CHAPTER **8**

THE IMPACT OF INFORMATION TECHNOLOGY ON PRODUCTIVITY AND QUALITY OF LIFE

VIGNETTE

Problems with the E-Rate Program

In March 2013, Democratic Senator John D. Rockefeller IV of West Virginia, chair of the Senate Commerce Committee, called for an expansion of the Education Rate (E-Rate) program, which provides money to connect schools and libraries to the Internet. The E-Rate program is overseen by the Federal Communications Commission (FCC) and is funded by fees charged to telecommunication companies. Those companies may, in turn, pass those charges along to their customers in the form of a "Universal Service" charge. The E-Rate program is administered by the Universal Service Administrative Company (USAC), a private nonprofit set up by the FCC. When the program started in 1996, only 14 percent of classrooms and 28 percent of public libraries in the United States were

connected to the Internet. Today, over 92 percent of classrooms and virtually 100 percent of public libraries have Internet access.[1,2] Rockefeller argued that the program should now be used to introduce high-speed, 1-gigabit Internet connections into every school in the United States.[3]

Rockefeller's proposal came just a year after a federal district court sentenced Gloria Harper, the owner of two information technology companies, to 30 months in prison for bribing school officials to win lucrative E-Rate contracts. Harper had offered kickbacks to employees of schools in Illinois, Arkansas, Florida, and Louisiana. In return, those employees helped ensure that contracts for IT services at those schools were awarded to Harper's companies. In addition to being sentenced to prison, Harper was fined $40 million. Xavier University Preparatory School in New Orleans and the Eagle School District in Arkansas were each denied E-Rate funding of $22,000 as a result of the scheme.[4,5] The scandal was not an isolated event. Gloria Harper is, in fact, one of 44 individuals or companies that have been convicted of E-Rate fraud since 2003.[6]

Following a yearlong investigation, a House subcommittee in 2005 approved a bipartisan staff report detailing abuse, fraud, and waste in the E-Rate program. In one infamous example, USAC disbursed $101 million between 1998 and 2001 to provide high-speed Internet access to over 1,500 schools in Puerto Rico, but a subsequent review found that very few computers were ever connected to the Internet. In fact, $23 million worth of equipment was found in unopened boxes in a warehouse. Eventually, the former Puerto Rican secretary of education was found guilty of fraud, sentenced to three years in prison, and fined $4 million.[7]

In November 2010, the U.S. Department of Justice settled two lawsuits for a total of $16.25 million against Hewlett-Packard (HP) in connection with the awarding of E-Rate technology and service contracts in the Dallas (DISD) and Houston Independent School Districts (HISD). The lawsuits alleged that between 2002 and 2005 contractors working with HP offered bribes in order to win very

profitable contracts that included some $17 million in HP equipment.[8] In 2006, HP banned the two resellers who were under investigation from selling its equipment. The two companies allegedly provided illegal inducements in the form of the use of a private yacht, sporting tickets, and other gifts to school district employees while the companies were bidding on the DISD and HISD E-Rate program contracts.[9]

In 2008, the former chief technology officer of DISD and the former chief executive officer of MSE were found guilty of bribery for illegal conduct relating to the DISD contract. They were each sentenced to over a decade in prison. In 2009, the DISD was fined $750,000 and agreed to drop its requests for more than $150 million in federal funding.[10] The HISD was fined $850,000.[11]

Just as the U.S. Department of Justice was handing down its ruling in the HP case, the General Accounting Office (GAO)—the investigative arm of Congress—released a report stating that the internal controls the FCC and USAC had established for the E-Rate program were lacking. These controls were set up to help the USAC make decisions about which institutions to fund, review payments made to the institutions, and audit the institutions to make sure they are complying with E-Rate rules. For instance, to qualify for E-Rate funds, applicants must go through a 39-step procedure. In addition, the USAC created a special team to review allegations of fraud that originate from the Whistleblower Hotline, law enforcement investigations, press reports, and the FCC Office of Inspector General audits. However, the E-Rate program continues to face challenges in ensuring that its participating institutions are complying with the various E-Rate rules designed to prevent fraud and waste. To review compliance to these rules, the USAC contracts with independent public accountants to conduct audits of E-Rate participants.[12] The USAC commissions between 100 and 150 audits per year.[13] However, USAC has no documented and approved policies for the audit procedure. More importantly, the GAO determined that USAC was not effectively using the information it gained from

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these audits. Of 64 program participants who were audited more than once over a three-year period, 36 had repeated the same rule violation. This may in part be a consequence of delays in the audit process. The GAO found that an average of 224 days passed between the submission of a draft audit and its final approval.[14]

The GAO recommended that the USAC conduct a detailed audit of its internal controls. As a result, USAC created a request for proposals and began the process of evaluating the proposals through a competitive bidding process.[15] However, by March 2013, when Senator Rockefeller proposed that the E-Rate program be expanded to offer higher-speed Internet to every school in the United States, USAC had yet to announce the awarding of a contract for the auditing of its internal controls.

Questions to Consider

1. What are the key points from this case that apply to anyone who is involved in competing for or awarding contracts for products or services?

2. Imagine you are a salesperson who will be awarded over $1 million in commissions if your firm is awarded a major contract. What ethical actions can you take to ensure that you and your firm are viewed favorably by the key decision maker in the deal?

3. What weaknesses exist in USAC's internal control procedures? Should these weaknesses prevent the government from expanding the program?

LEARNING OBJECTIVES

As you read this chapter, consider the following questions:

1. What impact has IT had on the standard of living and worker productivity?

2. What is being done to reduce the negative influence of the digital divide?

3. What impact can IT have on improving productivity by reducing costs and/or improving quality?

4. What ethical issues are raised because some entities can afford to make significant investments in IT while others cannot and thus are blocked in their efforts to raise productivity and quality?

Chapter 8

THE IMPACT OF IT ON THE STANDARD OF LIVING AND WORKER PRODUCTIVITY

The standard of living varies greatly among groups within a country as well as from nation to nation. The most widely used measurement of the material standard of living is gross domestic product (GDP) per capita. National GDP represents the total annual output of a nation's economy. Overall, industrialized nations tend to have a higher standard of living than developing countries.

In the United States, as in most developed countries, the standard of living has been improving over time. However, its rate of change varies as a result of business cycles that affect prices, wages, employment levels, and the production of goods and services. Major disasters—such as earthquakes, hurricanes, tsunamis, and war—can negatively impact the standard of living. The worst economic downturn in U.S. history occurred during the Great Depression, when the GDP declined by about 50 percent from 1929 to 1932; by 1932, the unemployment rate had reached 25 percent.[16] By way of comparison, during the latest recession in the United States (which began in 2007), the GDP growth rate declined by 6.8 percent during the fourth quarter of 2008[17] and the U.S. unemployment rate hit a peak of 10.2 percent in October 2009.[18]

IT Investment and Productivity

Productivity is defined as the amount of output produced per unit of input, and it is measured in many different ways. For example, productivity in a factory might be measured by the number of labor hours it takes to produce one item, while productivity in a service sector company might be measured by the annual revenue an employee generates divided by the employee's annual salary. Most countries have been able to produce more goods and services over time—not through a proportional increase in input but rather by making production more efficient. These gains in productivity have led to increases in the GDP-based standard of living because the average hour of labor produced more goods and services. The Bureau of Labor Statistics tracks U.S. productivity on a quarterly basis. In the United States, labor productivity growth has averaged about 2 percent per year for the past century, meaning that living standards have doubled about every 36 years.[19]

Figure 8-1 shows the annual change in U.S. nonfarm labor productivity since 1947. The increase in productivity averaged 2.8 percent per year from 1947 to 1973 as modern management techniques and automated technology made workers far more productive. Productivity dropped off in the mid-1970s, but rose again in the early years of the twenty-first century, only to drop dramatically from 2007 to 2012, a period of time corresponding to the deepest recession in the United States since the Great Depression.

Innovation is a key factor in productivity improvement, and IT has played an important role in enabling innovation. Progressive management teams use IT, as well as other new technology and capital investment, to implement innovations in products, processes, and services.

In the early days of IT in the 1960s, productivity improvements were easy to measure. For example, midsized companies often had a dozen or more accountants focused solely on payroll-related accounting. When businesses implemented automated payroll systems, fewer accounting employees were needed. The productivity gains from such IT investments were obvious.

