

PART FIVE

# Business and Technology

# The Role of Technology

Technology is an unmistakable economic and social force in both business and the world where we live. Global and local communications, business exchanges, the science that affects the quality of our lives, and the simple tasks that make up our daily lives are all significantly influenced by technology. Whether we are at home, in school, or in the workplace, emerging technological innovations have dramatically changed how we live, play, learn, work, and interact with others, raising important social and ethical questions for business.

## **This Chapter Focuses on These Key Learning Objectives:**

- LO 11-1 Defining technology and its characteristics.
- LO 11-2 Recognizing how technology has evolved throughout history and what fuels technological innovation today.
- LO 11-3 Analyzing and assessing how technology impacts organizations and individuals in society.
- LO 11-4 Recognizing the benefits, as well as the ethical and social challenges, that arise from technological breakthroughs in science and medicine.
- LO 11-5 Examining how technological innovations change the way organizations operate.
- LO 11-6 Evaluating the emerging ethical challenges raised by the increased presence of technology in our lives.

In 2014, flooding devastated the Kashmir region in South Asia. Thousands of residents were presumed hurt and in need of medical treatment, and even more were stranded and required assistance. Rescue efforts were hampered since floodwaters inundated ground-floor equipment rooms for most of the region's telecommunication service providers, crashing cellular telephone networks across the state. Local officials had no way to contact the federal government, or one another, or the military troops in charge of rescue operations. Though the army had satellite phones, they were of little help without knowing where people were waiting for rescue. There was only one place where information was flowing—and that was on social media. The relief forces turned to Twitter and other social media networks and began to screen the tens of thousands of messages being posted to identify where people most urgently needed emergency assistance. In a near communications vacuum, 3G Internet connections remained usable and enabled more than 130,000 people to be rescued from the flood zone.<sup>1</sup>

Even a few years earlier, these dramatic rescues would have been impossible. But mobile phones and the cellular networks that supported them had spread rapidly across South Asia, even into remote rural areas, connecting people as never before. In the past two or three decades, the rate of technology change has been extraordinary, encompassing the wireless revolution, the ability to process enormous amounts of data, and smart manufacturing. Today, processing power and data storage are virtually free in the cloud, and a simple handheld iPhone has the same computing power as the room-sized IBM mainframe computer of the 1970s. Utilizing new materials—such as metal alloys, graphene (instead of silicon) transistors, and meta-metals that possess properties not found in nature—will enable engineers to design and build from the molecular level, radically improving quality and reducing waste. The wireless revolution enables billions of people to communicate, socialize, and trade in real time. How we embrace and use technology is also changing dramatically.

*Technology is a major factor in our lives, helping us communicate with others around the world and across town, providing new opportunities for business to promote its activities, and improving the quality of our lives. But what are the consequences of the extraordinarily rapid pace of technological change? Has technology replaced human contact and, if so, what are the consequences of this change in how we relate to others? Who decides what technology should emerge and dramatically affect our lives? Should businesses be allowed to use technology freely or should there be some constraints on its use by business? Who should determine what these constraints are?*

## Technology Defined

**Technology** is a broad term referring to the practical applications of science and knowledge to commercial and organizational activities. The dominant feature of technology is *change and then more change*. As discussed at the beginning of this chapter, new technological breakthroughs are again changing our lives. Sometimes the pace of change is so fast and furious that it approaches the limits of human tolerance, and people lose their ability to cope with it successfully. Although technology is not the only cause of change in society, it is a primary cause. It is either directly or indirectly involved in most changes that occur in society, as noted in a recent article in *Foreign Affairs*:

<sup>1</sup>“Embrace of Social Media Aids Flood Victims in Kashmir,” *The New York Times*, September 12, 2014, [www.nytimes.com](http://www.nytimes.com).

“Technology has sped globalization forward, dramatically lowering communication and transaction costs and moving the world much closer to a single, large global market for labor, capital, and other inputs to production. Even though labor is not fully mobile, the other factors increasingly are. As a result, the various components of global supply chains can move to labor’s location with little friction or cost.”<sup>2</sup>

Another feature of technology is that *its effects are widespread*, reaching far beyond the immediate point of technological impact in unpredictable ways. Technology ripples through society until every community is affected by it.

A final feature of technology is that it is *self-reinforcing*. As stated by Alvin Toffler, “Technology feeds on itself. Technology makes more technology possible.”<sup>3</sup> This self-reinforcing feature means that technology acts as a multiplier to encourage its own faster development. It acts with other parts of society so that an invention in one place leads to a sequence of inventions in other places. Thus, invention of the microprocessor led rather quickly to successful generations of the modern computer, which led to new banking methods, electronic mail, bar-code systems, global tracking systems, and so on.

### Phases of Technology in Society

Six broad phases of technology have developed, as shown in Figure 11.1. Societies have tended to move sequentially through each phase, beginning with the lowest technology and moving higher with each step, so the six phases roughly represent the progress of civilization throughout history. The first phase was the nomadic-agrarian, in which people hunted wild animals for meat and gathered wild plants for food. The second was the agrarian, corresponding with the domestication of animals and plants. The first two used manual labor exclusively. The third was the industrial, characterized by the development of powered machinery, first in the textile industry and later in many other forms of manufacturing. The fourth was the service phase, marked by the rise of service industries and intellectual labor. The fifth was the **information phase**. This phase emphasized the use and transfer of knowledge and information rather than manual skill. Businesses of all sizes, including the smallest firms, explored the benefits of the information age through the availability of nanotechnology and similar inventions. These inventions catapulted societies into **cyberspace**, where information is stored, ideas are described, and communication takes place in and through an electronic network of linked systems. The technology developed in this age provided the mechanisms for more information to be produced in a decade than in the previous 1,000 years.

