpoker.com*.)

In each of the examples above, we can see the advantage of the new way of doing business over the old one in terms of at least one of the following: cost, quality, speed, strategic competitive advantage, and customer service. What is amazing is the *magnitude* of this advantage. In the past, business improvements were in the magnitude of 10 to 25 percent. Today, improvements can be hundreds or even thousands of times faster or cheaper. For example, it is about 250 times faster to get through immigration now, and there are fewer mistakes (Walker, 2003). The new economy brings not only digitization but also the opportunity to use new business models, such as Don Kogen uses at Thaigem.com—selling from the Internet.

Business Models in the Digital Economy

The Internet is challenging the economic, societal, and technological foundations of the old economy. In essence a *revolution* has been underway. And like all successful revolutions, when it ends, the landscape will look significantly different. Entrepreneurs are developing new models for business, the economy, and government.

A **business model** is a method of doing business by which a company can generate revenue to sustain itself. The model spells out how the company creates (or adds) value that consumers are willing to pay for, in terms of the goods and/or services the company produces in the course of its operations. Some models are very simple. For example, Nokia makes and sells cell phones and generates profit from these sales. On the other hand, a TV station provides free broadcasting. Its survival depends on a complex model involving factors such as

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advertisers and content providers. Internet portals, such as Yahoo, also use a similar complex business model.

Some examples of new business models brought about by the digital revolution are listed in *A Closer Look 1.1*. Further discussion of these models will be found throughout the book (especially in Chapter 4), and also in Afuah and Tucci (2003), Brynolfsson et al. (2003), Weill and Vitale (2001), and Turban et al. (2006), and at *digitalenterprise.org*. In part, these new business models have sprung up in response or reaction to business pressures, which is the topic we turn to next.

"A Closer Look" boxes contain detailed, in-depth discussion of specific concepts, procedures, or approaches.

A CLOSER LOOK

1.1 FIVE REPRESENTATIVE BUSINESS MODELS OF THE DIGITAL AGE

NAME-YOUR-OWN-PRICE. Pioneered by Priceline.com, this model allows the buyer to state a price he or she is willing to pay for a specific product or service. Using information in its database, Priceline will try to match the buyer's request with a supplier willing to sell on these terms. Customers may have to submit several bids before they find a price match for the product they want. Priceline's major area of operation is travel (airline tickets, hotels).

TENDERING VIA REVERSE AUCTIONS. If you are a big buyer, private or public, you are probably using a *tendering* (bidding) system to make your major purchases. In what is called a request for quote (RFQ), the buyer indicates a desire to receive bids on a particular item, and would-be sellers bid on the job. The lowest bid wins (if price is the only consideration), hence the name *reverse auction*. Now tendering can be done online, saving time and money (see Chapter 4). Pioneered by General Electric Corp. (*gxs.com*), tendering systems are gaining popularity. Indeed, several government entities are mandating electronic tendering as the only way to sell to them. Electronic reverse auctions are fast, they reduce administrative costs by as much as 85 percent, and products' prices can be 5 to 20 percent lower.

AFFILIATE MARKETING. *Affiliate marketing* is an arrangement in which marketing partners place a banner ad for a company, such as Amazon.com, on their Web site. Every time a customer clicks on the banner, moves to the advertiser's Web site, and makes a purchase there, the advertiser pays a 3 to 15 percent commission to the host site. In this way, businesses can turn other businesses into their *virtual commissioned sales force*. Pioneered by CDNow (see Hoffman and Novak, 2000), the concept is now employed by thousands of retailers or direct sellers. For details see Chapter 4 and Helmstetter and Metiviers (2000).

GROUP PURCHASING. It is customary to pay less per unit when buying more units. Discounts are usually available for such quantity purchases. Using e-commerce and the concept of *group purchasing,* in which purchase orders of many buyers are aggregated, a small business or even an individual can participate and get a discount. EC brings in the concept of *electronic aggregation* for group purchasing, in which a third party finds the individuals or SMEs (small/medium enterprises) that want to buy the same product, aggregates their small orders, and then negotiates (or conducts a tender) for the best deal. The more that join the group, the larger the aggregated quantity, and the lower the price paid. Some leading aggregators are *buyerzone.com* and *allbusiness.com*.

E-MARKETPLACES AND EXCHANGES. Electronic marketplaces have existed in isolated applications for decades. An example is the stock exchanges, some of which have been fully computerized since the 1980s. But, since 1999, thousands of electronic marketplaces of different varieties have sprung up. E-marketplaces introduce operating efficiencies to trading, and if well organized and managed, they can provide benefits to both buyers and sellers. Of special interest are *vertical marketplaces,* which concentrate on one industry (e.g., chemconnect.com in the chemical industry). (Chapter 4 will explore e-marketplaces and exchanges in more detail.)

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1.2 BUSINESS PRESSURES, ORGANIZATIONAL RESPONSES, AND IT SUPPORT

Environmental, organizational, and technological factors are creating a highly competitive business environment in which customers are the focal point. Furthermore, these factors can change quickly, sometimes unpredictably (see Tapscott et al., 2000). A Gartner Group survey, Gartner G2 (2004), revealed that the most important business issues of 2004 were retaining loyal customers, improving productivity, cutting costs, increasing market share, and providing timely organizational response. As we will see throughout the book, IT is a major enabler for dealing with these issues.

Companies need to react frequently and quickly to both the *problems* and the *opportunities* resulting from this new business environment (see Arens and Rosenbloom, 2003 and Drucker, 2001). Because the pace of change and the degree of uncertainty in tomorrow's competitive environment are expected to accelerate, organizations are going to operate under increasing pressures to produce more, using fewer resources.

Boyett and Boyett (1995) emphasize this dramatic change and describe it with a set of what they call **business pressures,** or *drivers*. These business pressures are forces in the organization's environment that create pressures on (that is, that "drive") the organization's operations.

Boyett and Boyett maintain that in order to succeed (or even merely to survive) in this dynamic world, companies must not only take traditional actions such as lowering costs, but also undertake innovative activities such as changing structure or processes or devise a competitive strategy (Chapter 12). We refer to these reactions, some of which are interrelated, as **critical response activities.** These activities can be performed in some or all of the processes of the organization, from the daily routines of preparing payroll and order entry, to strategic activities such as the acquisition of a company. A response can be a reaction to a pressure already in existence, an initiative intended to defend an organization against future pressures, or an activity that exploits an opportunity created by changing conditions. Most response activities can be greatly facilitated by information technology. In some cases IT is the only solution to these business pressures (see Simpson, 2003 and Arens and Rosenbloom, 2003).

The relationships among business pressures, organizational responses, and IT are shown in Figure 1.2. This figure illustrates a model of the new world of

FIGURE 1.2 IT support for organizational responses.

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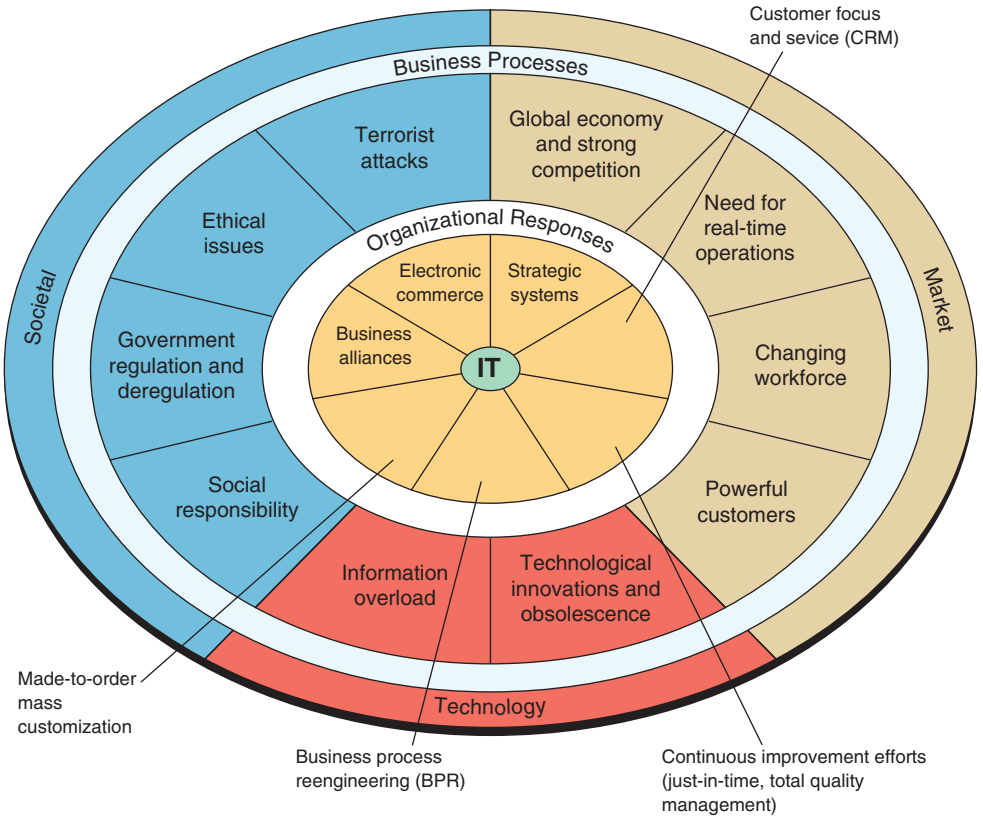

FIGURE 1.3 Business pressures, organizational responses, and IT support.

business. The business environment contains pressures on organizations, and organizations respond with activities supported by IT (hence the bidirectional nature of the arrows in the figure).

In the remainder of this section, we will examine two components of the model—business pressures and organizational responses—in more detail.

Business Pressures

The business environment consists of a variety of factors—social, technological, legal, economic, physical, and political (see Huber, 2004). Significant changes in any of these factors are likely to create business pressures on organizations. In this book, we will focus on the following business pressures: market pressures, technology pressures, and societal pressures. Figure 1.3 (the inner circle) presents a schematic view of these major pressures, which may interrelate and affect each other. These pressures are described next.

MARKET PRESSURES. The market pressures that organizations feel come from a global economy and strong competition, the changing nature of the workforce, and powerful customers.

Global Economy and Strong Competition. Within the last 20 or so years, the foundation necessary for a global economy has taken shape. This move to globalization has been facilitated by advanced telecommunication networks and especially by the Internet. Regional agreements such as the North American Free Trade Agreement (United States, Canada, and Mexico) and the creation of a unified European market with a single currency, the euro, have contributed to

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increased world trade. Further, reduction of trade barriers has allowed products and services to flow more freely around the globe.

One particular pressure that exists for businesses in a global market is the cost of labor. Labor costs differ widely from one country to another. While the hourly industrial wage rate (excluding benefits) is over $25 in some developed countries, it can be less than $1 in many developing countries, including those in Asia, South America, Eastern Europe, and Africa. Therefore, many companies in labor-intensive industries have found it necessary to move their manufacturing facilities to countries with low labor costs. Such a global strategy requires extensive communication and collaboration, frequently in several languages and under several cultural, ethical, and legal conditions. This can be greatly facilitated with IT (Chapter 8).

Using IT in a multicountry/multicultural environment may create ethical issues, such as invasion of privacy of individuals whose private data are taken across borders (see Appendix 1A at the end of this chapter). *Global competition* is especially intensified when governments become involved through the use of subsidies, tax policies, import/export regulations, and other incentives. Rapid and inexpensive communication and transportation modes increase the magnitude of international trade even further. Competition is now becoming truly global.

Need for Real-Time Operations. The world is moving faster and faster. Decisions need to be made very quickly, and speed is needed to remain competitive (Gates, 1999; Davis, 2001; and Meyer, 2001). Led by Cisco Systems, some companies are even attempting to close their accounting books in a day—a process that used to take as many as 10 days (McCleanahen, 2002).

Changing Nature of the Workforce. The workforce, particularly in developed countries, is changing rapidly. It is becoming more diversified, as increasing numbers of women, single parents, minorities, and persons with disabilities work in all types of positions. In addition, more employees than ever prefer to defer retirement. Finally, more and more workers are becoming knowledge workers (Drucker, 2002). Information technology is easing the integration of this wide variety of employees into the traditional workforce, and it enables homebound people to work from home (telecommute). (For more, see the discussions of telecommuting in Chapter 3, and of support for the disabled in Chapter 16.)

Powerful Customers. Consumer sophistication and expectations increase as customers become more knowledgeable about the availability and quality of products and services. On the Web, consumers can now easily find detailed information about products and services, compare prices, and buy at electronic auctions. As we mentioned earlier, in some cases buyers can even name the price they are willing to pay. Therefore, consumers have considerable power (Pitt et al., 2002). Companies need to be able to deliver information quickly to satisfy these customers.