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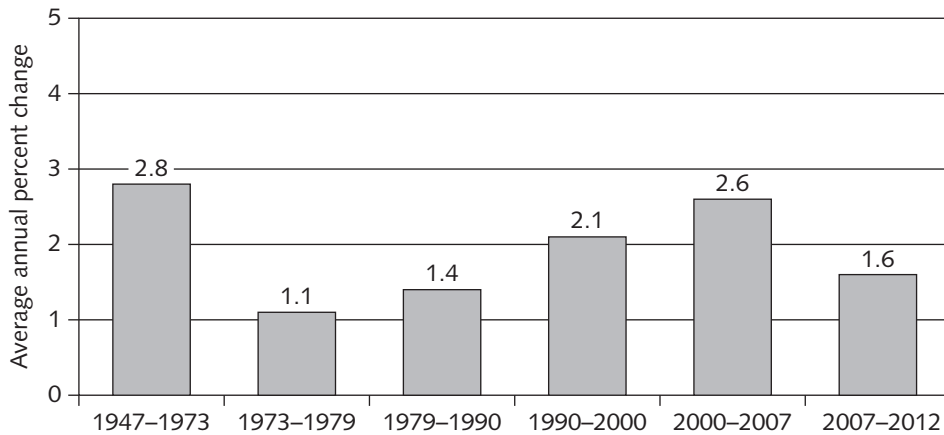
FIGURE 8-1   U.S. nonfarm labor productivity, 1947–2012

Source Line: U.S. Bureau of Labor Statistics, "Labor Productivity and Costs, 1947–2012," www.bls.gov/lpc/prodybar.htm.

Today, organizations are trying to further improve IT systems and business processes that have already gone through several rounds of improvement. Organizations are also adding new IT capabilities to help workers who already have an assortment of personal productivity applications on their desktop computers, laptops, and smartphones, such as the BlackBerry®, Droid®, and iPhone®. Instead of eliminating workers, IT enhancements are saving workers small amounts of time each day. Whether these saved minutes actually result in improved worker productivity is a matter for debate. Many analysts argue that workers merely use the extra time to do some small task they didn't have time to do before, such as respond to email they would have otherwise ignored. These minor gains make it harder to quantify the benefits of today's IT investments on worker productivity. The relationship between investment in information technology and U.S. productivity growth is more complex than you might think. Consider the following facts:

- The rate of productivity from 1990 to 2000 of 2.1 percent is only slightly higher than the long-term U.S. rate of 2 percent and not nearly as high as it was during the 26 years following World War II. So, although the increase in productivity was welcome, it is not statistically significant.
- Labor productivity in the United States increased despite a reduced level of investment in IT from 2000 to 2007. If there were a simple, direct relationship, the productivity rate should have decreased.[20]

One possible explanation for the previous points is that there is a lag time between the application of innovative IT solutions and the capture of significant productivity gains. IT can enhance productivity in fundamental ways by allowing firms to make radical changes in work processes, but such major changes can take years to complete because firms must make substantial complementary investments in retraining, reorganizing, changing reward systems, and the like. Furthermore, the effort to make such a conversion can divert resources from normal activities, which can actually reduce productivity—at least temporarily. For example, researchers examined data from 527 large U.S. firms from 1987 to 1994 and found that it can take five to seven years for IT investment to result in a significant increase in productivity.[21]

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Another explanation for the complex relationship between IT investment and U.S. productivity growth lies in the fact that many other factors influence worker productivity rates besides IT—the overall economic climate (expansion/contraction); the flexibility of the labor market; the actions taken by private industry, various government entities, and the financial sector; and changes in supply and demand.

Table 8-1 summarizes fundamental ways in which companies can try directly to increase productivity.

TABLE 8-1   Fundamental drivers for productivity performance

Reduce the amount of input required to produce a given output by:	Increase the value of the output produced by a given amount of input by:
Consolidating operations to better leverage economies of scale	Selling higher-value goods
Improving performance by becoming more efficient	Selling more goods to increase capacity and use of existing resources

Source Line: Course Technology/Cengage Learning.

The following list summarizes additional factors that can affect national productivity rates:

- Labor productivity growth rates differ according to where a country is in the business cycle—expansion or contraction. Times of expansion enable firms to gain full advantage of economies of scale and full production. Times of contraction present fewer investment opportunities.
- Outsourcing can skew productivity if the contracting firms have different productivity rates than the outsourcing firms.
- Regulations make it easier for companies in the United States to hire and fire workers and to start and end business activities compared with many other industrialized nations. This flexibility makes it easier for markets to relocate workers to more productive firms and sectors.
- More competitive markets for goods and services can provide greater incentives for technological innovation and adoption as firms strive to keep ahead of competitors.
- In today's service-based economy, it is difficult to measure the real output of such services as accounting, customer service, and consulting.
- IT investments don't always yield tangible results, such as cost savings and reduced head count; instead, many produce intangible benefits, such as improved quality, reliability, and service.

As you can see, it is difficult to quantify how much the use of IT has contributed to worker productivity. Ultimately, however, the issue is academic. There is no way to compare organizations that don't use IT with those that do, because there is no such thing as a noncomputerized airline, financial institution, manufacturer, or retailer. Businesspeople analyze the expected return on investment to choose which IT option to implement, but at this point, trying to measure its precise impact on worker productivity is like trying to measure the impact of telephones or electricity.

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Telework

Telework (also known as telecommuting) is a work arrangement in which an employee works away from the office—at home, at a client's office, in a hotel—literally, anywhere. In telework, an employee uses various forms of electronic communication, including texting, email, audio and videoconferencing, and online chat. Teleworkers access the Internet via smartphones, tablets, laptops, and similar devices to retrieve computer files; log on to software applications; access corporate databases; and communicate with fellow employees, managers, customers, and suppliers. The goal of telework is to allow employees to be effective and productive from wherever they are. According to the U.S. Bureau of Labor Statistics, 21 percent of employed Americans worked at least some hours at home each week during 2010.[22] Another study found that between 20 and 30 percent of Americans worked from home at least one day a week during 2011.[23]

Factors that have increased the prevalence of telework include advances in technology that enable people to communicate and access the Internet from almost anywhere, the increasing number of broadband connections in homes and retail locations, high levels of traffic congestion, rising gasoline prices, and growing concern over the effects of automobile CO_2 emissions. Another key factor is that increasingly scarce and highly trained workers frequently demand more flexible work arrangements, including flex hours and the ability to occasionally work from home.

A number of states and the federal government have passed laws to encourage telework. For example, Virginia set a goal in 2008 of having 20 percent of eligible state workers teleworking by 2010. The state met the goal and now has over 8,500 workers telecommuting out of 25,000 eligible employees (34 percent).[24] The Telework Improvement Act of 2010 makes all federal employees eligible to telework one day per week (unless their manager determines they are ineligible for telework). About 21 percent of eligible federal employees telework.[25]

However, not all organizations are fully supportive of telework. Several organizations, including Bank of America, Best Buy, and Yahoo!, have recently cut back their telework program for employees for a variety of reasons, including the need to cut costs, improve efficiency, and encourage greater collaboration among employees.[26,27,28]

Organizations should prepare guidelines and policies to define the types of positions and workers who represent ideal telework opportunities. Clear guidelines must be set for how and when work will be given to and collected from teleworkers. If there are certain hours during which the teleworker must be available, these too must be defined. Employee work expectations and performance criteria must also be delineated.

A Sensis® Consumer Report found that while the majority of teleworkers (62 percent) were positive about teleworking, nearly 25 percent felt teleworking had no real impact on their lives, and 13 percent of teleworkers reported a negative impact. The negative feelings were primarily because workers felt that teleworking had not really improved their productivity. In addition, many teleworkers felt that there was increased pressure to work outside the normal business hours so that they now worked longer hours, thus taking time away from their families.[29] Another recent study concluded that telework has led to an expansion of work hours beyond the standard workweek and has placed additional demands on salaried workers.[30]

Some positions—such as management positions or those in which face-to-face communication with other employees or customers is required—may not be well suited for telework. In addition, some individuals are not good candidates for teleworking.

Telework opportunities need to be weighed based on the characteristics of the individual as well as the requirements of the position. Table 8-2 and Table 8-3 list some of the advantages and disadvantages of telework from the perspectives of employees and organizations, respectively.

TABLE 8-2   Advantages/disadvantages of teleworking for employees

Advantages	Disadvantages
People with disabilities who otherwise find public transportation and office accommodations a barrier to work may now be able to join the workforce.	Some employees are unable to be productive workers away from the office.
Teleworkers avoid long, stressful commutes and gain time for additional work or personal activities.	Teleworkers may suffer from isolation and may not really feel "part of the team."
Telework can reduce the need for employees to take time off to stay home to care for a sick family member.	Workers who are out of sight also tend to be out of mind. The contributions of teleworkers may not be fully recognized and credited.
Teleworkers have an opportunity to experience an improved work/family balance.	Teleworkers must guard against working too many hours per day because work is always there.
Telework reduces ad hoc work requests and disruptions from fellow workers.	The cost of the necessary equipment and communication services can be considerable if the organization does not cover these.