The **semantic phase**, which began around 2000, saw the development of processes and systems to enable organizations and people to navigate through the expanding amount of links and information available on the Internet. Search engines, such as Google, employed massive clusters of computers to analyze the *metadata* or descriptive information embedded within web pages, documents, and files. A Google search for a specific airline flight, for example, might return links to a flight tracking website, an estimated time of departure or arrival for that day’s flight, weather forecasts, and airport maps. Social interaction is an important part of the semantic phase. Services such as Facebook, Twitter and, LinkedIn analyzed the transactions and metadata from each user’s activity to suggest new contacts, entertainment, and links.<sup>4</sup>

<sup>2</sup> Erik Brynjolfsson, Andrew McAfee, and Michael Spence, “New World Order: Labor, Capital, and Ideas in the Power Law Economy,” *Foreign Affairs*, July/August 2014, [www.foreignaffairs.com](http://www.foreignaffairs.com).

<sup>3</sup> Alvin Toffler, *Future Shock* (New York: Bantam, 1971), p. 26.

<sup>4</sup> Tim Berners-Lee, James Hendler, and Ora Lassila, “The Semantic Web,” *Scientific American*, May 2001, [www.scientificamerican.com](http://www.scientificamerican.com).

FIGURE 11.1 Phases in the Development of Technology

| Technology Level | Phases in the Development of Technology | Approximate Period | Activity                | Primary Skill Used          |
|------------------|-----------------------------------------|--------------------|-------------------------|-----------------------------|
| 1                | Nomadic-agrarian                        | Until 1650         | Harvesting              | Manual                      |
| 2                | Agrarian                                | 1650–1900          | Planting and harvesting | Manual                      |
| 3                | Industrial                              | 1900–1960          | Building material goods | Manual and machine          |
| 4                | Service                                 | 1960–1975          | Providing services      | Manual and intellectual     |
| 5                | Information                             | 1975–2000          | Thinking and designing  | Intellectual and electronic |
| 6                | Semantic                                | 2000–today         | Relevance and context   | Intellectual and networking |

Where will technology head next? Some observers have suggested that society is now at the beginning of a new phase dominated by *biotechnology*. **Biotechnology** is a technological application that uses biological systems or living organisms to make or modify products or processes for specific use. Its applications are common in agriculture, food science, and medicine. This emerging phase of technology extends beyond the design and analysis of information to the manipulation of organisms that produce fabricated products or act as components within a computer network.

### Fueling Technological Growth

As Figure 11.1 demonstrates, in recent decades the pace of technological change has accelerated, and the time lapse between phases has dramatically shortened. Various government and corporate programs are fueling these developments.

**Government:** Government investment has helped launch many new technologies, including the Internet, and these trends continue.

In 2012, President Obama unveiled the Big Data R&D Initiative and committed more than \$200 million in new funding to “improve our ability to extract knowledge and insights from large and complex collections of digital data.” Numerous government agencies were involved in this project, including the White House Office of Science and Technology, National Science Foundation, National Institute of Health, Department of Defense, and many others. The initiative’s goals were to advance state-of-the-art core technologies needed to collect, store, preserve, manage, analyze, and share huge quantities of data, to harness these technologies to accelerate the pace of discovery in science and engineering, to strengthen the country’s national security, and to expand the workforce needed to develop and use Big Data technologies.<sup>5</sup>

**Business investment.** Business firms have also invested directly in technology through their research and development (R&D) operations. Some firms have seen these investments are directly benefiting their business, as well as producing innovations that have moved their industries forward.

IBM announced a change in its strategic initiatives for 2015 and committed \$4 billion to projects focusing on cloud computing, data analytics, and mobile, social, and

<sup>5</sup>“Obama Administration Unveils \$200M Big Data R&D Initiative,” *The Computing Community Consortium Blog*, March 29, 2012, [www.cccblog.org/2012/03/29](http://www.cccblog.org/2012/03/29). For an update on this initiative see [www.nitrd.gov](http://www.nitrd.gov).

security technologies. IBM set a financial target of \$40 billion in annual revenues by 2018, more than 40 percent of the company's expected total revenues. This new and aggressive focus on technology was a response to IBM's total revenue decline from operations of 6 percent in 2014 and stagnant total revenue projected for 2015. IBM saw a need to transform its operational focus from a lagging semiconductor manufacturing business and declining technology services and software provider to new technologies and products to boost IBM's revenues.<sup>6</sup>

The combination of government and business investment in technology has continued to drive innovation forward. But ultimately, technology continues to evolve because of people's insatiable desire for it. They forever seek to expand the use of technology in their lives, probably because of the excitement in having new things and their belief that these new things may help them better adapt to their environment. As Bill Joy, Sun Microsystems' chief scientist, prophetically explained in 2000,

By 2030, we are likely to be able to build machines, in quantity, a million times as powerful as the personal computer of today. As this enormous computing power is combined with the manipulative advances of the physical sciences and the new, deep understanding in genetics, enormous transformative power is being unleashed. These combinations open up the opportunity to completely redesign the world, for better or worse: The replicating and evolving processes that have been confined to the natural world are about to become realms of human endeavor.<sup>7</sup>



## The Role of Technology in Society

Technology and society have been intertwined since the Industrial Revolution. The connection between the two became even stronger in the information and semantic phases. Today, technology has the potential to influence every aspect of every individual's global activity—driving innovation, affecting collaborative partnerships, and changing business–stakeholder relationships. It has created great opportunities for people—but also serious ethical and social challenges. This section will explore some ways in which four technologies—the Internet, the digital divide, mobile telephones, and social media—have presented both opportunities and challenges for people and profoundly affected society.