Customers today also want *customized products and services,* with high quality and low prices. Vendors must respond, or lose business. For example, a large department store in Japan offers refrigerators in 24 different colors with a delivery time of just a few days. Dell Computer will take an order over the Internet for a computer, made to specifications of your choice, and will deliver that computer to your home within 3 to 7 days. And Nike will let you design your own sneakers online and will make and ship them to arrive at your home in two weeks (*nike.com*). Finally, automakers are selling build-to-order cars whose configuration

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is done on the Internet (see *jaguar.com*). The old saying, "The customer is king," has never before been so true.

The importance of customers has created "competition over customers." This competition forces organizations to increase efforts to acquire and retain customers. An enterprisewide effort to do just that is called **customer relationship management (CRM)** (see Greenberg, 2002). This topic will be addressed in detail in Chapter 6.

TECHNOLOGY PRESSURES. The second category of business pressures consists of those related to technology. Two major pressures in this category are technological innovation and information overload.

Technological Innovation and Obsolescence. Technology is playing an increased role in both manufacturing and services. New and improved technologies create or support substitutes for products, alternative service options, and superb quality. In addition, some of today's state-of-the-art products may be obsolete tomorrow. Thus, technology accelerates the competitive forces. Many technologies affect business in areas ranging from genetic engineering to food processing. However, probably the technology with the greatest impact is Web-based information technology (see Evans and Wurster, 2000; Carr, 2001; and Motiwalla and Hashimi, 2003).

An example of technological obsolesence is illustrated in Minicase 1 (Maybelline) at the end of Chapter 2. The technology of interactive voice response (IVR), which is still new for many companies, is being replaced by mobile devices, which are being replaced by wireless devices and by voice portals.

Information Overload. The Internet and other telecommunication networks increase the amount of information available to organizations and individuals. Furthermore, the amount of information available on the Internet more than doubles every year, and most of it is free! The information and knowledge generated and stored inside organizations is also increasing exponentially. The world is facing a flood of information. Thus, the accessibility, navigation, and management of data, information, and knowledge, which are necessary for managerial decision making, become critical. The only effective solutions are provided by information technology (e.g., search engines, intelligent databases).

SOCIETAL PRESSURES. The third category of business pressures consists of those related to society. The "next society," as Drucker (2001, 2002) calls it, will be a knowledge society, and also a society of aging populations. Both of these have important societal implications related to education and health care (e.g., see the case of Elite-Care in Chapter 5), and handling of such issues likely will involve various information technologies (see Sipior et al., 2004). Other important societal issues include social responsibility, government regulation/deregulation, spending for social programs, and ethics.

Social Responsibility. The interfaces between organizations and society are both increasing and changing rapidly. Social issues that affect business range from the state of the physical environment to companies' contributions to education (e.g., by allowing interns to work in the companies). Corporations are becoming more aware of these and other social issues, and some are willing to spend time and/or money on solving various social problems. Such activity is known as organizational *social responsibility*. Online File W1.2 at the book's Web site lists some major areas of social responsibility related to business.

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Government Regulations and Deregulation. Several social responsibility issues are related to government regulations regarding health, safety, environmental control, and equal opportunity. For example, U.S. companies that spray products with paint must use paper to absorb the overspray. The paper must then be disposed of by a licensed company, usually at a high cost. A recent example is the Sonbanes-Oxley Act that requires extensive controls and reporting (see Online File W1.3). Government regulations cost money and make it more difficult to compete with countries that lack such regulations. In general, deregulation intensifies competition.

Terrorist Attacks and Protection. Since September 11, 2001, organizations have been under increased pressure to protect themselves against terrorist attacks. In addition, employees in the military reserves may be called up for active duty, creating personnel problems. Information technology and especially intelligent systems may make a valuable contribution in the area of protection, by providing security systems and possibly identifying patterns of behavior that will help to prevent terrorist attacks and cyberattacks against organizations.

Homeland Security. The National Strategy for Homeland Security of the United States includes a National Vision for the sharing of information related to the detection of terrorist activities. Its goals are to build a national environment that enables the sharing of essential homeland security information. It will be a system of systems that can integrate knowledge that resides across many disparate data sources, while ensuring that privacy and civil liberties are adequately safeguarded. Information will be shared across each level of government and among federal, state, and local governments, private industry, and citizens. With the proper use of people, processes, and technology, U.S. homeland security officials can have common awareness of threats and vulnerabilities as well as knowledge of the personnel and resources available to address these threats. Officials will receive the information they need so they can anticipate threats and respond rapidly and effectively.

These goals can be accomplished only if there is a means to facilitate the sharing of information among numerous agencies that currently maintain independent data silos. Border security alone engages 11 agencies. Ultimately a data warehouse of homeland security information will lead to increased security for the United States. It will be a model for how all countries can interact to protect their borders and ensure the safety of their citizenry. To accomplish the project, a data warehouse (Chapter 11) will be constructed. In Chapters 11 and 12 we will discuss the implementation of this project. Related to this project are some ethical issues about protecting the privacy of citizens. For further information, consult *whitehouse.gov/homeland/book/index.html*.

Use of this icon highlights IT-related ethics discussions.

Ethical Issues. **Ethics** relates to standards of right and wrong, and *information ethics* relates to standards of right and wrong in information processing practices. Organizations must deal with ethical issues relating to their employees, customers, and suppliers. Ethical issues are very important since they have the power to damage the image of an organization and to destroy the morale of the employees. Ethics is a difficult area because ethical issues are not cut-and-dried. What is considered ethical by one person may seem unethical to another. Likewise, what is considered ethical in one country may be seen as unethical in another.

The use of information technology raises many ethical issues. These range from the monitoring of electronic mail to the potential invasion of privacy of millions of customers whose data are stored in private and public databases. At

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this chapter's Website, in Online File W1.4, you will find resources that will help you develop and strengthen your understanding of ethical issues related to business, and to IT in particular. The online file consists of two parts: (1) a general framework of ethics in business and society, and (2) an Ethics Primer that poses various ethical situations and asks you to think about responses to these situations. In addition to the materials in Online File W1.4, specific ethical issues are discussed in all chapters of the book (and are highlighted by an icon in the margin).

The environments that surrounded organizations are becoming more complex and turbulent. Advances in communications, transportation, and technology create many changes. Other changes are the result of political or economic activities. Thus, the pressures on organizations are mounting, and organizations must be ready to take responsive actions if they are to succeed. In addition, organizations may see opportunities in these pressures. (For a framework for change analysis, see Online File W1.5 at the book's Web site.) Organizational responses to the increasing business pressures are described next.

Organizational Responses

Traditional organizational responses may not be effective with new types of pressures. Therefore many old solutions need to be modified, supplemented, or eliminated. Organizations can also take *proactive* measures, to create a change in the marketplace. Such activities also include exploiting opportunities created by the external pressures.

Organizations' major responses are divided here into seven categories: strategic management and systems, customer focus, continuous improvement, restructuring, make-to-order and mass customization, business alliances, and e-business. These responses can be interrelated, so the categories sometimes overlap.

Strategic Management and Systems. An important response activity is to develop a corporate strategy of how to handle the business pressures. Once such strategy is developed (including the supporting role of IT), the company can develop its tactical and operational plans as well as specific strategic IT-supported systems. For discussion of a well-known framework for analyzing competitive forces and developing strategic responses, see Appendix 1A at the end of the chapter.

Strategic systems provide organizations with strategic advantages that enable them to increase their market share and/or profit, to better negotiate with suppliers, or to prevent competitors from entering their territory (Callon, 1996). There are a variety of IT-supported strategic systems, as we will show throughout the book. According to Moss-Kanter (2001), the Internet is transforming companies and their strategies, changing the competitive landscape and requiring commitment to change. In particular these days, Web-based systems are providing considerable strategic advantage to companies (Lederer et al., 2001; Li et al., 2003; and Basu and Muylle, 2003).

A prime example of strategic systems is Federal Express's overnight delivery system, which can track the status of every individual package, anywhere in the delivery chain. The Federal Express (FedEx) system is heavily supported by IT. A major challenge with this kind of strategic system is the difficulty of sustaining competitive advantage. Most of FedEx's competitors duplicated the system. So FedEx moved the system to the Internet. However, the competitors quickly followed, and FedEx is now continuously introducing new innovations to keep or expand market share. For example, in an application called "My Account,"

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FedEx provides you comprehensive account management, including an online address checker (for shipping destinations) and an online wireless portal. An increasing number of mobile-computing-based strategic systems are appearing (e.g., see the Expedia case in Chapter 12). Strategic systems relate to appropriate decision-making practices and tools, as advocated by Huber (2004).

CUSTOMER FOCUS. Organizational attempts to provide super customer service sometimes make the difference between attracting and keeping customers, or losing them to other organizations. With a slew of IT tools, sophisticated mechanisms and innovations are designed to make customers happy (see Chapter 6).

CONTINUOUS IMPROVEMENTS. Many companies continuously conduct programs that attempt to improve their productivity and quality (see Brue, 2002), and they frequently do so with the facilitation of IT. Examples of such programs include total quality management (TQM) and Six Sigma, knowledge management, productivity and creativity improvements, just-in-time (JIT) processing, improvements in decision-making processes, change management, and customer service improvements. The underlying purpose of IT support in continuous improvement is (1) to monitor and analyze performance and productivity and (2) to gather, share, and better use organizational knowledge. (See Online File W1.6 for more details.) We will provide examples throughout the book of how IT is contributing to continuous improvement.

RESTRUCTURING BUSINESS PROCESSES. Organizations may discover that continuous improvement efforts have limited effectiveness in an environment full of strong business pressures. Therefore, a relatively new approach may be needed. This approach, initially called **business process reengineering (BPR),** refers to a situation in which an organization fundamentally and radically redesigns its business processes to achieve dramatic improvements (Hammer and Champy, 2001). Such redesign effects a major innovation in an organization's structure and the way it conducts its business. If done on a smaller scale than corporatewide, the redesign process may be referred to as a *restructuring* (see El-Sawy, 2001). Technological, human, and organizational dimensions of a firm may all be changed in restructuring and BPR (see Chapter 14). The major areas in which IT supports restructuring are described in Chapter 14.

MAKE-TO-ORDER AND MASS CUSTOMIZATION. A major response area is the trend to produce customized products and services. This strategy is referred to as **build-to-order.** As today's customers demand customized products and services, the business problem is how to provide customization and do it efficiently. This can be done, in part, by changing manufacturing processes from mass production to mass customization (Anderson, 2002; Smith and Rupp, 2002; and Zhu and Kraemer, 2002; see also Appendix 2A in this book). In mass production, a company produces a large quantity of identical items. In **mass customization,** items are produced in a large quantity but are customized to fit the desires of each customer. IT and EC are ideal facilitators of mass customization, for example, by enabling interactive communication between buyers and designers so that customers can quickly and correctly configure the products they want. Also, electronic ordering reaches the production facility in minutes.

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BUSINESS ALLIANCES. Many companies realize that alliances with other companies, even competitors, can be very beneficial. For example, General Motors and Ford created a joint venture to explore electronic-commerce applications, and the major airlines in Southeast Asia created a joint portal in 2003 that promotes travel to the region. There are several types of alliances: sharing resources, doing procurement jointly, establishing a permanent supplier-company relationship, and creating joint research efforts. Any of these might be undertaken in response to business pressures and usually is supported by IT.

One of the most interesting types of business alliance is the **virtual corporation,** which operates through telecommunications networks, usually without a permanent headquarters. (The term is used by some to describe a purely online business that does not have physical stores.) Virtual corporations may be temporary or permanent. A *temporary* virtual corporation is typically a joint venture in which companies form a special company for a specific, limited-time mission. A *permanent* virtual corporation is designed to create or assemble productive resources rapidly or frequently, on an ongoing basis. The virtual corporation form of organization could become common in the future. More details of virtual corporations are provided in Chapter 14.

All types of business alliances can be heavily supported by information technologies ranging from collaborative portals to electronic transmission of drawings.

ELECTRONIC BUSINESS AND E-COMMERCE. As seen in the opening case, companies are transforming themselves into e-businesses. Doing business electronically is the newest and perhaps most promising strategy that many companies can pursue (see Turban et al., 2006). Several of the business models introduced earlier (in *A Closer Look 1.1*) are in fact e-commerce. Chapter 4 will focus extensively on this topic, and e-commerce applications are introduced throughout the book.

To illustrate the importance of e-commerce, let's look at what a management guru, Peter Drucker, has to say about EC.