Source Line: Course Technology/Cengage Learning.

TABLE 8-3   Advantages/disadvantages of teleworking for organizations

Advantages	Disadvantages
As more employees telework, there is less need for office and parking space; this can lead to lower costs.	Allowing teleworkers to access organizational data and systems from remote sites creates potential security issues.
Allowing employees to telework can improve morale and reduce turnover.	Informal, spontaneous meetings become more difficult if not impossible.
Telework allows for the continuity of business operations in the event of a local or national disaster and supports national pandemic-preparedness planning.	Managers may have a harder time monitoring the quality and quantity of the work performed by teleworkers, wondering, for instance, if they really "put in a full day."
The opportunity to telework can be seen as an additional perk that can help in recruiting.	Increased planning is required by managers to accommodate and include teleworkers.
There may be an actual gain in worker productivity.	There are additional costs associated with providing equipment, services, and support for people who work away from the office.
Telework can decrease an organization's carbon footprint by reducing daily commuting.	Telework increases the potential for lost or stolen equipment.

Source Line: Course Technology/Cengage Learning.

The Digital Divide

When people talk about standard of living, they are often referring to a level of material comfort measured by the goods, services, and luxuries available to a person, group, or nation—factors beyond the GDP-based measurement of standard of living. Some of these indicators include the following:

- Average number of calories consumed per person per day
- Availability of clean drinking water
- Average life expectancy
- Literacy rate
- Availability of basic freedoms
- Number of people per doctor
- Infant mortality rate
- Crime rate
- Rate of home ownership
- Availability of educational opportunities

Another indicator of standard of living is the availability of information and communications technology. The **digital divide** is a term used to describe the gulf between those who do and those who don't have access to modern information and communications technology, such as cell phones, smartphones, personal computers, and the Internet. There are roughly 2.4 billion Internet users worldwide, but the worldwide distribution of Internet users varies greatly from region to region.

The digital divide exists from country to country (see Table 8-4) and even within countries—among age groups, economic classes, and people who live in cities versus those in rural areas. For example, in India, while 20 percent of urban Indians are connected to the Internet, only 3 percent of rural Indians are connected.[31] In the United States, Hispanics and African Americans, adults living in poor households, and senior citizens are least likely to have Internet access.[32]

TABLE 8-4   High-low Internet penetration by country within region

Region	Country with the highest Internet penetration	% of population	Country with the lowest Internet penetration	% of population
Africa	Morocco	51%	Ethiopia	1%
Americas	Falkland Islands	96%	Belize	23%
Asia	South Korea	82%	Myanmar	1%
Europe	Monaco	100%	Kosovo	20%
Middle East	Qatar	86%	Iraq	7%
Oceania/Australia	Australia	89%	Papua New Guinea	2%

Source Line: Internet World Stats, www.internetworldstats.com/stats.htm.

Many people believe that the digital divide must be bridged for a number of reasons. Clearly, health, crime, and other emergencies could be resolved more quickly if a person

in trouble had easy access to a communications network. Access to IT and communications technology can also greatly enhance learning and provide a wealth of educational and economic opportunities as well as influence cultural, social, and political conditions. Much of the vital information people need to manage their career, retirement, health, and safety is increasingly provided by the Internet.

The E-Rate program discussed in the opening vignette was designed to help eliminate the digital divide within the United States. This program and others designed to increase the availability of low-cost computers, cell phones, and smartphones are discussed in the following sections.

E-Rate Program

The **Education Rate (E-Rate) program** was created through the Telecommunications Act of 1996. The full name of the program is The Schools and Libraries Program of the Universal Service Fund. E-Rate helps schools and libraries obtain broadband Internet services to advance the availability of educational and informational resources. The program provides cost discounts that range from 20 percent to 90 percent for eligible telecommunications services, depending on location (urban or rural) and economic need. (Economic need is determined by percentage of students eligible for participation in the National School Lunch Program.)

E-Rate reimburses telecommunications, Internet access, and internal connections providers for discounts on eligible services provided to schools and libraries. Schools and libraries must apply for the discounts, and the USAC works with the service providers to make sure that the discounts are passed along to program participants.

While the program has steadily increased the number of schools and libraries connected to the Internet, there have been problems with fraud, as detailed in the opening vignette. In addition, the benefits delivered by the program have been called into question. A University of Chicago study examined the impact of the E-Rate program in California and found that the number of students in poor schools going online had indeed increased dramatically. However, the study found no evidence that the program had any effect on students' performance on any of the six subjects (math, reading, science, language, spelling, and social studies) covered in the Stanford Achievement Test. Researchers concluded that either the schools did not know how to make effective use of the Internet or that Internet use was simply not a productive way to boost test scores.[33] Despite the fraud and lack of evidence of a positive impact on student test scores, the $2.3 billion per year E-Rate program continues today.

Low-Cost Computers

As noted above, it is estimated that as of June 2012, nearly 2.4 billion people worldwide have access to the Internet.[34] Although that number is impressive, it still leaves nearly 5 billion people (72 percent of the world's population) unconnected. What most of those 5 billion people have in common is low income. Increasing the availability of low-cost computers can help reduce the digital divide.

One Laptop per Child (OLPC)

The nonprofit organization **One Laptop per Child (OLPC)** has a goal of providing children around the world with low-cost laptop computers to aid in their education. As of 2013, the program has worked with federal, state, and local governments to help distribute over

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2.4 million low-cost computers to students in 40 countries.[35] The first version of its laptop, the OLPC XO, was made available to third-world countries in 2007 and came with a hand crank for generating power in places where electricity is not readily available. It was distributed at a cost of around $200. The current version of the OLPC is the XO-4 (see Figure 8-2), which was designed to require just 1 watt of electricity per hour and sell for $206, with a minimum purchase of 10,000 units. The machine comes with up to an 8 GB hard drive and 1.2 GHz processor.[36] The computer runs a Linux-based operating system and comes with a suite of 300 or so learning applications called Sugar. The computer can connect to the Internet via wireless or satellite communications.[37]

FIGURE 8-2   The OLPC XO-3 tablet computer
Credit: Courtesy of fuseproject.

Nepal is one of the poorest countries in the world, with an average annual per capita income of about $475 (USD)[38] and an unemployment rate of 46 percent.[39] Much of its rural population has limited access to even the most basic of social services. The OLPC program in Nepal started in 2008 as a small pilot project in two schools. Within three years, it expanded to 32 schools with a total enrollment of 3,300 students in grades 2 to 6. The goal of the program in Nepal is to improve the quality of education and the access to instructional materials. Some 180 teachers are learning how to integrate the technology into their teaching practices and developing curriculum-based computer educational activities. The OLPC program in Nepal has shown that technology-based education can be successfully introduced into rural schools using prepared local teachers already in the school system.[40]

Classmate+

In 2006, Intel introduced a low-cost laptop called the Classmate PC. The first generation of this notebook computer cost under $400 and was designed for use in kindergarten through high school classrooms in developing countries.[41] The computer began shipping in early

2007 to 25 countries, including Brazil, Chile, Nigeria, China, India, and Vietnam.[42] Since then, Intel and Lenovo have partnered to introduce the Classmate+ laptop, targeted for sale in bulk quantities to educational institutions and agencies in third-world countries. Some Classmate models are the traditional clamshell style, while others are convertible tablet-style machines. Intel does not actually build the machine but instead provides the basic design used by various manufacturers around the world. Over 4 million Classmate computers have been deployed globally.[43] The Classmate has a 10-inch screen, runs the Windows 7 or Linux operating system, comes with 1 or 2 GB of RAM, has a built-in camera, and has wireless capability. The laptop comes equipped with the Intel Learning Series Software Suite of educational software.[44]

Raspberry Pi

The Raspberry Pi is a small (about the size of a credit card), inexpensive ($25–$35) computer developed by the Raspberry Pi Foundation, a United Kingdom charity. This stripped-down computer comes with either 256 MB or 512 MB of RAM, a 700 MHz processor, one or two USB ports, and an Ethernet port—but no case and no monitor. The computer, which runs the Linux operating system, was designed to teach computer programming to young children, and as an alternative, low-cost desktop computer replacement for those willing to try new technology.[45,46] Although the price of the Pi certainly makes it attractive, it is not clear that this device has the necessary ruggedness, portability, and functionality to meet the educational computing needs of schoolchildren. The quantity of these computers to be manufactured remains to be seen.