### The Internet

More people have more access to technology than ever before. Residents of developing countries increasingly enjoy energy-powered appliances, entertainment devices, and communications equipment. Individuals in developed countries in North America, Europe, portions of Asia, and the Middle East more than ever are dependent on electronic communication devices for access to information and for interactions with others and businesses. In today's environment, nearly every individual in a developed country has a desktop or laptop computer, tablet, mobile phone, and a host of other electronic devices to connect them with others in their family, neighborhood, country, or world. These technology devices have become common.

<sup>6</sup> "IBM Pumps \$4 Billion into Cloud and Mobile Initiatives," *The Wall Street Journal*, February 26, 2015, [www.wsj.com](http://www.wsj.com).

<sup>7</sup> Bill Joy, "Why the Future Doesn't Need Us," *Wired*, April 2000, [www.wired.com/wired/archive/8.04/joy](http://www.wired.com/wired/archive/8.04/joy).

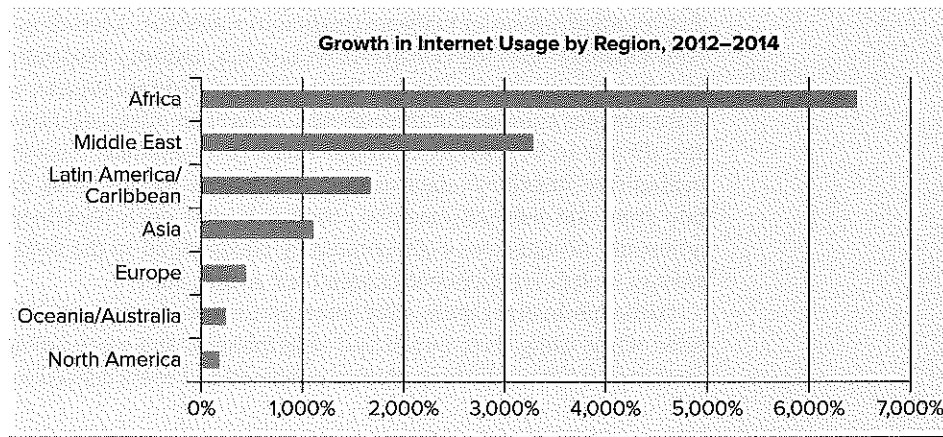
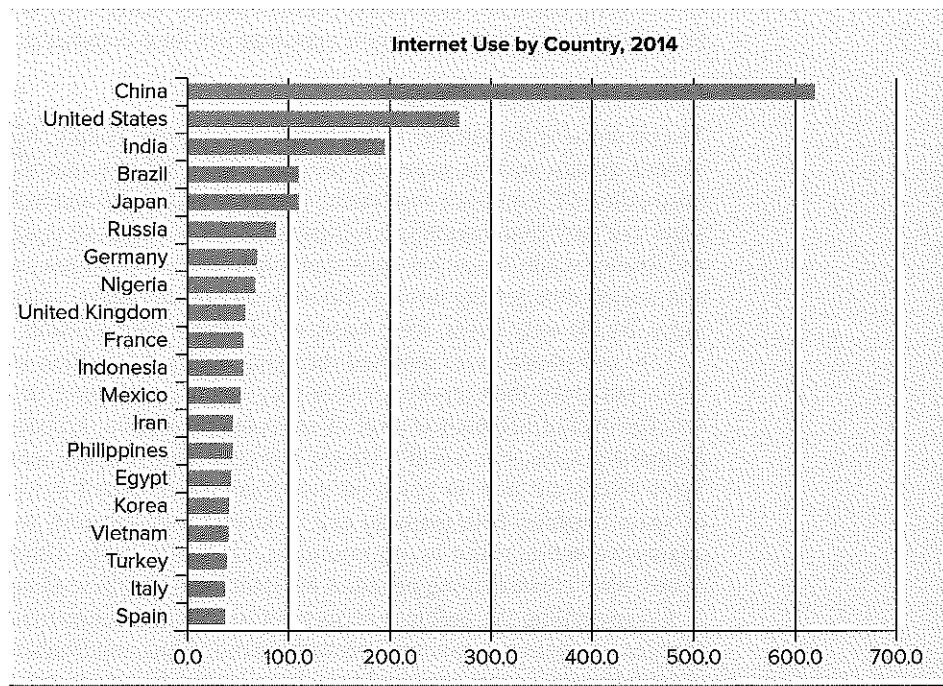
### The Emergence of the Internet

One of the most visible and widely used technological innovations over the past decade has been the Internet. Springing to life in 1994, this conduit of information revolutionized how business was conducted, students learned, and households operated.