> The truly revolutionary impact of the Internet Revolution is just beginning to be felt. But it is not "information" that fuels this impact. It is not "artificial intelligence." It is not the effect of computers and data processing on decision-making, policy-making, or strategy. It is something that practically no one foresaw or, indeed even talked about ten or fifteen years ago: e-commerce—that is, the explosive emergence of the Internet as a major, perhaps eventually *the* major, worldwide distribution channel for goods, for services, and, surprisingly, for managerial and professional jobs. This is profoundly changing economics, markets and industry structure, products and services and their flow; consumer segmentation, consumer values and consumer behavior, jobs and labor markets. But the impact may be even greater on societies and politics, and above all, on the way we see the world and ourselves in it. (Drucker, 2002, pp. 3–4)

E-business not only is revolutionizing business but, according to Earl and Khan (2001), is changing the face of IT by pushing companies to redefine technology's role in new business models. For example, many EC systems need to be built quickly and inexpensively since they are used only for a short time, due to rapid technological and market changes. Some companies are introducing dozens of EC projects that enable them to compete globally. For example, see Online Minicase W1.1 about Qantas Airlines at the book's Web site.

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While some critical response activities can be executed manually, the vast majority require the support of information systems. Before we provide more examples on the role of information systems and IT, let us briefly explore the terms themselves.

1.3 INFORMATION SYSTEMS: DEFINITIONS AND EXAMPLES

What Is an Information System?

An **information system (IS)** collects, processes, stores, analyzes, and disseminates information for a specific purpose. Like any other system, an information system includes *inputs* (data, instructions) and *outputs* (reports, calculations). It *processes* the inputs by using technology such as PCs and produces outputs that are sent to users or to other systems via electronic networks. A *feedback* mechanism that controls the operation may be included (see Figure 1.4). Like any other system, an information system also includes people, procedures, and physical facilities, and it operates within an *environment*. An information system is not necessarily computerized, although most of them are. (For more general discussion of *systems,* see Online File W1.7 at the book's Web site.)

FORMAL AND INFORMAL INFORMATION SYSTEMS. An information system can be formal or informal. *Formal* systems include agreed-upon procedures, standard inputs and outputs, and fixed definitions. A company's accounting system, for example, would be a formal information system that processes financial transactions. *Informal* systems take many shapes, ranging from an office gossip network to a group of friends exchanging letters electronically. Both types of information systems must be studied.

WHAT IS A COMPUTER-BASED INFORMATION SYSTEM? A **computer-based information system (CBIS)** is an information system that uses computer technology to perform some or all of its intended tasks. Such a system can include as little as a personal computer and software. Or it may include several thousand computers of various sizes with hundreds of printers, plotters, and other devices, as well as communication networks (wireline and wireless) and databases. In most cases an information system also includes people. The basic

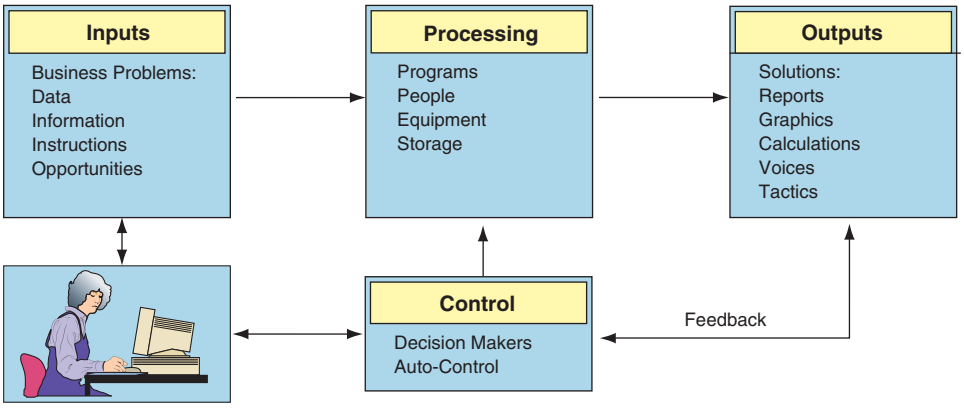

FIGURE 1.4 A schematic view of an information system.

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components of information systems are listed below. Note that not every system includes all these components.

- *Hardware* is a set of devices such as processor, monitor, keyboard, and printer. Together, they accept data and information, process them, and display them.
- *Software* is a set of programs that instruct the hardware to process data.
- A *database* is a collection of related files, tables, relations, and so on, that stores data and the associations among them.
- A *network* is a connecting system that permits the sharing of resources by different computers. It can be wireless.
- *Procedures* are the set of instructions about how to combine the above components in order to process information and generate the desired output.
- *People* are those individuals who work with the system, interface with it, or use its output.

In addition, all information systems have a *purpose* and a *social context*. A typical purpose is to provide a solution to a business problem. In the Siemens case, for example, the purpose of the system was to coordinate internal units, to collaborate with the many suppliers and customers, and to improve costs and customer service. The social context of the system consists of the values and beliefs that determine what is admissible and possible within the culture of the people and groups involved.

THE DIFFERENCE BETWEEN COMPUTERS AND INFORMATION SYSTEMS. Computers provide effective and efficient ways of processing data, and they are a necessary part of an information system. An IS, however, involves much more than just computers. The successful application of an IS requires an understanding of the business and its environment that is supported by the IS. For example, to build an IS that supports transactions executed on the New York Stock Exchange, it is necessary to understand the procedures related to buying and selling stocks, bonds, options, and so on, including irregular demands made on the system, as well as all related government regulations.

In learning about information systems, it is therefore not sufficient just to learn about computers. Computers are only one part of a complex system that must be designed, operated, and maintained. A public transportation system in a city provides an analogy. Buses are a necessary ingredient of the system, but more is needed. Designing the bus routes, bus stops, different schedules, and so on requires considerable understanding of customer demand, traffic patterns, city regulations, safety requirements, and the like. Computers, like buses, are only one component in a complex system.

WHAT IS INFORMATION TECHNOLOGY? Earlier in the chapter we broadly defined *information technology* as the collection of computer systems used by an organization. Information technology, in its narrow definition, refers to the technological side of an information system. It includes the hardware, software, databases, networks, and other electronic devices. It can be viewed as a subsystem of an information system. Sometimes, though, the term information technology is also used interchangeably with *information system*. In this book, we use the term *IT* in its broadest sense—to describe an organization's collection of information systems, their users, and the management that oversees them. The purpose of

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this book is to acquaint you with all aspects of information systems/information technology.

Now that the basic terms have been defined, we present some examples of IS applications worldwide.

Examples of Information Systems

Millions of different information systems are in use throughout the world. The following examples are intended to show the diversity of applications and the benefits provided. At the end of each example, we list the *critical response activities* supported by the system.

As the examples in this section show, information systems are being used successfully in all functional areas of business. We provide here five examples, one for each of the major functional areas: accounting, production/operations management, marketing, human resource management, and finance. Beginning here, and continuing throughout this book, icons positioned in the margins will call out the functional areas to which our real-world examples apply. In addition we will point to IT applications in government and in other public services such as health care and education by using icons. Finally, you've already seen that other icons will identify global examples—IT used by non-U.S.-based companies or by any company with significant business outside the United States. For a key that identifies the icons, see the marginal note at left and the preface.

Managing Accounting Information Across Asia. Le Saunda Holding Company (Hong Kong) manages 32 subsidiaries in four Asian countries, mostly in the manufacture, import, and sale of shoes (*lesaunda.com.hk*). Managing the financing and cash flow is a complex process. All accounting information flows to headquarters electronically. Also, sales data are electronically collected at point-of-sale (POS) terminals. The sales data, together with inventory data (which are updated automatically when a sale occurs), are transferred to headquarters. Other relevant data, such as advertising and sales promotions, merchants, and cash flow, are also transmitted electronically and collected in a centralized database for storage and processing.

To cope with the rapid growth of the company, a sophisticated accounting software package was installed. The result was radical improvements in accounting procedures. For example, it now takes less than 10 minutes, rather than a day, to produce an ad-hoc complex report. The company's accountants can generate reports as they are needed, helping functional managers make quicker and better decisions. The system is also much more reliable, and internal and external auditing is easier. Headquarters knows what is going on almost as soon as it occurs. All these improvements have led to a substantial growth in revenue and profits for the firm. (*Source: lesaunda.com.hk,* press releases.)

Critical response activities supported: decision making, managing large amounts of information, improved quality, reduced cycle time, enhanced strategic competitiveness.

The Dallas Mavericks: Using IT for a Successful Play and Business. Mark Cuban, the owner of the Dallas Mavericks of the National Basketball Association (NBA), expects the franchise to play well and also to perform as a business. He wants to fill every seat at every game and to maximize sales from concessions and souvenir sales.

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Cuban's strategy to reach his business goals is to give fans the best possible experience, with a high-quality team on the field and excellent service at arena bars, barbecue stands, and souvenir shops. In the 2002 season, the "Mavs" filled the 19,200-seat American Airlines Center to 103.7 percent capacity, bringing in folding chairs to handle the overflow demand for tickets. Dallas was named in 2003 the best NBA city by *The Sporting News.*

Filling seats is critical. To track attendance, the Mavs became the first NBA team to put barcodes on tickets and then scan them, in part to find out if group sales and community-organization giveaways were putting bodies in seats or just wasting tickets. The team's business managers have found other uses for the attendance information as well. By enabling improved attendance forecasting for particular games, for example, the system has helped reduce beverage inventories by 50 percent.

Each of the 144 luxury suites in the Center is equipped with PCs that handle orders for merchandise, food, and beverages. Wireless access from all seats in the arena is available so that fans can place orders directly from their seats. All 840 cash registers at concessions stands, restaurants, stores, and bars use a sophisticated point-of-sale system. In the big retail store on the ground floor, salespeople using hand-held computing devices ring up credit-card purchases when lines get too long. The system allows the Mavs to process credit-card transactions in only 3 seconds, because there is an always-on Internet connection to the processing facility. During a game, managers can see which concession stands are busy and which ones can be closed early to cut labor costs.

Technology also supports the Mavs on court. The team has 10 assistant coaches, and each has a laptop computer and a hand-held computing device. Game film is streamed over the Web for coaches to view on the road or at home. A digital content management system developed in-house matches game footage with the precise, to-the-minute statistics provided for every play of every game by the NBA. The searchable database allows coaches to analyze the effectiveness of particular plays and combinations of players in different game situations.

In 2002, the Mavs started using hand-held computers to track the performance of each referee in every one of their games. The coaches can look at trends—for example, to see which referee favors a given team or which one calls more 3-second violations—and they can tell the team's players. Another program logs different offensive and defensive schemes used against the Mavs. This system will let coaches make real-time adjustments in statistics from previous games. (*Source:* Cone, 2003.)

Critical response activities supported: Decision making, increased sales, improved customer service, improved inventory management, better utilization of capacity.

The Success Story of Campusfood.com. Campusfood.com's recipe for success was a simple one: Provide interactive menus to college students, using the power of the Internet to enhance traditional telephone ordering of meals. Launched at the University of Pennsylvania, the company has taken thousands of orders for local restaurants, bringing pizza, hoagies, and wings to the Penn community.

Founder Michael Saunders began developing the site in 1997, while he was a junior at Penn, and with the help of some classmates, launched the site in 1998. After graduation, Saunders began building the company's customer base.

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This involved registering other schools, attracting students, and generating a list of local restaurants from which students could order food to be delivered. Currently, this activity is outsourced to a marketing firm, and schools nationwide are being added to the list. By 2003 there were more than 200 participating schools and more than 1,000 participating restaurants.

Financed through private investors, friends, and family members, the site was built on an investment of less than $1 million. (For comparison, another company, with services also reaching the college-student market, has investments of $100 million.) Campusfood.com's revenue is generated through transaction fees; the site takes a 5 percent commission on each order.

When you visit *Campusfood.com,* you can do the following: Search a list of local restaurants, their hours of operation, addresses, phone numbers, and other information. Browse an interactive menu, which shows each participating restaurant's standard print menus, including the latest prices and a listing of every topping, every special, and every drink offered. Bypass busy-signals and place an order without being placed on hold, and avoid miscommunications. Get access to more specials, including discounts and meal deals available online exclusively to Campusfood.com customers. Have access to electronic payment capabilities and your own account record ("My Account"). (*Source:* Prince, 2002 and *campusfood.com*.)

Critical response activities supported: customer service, improved cycle time, and innovative marketing method.