Mobile Phone: The Tool to Bridge the Digital Divide?

Some industry observers identify the increasing use of cell phones as an important first step in bridging the digital divide in many countries. The rapid and widespread use of cell phones has resulted in an increased investment in the infrastructure required to support wireless communications. In addition, as cell phone use has spread, financial institutions and other organizations have built applications capable of accepting text-based input to process user transactions and store cash or credits on users' phones.

In almost all countries, many more people have access to cell phones than they do computers. Cell phones have several advantages over personal computers, including the following:

- Cell phones come in a wide range of capabilities and costs, but are cheaper than personal computers. Some users simply purchase a SIM card (essentially a memory chip that holds the owner's account information, including his or her phone number and contacts information), and then swap SIM cards in and out of a shared cell phone to lower the costs even further.
- Cell phones are more portable and convenient than the smallest laptop computer.
- Cell phones come with an extended battery life (much longer than any personal computer battery), which makes the cell phone more reliable in regions where access to electricity is inadequate or nonexistent.
- There is almost no learning curve required to master the use of a cell phone.
- Basic cell phones require no costly or burdensome applications that must be loaded and updated.
- There are essentially no technical-support challenges to overcome when using a cell phone.

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For many people who can afford it, the next step in bridging the digital divide is the acquisition of a smartphone—complete with an operating system capable of running applications and providing access to the Internet. As the cost of the technology and monthly usage fees decrease, even more people will be able to make this upgrade, and when they do, they will gain access to thousands of applications and Web sites that they can use for business, educational, and personal purposes.

When IT is available to everyone—regardless of economic status, geographic location, language, or social status—it can enhance the sharing of ideas, culture, and knowledge. How much will the benefits of IT raise the standard of living in underdeveloped countries? Could the end of the digital divide change the way people think about themselves in relation to the rest of the world? Could such enlightenment, coupled with a better standard of living, contribute to a reduction in violence, poverty, poor health, and even terrorism?

THE IMPACT OF IT ON HEALTHCARE COSTS

The rapidly rising cost of health care is one of the twenty-first century's major challenges. U.S. healthcare spending hit an estimated $2.7 trillion in 2011 and is expected to increase an average of 6.3 percent per year (a rate much higher than overall inflation) between 2015 and 2021, according to the Centers for Medicare and Medicaid Services.[47] Much of this growth is due to the continued aging of the population in the United States and the rise in healthcare expenditures per person. The development and use of new medical technology, such as new diagnostic procedures and treatments (see Figure 8-3), account for much of the increase in healthcare spending per person in excess of general inflation.[48,49,50] Although many new diagnostic procedures and treatments are at least moderately more effective than their older counterparts, they are also more costly. In addition, even if new procedures and treatments cost less (for example, magnetic resonance imaging), they may stimulate much higher rates of use because they are more effective or cause less discomfort to patients.

Patients sometimes overuse medical resources that appear to be free or almost free thanks to the share of medical bills that is paid by third parties, such as insurance companies and government programs. A patient who doesn't have to pay for a medical test or procedure is probably less likely to consider its cost-to-benefit ratio. Attempts by insurance companies to rein in those costs have led to a blizzard of paperwork but have proven largely ineffective.

To really gain control over soaring healthcare costs, patient awareness must be raised and technology costs must be managed more carefully. In the meantime, however, the improved use of IT in the healthcare industry can lead to significant cost reductions in a number of ways.

Electronic Health Records

Although the healthcare industry depends on highly sophisticated technology for diagnostics and treatment, it was slow to implement IT solutions to improve productivity and efficiency. As of 2005, the healthcare industry only invested about $3,000 in IT for each worker, compared with about $7,000 per worker in private industry generally, and nearly $15,000 per worker in the banking industry. However, the healthcare industry has now greatly increased its investment in IT— spending over $88 billion in 2010 alone to

FIGURE 8-3   The development and use of new technology has contributed to increased healthcare spending

Credit: © Farferros/Shutterstock.com

implement electronic health records (EHRs), convert to a new coding system (known as ICD-10) for diagnosis and inpatient codes, and begin use of a new Food and Drug Administration Web portal to report deaths and injuries caused by medical devices.[51]

Using IT to capture and record patient data provides a significant opportunity for improving health care and increasing productivity. Before seeing a physician, many patients are given a clipboard and pen with a standard form to complete. Some people must wonder: "This is the same form I filled out last time; what did they do with the data from my last visit?"

It can be extremely difficult to pull together the paper trail created by a patient's interactions with various healthcare entities to create a clear, meaningful, consolidated view of that person's health history. In some cases, medical personnel are simply unable to locate paper medical records. This lack of patient data transparency can result in diagnostic and medication errors as well as the ordering of duplicate tests, which dramatically increase healthcare costs. It can even compromise patient safety. For example, emergency room physicians must often treat patients who are unconscious and incapable of providing essential medical information, such as the name of his or her primary care physician, information about recent illnesses or surgeries, medications taken, allergies, and other useful data. Without such data, an emergency room physician is essentially taking a gamble in treating that patient. If the United States had a comprehensive healthcare information network, such medical data could be readily available for all patients at any medical facility. Some studies have estimated that over 98,000 people die in hospitals each

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year due to preventable medical mistakes.[52] As far back as 2004, healthcare experts agreed that "going digital" could eliminate many of these needless deaths.

An **electronic health record (EHR)** is a computer-readable record of health-related information on an individual. An EHR can include patient demographics, medical history, family history, immunization records, laboratory data, health problems, progress notes, medications, vital signs, and radiology reports. Healthcare professionals can use an EHR to generate a complete electronic record of a clinical patient encounter. Data in an EHR can then be easily accessed by other healthcare professionals. See Figure 8-4.

FIGURE 8-4   An EHR is a computer-readable record of health-related information on an individual
Credit: Courtesy of U.S. Department of Veterans Affairs.

The **Health Information Technology for Economic and Clinical Health Act (HITECH Act)** was passed as part of the $787 billion 2009 American Recovery and Reinvestment Act economic stimulus plan. HITECH is intended to increase the use of health information technology by (1) requiring the government to develop standards for the nationwide electronic exchange and use of health information; (2) providing $20 billion in incentives to encourage doctors and hospitals to use EHR to electronically exchange patient healthcare data; (3) saving the government $10 billion through improvements in the quality of care, care coordination, reductions in medical errors, and duplicate care; and (4) strengthening the protection of identifiable health information. Under this act, increased Medicaid or Medicare reimbursements will be made to doctors and hospitals that demonstrate "meaningful use" of EHR technology. Meaningful use is defined as EHR technology that enables a hospital to prescribe electronically, exchange data with other providers, and generate certain "clinical quality measure" reports.[53]

The PricewaterhouseCoopers LLP Health Research Institute estimated that a 500-bed hospital could receive $6.1 million in HITECH incentives to purchase, deploy, and

maintain an EHR system. On the other hand, failure to implement such a system by 2015 could cause the hospital to lose $3.2 million in funding annually, depending on the hospital's volume of Medicare, Medicaid, and charity-care patients. Adoption of basic EHR systems—which include a set of basic EHR functions, including clinician notes—at nonfederal acute-care hospitals has increased nearly fivefold from 2008 to 2012. The percentage of hospitals in possession of a certified EHR system is also rising. A certified EHR is EHR technology that has been certified as meeting federal requirements for some or all of hospital objectives for meaningful use. See Figure 8-5.[54]
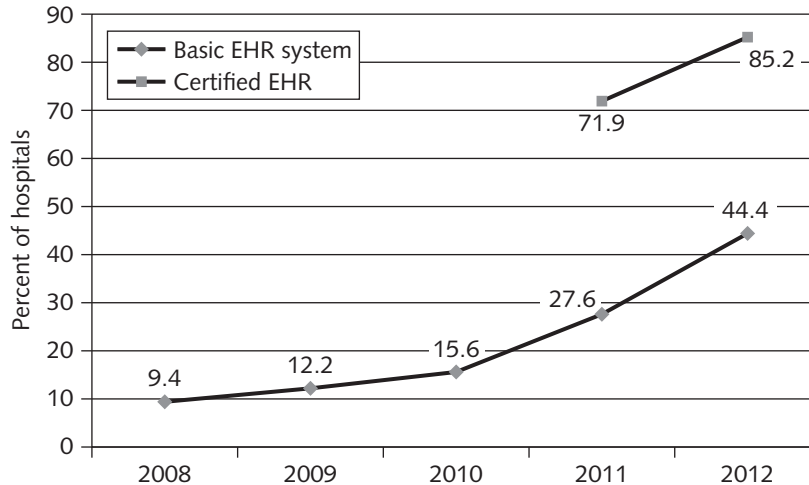
FIGURE 8-5   Percent of nonfederal acute-care hospitals with adoption of at least a basic EHR system and those in possession of a certified EHR

Source Line: Dustin Charles, MPH; Jennifer King, PhD; Vaishali Patel, PhD; Michael F. Furukawa, PhD, "Adoption of Electronic Health Record Systems among U.S. Non-Federal Acute Care Hospitals: 2008-2012," ONC Data Brief No. 9.