Any estimate of the number of Internet users is quickly out of date but some important trends have emerged. In 2008, China surpassed the United States with the most Internet users by country. Just four years later China had more than 500 million Internet users, compared to the United States' 245 million. The top 20 countries by Internet usage by 2014 are shown in Figure 11.2. Since 2012, India and Brazil surpassed Japan as the third and fourth largest number of Internet users by country. Russia jumped from #9 in 2012 to #6 in 2014

**FIGURE 11.2**  
Top 20 Internet Use  
by Country, 2014,  
and Growth in World  
Internet Usage by  
Region, 2012–2014

Sources: "Top Ten Languages  
Used in the Web" and "World  
Internet Usage and Population  
Statistics—June 2014,"  
Internet World Statistics, [www.  
internetworldstats.com](http://www.internetworldstats.com).



and Nigeria went from #11 in 2012 to #8 by 2014. Figure 11.2 also shows the new emerging markets for Internet usage: Africa, the Middle East, and Latin America/Caribbean. The developing countries, especially in the Southern Hemisphere, are catching up to the integration of Internet usage into the lives of managers and citizens in developed countries.

New ways of connecting online are contributing to the growing use of the Internet. Digital music players and game consoles from Apple, Microsoft, Sony, and Nintendo include web browsers, e-mail and messaging capability, and wireless Internet access. Smartphones include Wi-Fi connectivity to provide users with faster data transfer speeds than mobile phone carriers can provide. Manufacturers added new features, such as digital cameras, video recording, and GPS, to enable these portable devices to become even more useful tools for collecting and distributing information. Smartwatches hit the marketplace in 2014, allowing individuals to connect with the Internet (and others) with greater ease and convenience.

Thousands of new Internet users each day demonstrate the power of this technology as a force in our lives. The Internet is increasingly being used as a place for shopping and businesses are quick to create new opportunities for e-commerce, as described later.

### ***Unwanted Internet Threats***

The presence of the Internet in our lives is a welcomed benefit, but also opened the door to various threats, such as *spam* and *phishing*. **Spam** refers to unsolicited commercial e-mails (also called *UCE* or *junk e-mail*) sent in bulk to valid e-mail and mobile accounts. These messages can vary from harmless advertisements for commercial products to offensive material and finance scams. Spam has created problems for users as it has caused extra network traffic and wasted time sorting through the irrelevant or unwanted e-mails to access desired messages. By the early 2010s, spam began to infiltrate e-mail accounts on mobile or cell phones.

U.S. cell phone users reported receiving nearly 4.5 million spam e-mails annually by 2012, but since then reports of receiving spam e-mail have declined. The main reason was the overall heightened level of antispam protection, according to a spokesperson at Kaspersky Labs, the world's largest antivirus and Internet security software company. Spam filters are now in place on just about every e-mail system, reducing the amount of spam reaching both personal and corporate user accounts to a bare minimum. Also, aggressive action taken by governments, especially in the United Kingdom and United States, have created strong penalties for spammers caught sending out malicious e-mails.

Compounding the problem of spam or unsolicited commercial e-mail is **phishing**, the practice of stealing consumers' personal identity data and financial account credentials by using fake e-mails that appeared to be from legitimate businesses to trick users into divulging identifying personal data such as usernames and passwords, or to open attachments that installed viruses or malware (malicious software). According to a 2015 report from the Anti-Phishing Working Group (APWG), a U.S. industry association, reports of new phishing sites was on the decline but the number of malware attacks was on the rise. The malware samples consisted of three groups: crimeware (data-stealing malicious code designed specifically to be used to victimize financial institutions' customers and to co-opt those institutions' identities); data stealing and generic trojans (code designed to send information from the infected machine, control it, and open backdoors on it); and other (the remainder of malicious code commonly encountered in the field such as auto-replicating worms, dialers for telephone charge-back scams, etc.).<sup>8</sup>

Although Internet users were more aware of potential problems that might be encountered when using their e-mail and smartphones, and were taking precautions to prevent unwanted spam or phishing, threats remained and users needed to remain vigilant.

<sup>8</sup> "Phishing Activities Trends Report," Anti-Phishing Working Group, published March 2015, [www.antiphishing.org/reports](http://www.antiphishing.org/reports).

## The Digital Divide in the United States and Worldwide

The gap between those who have access to the Internet through technology and those who do not is called the **digital divide**.<sup>9</sup> Some people have Internet access through computers, cell phones, and other devices; others do not. People in developing countries often have less Internet access than people in developed countries; and within developed countries, persons of color and the less affluent often have less access. The presence of a digital divide is a problem because less advantaged individuals and societies may not enjoy the same benefits of technology as others.

In the United States, the government has acted to break down the digital divide.

The U.S. government launched a \$7 billion effort to expand access, chiefly through grants to build wired and wireless systems in the most technologically neglected areas of the country. This government effort subsidized Internet upgrades for schools and libraries and provided digital textbooks in poor and rural areas.

The falling prices of laptops and the newest generation of cell phones and Internet-enabled handheld devices enabled Internet access to be more affordable to many.

The government also provided free cell phones and up to 250 free minutes for individuals who qualified, such as people seeking housing or job opportunities.<sup>10</sup>

By 2013, nearly 98 percent of American homes were able to access the Internet on some sort of high-speed broadband network, either at home or work.<sup>11</sup>

Some experts argued that the most important issue going forward was not access, but educating Americans on how the Internet could be a valuable aid for job hunting, acquiring health insurance, and accessing government services and other benefits. Yet, some pointed out that Internet access was still be too expensive for a majority of families in the poorest U.S. cities. The U.S. Census Bureau data reported that less than 50 percent of households (about 31 million) in the most economically depressed cities in the United States had access to broadband service.<sup>12</sup>

Globally, progress in narrowing the digital divide was slower, but there appeared to be reasons for optimism. Many businesses saw providing Internet access at the bottom of the pyramid as a lucrative business opportunity.