State-of-the-Art Human Resources Management in China. International Information Products Company LTD (IIPC) produces IBM personal computers (PCs) in Shenzhen, China. The company is one of China's top-10 exporters and one of the world's most efficient manufacturers of IBM PCs. The company's success is attributed, in part, to its world-class Human Resources Information System (powered by PeopleSoft's HRMS). In operation since October 2001, the system includes these basic elements: employee record management, recruitment, variable pay analysis, performance appraisal, payroll, and management of fringe benefits and absence records. In addition, employees can self-manage their personal data and report leaves and absences on the intranet. Using e-kiosks placed in several locations within the plant (e.g., the cafeteria), employees who do not have Internet access at work or home can use the system as well.

China's employee tax and benefits systems (e.g., health care and social insurance) are very complex, requiring many computations. Using HRMS and its Global Payroll component, IIPC was able to reduce the payroll cycle from 11 days to 4 days, and to reduce the computation run time from 6 hours to 2 hours, while eliminating errors. The system automates labor-intensive HR processes such as workforce administration, enabling HR staff to concentrate on staffing, training, career planning, rewards and promotions, and other nonclerical HR services. Furthermore, the data collected in the system are used by top management for supporting strategic decisions. (*Source:* Smith, 2002.)

Critical response activities supported: improved cycle time, improved dissemination of information, automated clerical tasks, use by employees for self-service.

Mobile Banking at Handelsbanken of Sweden. Handelsbanken of Sweden is the largest bank in Scandinavia, where more than 80 percent of the population over 15 years old carry mobile phones. Operating in a very competitive banking

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environment, the bank is trying to meet customers' expectations of using their mobile phones to organize their personal and working lives while on the move. Mobile banking services, including stock trading, was an opportunity for the bank to gain a competitive edge, and so the bank become the world's first to have mobile banking applications.

An interactive service allows customers to access up-to-the-minute banking information, including the latest stock market and interest rate data, whenever and wherever they like. Handelsbanken's e-banking has become so popular that it is used by tens of thousands of customers. It opens up critical business and personal information to safe and easy access from mobile devices. Both the bank's financial advisors and its customers can access general and personalized stock market and account information, transfer money, request loans, buy and sell stocks and bonds, and pay bills. This move into mobile banking is a key first step in a strategy to exploit the potential of e-business, while also extending the bank's brand reach. (*Sources:* Compiled from IBM's case study: Handelsbanken at *www-3.ibm.com/e-business/doc/content/casestudy/35433.html,* accessed March 2003, and from press releases at *handelsbanken.com.*)

Critical response activities supported: improved customer service, innovative strategic marketing methods, competitive advantage.

In addition to functional areas, we can classify applications by the industry in which they are used. For example, retailing, financial services, education, health care, social services, and government are heavy users. An example of a government service is provided in Online Minicase W1.2.

Information Systems Failures

Use of this icon indicates a description of an IT failure, and discussion of the lessons that can be learned from it.

So far we have introduced you to many success stories. You may wonder, though, is IT always successful? The answer is, "Absolutely not." There are many failures. We will show you some of these (marked with a "lessons from failures" icon) in this book, and in some cases we present them on our Web site. (See, for example, the 2000 U.S. Presidential Election Case in Online File W1.8 at the Web site.) We can learn from failures as much as we can learn from successes, as illustrated in *IT at Work 1.2* (page 26).

As mentioned earlier, one area of failure is that of the dot-coms. As will be seen in Chapter 4, hundreds of dot-coms folded in 2000 and 2001. It was a shakeout that resulted from a rush to capitalize on e-commerce (see Kaplan, 2002). In addition there were many failures of Internet projects in established companies. (For example, the Go.com project of Walt Disney Company was supposed to manage all the Web sites owned by Disney and generate money from advertisers at the sites. Unfortunately, the income generated from advertising was not sufficient to keep the site going.) Like the gold rush and the rush to create companies when the automobile was invented, only a relatively few made it. The rest failed. According to Barva et al. (2001), the reason for EC failures is that many of the models used were too narrow. In place of these models, they offer an e-business value model, which we describe in Chapter 4.

Another reason for failure is that it is hard to predict the future. It is especially hard to predict the future in the field of information technology, which is evolving and continuously changing, as shown next.

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IT at Work 1.2
HOW NIKE'S $400 MILLION SUPPLY CHAIN MANAGEMENT SOFTWARE SYSTEM FAILED

In certain retail stores, fans of Nike's Air Terra Humara 2 running shoe have hit the jackpot. Once selling for over $100 US, they were selling for less than $50 in fall 2001. The cheaper shoes were the aftermath of the breakdown in Nike's supply chain, a breakdown attributed to a software problem.

Nike had installed a $400 million supply chain system in early 2001. The system was supposed to forecast sales demand and plan supplies of raw materials and finished products accordingly. However, the newly deployed demand and supply planning application apparently overestimated the demand for certain shoes in some locations and underestimated demand in others. As a result, some raw materials were overpurchased, while inventory levels of other materials were insufficient. Some shoes were overmanufactured, while the most-demanded ones were undermanufactured. To speed the right shoes to market, Nike had to spend around $5 a pair in air freight cost, compared to the usual cost of 75 cents by ocean shipping. In all, Nike attributed some $100 million in lost sales in the third quarter of 2001 alone to this problem.

What went wrong? The system was developed with software from i2, a major software producer. However, Nike insisted on modifying the i2 standard software, customizing it to its needs. Specifically, Nike wanted a forecast by style, by color, and by size (several thousand combinations). This resulted in a need to make thousands of forecasts, very rapidly, to quickly respond to changing market conditions and consumer preferences. To meet Nike's need it was necessary to customize the standard software, and to do so quickly because Nike wanted the system fast. The reprogramming was apparently done *too* fast. The software had bugs in it when it was deployed. Almost any new software contains bugs that need to be fixed; appropriate testing is critical, and it is a time-consuming task (see Murphy, 2003). Nike and i2 failed to recognize what was achievable.

Customizing standard software requires a step-by-step systematic process (see Chapter 14). It should be done only when it is absolutely necessary, and it must be planned for properly. Furthermore, Nike could have discovered the problem early enough if they had used appropriate deployment procedures (see Chapter 14).

To avoid disasters such as the one Nike experienced, companies must fully understand what they are trying to achieve and why. They must use performance-level indicators to properly measure the system during testing. Incidentally, Nike fixed the problem after spending an undisclosed amount of time and money in 2002.

Sources: Compiled from Sterlicchi and Wales (2001) and from *nike.com* press releases, 2002, 2003.

For Further Exploration: Why did Nike need the detailed forecasting? How can a company determine if it really needs to customize software? Whose responsibility is it to test and deploy the software: the software vendor's or the user's?

1.4 INFORMATION TECHNOLOGY DEVELOPMENTS AND TRENDS

In the previous sections, we described the role of IT in supporting business activities. We also pointed out (in Table 1.1) some of the capabilities that enable IT to play a support role. Next we will describe some of IT's developments and trends, and especially the move toward Web-based computing, wireless applications, and intelligent systems.

First imagine this scenario: It's a Monday morning in the year 2008. Executive Joanne Smith gets into her car, and her voice activates a wireless telecommunications-access workstation. She requests that all voice and mail messages open and pending, as well as her schedule for the day, be transmitted to her car. The office workstation consolidates these items from home and office databases. The message-ordering "knowbot" (knowledge robot), which is an enhanced e-mail messaging system, delivers the accumulated messages (in the order she prefers) to the voice and data wireless device in Joanne's car. By the time

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Joanne gets to the office, she has heard the necessary messages, sent some replies, revised her day's schedule, and completed a to-do list for the week, all of which have been filed in her virtual database by her personal organizer knowbot. She has also accessed the Internet by voice and checked the traffic conditions, stock prices, and top news stories.

The virtual organizer and the company intranet have made Joanne's use of IT much easier. No longer does she have to be concerned about the physical location of data. She is working on a large proposal for the Acme Corporation today; and although segments of the Acme file physically exist on several databases, she can access the data from her *wireless workstation* wherever she happens to be. To help manage this information resource, Joanne uses an *information visualizer* that enables her to create and manage dynamic relationships among data collections. This information visualizer has extended the graphical user interface to a three-dimensional graphic structure.

Joanne could do even more work if her car were able to drive itself and if it were able to find an empty parking space on its own. Although this kind of car is still in an experimental stage, it will probably be in commercial use before 2015 due to developments in pervasive computing (see Chapter 5).

Six Technology Guides at the book's Web site provide up-to-date presentations on hardware, software, databases, telecommunications, and the Internet.

It may be possible for parts of this year-2008 scenario to become a reality even sooner, owing to important trends in information technology. For example, voice access to the Internet is already becoming popular (e.g., see *tellme.com* and *bevocal.com*). These trends, which are listed in Table 1.2 (page 28), fall into two categories: general and networked computing. Here we describe only *selected* items from Table 1.2. The rest are described in Chapter 2 and in the Technology Guides on the book's Web site.

General Technological Trends

General trends are relevant to any computing system. Two representative examples are discussed below. Additional trends are presented in Chapter 2 and in the online Technology Guides.

COST-PERFORMANCE RATIO OF CHIPS: IMPROVEMENT BY A FACTOR OF AT LEAST 100. In about 10 years, a computer will cost the same as it costs today but will be about 50 times more powerful (in terms of processing speed, memory, and so on). At the same time labor costs could double, so the cost-performance ratio of computers versus manual work will improve by a factor of 100. This means that computers will have increasingly greater *comparative advantage* over people in performing certain types of work. This phenomenon is based on a prediction made in 1965 by Gordon Moore, the co-founder of Intel. Popularly called **Moore's Law,** this prediction was that the processing power of silicon chips would double every 18 months. And so it has, resulting in enormous increases in computer processing capacity and a sharp decline in cost (see Chapter 13).

Moore's Law applies to electronic chips. An extension of Moore's Law, according to McGarvey (2000) and *tenornetworks.com,* states that the performance of optical communication networks (see Technology Guide 4) is growing by a factor of 10 every three years. For example, according to Donofrio (2001), IBM is working on a supercomputer that will run at a petaflop (10^{15}) operations per second—which is 500 times faster than the fastest supercomputer of 2002. Such a computer will tackle brain-related diseases (such as Alzheimer's and stroke). It is expected to reach a speed of 20 to 30 petaflops in 2010.

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TABLE 1.2 Major Technological Developments and Trends

General Developments and Trends

- The cost-performance advantage of computers over manual labor will increase.
- Graphical and other user-friendly interfaces will dominate PCs.
- Storage capacity will increase dramatically.
- Data warehouses will store ever-increasing amounts of information.
- Multimedia use, including virtual reality, will increase significantly.
- Intelligent systems, especially artificial neural computing and expert systems, will increase in importance and be embedded in other systems.
- The use of intelligent agents will make computers "smarter."
- There is a push for open architecture (e.g., the use of Web Services and Linux).
- Object-oriented programming and document management will be widely accepted.
- Artificial intelligence systems are moving to learning-management systems.
- Computers will be increasingly compact, and more portable.
- There is proliferation of embedded technologies (especially intelligent ones).
- The use of plug-and-play software will increase.

Networked Computing Developments and Trends

- Optical computing will increase network capacity and speed, facilitating the use of the Internet.
- Storage networks will become popular.
- Mobile and wireless applications will become a major component of IT.
- Home computing will be integrated with the telephone, television, and other electronic services to create smart appliances.
- The use of the Internet will grow, and it will change the way we live, work, and learn.
- Corporate portals will connect companies with their employees, business partners, and the public.
- Intranets will be the dominating network systems in most organizations.
- E-commerce over the Internet will grow rapidly, changing the manner in which business is conducted.
- Intelligent software agents will roam through databases and networks, conducting time-consuming tasks for their masters.
- Interpersonal transmission will grow (one-to-one, one-to-many, many-to-many).
- More transactions among organizations will be conducted electronically, in what is called business-to-business (B2B) commerce.
- Networks and intelligent systems will be major contributors toward improved national security and counter-terrorism efforts.
- RFID (radio frequency identification) will change supply chains and retailing.

STORAGE. Whereas Moore's Law expresses computing speed, improvements in storage contribute to the cost-performance ratio in a similar way. Large storage capabilities are essential for advanced applications. There are several new devices and methods to increase storage (see Technology Guide 3). Of special interest are memory sticks that in 2004 were capable of storing 150 gigabytes in a device the size of a credit card.

OBJECT-ORIENTED ENVIRONMENT, COMPONENTS, AND WEB SERVICES. An *object-oriented environment* is an innovative way of programming and using computers that is significantly reducing the costs of building and maintaining information systems. **Object technology** enables the development of self-contained units of software that can be shared, purchased, and/or reused. This technology enables developers to assemble information systems rather than building them from scratch. This is a faster and cheaper process. This environment

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includes object-oriented programming, databases, and operating systems (Elrad et al., 2001). Object technology applications include component-based development and Web Services, both of which are based in part on object-oriented technology (described in Chapter 14 and Technology Guide 6).