Individual physicians are eligible to receive as much as $44,000 under Medicare and $63,750 under Medicaid for the implementation and meaningful use of EHR systems. To meet the meaningful use requirement, physicians must be able to demonstrate that they are using certified EHR technology in ways that lead to significant and measurable results in achieving health and efficiency improvements, such as e-prescribing of medications and treatments, electronic exchange of health information, and electronic submission of clinical quality data.[55]

HITECH also attempts to improve federal privacy and security measures safeguarding health information. It requires that individuals be notified if there is any unauthorized use of their health information, allows patients to request an audit trail showing all disclosures of their health information via electronic means, requires health providers to gain authorization from patients to use their health information for marketing and fund-raising activities, and increases penalties for violations and provides greater resources for enforcement and oversight activities.[56]

In 2005, RAND Corporation predicted that if the American healthcare system broadly adopted the use of EHR systems, healthcare costs would decline by over $81 billion per year and the quality of health care would rise.[57] This prediction stimulated a major increase in investment in EHR and stimulated the federal government to award billions

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of dollars through the HITECH program as an incentive for physicians and hospitals to implement such systems.

With the benefit of 20/20 hindsight, the RAND forecasts have proven to be overly optimistic. There is little evidence of any savings—with overall healthcare costs actually increasing $800 billion since the 2005 report. As far as improving the quality of health care, there is also a lack of solid evidence. A second study published by the RAND Corporation in late 2010, involving half the acute-care hospitals in the United States, found that except for basic systems used to treat congestive heart failure patients, EHRs are not improving process of care measures for many large hospitals.[58] Another opinion on the value of EHR comes from David Kibbe, a physician and technology advisor to the American Academy of Family Physicians, who wrote that "electronic records are notoriously expensive and difficult to implement." He went on to note that we still do not have conclusive evidence that the use of EHRs improves the quality of patient care.[59]

EHR skeptics point out that the rate of adoption of EHR systems has been slower than expected, and that the systems are often difficult to use. Critics also point out that most EHR systems do not allow care providers to share patient information across different vendors' systems. Some critics believe that the use of EHR may actually have contributed to increased healthcare costs by making it easier to bill for patient services.[60] On the other hand, some physicians believe that the data collected by the government through EHR reporting will be used to justify a decrease in their Medicare and Medicaid reimbursements.[61]

The cost to implement EHR systems is a concern for both large and small medical providers. A typical three-physician practice would need to spend between $173,000 and $296,000 to purchase and maintain an EHR system, while a larger medical institution could easily spend millions of dollars to fully implement an EHR system.[62] For example, Wake Forest Baptist Medical Center, an academic medical center with 1,004 acute-care and rehabilitation beds, and over 13,000 employees, has been in the process of implementing an EHR system for years and recently reported $13.3 million in expenses related directly to those efforts.[63] It also reported an additional $8 million in implementation expenses, due in part to the handling of fewer operating-room cases because surgeons had to spend time learning the new system.[64]

One cannot help but wonder where we will be in 10 years in terms of healthcare spending. Will we have made a meaningful reduction in the number of avoidable deaths? Will we have earned a worthwhile return on the investment in EHR? Are those who are advocating the adoption of EHR acting ethically or are they pushing some other agenda?

Use of Mobile and Wireless Technology in the Healthcare Industry

Although slow to invest in IT, the healthcare industry was actually a leader in adopting mobile and wireless technology, perhaps because of the frequent urgency of communications with doctors and nurses, who are almost always on the move. For example, doctors were among the first large groups to start using personal digital assistants

(PDAs) on the job. Other common uses of wireless technology in the healthcare field include the following:

- Providing a means to access and update EHRs at patients' bedsides to ensure accurate and current patient data
- Enabling nurses to scan bar codes on patient wristbands and on medications to help them administer the right drug in the proper dosage at the correct time of day (an attached computer on a nearby cart is linked via a wireless network to a database containing physician medication orders)
- Using wireless devices to communicate with healthcare employees wherever they may be

Telehealth

Telehealth employs electronic information processing and telecommunications to support at-a-distance health care, provide professional and patient health-related training, and support healthcare administration. The Internet, broadband and wireless technologies, laptop and tablet computers, videoconferencing, streaming media, and store-and-forward, high-resolution imaging are technologies frequently used to support telehealth.

Thousands of mobile applications are available to improve patient access to healthcare information and to enable doctors to keep a close watch on patients' conditions. Appointment and prescription reminders, medication and vital sign tracking, and diet and weight monitoring are common applications based on the sending of text messages to the patient, the healthcare professional, or a monitoring computer. For example, one iPhone app can measure your blood pressure and heart rate, timestamp and record the readings, and then email the data to a physician.[65]

There are potential issues with the use of mobile applications, however. The Joint Commission on Accreditation of Healthcare Organizations has stated that it is not acceptable for medical professionals to communicate with patients via SMS text messages. HIPAA regulations could be violated if sensitive patient information is sent via standard text messages. This ruling is driving developers of mobile apps to move away from the use of SMS text messages to a more secure communications method.[66]

Telemedicine is the component of telehealth that provides medical care to people at a location different from the healthcare providers. This technology reduces the need for patients to travel for treatment and allows healthcare professionals to serve more patients in a broader geographic area. There are three basic forms of telemedicine: store-and-forward, live telemedicine, and remote monitoring.

Store-and-forward telemedicine involves acquiring data, sound, images, and video from a patient and then transmitting everything to a medical specialist for later evaluation (see Figure 8-6). This type of monitoring does not require the presence of the patient and care provider at the same time. Yet, having access to such information can enable healthcare professionals to recognize problems and intervene with remote patients before high-risk situations become life threatening.

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FIGURE 8-6 Teleradiology involves the transfer of CT scans, MRIs, X-rays, and other forms of medical imaging—such as to an imaging center for review by a radiologist

Credit: © iStockphoto.com/WILLSIE.

In one example, the life of a 16-year-old Venezuelan boy was saved by the use of store-and-forward telemedicine. He was admitted to a rural clinic in Venezuela with severe abdominal pain and a large abdominal mass. The local physician examined the boy and sent his findings via the Internet to a specialty physician hundreds of miles away. The specialist recognized a potential deadly condition and requested emergency surgery be performed immediately.[67]

Live telemedicine requires the presence of patients and healthcare providers at different sites at the same time and often involves a videoconference link between the two sites. For example, work on an oil rig can be extremely dangerous and the nearest hospital is often hundreds of miles away. Oil companies are increasingly relying on live telemedicine to connect a nurse or EMT on an oil platform to emergency physicians at a major medical center.

Remote monitoring (also called home monitoring) involves the regular, ongoing measurement of an individual's vital signs (temperature, blood pressure, heart rate, and breathing rate) and other health measures (e.g., glucose levels for a diabetic) and the transmission of this data to a healthcare provider. Patients who have chronic diseases often don't recognize early warning signs that indicate an impending health crisis. For example, a sudden weight gain by a patient who has suffered congestive heart failure could indicate retention of fluids, which could lead to a traumatic trip to the emergency room or even loss of life. While the patient might not be aware of the potential danger, a physician using telemedicine to keep tabs on such a patient could be alerted to this potentially life-threatening development before a health crisis occurs. It is estimated that 2.8 million people worldwide used some form of home monitoring device in 2012.[68]

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The use of telemedicine does raise some new legal and ethical questions, including the following:

- Must the physicians providing advice to patients at a remote location be licensed to perform medicine in that location—perhaps a different state or country?
- Must a healthcare system be required to possess a license from a state in which it has a "virtual" facility, such as a videoconferencing room?
- Will the various states require some form of assurance that minimum technological standards (such as the minimum resolution of network-transmitted images) are being met?
- What sort of system certification and verification is necessary to ensure that a critical system performs as expected in crisis situations, and what are the ramifications if it does not?

In addition, recent studies have shown that there is reluctance on the part of many doctors and nurses for remote doctors to have anything more than minimal involvement with their patients. There is concern that patient involvement with remote doctors may have a negative effect on the local doctors' relationships with their patients and could adversely affect patient care.[69]

Medical Information Web Sites for Laypeople

Healthy people as well as those who suffer from illness need reliable information on a wide range of medical topics to learn more about healthcare services and to take more responsibility for their health. Clearly, laypeople cannot become as informed as trained medical practitioners, but a tremendous amount of healthcare information is available via the Web. These sites have a critical responsibility to publish current, reliable, and objective information. Table 8-5 provides just a small sample of Web sites that offer information on a variety of medical-related topics.