Smartphone maker BlackBerry unveiled a new model exclusively targeting mobile phone users in Indonesia in 2014. Its low-cost touch-screen model retailed for 2.2 million rupiah, or about \$190, and contained a number of special applications for Indonesian users, including local banking and travel services and a directory of halal food outlets, critical in the world's largest Muslim-majority country. Google, Facebook, and other companies joined forces to fund the Alliance for Affordable Internet, a global coalition seeking to bring down the cost of getting online for individuals in developing countries. Intel partnered with African phone manufacturers to bring down the price of smartphones running on Intel processors.<sup>13</sup>

The African marketplace, with only 16 percent of its population connected to the Internet, was a very attractive market for technology companies and corporate initiatives, such

<sup>9</sup> For a different viewpoint, see Walter Block, "The 'Digital Divide' Is Not a Problem in Need of Rectifying," *Journal of Business Ethics* (2004), pp. 393–406.

<sup>10</sup> "F.C.C. Chief Alms to Bolster Internet for Schools," *The New York Times*, November 17, 2014, [www.nytimes.com](http://www.nytimes.com).

<sup>11</sup> "Most of U.S. Is Wired, but Millions Aren't Plugged In," *The New York Times*, August 18, 2013, [www.nytimes.com](http://www.nytimes.com).

<sup>12</sup> "Digital Divide Exacerbates US Inequality," *Financial Times*, October 28, 2014, [www.ft.com](http://www.ft.com).

<sup>13</sup> "Blackberry Unveils Low-Cost Smartphone with Indonesia in Mind," *The New York Times*, May 13, 2014, [www.nytimes.com](http://www.nytimes.com); and "Using Free Wi-Fi to Connect Africa's Unconnected," *The Wall Street Journal*, April 13, 2014, [online.wsj.com](http://online.wsj.com).

as those described above. Christopher Vollmer, executive at Booz & Company, explained the vital importance of bridging the digital divide globally: “We found that economically, the more countries are able to move up the digitization index, it actually improves GDP [gross domestic product] performance, it’s associated with positive job growth and it’s very critical for innovation.”<sup>14</sup> Yet, more work was needed; some countries, such as Sweden, Singapore, Finland, Denmark, Switzerland, Netherlands, Norway, United States, Canada, and Britain, were at the high end of the digitization index, while poorer countries, such as Nepal, Syria, East Timor, and Haiti, were at the low end.

### Mobile Telephones

**Mobile telephones**, or cell phones, use radio technology to enable users to place calls from a mobile device, with transmission over a service area divided into small “cells,” each with its own low-power radio transmitter. The first generation of cell phones, introduced in the 1980s, were clumsy analog devices; today’s digital smartphones provide a range of applications, including e-mail and Internet access, voice communications, video recording, and many more.

In North America, mobile phones were initially used mainly as a communications tool. But American cell phone users have recently joined many Europeans and Asians to embrace using their mobile phones for commerce. **M-commerce**, commerce conducted via mobile or cell phones, allows consumers to use their mobile phones as an electronic wallet. People can trade stocks or make consumer purchases of everything from hot dogs to washing machines. France Telecom marketed a mobile phone with a built-in credit card slot for easy wireless payments.

In 2014, Apple hoped to change how shopping was done with the introduction of Apple Pay, a mobile payment and digital wallet service that lets users make payments using Apple devices, phones, tablets, and watches. Credit cards and banks, including American Express, Mastercard, Visa, Citi, Bank of America, and PNC, supported the system. Among retailers on board at the launch of Apple Pay were Macy’s, Bloomingdale’s, Walgreens, Duane Reade, Whole Foods, Disney stores, and Staples. Restaurants supporting Apple Pay included Subway and Panera Bread. Apple touted its proprietary system as safe and secure because it created one-time payment numbers for purchases, rather than transmitting credit card numbers and security codes. “It’s easy, it’s secure and yes, it’s a private way to pay for things,” said Apple CEO Tim Cook.<sup>15</sup>

Mobile devices can be used for more than making calls or shopping. These devices can run apps and GPS systems, access the Internet, send text messages and photos, and stream music and videos. Mobile data usage was predicted to significantly increase by 2018, an 11-fold increase in traffic, according to technology experts at Cisco Systems. “Global mobile network will increase three times as fast as global fixed traffic, helped primarily by the increase in the number of mobile device users worldwide, which will rise to 4.9 billion by 2018,” according to Cisco’s Visual Networking Index Forecast.<sup>16</sup>

But with the potential for greater mobile device activity worldwide, some stakeholder groups warned that accompanying the increased usage would be increased frustration. Critics predicted more unwanted and unsolicited mobile text messages and incidents of malware and spyware. Some other undesirable consequences of mobile technology are described in Exhibit 11.A.

<sup>14</sup> “Digital Divide Splits Developed and Developing Nations,” *Dawn.com*, April 5, 2012, [dawn.com](http://dawn.com).

<sup>15</sup> “Apple Pay to Launch Monday,” *USA Today*, October 16, 2014, [www.usatoday.com](http://www.usatoday.com).

<sup>16</sup> “Mobile Data Usage to Increase 11-fold by 2018 – Cisco,” *TechWeek Europe*, February 6, 2014, [www.techweekeurope.co.uk](http://www.techweekeurope.co.uk).