SELF-HEALING COMPUTERS. IBM Corp. is developing computers, called *self-healing computers,* that can take of themselves. The first such computer (named eLiza), a supercomputer at the National Center for Atmosphere Research, was installed at Blue Sky. With 2 trillion calculations per second, this computer (which, incidentally, is the world's most powerful) has the ability to repair itself and keep running without human intervention. For details see Van (2003).

QUANTUM COMPUTING. Researchers are looking into using the basic quantum states of matter as a fundamental unit of computing. If successful, quantum computers will be hundreds of times faster than today's fastest supercomputers.

NANOTECHNOLOGY. Sometime in the future there will be superfast molecular computers. Built on a crystalline structure, these still-experimental computers will be very tiny so they could be woven into our clothing. They will require very little power, yet they will have huge storage capacities and be immune to computer viruses, crashes, and other glitches.

Networked and Distributed Computing

The technology of networked and distributed computing enables users to reach other users and to access databases anywhere in the organization and in any other place, using intranets and the Internet. The networks' power stems from what is called **Metcalfe's Law.** Robert Metcalfe, a pioneer of computer networks, claimed that the value of a network grows roughly in line with the square of the number of its users (or nodes). Thus, if you increase the number of users, say from 2 to 10, the network's value will change from 2^2 (4) to 10^2 (100), or 25 times more. With 350 million Internet users, the value is $(350 \text{ million})^2$, an astronomical number.

Kelly (1999), in what is called *Kelly's Extension* of Metcalfe's Law, claims that the value of the Internet is actually much larger. The reason is that Metcalfe's Law of n^2 is based on the idea of the telephone network, where the connections are point-to-point. On the Internet we can make multiple simultaneous connections between groups of people. So, claims Kelly, the potential value of the Internet is n^n, which is obviously a much larger number.

Network-based technologies are some of the most exciting IT developments, which we will discuss throughout the text. Here we provide an overview of some representative network-based technologies.

THE INTERNET AND THE WEB. From about 50 million Internet users in 1997, there could be as many as 1.46 billion by 2007 (*Computer Industry Almanac,* 2004). The wireless devices that access the Internet and the integration of television and computers will allow the Internet to reach every home, business, school, and other organization. Then the **information superhighway** will be complete. This is a national fiber-optic-based network and wireless infrastructure that will connect all Internet users in a country, and will change the manner in which we live, learn, and work. Singapore is likely to be the first country to have such a national information superhighway completely installed. Maui, Hawaii, is the first community in the United States to have a wireless Internet all over the island.

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INTRANETS AND EXTRANETS. Just as use of the Internet is becoming common, so too is the use of *intranets* ("internal networks") that connect the computing devices within individual organizations. As the intranet concept spreads and the supporting hardware and software are standardized, it is logical to assume that most organizations will use an intranet for internal communication. In addition, combining an intranet with the Internet, in what is called an *extranet,* creates powerful interorganizational systems (Chapter 8) for communication and collaboration.

MOBILE COMPUTING AND M-COMMERCE. **M-commerce (mobile commerce)** refers to the conduct of e-commerce via wireless devices. It is the commercial application of **mobile computing,** which is computing using *mobile devices* and done primarily by *wireless networks* (see Chapter 5). There is a strong interest in the topic of mobile commerce because according to industry research firms, the number of mobile commerce users will grow from about 95 million in 2003 to about 1.7 billion by 2008. In addition, revenues from mobile commerce are expected to grow globally from nearly $7 billion in 2003 to over $554 billion in 2008 (*cellular.co.za,* 2004). Furthermore, these devices can be connected to the Internet, enabling transactions to be made from anywhere and enabling many applications (see Sadeh, 2002 and *A Closer Look 1.2*). For example, m-commerce can offer customers the location information of anything they want to purchase. This is a useful feature for customers, but it is even more important for merchants because it enables customers to act instantly on any shopping impulse. This wireless application is referred to as *location-based commerce,* or **l-commerce.** (For details, see Chapter 5.)

PERVASIVE COMPUTING. Strongly associated with m-commerce and wireless networks is **pervasive computing,** in which computation becomes part of the environment. The computer devices (personal computer, personal digital assistant, game player) through which we now relate to computation will occupy only a small niche in this new computational world. Our relationship to pervasive computing will differ radically from our current relationship with computers. In pervasive computing, computation will be embodied in many things, not in what we now know as computers (e.g., RFID).

RFID. *Radio frequency identification* uses tiny tags that contain a processor and an antenna and can communicate with a detecting unit. (See Chapter 5 for details.) With their declining cost, RFIDs will have many applications, one of which is supply chain improvement and inventory control (see Minicase 2 at the end of this chapter).

We can already put computation almost anywhere. Embedded computation controls braking and acceleration in our cars, defines the capability of medical instruments, and runs virtually all machinery. Hand-held devices (especially cell phones and pagers) are commonplace; useful computational wristwatches and other wearables are becoming practical; computational furniture, clothes, and rooms are in the demonstration stage. Soon, **smart appliances,** which are home appliances that are connected to the Internet and among themselves for increased capabilities, will be integrated and managed in one unit. (See Chapter 5 for further discussion.)

At present, most large-scale applications of pervasive computing, such as intelligent cities, hospitals, or factories, are still under development. However,

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A CLOSER LOOK
1.2 MOBILE AND WIRELESS APPLICATIONS: A SAMPLER

Mobile computing supports existing and entirely new kinds of applications. For example, each of the following can be done from any place, at any time.

- ***Mobile personal communications capabilities,*** such as personal digital assistants (PDAs) and cell phones for networked communications and applications.
- ***Online transaction processing.*** For example, a salesperson in a retail environment can enter an order for goods and also charge a customer's credit card to complete the transaction.
- ***Remote database queries.*** For example, a salesperson can use a mobile network connection to check an item's availability or the status of an order, directly from the customer's site or on the road.
- ***Dispatching,*** like air traffic control, rental car pickup and return, delivery vehicles, trains, taxis, cars, and trucks.
- ***Front-line IT applications.*** Instead of the same data being entered multiple times as they go through the value chain (the series of business activities that add value to a company's product or service), they are entered only once at any time and place and transmitted electronically thereafter.
- ***M-commerce.*** Users of wireless devices can access the Internet, conduct information searches, collaborate with others and make decisions jointly, and buy and sell from anywhere.

Wireless communications support both mobile computing applications and low-cost substitutions for communication cables. For example:

- Temporary offices can be set up quickly and inexpensively by using wireless network connections.
- Wireless connections to permanent office locations are often practical in difficult or hazardous wiring environments.
- Installing a wireless connection can replace leased lines that are used to connect local area networks (LANs), thus eliminating the costs of monthly line leases.

There are mobile and wireless application opportunities in many industries, such as:

- ***Retail.*** Retail applications have been very successful to date, particularly in department stores where there are frequent changes of layout. Also, retail sales personnel can conduct inventory inquiries or even sales transactions on the retail floor with wireless access from their PCs or cell phones. Radio-frequency devices are helping retailers in inventory and security management.
- ***Wholesale/distribution.*** Wireless networking is used for inventory picking in warehouses with PCs mounted on forklifts, and for delivery and order status updates with mobile PCs inside distribution trucks.
- ***Field service/sales.*** Mobile computing can be used for dispatching, online diagnostic support from customer sites, and parts-ordering/inventory queries in all types of service and sales functions.
- ***Factories/manufacturing.*** Environments and applications include mobile shop-floor quality control systems or wireless applications that give added flexibility for temporary setups.
- ***Health care/hospitals.*** Health care personnel can access and send data to patient records, or consult comparative diagnosis databases, wherever the patient or the health care worker may be located.
- ***Education.*** Pilot applications equip students with PCs in lecture halls, linked by a wireless network, for interactive quizzes, additional data and graphics lecture support, and online handout materials. (See Minicase 1 at the end of the chapter and Chapter 5.)
- ***Finance.*** Mobile transactional capabilities can assist in purchasing, selling, inquiry, brokerage, and other dealings, using wireless devices.
- ***Banking.*** Mobile personal, programmable communications devices (e.g., hand-held computers such as PDAs) are effective for authorizing and managing payment and banking transactions.
- ***Entertainment.*** New technologies, such as GPRS, accelerate the quality of the end-user experience of mobile entertainment services. With the improvement of ringtone quality (from monophonic to polyphonic) and the development of streaming audio, mobile music creates immense revenues for operators and content providers. Through third-generation networks and improved multimedia, mobile video offers a widely touted capability that will enrich the mobile entertainment experience immeasurably.

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smaller-scale applications, such as the "intelligent restaurant" described in *IT at Work 1.3,* are already in place.

CORPORATE PORTALS. A **corporate portal** refers to a company's Web site that is used as a *gateway* to the corporate data, information, and knowledge. Corporate portals may be used both by employees and by outsiders, such as customers or suppliers. (Employees have a password that allows them to access data through the portal that are not available to the public.) A variety of corporate portals provide a wide range of functionalities (see Chapter 3 for details).

THE NETWORKED ENTERPRISE. The various components and technologies just described can be integrated together into an *enterprisewide network* that is a seamless system, extending the corporate contacts to all entities a company does business with. The networked enterprise provides two primary benefits: First, by creating new types of services, businesses can engage customers in a direct interactive relationship that results in customers getting precisely what they want when they want it, resulting in stronger customer relationships and better relationships with suppliers and other business partners. Second, by taking the entire product design process online—drawing partners and customers into the process and removing the traditional communication barriers that prevent rapid product design and creation—companies can bring products and services to market far more quickly.

The networked enterprise is shown schematically in Online File W1.9 at the book's Web site. As a result of the technology pressures discussed earlier, companies that implement standards-based intranets can quickly create or join extranets, as we discuss in Chapters 4 and 8.

THE NETWORK COMPUTER. In 1997, the *network computer* was introduced. This computer does not have a hard drive. Instead, it is served by a central computing station. At a "dumb" (passive) terminal, it temporarily receives and can use applications and data stored elsewhere on the network. Also called "thin clients," network computers are designed to provide the benefits of desktop computing without the high cost of PCs. Prices of network computers are getting close to $200. A variation of the thin client is the **Simputer** or "simple computer" (see *simputer.org*).

OPTICAL NETWORKS. A major revolution in network technology is *optical networks*. These are high-capacity telecommunication networks that convert signals in the network to colors of light and transmit these over fiber-optic filaments. Optical networks are useful in Internet, video, multimedia interaction, and advanced digital services. (For more, see Technology Guide 4.)

STORAGE NETWORKS. **Network storage devices** are attached to the corporate network (usually intranets) and can be accessed from network applications throughout the enterprise. Their benefits are optimal data sharing, simplicity, scalability (ability to adapt to increased demands), and manageability. Online storage is also available from independent vendors.

Rather than handling their own server computers, many corporations are relying on outside outfits to manage their technology at remote data centers, which pipe data to their premises via the Web. Ferelli (2004) discusses the issue of

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IT at Work 1.3
PERVASIVE COMPUTING AT ROYAL MILE PUB

All of us are familiar with the service at restaurants, and most of us have encountered inconvenient scenarios such as long waits, cold food, or even service of a wrong order. These inconveniences are the result of a conventional process that works like this: A server takes your drink order and then walks to the bar to place the order. She or he knows that after approximately five minutes your drink will be ready, so in the meantime the server takes an order from someone else and then heads back to the bar. If your order is not ready, the server comes to your table, apologizes for the delay, and takes your food order. That order is written on a piece of paper, which the server carries to the kitchen and places on a revolving wheel, which the chef rotates into view when he or she is ready to begin preparing the next order. At that point, the server may find that the kitchen is out of this selection, so he or she comes to your table and asks you to reorder. Sometimes, the server makes a mistake in writing your order, or the chef reads the handwritten order incorrectly. In such a case, after a long wait, the customer is frustrated at getting the wrong food.

The situation is different at Royal Mile Pub (Silver Springs, Maryland), thanks to pervasive computing. The Royal Mile is a medium-size restaurant (about 20 tables), with a bar that specializes in a wide selection of beverages. But what is really different about the Royal Mile is that the servers' green order pads have been replaced with iPaq PDAs connected to the kitchen using wireless networking.

The new system works as follows: The server uses a special PDA to take the orders. Most menu items are visible on the PDA, which also has handwriting capabilities for writing in special instructions. To take drink or food orders requires only one or two keystrokes. The server glances at the screen to verify that the correct item has appeared. Experienced servers can be trained in about 15 minutes on how to use the devices.