The contents of a medical information Web site, such as text, graphics, and images, are for informational purposes only. These Web sites are not intended to be substitutes for professional medical advice, diagnosis, or treatment. Individuals should always seek the advice of a physician or other qualified healthcare provider with any questions regarding a medical condition. A patient should never disregard professional medical advice or delay seeking it because of something he or she reads on a medical information Web site.

In addition to publicly available information on the Web, many healthcare providers, employers, and medical insurers offer useful online tools that go beyond basic health information. These tools enable patients to go online and compare the quality, safety, and cost information on hospitals nationwide. You can also find risk indicators for specific health treatment options and nationwide average prices of drugs and treatment options. In addition, the coverage and costs for treatments by in-network and out-of-network healthcare providers can be found on many of these Web sites.

For example, an individual who needs a hip replacement can go online and find information about the surgery; other available treatment options; a list of questions to ask the physician; potential risks; nearby hospitals that perform the surgery; and quality-of-service information about the hospitals, such as the number of reported postoperative infections and other complications.

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TABLE 8-5 Health information Web sites

URL	Site
www.americanheart.org	American Heart Association
www.cancer.org	American Cancer Society
www.cdc.gov	Centers for Disease Control and Prevention
www.diabetes.org	American Diabetes Association
www.healthcentral.com	A collection of Web sites that includes news and videos on health topics
www.heartburn.about.com	Information on the causes of heartburn and how to prevent it
www.heartdisease.about.com	Basic information about heart disease and cardiology
www.medicinenet.com	Source for medical information on a variety of topics, including symptoms, procedures, tests, and medications, as well as a medical dictionary
www.mentalhelp.net	A site that promotes mental health and wellness plus education
www.nia.nih.gov/Alzheimers	National Institute on Aging—Alzheimer's Disease Education and Referral Center
www.niddk.nih.gov	National Institute of Diabetes and Digestive and Kidney Diseases
www.oncolink.org	Abramson Cancer Center of the University of Pennsylvania
www.osteo.org	National Institutes of Health—Osteoporosis and Related Bone Diseases National Resource Center
www.urologyhealth.org	Information about urologic conditions, including erectile dysfunction, HIV, AIDS, kidney stones, and STDs
www.webmd.com	Access to medical reference material and online professional publications

Source Line: Course Technology/Cengage Learning.

Summary

- The most widely used measurement of the material standard of living is gross domestic product (GDP) per capita.

- In the United States, as in most developed nations, the standard of living has been improving over time. However, its rate of change varies as a result of business cycles that affect prices, wages, employment levels, and the production of goods and services.

- Productivity is defined as the amount of output produced per unit of input.

- Most countries have been able to produce more goods and services over time—not through a proportional increase in input but by making production more efficient. These gains in productivity have led to increases in the GDP-based standard of living because the average hour of labor produced more goods and services.

- Progressive management teams use IT, other new technology, and capital investment to implement innovations in products, processes, and services.

- It can be difficult to quantify the benefits of IT investments on worker productivity because there can be a considerable lag between the application of innovative IT solutions and the capture of significant productivity gains. In addition, many factors other than IT influence worker productivity rates.

- Telework (also known as telecommuting) is a work arrangement in which an employee works away from the office—at home, at a client's office, in a hotel—literally, anywhere.

- Many organizations offer telework opportunities to their employees as a means of reducing costs, improving morale, reducing turnover, increasing productivity, reducing the organization's carbon footprint, and allowing for the continuity of business operations.

- Telework opportunities provide many advantages for employees, such as avoiding long, stressful commutes, providing more flexibility to balance the needs of work and family life, and enabling people with disabilities to be productive members of the workforce.

- The *digital divide* is a term used to describe the gulf between those who do and those who don't have access to modern information and technology, such as smartphones, personal computers, and the Internet.

- The digital divide exists not only between more and less developed countries but also within countries—among age groups, economic classes, and people who live in cities versus those in rural areas.

- The Education Rate (E-Rate) program was created through the Telecommunications Act of 1996. The E-Rate program helps schools and libraries obtain broadband Internet services to advance the availability of educational and informational resources.

- One Laptop per Child is a nonprofit organization whose goal is to provide children around the world with low-cost laptop computers to aid in their education. Intel and the Raspberry Pi Foundation also provide low-cost computers for educational purposes.

- Many people think that it will be the cell phone and the smartphone—and not the computer—that will ultimately bridge the digital divide.

- Healthcare costs are soaring and are expected to increase an average of 6.3 percent per year from 2015 to 2021.

- To gain control over healthcare costs, patients will need to gain a much greater awareness of medical costs, and new technology costs will need to be managed more carefully.
- Improved use of IT in the healthcare industry can lead to significantly reduced costs in a number of ways: Electronic health records (EHRs) of patient information can be generated from each patient visit in every healthcare setting; wireless technology can be used to access and update EHRs at patients' bedsides, match bar-coded patient wristbands and medication packages to physician orders, and communicate with healthcare employees wherever they may be.
- Skeptics question the ability of EHR to lower healthcare costs and improve the quality of care.
- Telehealth employs modern telecommunications and information technologies to provide medical care to people who live or work far away from healthcare providers, provide professional and patient health-related training, and support healthcare administration. It reduces the need for patients to travel for treatment and allows healthcare professionals to serve more patients in a broader geographic area.
- Web-based health information can help people inform themselves about medical topics.

Key Terms

digital divide

Education Rate (E-Rate) program

electronic health record (EHR)

Health Information Technology for Economic and Clinical Health Act (HITECH Act)

live telemedicine

One Laptop per Child (OLPC)

productivity

remote monitoring

store-and-forward telemedicine

telehealth

telemedicine

telework

Self-Assessment Questions

The answers to the Self-Assessment Questions can be found in Appendix B.

1. Which of the following statements about the standard of living is *no*t true?
   a. It is frequently measured using the gross domestic product per capita.
   b. It varies little among groups within the same country.
   c. Industrialized nations generally have a higher standard of living than developing countries.
   d. It varies greatly from nation to nation.

2. _____ is the amount of output produced per unit of input.

3. The period of time with the highest level of nonfarm productivity in the United States is _____.
   a. 1947–1973
   b. 1973–1979
   c. 2000–2007
   d. 2007–2012

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4. A study of 527 large U.S. firms from 1987 to 1994 found that the benefits of applying IT grow over time and that an IT investment can take:

   a. one to three years to break even.

   b. three to five years for its users to become efficient in its use.

   c. over seven years to fully recover the initial investment costs.

   d. five to seven years to result in a substantial increase in productivity.

5. _____ is a term used to describe the gulf between those who do and those who don't have access to modern information and communications technology, such as cell phones, smartphones, personal computers, and the Internet.

6. It is estimated that during 2011, roughly _____ of employed Americans worked at least one day per week from home.

   a. 0% to 10%

   b. 10% to 20%

   c. 20% to 30%

   d. 30% to 40%

7. The group(s) of people living in the United States that is least likely to have Internet access is/are _____.

   a. Hispanics and African Americans

   b. urban dwellers

   c. residents of the Northeast

   d. Asians

8. North America has a greater Internet penetration rate than Asia. True or False?

9. The _____ program was designed to eliminate the digital divide in the United States by helping schools and libraries obtain high-speed Internet connections.

10. Which of the following statements about healthcare spending is *not* true?

    a. U.S. spending on health care in 2011 was about $2.7 trillion.

    b. The development and use of new medical technology in the United States has clearly led to a reduction in healthcare costs.

    c. Much of the growth in healthcare costs is due to the continued aging of the population in the United States.

    d. U.S. spending on health care is expected to increase an average of 6.3 percent from 2015 until 2021.

11. Some studies have estimated that at least 98,000 people die in hospitals each year due to preventable mistakes. True or False?

12. A(n) _____ is a summary of health information generated by each patient encounter in any healthcare delivery setting.

13. Under the Health Information Technology for Economic and Clinical Health Act, increased Medicaid or Medicare reimbursements will be made to doctors and hospitals that demon-strate _____ of EHR technology.