Robert Bornstein, a psychologist at Adelphia University, says, “The superconnected may develop a dual-dependency. They’re not only counting on other people too much, they’re also hooked on the devices themselves, sometimes to the point where they feel utterly disconnected, isolated and detached without them.” Exactly how bad is the dependency on technology, specifically wireless devices? Some experts have warned that handheld e-mailing devices are so addictive that soon compulsive users will need to be weaned off them using treatment programs like the ones used by drug addicts. This overreliance upon technology can also cause physical problems, such as:

- BlackBerry thumb—a pain or numbness in the thumbs caused by constant e-mailing, messaging, or Internet surfing on handheld devices,
- Cell phone elbow—arthritic pain and swelling in the elbow from constantly holding a cell phone to the ear, which in some severe cases may cause nerve damage.
- PDA (personal data assistant) hunch—neck pain caused by looking straight down at your PDA minimonitor.

Or, psychological dependency problems:

It is common in the technological world for someone to view multiple screens, listen to music on an iPod, and send an e-mail or tweet all at the same time and for hours on end. The extensive interaction with many technological devices can be hazardous for the user. The term *web junkie* has been applied to individuals who become hooked on video games, playing for dozens of hours at a time often without breaks to eat, sleep, or even use the bathroom. Many come to view the real world as fake. Loren Frank, a researcher at the University of California, San Francisco, concluded, “Almost certainly, downtime lets the brain go over experiences it’s had, solidify them and turn them into permanent long-term memories.” When the brain is constantly stimulated, this learning process is prevented. “Instead of having long relaxing breaks [allowing time for the brain to process the information], like taking two hours for lunch, we have a lot of micro-moments,” explained Marc Berman, a University of Michigan neuroscientist.

**Sources:** “Wireless Dependency,” *New York Times*, February 17, 2007, [www.nytimes.com](http://www.nytimes.com); “Digital Devices Deprive Brain of Needed Downtime,” *The New York Times*, August 24, 2010, [www.nytimes.com](http://www.nytimes.com); and “Screen Addiction Is Taknig a Toll on Children,” *The New York Times*, July 6, 2015, [well.blogs.nytimes.com](http://well.blogs.nytimes.com).

## Social Networking

**Social networking**, a system using technology to enable people to connect, explore interests, and share activities around the world, exploded onto the technology scene in the 2000s, altering many social and human interactions. One positive example of social networking and how it saved lives was presented at the beginning of this chapter.

Similar to estimating the number of Internet users, any estimate on the number of people using social media is quickly outdated the moment the calculations are completed. In 2011, 1.2 billion people worldwide used social networking sites at least once per month; by 2015, that number was estimated to be more than 2 billion. Facebook was the most frequently used social network, with nearly 1.5 billion users by 2015, with QZone (a social networking site popular in China), Google, LinkedIn, Instagram, Twitter, and Tumblr also among the top seven social network sites with more than 250 million users each by 2015. The most engaged countries for social networking in 2015 were Israel (where users spent an average of 11.1 hours per month on social networking), Argentina (10.7 hours), Russia (10.4 hours), Turkey (10.2 hours), and Chile (9.8 hours). In the United States, social network users spend 7.6 hours per month on networking sites.<sup>17</sup>

<sup>17</sup> “Social Networking Reaches Nearly One in Four Around the World,” *eMarketer*, June 18, 2013, [www.emarketer.com](http://www.emarketer.com); and “Social Networking Statistics,” *Statistic Brain Research Institute*, accessed May 3, 2015, [www.statisticbrain.com](http://www.statisticbrain.com).

Clearly the dramatic rise in social networking has taken the world by storm and has become a central aspect of individuals' lives. With these news ways to interact with others comes additional responsibilities to ensure that the interactions are ethical and socially beneficial.



## The Impact of Scientific Breakthroughs

Dramatic advances in the biological sciences also have propelled the impact of technology on our lives. Recent unprecedented applications of biological science have made possible new, improved methods of agricultural food production as well as medical care, but they have also posed numerous ethical challenges regarding safety and the quality of life. Three of the most profound impacts on our lives come from the scientific breakthroughs in genetically modified (GM) or engineered foods; the sequencing of the human genome and the use of genetic information; and the advent of biotechnology and the resulting stem cell research. These topics are discussed in this section.

As Bill Joy of Sun Microsystems warns, speaking of biotechnology as well as other innovative applications of science, “21st century technologies . . . are so powerful that they can spawn whole new classes of accidents and abuses. Most dangerously, for the first time, these accidents and abuses are widely within the reach of individuals or small groups. They will not require large facilities or rare raw materials. Knowledge alone will enable the use of them.”<sup>18</sup>

### Genetically Engineered Foods

The biotechnological revolution resulted in applications for use by the agricultural industry and brought promises of larger than ever crop production through advances in genetic engineering of food. *Genetic engineering* involves altering the natural makeup of a living organism and allows scientists to insert virtually any gene into a plant and create a new crop or a new species. **Genetically modified foods**, or GM foods, are foods that are processed from genetically modified crops. The explosion of GM foods into our food chain in just a few decades was remarkable. In 1982 the first tomato plant was genetically engineered. Corn became genetically modified and developed a resistance to insects that allowed corn crop yields to double to 26 bushels per acre from 2001 to 2010. Commercial planting of an herbicide-tolerant sugar beet began in the United States in 2008. And, more than 90 percent of all soybeans grown in the United States annually are genetically engineered.<sup>19</sup>

Despite a lack of scientific evidence that GM foods are harmful to humans, social advocates in Europe led the charge against genetically modified foods, calling GM foods “Frankenstein foods.”