The Wi-Fi (wireless fidelity) system, which is a local area network, transmits the orders within the range of the restaurant (described further in Chapter 5). The orders appear immediately on screens in the kitchen and bar. After transmitting an order, the server can move to the next table rather than hurrying off to hand the orders to the cooks or bartenders.

The system is liked by all. Servers can spend more time with each customer and handle more tables because they make half as many trips out of the serving area. The PDA interface tells servers which menu items are unavailable; getting that information immediately to the customers reduces servers' trips to the kitchen, thus eliminating another source of customer and server dissatisfaction. Because the kitchen becomes aware of orders immediately, the food arrives more quickly. The system also totals each bill, eliminating arithmetic errors.

PPT 8800 from Symbol Technologies, another type of personal digital assistant, used for the same purpose as an iPaq PDA.

The owner is very positive about the system's effects on his business. The order system costs about $30,000 to install. Its benefits include fewer errors, better inventory control, and smaller payrolls. As orders transmit, they are processed against the inventory database, allowing kitchen managers to track raw material purchases against the food orders and identify waste or other delivery and processing problems. Integration with the enterprise database and inventory control systems is fundamental to realizing cost reductions, improved workflow, and inventory and personnel management. The pervasive order system has reduced the error rate from several wrong meals per night to about one every two nights. Improvements occur not only in wasted (and replacement) meals, but also in customer satisfaction. In addition, now only three food servers are needed, meaning lasting cost reductions and lower overhead. Also, three data-entry stations on the serving floor for processing credit card charges were reduced to one, freeing up space on the serving floor.

Sources: Compiled from Stanford (2003), and *royalmilepub.com* (accessed March 2003).

For Further Exploration: Why would customers appreciate this pervasive computing system? What strategic advantage is generated? If such a system is beneficial to all, why have not all restaurants adopted it? Why it is classified as pervasive computing?

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security in storage networks, as well as major benefits and implementation issues. Data centers are operated by a third party, such as application service providers (ASPs) (see Chapters 13 and 14). Major software vendors including IBM and SAP are in this business. For details on storage networks, see Technology Guide 3.

WEB SERVICES. By using universal prefabricated business process software, called **Web Services,** computer users will soon be able to integrate applications, business processes, databases, and more into all kinds of applications, and do so rapidly and inexpensively. By using agreed-upon protocols and standards for the Web Services, developers can create a truly open computing environment independent of any vendor or product. Web Services will impact e-business application development, application integration, and application access. See Chapters 2, 3, 4, and 14 for details. Also see Clark et al. (2002).

All of these developments and prospects will increase the importance of IT both at home and at work. Therefore, it is obvious that to function effectively in the digital era, it makes sense to learn about IT.

1.5 WHY SHOULD YOU LEARN ABOUT INFORMATION TECHNOLOGY?

The field of IT is growing rapidly, especially with the introduction of the Internet and e-commerce, so the organizational impacts keep increasing. We are becoming more and more dependent on information systems. For example, on March 1, 2003, a computer glitch disturbed hundreds of flights in Japan.

In this part of the chapter we describe some specific benefits you can derive from studying IT.

Benefits from Studying IT

A major role of IT is being a *facilitator* of organizational activities and processes. That role will become more important as time passes. Therefore, it is necessary that every manager and professional staff member learn about IT not only in his or her specialized field, but also in the entire organization and in interorganizational settings as well.

Obviously, you will be more effective in your chosen career if you understand how successful information systems are built, used, and managed. You also will be more effective if you know how to recognize and avoid unsuccessful systems and failures. Also, in many ways, having a comfort level with information technology will enable you, off the job and in your private life, to take advantage of new IT products and systems as they are developed. (Wouldn't you rather be the one explaining to friends how some new product works, than the one asking about it? For help in that role, by the way, see *howthingswork.com*.) Finally, you should learn about IT because being knowledgeable about information technology can also increase employment opportunities. Even though computerization eliminates some jobs, it also creates many more.

The demand for traditional information technology staff—such as programmers, systems analysts, and designers—is substantial. In addition, many well-paid opportunities are appearing in emerging areas such as the Internet and e-commerce, m-commerce, network security, object-oriented programming, telecommunications, multimedia design, and document management. (See Online File W1.10 at the book's Web site for a listing of jobs in e-commerce.) According to a study by the U.S. Bureau of Labor Statistics, each of the top seven

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fastest-growing occupations projected through 2010 fall within an IT- or computer-related field. These top seven occupations are (Pollock, 2003):

1. Computer software applications engineers
2. Computer support specialists
3. Computer software systems engineers
4. Network and computer systems administrators
5. Network systems and data communications analysts
6. Desktop publishers
7. Database administrators

At about $60,000 per year, workers in the software and information services industries were the highest-paid U.S. wage earners in 2000, about twice that of the average worker in the private sector. Furthermore, earnings of IT employees were growing twice as fast as those in the entire private sector. Thus, salaries for IT employees are generally high.

To exploit the high-paying opportunities in IT, a college degree in any of the following fields, or combination of them, is advisable: computer science, computer information systems (CIS), management information systems (MIS), electronic commerce, and e-business. Within the last few years, many universities have started e-commerce or e-business degrees (e.g., see *is.cityu.edu.hk* and *cgu.edu*). Many schools offer graduate degrees with specialization in information technology.

Majoring in an IT-related field can be very rewarding. For example, students graduating with baccalaureate degrees in MIS usually earn the highest starting salaries of all undergraduate business majors (more than $45,000 per year). MBAs with experience in Web technologies and e-commerce are getting starting salaries of over $100,000/year, plus bonuses. Many students prefer a double major, one of which is MIS. Similarly, MBAs with an undergraduate degree in computer science have little difficulty getting well-paying jobs, even during recessionary times. Many MBA students select IS as a major, a second major, or an area of specialization. In addition, nondegree programs are also available on hundreds of topics. For details about careers in IT, see *techjourney.com* and also "Career resources" and "Technology careers" at *wageweb.com*.

Finally, another benefit from studying IT is that it may contribute to future organizational leadership. In the past, most CEOs came from the areas of finance and marketing. Lately, however, we see a trend to appoint CEOs who have strong IT knowledge and who emerge from the technology area.

1.6 PLAN OF THE BOOK

A major objective of this book is to demonstrate how IT in general and Web systems in particular support different organizational activities. In addition, we will illustrate the role that networked computing plays in our society today and will play tomorrow. Furthermore, we describe how information systems should be developed, maintained, and managed.

The book is divided into six parts. Figure 1.5 (page 36) shows how the chapters are positioned in each part and how the parts are connected. Notice that in the center of the figure are the six Technology Guides. These guides can be found on the book's Web site (*wiley.com/college/turban*).

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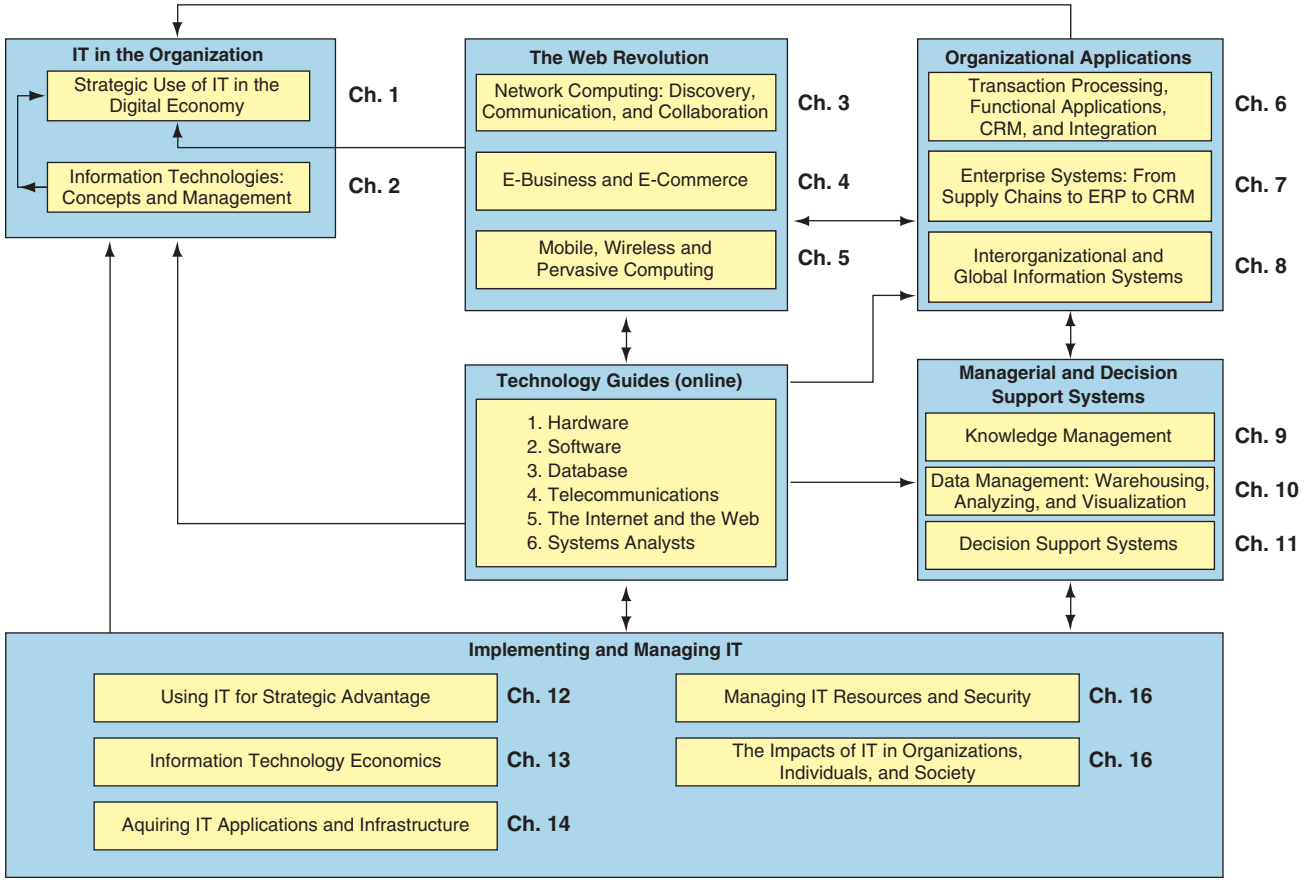

FIGURE 1.5 Plan of the book.

MANAGERIAL ISSUES

At the end of every chapter, you will find a list of some of the special concerns managers face as they adapt technology to their organization's needs.

1. ***Recognizing opportunities for using IT and Web-based systems for strategic advantage.*** These opportunities are highlighted and discussed in most chapters of the book, but especially in Chapters 3, 4, 5, 6, 7, and 13.
2. ***Who will build, operate, and maintain the information systems?*** This is a critical issue because management wants to minimize the cost of IT while maximizing its benefits. Some alternatives are to outsource portions, or even all, of the IT activities, and to divide the remaining work between the IS department and the end users. Details are provided in Chapters 13 through 15 and in Technology Guide 6.
3. ***How much IT?*** This is a critical issue related to IT planning. IT does not come free, but *not* having it may be much costlier. Chapters 12 and 13 deal with this issue.
4. ***How important is IT?*** In some cases, IT is the only approach that can help organizations. As time passes, the *comparative advantage* of IT increases.
5. ***Is the situation going to change?*** Yes, the pressures will be stronger as time passes. Therefore, the IT role will be even more important.

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6. ***Globalization.*** Global competition will have an impact on many companies. However, globalization opens many opportunities, ranging from selling and buying products and services online in foreign markets, to conducting joint ventures or investing in them. IT supports communications, collaboration, and discovery of information regarding all the above (Chapter 8).

7. ***Ethics and social issues.*** The implementation of IT involves many ethical and social issues that are constantly changing due to new developments in technologies and environments. These topics should be examined any time an IT project is undertaken. Appendix 1A at the end of this chapter presents an introduction to ethics. Ethical issues are highlighted in most chapters throughout the book.
8. ***Transforming the organization to the digital economy.*** The transformation can be done on several fronts, as Siemens AG did. Management should study the opportunities, consider alternatives, and prioritize them. A prime area to start with is e-procurement (Chapters 4 and 7).