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Discussion Questions

1. Discuss how the average annual percent change in nonfarm productivity has varied over the past 65 years.

2. Briefly discuss the correlation between IT investment and U.S. productivity growth.

3. Why is it harder to quantify the benefits of today's IT investments than it was in the 1960s?

4. Define the term telework. What technologies are essential for effective telework?

5. Would you accept a telework position in which you would work from home three or four days per week? Why or why not?

6. What is the digital divide? Where does it exist? Why is it important to bridge the digital divide?

7. What is your opinion of the effectiveness of the E-Rate program? What facts back up your opinion?

8. Which tool do you believe can be most effective in bridging the digital divide—the personal computer or the smartphone? Why?

9. The development and use of new medical technology has increased healthcare spending. Should the medical industry place more emphasis on using older medical technologies and containing medical costs? Which approach to dealing with moral issues discussed in Chapter 1 would you use to analyze this question? What decision did you come to as a result of your analysis?

10. The value of EHRs is being challenged by many in the healthcare industry. Why is this? In your opinion, is the investment in EHRs worth it? Why or why not?

11. Medical information that you obtain from Web sites must be accurate and reliable. Identify three characteristics of a credible Web site.

What Would You Do?

Use the five-step decision-making process discussed in Chapter 1 to analyze the following situations and recommend a course of action.

1. It is the year 2028, and robots are being introduced to handle the screening of patients at physicians' offices in the United States. The robots look human and are able to speak and understand English and Spanish. The robots are capable of performing basic nursing tasks such as taking a patient's vital signs. Upon arriving at a physician's office, a patient would meet with the robot to determine the patient's current conditions and symptoms and to review pertinent medical history from the patient's EHR. The robot would then form a preliminary diagnosis and suggest a course of action, which could include additional tests, medication, referral to a specialist, or hospitalization. A human physician would then review the preliminary diagnosis and suggested course of action. If necessary, the physician would meet with the patient to confirm the robot's diagnosis and order any additional work or medications that might be necessary. The robotic physician assistant can be made available 24×7 and can even be stationed at convenient locations such as shopping malls, schools, and college campuses. The goal of using robotic physician

assistants is to increase the number of patients that could be seen by a single physician while also cutting patient wait time.

You are on the administrative staff of a large physician group that is among the first to introduce robotic physician assistants. What would you do to make the use of a robotic physician assistant more acceptable to patients and to ensure patient care does not suffer?

2. You have been diagnosed with a rare bone marrow disorder that affects only 2 people out of 1 million. The disease is potentially life threatening, but your symptoms are currently only mild and do not yet present a major concern. Your physician recommends that you go to the Mayo Clinic in Rochester, Minnesota, for further diagnosis and possible treatment. As you do some research on the Internet, you find a support group for those afflicted by this rare disease. You are alarmed to hear that the disease can cause a very rapid decrease in the quality of one's life, with many victims confined to a wheelchair or bed and in great discomfort for the last months of their life. When you meet with specialists at the Mayo Clinic, they provide a much more optimistic outlook and claim that medical breakthroughs in treating the disease have been made. You do not know what to believe. You wonder about reaching out to the support group to get further information or to convey what doctors have told you. What would you do?

3. You are in your local computer store and see a "low-cost" laptop selling for just $299. There is a note on the price tag stating that $50 of the purchase price will be used to subsidize the cost of this computer to students in developing countries. How do you feel about paying an extra $50 for this purpose? Would you attempt to negotiate a lower price? Would you be willing to pay the additional $50?

4. You are a midlevel manager at a major metropolitan hospital and are responsible for capturing and reporting statistics regarding the cost and quality of patient care. You believe in a strict interpretation when defining various reportable incidents; as a result, your hospital's rating on a number of quality issues has declined in the six months you have held the position. Your predecessor was more lenient and was inclined to let minor incidents go unreported or to classify some serious incidents as less serious. The quarterly quality meeting is next week, and you know that your reporting will be challenged by the chief of staff and other members of the quality review board. How should you prepare for this meeting? Should you defend your strict reporting procedures or revert to the former reporting process for the "sake of consistency in the numbers," as several people have urged?

5. As a second-year teacher at a low-rated inner-city elementary school, you have been asked to form and lead a three-person committee to define and obtain funding for an E-Rate program for your school. Do some research on the Internet and outline a process you would follow to request funding.

6. You are a recent college graduate and an employee of a high-tech firm located in Silicon Valley. In a highly unusual move, your company's Human Resources Department is conducting a series of focus groups to get employee input on a number of issues, including telework. You have been invited to attend one of the focus group sessions and have been asked to be prepared to discuss your feelings on the firm's current telework policy. The current policy is that telework is not approved for employees unless they will be out of the

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office for an extended period of time due to illness. You will be given two minutes to express your opinion. What would you say?

7. You are an elected official in a small, third-world country's house of parliament, which is responsible for initiating revenue spending bills. Your country is very poor; unemployment is high; most families cannot afford a healthy diet; there is an insufficient amount of doctors and healthcare services; and there is an inadequate infrastructure for water, telephone, and power. Recently, senior executives from technology firms have approached you and lobbied you strongly to support increased spending on information technology infrastructure, including the placement of 1 million low-cost computers in your nation's schools. They make a strong case that the computers will increase the educational opportunities for your nation's children. They are willing to subsidize one-half of the estimated $1 billion (USD) required to implement this program successfully. While their idea provides hope for a better life for the children, your country has many needs. How would you proceed to evaluate this opportunity and weigh its costs against your country's other needs?

8. You have volunteered to lead a group of citizens in approaching the board of directors of the nearest hospital (55 miles away) about establishing remote monitoring of 50 or so chronically ill people in your small community. What sort of facts do you need to gather to make a sound recommendation to the board? What are some specific items that you would request?

9. You have been offered a position as a software support analyst. If you accept, you will have three weeks of on-site training, after which you will work from your home full-time, answering customer service calls. What questions would you want answered before you decide whether or not to take this position?

Cases

1. Is the Tide Turning on Telework?

Tech companies in Silicon Valley are often noted for their generous employee benefits, such as providing free meals for workers, allowing dog owners to bring their pets to work, and offering flexible working hours, including support for telework from home. The goal of these policies is to encourage workers to put in longer hours at work or to work more productively. Thus, it came as a surprise when Marissa Mayer, newly appointed CEO of Yahoo!, directed her human resources chief to send out a memo to all employees that essentially put an end to flexible work hours and the ability of Yahoo! employees to work from home. The memo said in part: "Speed and quality are often sacrificed when we work from home. We need to be one Yahoo!, and that starts with physically being together." Yahoo!'s move is an attempt to improve collaboration and to become more competitive.[70,71]

The change in policy came at a difficult time for Yahoo!. The firm went through four CEOs in five years, and industry experts had been questioning Yahoo!'s ability to develop new and innovative services. Many have also questioned the quality of its workforce.[72] After Yahoo!'s earnings were announced on April 17, 2013, shares in the company fell more than 3 percent on news of a decrease in sales of display ads.[73]

The ban on working from home drew both sharp criticism and praise from industry observers and employees. On the negative side, management consultants and authors Jody Thompson and Cali Ressler believe the policy change is a major mistake and that Yahoo! will end up with workers who earn good work attendance marks but are not effective and efficient at meeting company goals.[74] Jennifer Glass—a sociology professor and research associate at the Population Research Center at the University of Texas, Austin—points out that the United States already trails other industrialized nations when it comes to providing flexible work arrangements. Sir Richard Branson, billionaire business magnate and founder of Virgin Airlines and Virgin Records, said Mayer's policy was a step backwards "in an age when remote working is easier and more effective than ever." Another professor felt that the changed policy could further lower employee morale and hurt recruiting efforts.[75]

Supporters of the new policy include many who believe that employees are more productive in the office. Just prior to Yahoo!'s announcement, Patrick Pichette, CFO at Yahoo! rival Google, had pointed out that his firm believes strongly in employees working physically close to one another to encourage collaboration.[76] Perhaps encouraged by Mayer's announcement, just one week after Yahoo!'s change in policy, Best Buy informed its headquarters employees that its flexible work program was canceled and that it expected employees to work a traditional 40-hour week at its headquarters. The need to collaborate and work together in turning the company around was given as the reason for the change in policy.[77]

Discussion Questions

1. Do further research on business results and employee morale at Yahoo! to develop an opinion on whether the ban on telework has helped the firm. Write a paragraph stating your opinion and providing supporting facts.

2. Should telework only be considered a "perk" for those companies and employees that are already producing good business results? Why or why not?

3. Imagine that you are a member of a firm's human resources group trying to decide whether or not to support telework. What factors would you consider in making this decision? What process would you follow to arrive at a decision that could be accepted by employees and senior management as well?