In the late 2000s, both France and Germany passed national bans on the use of various kinds of GM seeds. Despite French and German farmers' protests that the ban would inflict great economic harm on them and their countries' economies, the German agriculture minister said, “The decision is not a political decision, it's a decision based on the facts.” He affirmed the government's commitment to protect

<sup>18</sup> Bill Joy, “Why the Future Doesn't Need Us,” *Wired*, April 2000, [www.wired.com](http://www.wired.com).

<sup>19</sup> “GMOs Are Everywhere,” *Bloomberg Businessweek*, July 31, 2014, [www.bloomberg.com](http://www.bloomberg.com).

the safety of consumers and the environment. Austria and Hungary also passed their own national bans on growing GM crops. While Europe continued to allow each nation to decide whether to allow the planting or sale of GM foods, the European Union passed a GM food labeling law so that all European consumers can also make their own decisions to purchase this type of food or not.<sup>20</sup>

By contrast with Europe, GM foods became quite common in grocery stores in the United States. Although most GM corn grown in the United States was made into animal feed or ethanol, it was also processed into food industry staples such as corn syrup or tortilla chips. But problems with using GM seed surfaced in the early 2010s.

In 2011 Monsanto reported that some of its GM seed, grown to resist attacks by bugs that could ruin crops, was losing its bug resistance possibly due to the way that farmers were using biotech crops. This could cause some farmers to switch to a different strain of GM seed produced by one of Monsanto's competitors. The problem continued to grow when it was reported that other seed makers, including DuPont and Dow Chemical, also began to experience problems. The Environmental Protection Agency considered proposing limits on some genetically engineered corn to combat a greedy pest that evolved and was resistant to the bug-killing crops.<sup>21</sup>

It appears that the tide against GMO food in the United States was gaining momentum by the 2010s. In 2013, Ben & Jerry's Homemade initiated a plan to eliminate GM ingredients from its ice cream. A year later, General Mills started selling its original flavored Cheerios without GMOs. Post Holdings took the GMOs out of Grape-Nuts. In 2015, Chipotle Mexican Grille was the first major restaurant chain to serve only food free of genetically engineered ingredients. Whole Foods stores were on track to be free of all GMO products by 2018 and Walmart vastly expanded its selection of organic foods, free from genetic alteration.<sup>22</sup>

Yet, growing GMO crops appears to be flourishing globally. In some economically developed countries and most developing countries around the world GM food was welcomed as a way to increase crop yields. According to a report from the International Service for the Acquisition of Agri-biotech Applications (ISAAA), of the 28 countries that planted biotech crops in 2012, 20 were developing and 8 were industrial countries. As shown in Figure 11.3, the top nine each grew more than 2 million hectares, meaning more than half the world's population, 60 percent or nearly 4 billion people, live in the 28 countries planting biotech crops.<sup>23</sup>

Some activists have supported a movement to label food products that include GM ingredients. Vermont became the first state in the United States, in April 2014, to require food makers to label products that included GMOs. The law, which takes effect in 2016, was hailed as a victory by activists who argued that consumers have the right to

<sup>20</sup> "French Court Says Ban on Gene-Altered Corn Seed Will Remain, Pending Study," *New York Times*, March 20, 2008, [www.nytimes.com](http://www.nytimes.com); "Germany Bars Genetically Modified Corn," *New York Times*, April 15, 2009, [www.nytimes.com](http://www.nytimes.com); "Europe to Allow Two Bans on Genetically Altered Crops," *New York Times*, March 3, 2009, [www.nytimes.com](http://www.nytimes.com); and "Europe Has GM Food Label Law," *Health Impact News Daily*, May 22, 2012, [healthimpactnews.com](http://healthimpactnews.com).