KEY TERMS

Build-to-order *xx*
Business model *xx*
Business pressures *xx*
Business process reengineering (BPR) *xx*
Computer-based information system (CBIS) *xx*
Corporate portal *xx*
Critical response activities *xx*
Customer relationship management (CRM) *xx*
Digital economy *xx*
E-business *xx*
Electronic commerce (EC) *xx*
Ethics *xx*
Extranet *xx*
Information superhighway *xx*
Information system (IS) *xx*
Information technology (IT) *xx*
Internet *xx*
Intranet *xx*
L-commerce *xx*
Mass customization *xx*
Metcalfe's Law *xx*
M-commerce *xx*
Mobile computing *xx*
Moore's Law *xx*
Network storage device *xx*
Networked computing *xx*
Object technology *xx*
Pervasive computing *xx*
Simputer *xx*
Smart appliances *xx*
Virtual corporation *xx*
Web Services *xx*

CHAPTER HIGHLIGHTS (Numbers Refer to Learning Objectives)

1. The world is moving to a digital economy, which can be viewed as a major economic, societal, and organizational revolution. This revolution automates business processes by using the Internet, intranets, VANs, and extranets to connect organizations and people.
1. The digital economy is characterized by extensive use of information technology in general and the Internet in particular. These drive new business models that dramatically reduce cost and increase quality, customer service, and speed.
1. Companies are trying to transform themselves to e-businesses by converting their information systems to Web-based and by automating as many business processes as possible.
2. Many market, technology, and societal pressures surround the modern organization, which is responding with critical response activities supported by information technology.
3. An accelerated rate of technological change, complexity, and turbulence and a move toward a global economy

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today characterize the business environment. In addition, the competition faced by businesses is ever increasing.

3 Organizational responses include strategic information systems, continuous improvements, business process restructuring, electronic commerce, and business alliances. IT plays a major role in all of these.

3 Organizations are adopting a customer-focused approach in order to succeed.

3 Organizations are changing their mode of operation by using IT-supported innovative approaches such as e-commerce, mass customization, CRM, and business alliances.

4 An information system collects, processes, stores, and disseminates information for a specific purpose. A computer-based information system uses computers to perform some or all of these activities.

4 Information technology refers to the network of all information systems in an organization.

5 Information technology is a major agent of change, supporting critical response activities in all functional areas, in all industries, and in both the private and the public sectors.

6 The major generic technological developments in IT are: increasing cost/performance, proliferation of object technology, and introduction of component-based development.

6 The major networked-computing developments are: increasing use of the Internet and intranets, mobile commerce, portals, optical networks, storage networks, and Web Services.

7 Learning about IT is essential because the role of IT is rapidly increasing in the support of organizations. We are getting more dependent on IT as time passes. Also, more IT-related jobs with high salaries are available.

VIRTUAL COMPANY ASSIGNMENT

Instructions for accessing The Wireless Café on the Student Web Site

1. Go to wiley.com/college/turban
2. Select Turban/Leidner/McLean/Wetherbe's *Information Technology for Management, Fifth Edition.*
3. Click on Student Resources site, in the toolbar on the left.
4. Click on the link for Virtual Company Web Site.
5. Click on Wireless Café.

Starting Your Internship at The Wireless Café

Go to The Wireless Café's link on the Student Web site. There you will find a description of your internship at this diner, as well some assignments that will help you learn more about how IT solutions could help the restaurant improve its business.

More Resources

More resources and study tools are located on the Student Web site. You'll find additional chapter materials and useful Web links. In addition, self-quizzes that provide individualized feedback are available for each chapter.

QUESTIONS FOR REVIEW

1. Define an information system and list its major components.
2. Define digital economy and list its major characteristics.
3. Define a business model by giving an example of one.
4. What are the major pressures in the business environment?
5. List the major critical response activities used by organizations.
6. Define information technology.
7. What is a virtual corporation?
8. Define mobile computing and m-commerce.
9. Define corporate portals.

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10. Describe mass customization.
11. What are Moore's Law and Metcalfe's Law?
12. What is cycle-time reduction? Why is it so important?
13. Define Web Services.
14. List the major capabilities of IT.
15. Define optical networks and network storage.
16. Describe a Simputer (simple computer).
17. Define the Internet, an intranet, and an extranet.
18. Define networked computing and networked organizations.
19. Describe pervasive computing.

QUESTIONS FOR DISCUSSION

1. Discuss the motivation for becoming an e-business.
2. Review the examples of the new versus the old economy cases. In what way did IT make the difference?
3. Explain why IT is a business pressure and also an enabler of response activities that counter business pressures.
4. Why is m-commerce perceived as being able to increase EC applications?
5. Explain why the cost-performance ratio of IT will improve by a factor of 100, while performance is expected to improve only by a factor of 50.
6. Is IT a strategic weapon or a survival tool? Discuss.
7. It is said that networked computing changes the way we live, work, and study. Why?
8. Relate cycle-time reduction to improved financial and business performance.
9. Distinguish between network computers and networked computing.
10. Why is the Internet said to be the creator of new business models?
11. Explain why mass customization is desirable.
12. Discuss why some information systems fail.
13. Discuss the potential impact of utility computing.
14. Discuss the ethics related to use of RFID tags.

EXERCISES

1. Review the examples of IT applications in Section 1.3, and identify the business pressures in each example.
2. The market for optical copiers is shrinking rapidly. It is expected that by 2005 as much as 85 percent of all duplicated documents will be done on computer printers. Can a company such as Xerox Corporation survive?
   a. Read about the problems and solution of Xerox in 2000–2003 at *fortune.com*, *findarticles.com*, and *google.com*.
   b. Identify all the business pressures on Xerox.
   c. Find some of Xerox's response strategies (see *xerox.com*, *fortune.com*, and *forbes.com*).
   d. Identify the role of IT as a contributor to the business technology pressures.
   e. Identify the role of IT as a facilitator of the critical response activities.
3. Reread the Siemens case at the start of the chapter and prepare a presentation to the CEO of a competing company. Stress both the benefits and the cost and limitations of such a transformation.

GROUP ASSIGNMENTS

1. Review the *Wall Street Journal*, *Fortune*, *Business Week*, and local newspapers of the last three months to find stories about the use of Web-based technologies in organizations. Each group will prepare a report describing five applications. The reports should emphasize the role of the Web and its benefit to the organizations. Cover issues discussed in this chapter, such as productivity, quality, cycle time, and globalization. One of the groups should concentrate on m-commerce and another on electronic marketplaces. Present and discuss your work.
2. Identify Web-related new business models in the areas of the group's interests. Identify radical changes in the operation of the functional areas (accounting, finance, marketing, etc.), and tell the others about them.
3. Enter *digitalenterprise.org;* go to Net-centrism and read the latest "hungry minds" items there. Prepare a report regarding the latest in the digital age.

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INTERNET EXERCISES

1. Enter the Web site of UPS (*ups.com*).
   a. Find out what information is available to customers before they send a package.
   b. Find out about the "package tracking" system; be specific.
   c. Compute the cost of delivering a 10″ × 20″ × 15″ box, weighing 40 pounds, from your hometown to Long Beach, California. Compare the fastest delivery against the least cost.
2. Surf the Internet (use *google.com, brint.com,* or a similar engine) to find information about:
   a. International virtual corporations (at least two examples).
   b. Virtual corporations in general.
3. Enter *digitalenterprise.org*. Prepare a report regarding the latest EC developments in the digital age.
4. Visit some Web sites that offer employment opportunities in IT (such as *execunet.com* and *monster.com*). Compare the IT salaries to salaries offered to accountants. For other information on IT salaries, check *Computerworld's* annual salary survey and *techjourney.com*.
5. Prepare a short report on the role of information technology in government. Start with *whitehouse.gov/omb/egov/2003egov-strat.pdf, ctg.albany.edu, e-government.govt.nz,* and *worldbank.org/publicsector/egov*. Find e-government plans in Hong Kong and in Singapore (*cca.gov.sg;* check action plan).
6. Enter *x-home.com* and find information about the easy life of the future.
7. Enter *tellme.com* and *bevocal.com*. Observe the demos. Write a report on the benefits of such technologies.
8. Experience customization by designing your own shoes at *nike.com,* your car at *jaguar.com,* your CD at *saregama.com,* and your business card at *iprint.com*. Summarize your experiences.
9. Enter *dell.com* and configure the computer of your dreams. (You do not have to buy it.) What are the advantages of such configuration?

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Minicase 1

Dartmouth College Goes Wireless

Dartmouth College, one of the oldest in the United States (founded in 1769), was one of the first to embrace the wireless revolution. Operating and maintaining a campuswide information system with wires is very difficult, since there are 161 buildings with more than 1,000 rooms on campus. In 2000, the college introduced a campuswide wireless network that includes more than 500 Wi-Fi (wireless fidelity; see Chapter 5) systems. By the end of 2002, the entire campus became a fully wireless, always-connected community—a microcosm that provides a peek at what neighborhood and organizational life may look like for the general population in just a few years.

To transform a wired campus to a wireless one requires lots of money. A computer science professor who initiated the idea at Dartmouth in 1999 decided to solicit the help of alumni working at Cisco Systems. These alumni arranged for a donation of the initial system, and Cisco then provided more equipment at a discount. (Cisco and other companies now make similar donations to many colleges and universities, writing off the difference between the retail and the discount prices for an income tax benefit.)

As a pioneer in campuswide wireless, Dartmouth has made many innovative usages of the system, some of which are the following:

- Students are developing new applications for the Wi-Fi. For example, one student has applied for a patent on a personal-security device that pinpoints the location of campus emergency services to one's mobile device.
- Students no longer have to remember campus phone numbers, as their mobile devices have all the numbers and can be accessed anywhere on campus.
- Students primarily use laptop computers on the network. However, an increasing number of Internet-enabled PDAs and cell phones are used as well. The use of regular cell phones is on the decline on campus.
- An extensive messaging system is used by the students, who send SMSs (Short Message Services) to each other. Messages reach the recipients in a split second, any time, anywhere, as long as they are sent and received within the network's coverage area.
- Usage of the Wi-Fi system is not confined just to messages. Students can submit their classwork by using the network, as well as watch streaming video and listen to Internet radio.
- An analysis of wireless traffic on campus showed how the new network is changing and shaping campus behavior patterns. For example, students log on in short bursts, about 16 minutes at a time, probably checking their messages. They tend to plant themselves in a few favorite spots (dorms, TV room, student center, and on a shaded bench on the green) where they use their computers, and they rarely connect beyond those places.
- Some students invented special complex wireless games that they play online.
- One student has written a code that calculates how far away a networked PDA user is from his or her next appointment, and then automatically adjusts the PDA's reminder alarm schedule accordingly.
- Professors are using wireless-based teaching methods. For example, students armed with Handspring Visor PDAs, equipped with Internet access cards, can evaluate material presented in class and can vote on a multiple-choice questionnaire relating to the presented material. Tabulated results are shown in seconds, promoting discussions. According to faculty, the system "makes students want to give answers," thus significantly increasing participation.
- Faculty and students developed a special voice-over-IP application for PDAs and iPAQs that uses live two-way voice-over-IP chat.

Sources: Compiled from McHugh (2002), Hafner (2003), and *dartmouth.edu* (March 2003).

Questions for Minicase 1

1. In what ways is the Wi-Fi technology changing the life of Dartmouth students?
2. Some say that the wireless system will become part of the background of everybody's life—that the mobile devices are just an afterthought. Explain.
3. Is the system contributing to improved learning, or just adding entertainment that may reduce the time available for studying? Debate your point of view with students who hold a different opinion.
4. What are the major benefits of the wireless system over the previous wireline one? Do you think wireline systems will disappear from campuses one day? (Do some research on the topic.)

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Minicase 2

Wal-Mart Leads RFID Adoption

In the first week of April 2004, Wal-Mart Stores Inc. (*walmart.com*) launched its first live test of RFID-tracing technology. Using one distribution center and seven stores, 21 products from participating vendors were in the pilot test.

In the supply chain pilot application, passive RFID chips with small antennae are attached to cases and pallets. When passed near an RFID "reader," the chip activates, and its unique product identifier code is transmitted back to an inventory control system. Cases and pallets containing the 21 products featuring RFID tags are delivered to the distribution center in Sanger, Texas, where RFID readers installed at the dock doors notify both shippers and Wal-Mart what products enter the Wal-Mart distribution center and where the products are stored. RFID readers are also installed in other places, such as conveyor belts, so that each marked case can be tracked. Readers used by Wal-Mart have an average range of 15 feet. (For more detail, see Chapter 5's discussion of how RFID works.)

Wal-Mart has set a January 2005 target for its top 100 suppliers to be placing RFID tags on cases and pallets destined for Wal-Mart stores, and believes that the implementation of this pilot scheme will pave the way for achieving this goal. The system is expected to improve flows along the supply chain, reduce theft, increase sales and reduce inventory costs (by eliminating both overstocking and understocking), and gain visibility and accuracy throughout Wal-Mart's supply chain.

While some of Wal-Mart's suppliers are late in implementing the system, it is clear that if the pilot is successful (and so far it is), RFID will become an industry standard. After all, nearly $70 billion is lost in the retail sector in the United States every year, due to products lost in the supply chain or being stored in wrong places.