2. Kaiser Permanente Implements Electronic Health Record (EHR) System

Kaiser Permanente is an integrated healthcare organization founded in 1945. The company operates one of the nation's largest not-for-profit health plans, with over 9 million health plan subscribers. Kaiser Permanente also includes Kaiser Foundation Hospitals (encompassing 37 hospitals) and The Permanente Medical Groups, with 611 medical offices. The company employs nearly 173,000 people, including 16,658 physicians. Its 2011 operating revenue was almost $48 billion.[78]

HealthConnect is the name of Kaiser's comprehensive health information system, which includes an EHR application that was fully implemented at all of its hospitals and clinics in March 2010. In 2003, Kaiser had announced its intention to work with Epic Systems Corporation over a three-year period to build an integrated set of systems to support EHRs, computerized physician order entry, scheduling and billing, and clinical decision support at an estimated cost of $1.8 billion. This decision came after Kaiser had already made several unsuccessful attempts

at clinical automation projects. The project eventually ballooned into a seven-year, $4.2 billion effort as the scope of the project was expanded time and again.[79] Training and productivity losses made up more than 50 percent of the cost of the project as Kaiser had to cut physicians' hours at clinics during training and was forced to hire physicians temporarily to handle the workload.[80]

The HealthConnect system connects Kaiser plan subscribers to their healthcare providers and to their personal healthcare information. The system uses EHRs to coordinate patient care among physician's offices, hospitals, testing labs, and pharmacies. The EHR is designed to ensure that patients and their healthcare providers all have access to current, accurate, and complete patient data. The system and its data are now accessible via smartphone as well as personal computer. During 2012, there were over 88 million subscriber sign-ons to the system.[81]

Physicians and nurses in hospitals, clinics, and private offices document treatment in the EHR system. After a physician enters a diagnosis into the system, he or she may receive a system message indicating that there is a "best practice order set" available for treating the condition. When they enter a medication order, physicians receive alerts about potential allergic reactions or adverse drug reactions based on other medications a patient is already taking.[82] Physicians also receive automatic notifications about how lab test results should affect medication orders.[83]

HealthConnect also provides capabilities to support bar coding for the safe administration of medicine. Under this system of administering medication, the nurse first scans the patient's bar-coded identification wristband. The nurse next scans a bar code on the medication container that identifies the specific medicine and dosage. The system verifies that this medicine and dosage has been ordered for this patient. If there is not a match, the nurse receives an audible warning signal.[84]

Kaiser has found that use of a comprehensive EHR improves health plan subscribers' satisfaction with the healthcare delivery system. In addition, HealthConnect empowers healthcare plan subscribers to take more responsibility for managing their own health care. Kaiser subscribers can access HealthConnect via a Web portal at *kp.org.* Here they are able to view most of their personal health records online, including their lab results, medication history, and treatment summaries. Patients can enter their own readings from blood pressure and glucose meters.[85] They can also securely email their healthcare providers, which cuts down on the amount of time patients spend on hold waiting to speak to a doctor and on the number of office visits (the number of outpatient visits has dropped an average of 8 percent in the one and one-half years following EHR implementation at each hospital).[86] Each month patients send over 1 million emails to their doctors and healthcare teams through this component of the system. Over 29 million lab test results were viewed online in 2011. In addition, approximately 827,000 prescriptions are being refilled online monthly, and 230,000 appointments are scheduled monthly.[87]

HealthConnect enables physicians to benchmark their performance against colleagues on a number of fronts—efficiency, quality, safety, and service. Hospitals can also benchmark each other on measures such as adverse events and complications. "Best in class" practices can be identified, and physicians and hospitals can borrow these best practices from one another to further improve the overall quality of care.[88]

Kaiser began working on implementing an EHR system in 2003 and finally completed the implementation in 2010. Along the way, the company tried several different approaches, ran into numerous problems, and spent millions of dollars. It is just now beginning to reap the benefits

from this effort. It likely will take time, further system enhancements, and additional expenditures for many other organizations to see similar benefits.

Discussion Questions

1. What do you think are the greatest benefits of the HealthConnect system for Kaiser Permanente subscribers? Can you identify any potential risks or ethical issues associated with the use of this system for Kaiser healthcare plan subscribers? How would you answer these questions from the perspective of a physician or nurse?

2. This system took over seven years to implement and is estimated to have cost at least $4.2 billion. Would you say that this was a wise investment of resources for Kaiser Permanente? Why or why not?

3. Researchers associated with Kaiser Permanente have used the patient record database to make numerous worthwhile discoveries in the areas of preventing whooping cough, determining the correlation between HPV vaccination and sexual activity in young girls, improving methods of cancer detection, avoiding blood clots in women using birth control pills, and lowering cholesterol. Do you think that access to this valuable data should be granted to researchers not associated with Kaiser Permanente? What potential legal and ethical issues could arise if this were done? Should researchers be charged a fee to access this data to help offset the ongoing cost of upgrading the system?

3. Decision Support for Healthcare Diagnosis

Diagnosis errors (including missed, wrong, or delayed diagnosis) are a frequent and serious problem in the healthcare industry. It is estimated that such errors result in death or permanent injury for up to 160,000 U.S. patients each year. In a recent Johns Hopkins University study examining malpractice claims, researchers found that claim payments for diagnostic errors added up to $38.8 billion over the time period 1986 to 2010.[89] Failure to fully diagnose a patient's condition puts the patient at risk of suffering a recurrence of the problem—such as incurring further damage from another accident caused by, for example, an undiagnosed brain injury. Misdiagnosis of a patient's condition can lead to costly, painful, potentially harmful, and inappropriate treatments. A delay in the diagnosis of a patient can allow an otherwise reversible condition to advance to the point that it is no longer treatable.

Over the past decade, several decision support systems to aid in healthcare diagnosis have been developed, including DiagnosisPro®, DXPlain®, First Consult©, PEPID, and Isabel©. A decision support system is an interactive computer application that aids in decision making by gathering data from a wide range of sources and presenting that data in a way that aids in decision making. Isabel, one of the more advanced healthcare decision support systems, is a Web-based system developed in the United Kingdom. Isabel uses key facts from the patient's history, physical exam, and laboratory findings to identify the most likely diagnosis based on pattern matches in the system's database. The system can interface with electronic medical records systems to obtain patient data, or the data can be entered manually. Each diagnosis is linked to information in commonly used medical reference sources such as *The 5 Minute Clinical Consult, Oxford Textbook of Medicine,* and Medline—the U.S. National Laboratory of Medicine's online bibliographic database. Isabel can also suggest bioterrorism agents that might be responsible for a patient's symptoms, as well as identify drugs or drug combinations

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that might be the cause.[90] The cost of using Isabel ranges from a few thousand dollars for a family practice to as much as $400,000 for a health system.[91]

United Hospital, a large hospital in St. Paul, Minnesota, recently implemented the Isabel system to help physicians investigate and diagnose patient cases. The system will integrate directly with the hospital's electronic medical record system and physicians will be able to access Isabel from mobile devices.[92]

On another front, medical researchers at Memorial Sloan-Kettering Cancer Center in New York are busy feeding data from medical textbooks and journals into IBM's Watson super-computer to create a world-class healthcare diagnostic tool. Watson is the same supercomputer that gained recognition in 2011 for beating the world's best players on the TV game show *Jeopardy!*. Watson is now being programmed to understand plain language so that it can absorb data about a patient's symptoms and medical history, form a diagnosis, and suggest an appropriate course of treatment. When presented with a set of symptoms, Watson will be able to provide several diagnoses, ranked in order of its confidence.[93,94]

One incentive hospitals have to adopt such systems is concern that a failure to adopt new technology could subject the hospital to liability in cases where it could be shown that adoption of the technology would not have been overly costly and could have prevented patient injury.[95]

Discussion Questions

1. What concerns might a physician have about using a decision support system such as Isabel or Watson to make a medical diagnosis? How might those concerns be alleviated?

2. Is it possible that in a decade this type of technology could be easily accessible by laypeople who could then perform self-diagnosis, thus helping to reduce the cost of medical care?

3. Does the use of decision support systems to support healthcare decisions seem like an effective way to reduce healthcare costs? Why or why not?

End Notes

[1] Edward Wyatt, "Fund That Subsidizes Internet for Schools Should Expand, a Senator Says," *New York Times*, March 12, 2013, www.nytimes.com/2013/03/13/technology/fund-that-subsidizes-internet-for-schools-should-expand-a-senator-says.html?_r=1&.

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[3] Edward Wyatt, "Fund That Subsidizes Internet for Schools Should Expand, a Senator Says," *New York Times*, March 12, 2013, www.nytimes.com/2013/03/13/technology/fund-that-subsidizes-internet-for-schools-should-expand-a-senator-says.html?_r=1&.

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