The next step in Wal-Mart's pilot is to mark each individual item with a tag. This plan raises a possible privacy issue: What if the tags are not removed from the products? People fear that they will be tracked after leaving the store. Wal-Mart also can use RFIDs for many other applications. For example, it could attach tags to shoppers' children, so if they are lost in the megastore, they could be tracked in seconds.

Retailers such as Wal-Mart believe that the widespread implementation of RFID technology marks a revolutionary change in supply chain management, much as the introduction of barcodes was seen as revolutionary two decades ago.

Sources: Condensed from Landoline (2003), BusinessWeek Online (2004), and *FoodProductionDaily.com* (2004).

Questions for Minicase 2

1. Assuming the cost of RFID is low (less than $0.05 per item), what advantages can you see for tagging individual items in each store? Is it necessary to do it?
2. Find some information regarding the advantages of RFIDs over regular barcodes.
3. Is this an e-business application? Why, or why not? If yes, can you identify the business model used?
4. What are some of the business pressures that drive use of RFID in retailing?

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APPENDIX 1A

PORTER'S MODELS

Researcher Michael Porter has proposed two models that have become classic ways to study and explain basic business activities—the *competitive forces model* and the *value chain model*. We present an overview of these two models in this appendix, and will refer to these models throughout the book.

Porter's Competitive Forces Model and Strategies

The most well-known framework for analyzing competitiveness is Porter's **competitive forces model** (Porter, 1985). It has been used to develop strategies for companies to increase their competitive edge. It also demonstrates how IT can enhance the competitiveness of corporations.

The model recognizes five major forces that could endanger a company's position *in a given industry.* (Other forces, such as those cited in Chapter 1, including the impact of government, affect all companies in the industry and therefore may have less impact on the relative success of a company within its industry.) Although the details of the model differ from one industry to another, its general structure is universal.

The five major forces in an industry can be generalized as follows.

1. The threat of entry of new competitors
2. The bargaining power of suppliers
3. The bargaining power of customers (buyers)
4. The threat of substitute products or services
5. The rivalry among existing firms in the industry

The strength of each force is determined by factors related to the industry's structure, as shown in Figure 1A.1. Companies need to protect themselves against the forces, or they can use the forces to improve their position or to challenge the leaders in the industry.

Some have suggested semiradical changes in Porter's model. For example, Harmon et al. (2001) proposed adding a sixth force—bargaining power of employees—to the original five. Another major force is the Internet, which has changed the nature of doing business as well as the nature of competition in many industries.

Porter's model identifies the forces that influence competitive advantage in the marketplace. Of greater interest to most managers is the development of a *strategy* aimed at performing activities differently from a competitor. Porter (1985) proposed three such strategies—cost leadership, differentiation, and niche strategies. Other strategic-management authors have proposed additional strategies (e.g., see Neumann, 1994; Wiseman, 1988; and Frenzel, 1996).

In Table 1A.1 we cite 12 general strategies for competitive advantage. Each of these strategies (and some others) can be enhanced by IT, as will be shown throughout the book and especially in Chapter 12. Forthcoming chapters will show: (1) how different information technologies impact the five forces, and (2) how IT facilitates the 12 strategies.

Porter's Value Chain Model

According to Porter's **value chain model** (Porter, 1985), the activities conducted in any manufacturing organization can be divided into two parts: *primary activities and support activities.*

The **primary activities** are those business activities through which a company produces goods, thus creating value for which customers are willing to pay. Primary activities involve the purchase of materials, the processing of materials into products, and delivery of products to customers. Typically, there are five primary activities:

1. Inbound logistics (inputs)
2. Operations (manufacturing and testing)
3. Outbound logistics (storage and distribution)
4. Marketing and sales
5. Services

The primary activities usually take place in a sequence from 1 to 5. As work progresses according to the sequence, value is added to the product in each activity. To be more specific, the incoming materials (1) are processed (in receiving, storage, etc.) in activities called *inbound logistics*. Next, the materials are used in *operations* (2), where significant value is added by the process of turning raw materials into products. The products need to be prepared for

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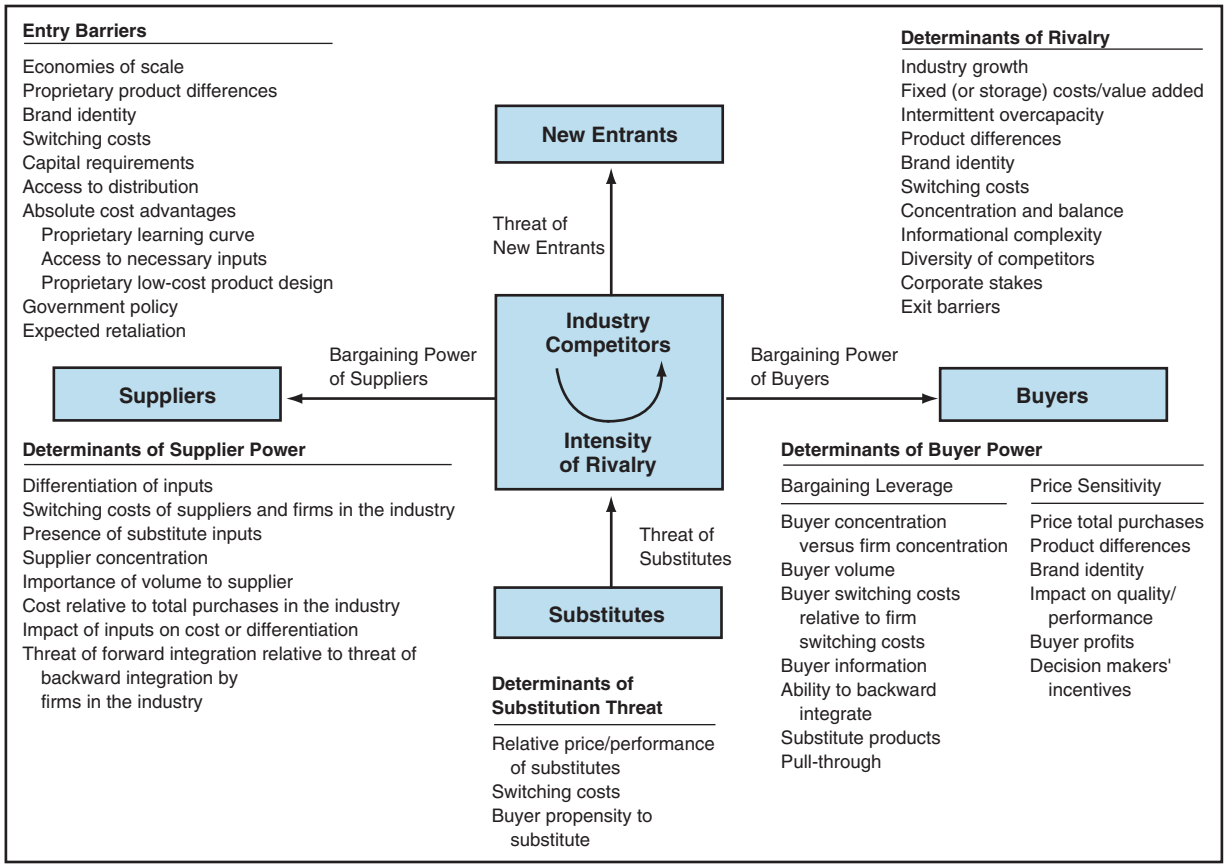

FIGURE 1A.1 Porter's five forces model, including the major determinant of each force. (*Source:* Adapted with permission of the Free Press, a division of Simon & Schuster, Inc., from Michael Porter, *Competitive Advantage: Creating and Sustaining Superior Performance*, p. 6. © 1985, 1998 by Michael Porter.)

TABLE 1A.1 Twelve Strategies for Competitive Advantage

Strategy	Description
Cost leadership	Produce product/service at the lowest cost in the industry.
Differentiation	Offer different products, services, or product features.
Niche	Select a narrow-scope segment (*market niche*) and be the best in quality, speed, or cost in that market.
Growth	Increase market share, acquire more customers, or sell more types of products.
Alliance	Work with business partners in partnerships, alliances, joint ventures, or virtual companies.
Innovation	Introduce new products/services; put new features in existing products/services; develop new ways to produce products/services.
Operational effectiveness	Improve the manner in which internal business processes are executed so that the firm performs similar activities better than rivals.
Customer-orientation	Concentrate on customer satisfaction.
Time	Treat time as a resource, then manage it and use it to the firm's advantage.
Entry-barriers	Create barriers to entry. By introducing innovative products or using IT to provide exceptional service, companies can create entry barriers to discourage new entrants.
Lock in customers or suppliers	Encourage customers or suppliers to stay with you rather than going to competitors. Locking in customers has the effect of reducing their bargaining power.
Increase switching costs	Discourage customers or suppliers from going to competitors for economic reasons.

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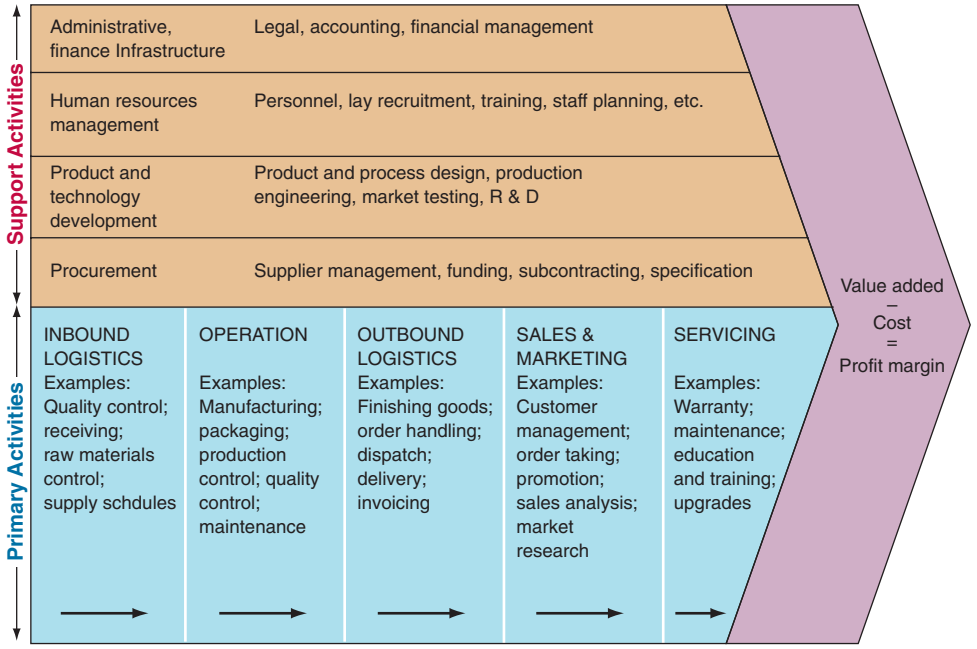

FIGURE 1A.2 The firm's value chain. The arrows illustrate the flow of goods and services (the internal part of the supply chain). (*Source:* Drawn by E. Turban.)

delivery (packaging, storing, and shipping) in the *outbound logistics* activities (3). Then *marketing and sales* (4) attempt to sell the products to customers, increasing product value by creating demand for the company's products. (The value of a sold item is much larger than that of an unsold one.) Finally, *after-sales service* (5) such as warranty service or upgrade notification is performed for the customer, further adding value. The goal of these value-adding, primary activities is to make a profit for the company.

Primary activities are sustained and furthered by the following **support activities:**

1. The firm's infrastructure (accounting, finance, management)
2. Human resources management
3. Technology development (R&D)
4. Procurement

Each support activity can be applied to any or all of the primary activities, and the support activities may also support each other (see Figure 1A.2). For an example of Porter's value chain model applied to the airline industry, see Online File W1.11.

A firm's value chain is part of a larger stream of activities, which Porter calls a value system. A **value system** (also called an *industry value chain*) includes the suppliers that provide the inputs necessary to the firm and their value chains. Once the firm creates products, these products pass through the value chains of distributors (which also have their own value chains), all the way to the buyers (customers). All parts of these chains are included in the value system. Gaining and sustaining a competitive advantage, and supporting that advantage by means of IT, requires an understanding of this entire value system.

In forthcoming chapters, we will show how different functional departments relate to Porter's value chain model and how IT impacts the addition of value (and hopefully profit) in companies. For in-depth discussion, see Chapter 12.

KEY TERMS FOR APPENDIX 1A

Competitive forces model *xx*
Primary activities *xx*
Support activities *xx*
Value chain model *xx*
Value system *xx*

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