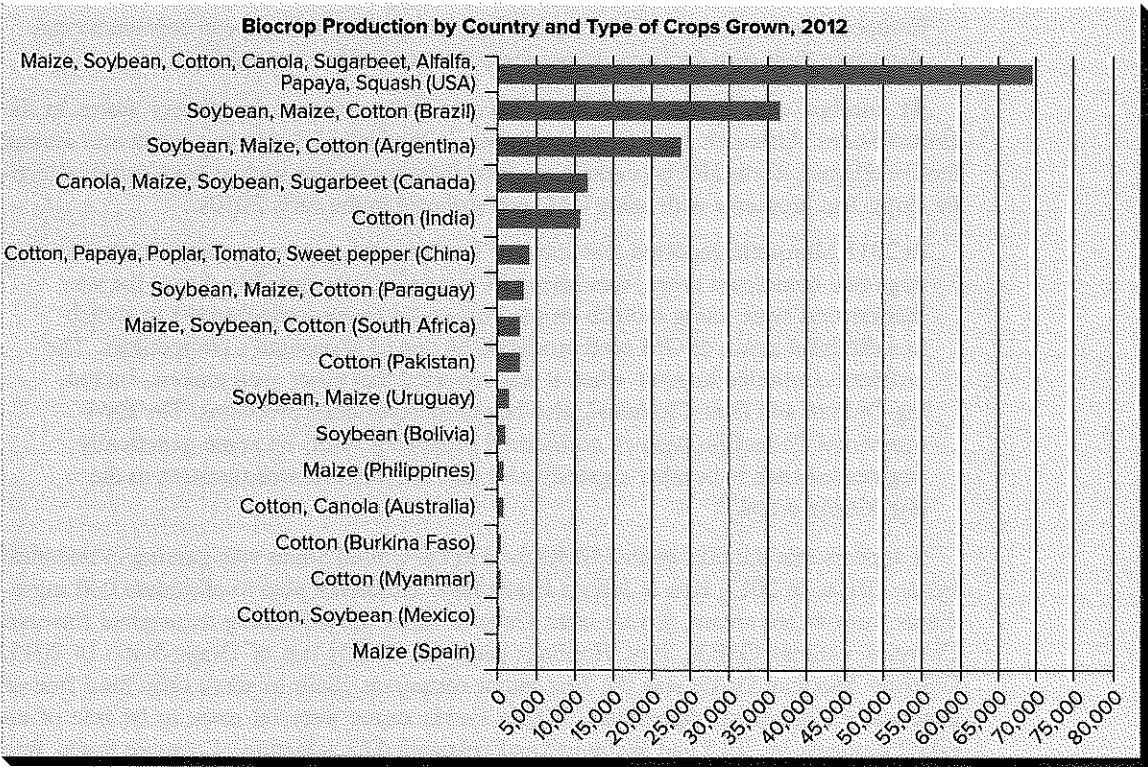
<sup>21</sup> "Monsanto Corn Plant Losing Bug Resistance," *The Wall Street Journal*, August 29, 2011, [online.wsj.com](http://online.wsj.com); and "Limits Sought on GMO Corn as Pest Resistance Grows," *The Wall Street Journal*, March 5, 2015, [www.wsj.com](http://www.wsj.com).

<sup>22</sup> "The GMO Fight Ripples Down the Food Chain," *The Wall Street Journal*, August 7, 2014, [online.wsj.com](http://online.wsj.com); and "Chipotle to Stop Serving Genetically Altered Food," *The New York Times*, April 26, 2015, [www.nytimes.com](http://www.nytimes.com).

<sup>23</sup> See the ISAAA Brief 44–2012: Executive Summary, ISAAA, 2012, [www.isaaa.org](http://www.isaaa.org).

FIGURE 11.3 Biocrop Production by Country and Type of Crops Grown, 2012 (in thousands of hectares)

Source: ISAAA Brief 44-2012: Executive Summary, ISAAA, 2012, [www.isaaa.org](http://www.isaaa.org).



transparency. It was opposed by food and agricultural industry groups, saying that the Vermont law was backed by faulty science and would harm consumers. Nonetheless, consumers in poll after poll have overwhelmingly said they want labels on food that contain GM ingredients, often as many as 66 percent of those surveyed.<sup>24</sup>

But the GMO labeling movement took a step back in November 2014 when GMO labeling measures in Oregon and Colorado were defeated. In Oregon, the food and agricultural industries, led by Kraft Food, Pepsi, and Monsanto, outspent advocates for the bill by \$20.5 million to \$8.2 million; whereas, in Colorado the ratio was \$16.7 million for anti-labeling forces to less than \$1 million for proponents. These results followed the pattern seen earlier, before the labeling victory in Vermont, when voters in 2013 in California and Washington voted against a labeling bill. In these two states, opponents of the law spent more than \$100 million during the campaign and outspent the advocates of the bill four to one.<sup>25</sup>

Sequencing of the Human Genome

When Celera Genomics Group announced that it had finished the first sequencing of a human genome, the achievement was hailed as the most significant scientific breakthrough since landing a man on the moon. Strands of human deoxyribonucleic acid, or DNA, are arrayed across 23 chromosomes in the nucleus of every human cell, forming

<sup>24</sup> "Vermont to Enact GMO Food-Labeling Law," *The Wall Street Journal*, April 23, 2014, [online.wsj.com](http://online.wsj.com).  
<sup>25</sup> "Food Industry Wins Round In GMO-Labeling Fight," *The Wall Street Journal*, November 5, 2014, [online.wsj.com](http://online.wsj.com).

a unique pattern for every human. These strands are composed of four chemical units, or letters, used over and over in varying sequences. These replicated letters total 3 billion and form the words, or genes—our unique human signature—that instruct cells to manufacture the proteins that carry out all of the functions of human life.<sup>26</sup> The identification of human genes is critical to the early diagnosis of life-threatening diseases, the invention of new ways to prevent illnesses, and the development of drug therapies to treat a person's unique genetic profile.

By 2014, the Human Genome Project had fueled the discovery of more than 1,800 disease genes and more than 2,000 genetic tests for human conditions were ongoing. These tests enabled a countless number of patients to learn their genetic risks for disease and also helped healthcare professionals to diagnose disease. One major step forward was taken in 2005 with the creation of the HapMap,<sup>27</sup> which catalogs common genetic variation, or haplotypes, in the human genome. By 2010, the third phase of the HapMap project was published, with data from 11 global populations, the largest survey of human genetic variation performed to date.

However, in addition to the remarkable advances in understanding DNA, touted as one of humanity's greatest achievements, numerous ethical challenges emerged in private and public research focusing on genetics.

One family, afflicted by a rare genetic heart disease called Brugada syndrome, wondered how others might react if they learned of the family's medical condition. Would employers want to hire someone who might die prematurely or require an expensive implantable defibrillator? Would they be eligible for individual health care coverage or be able to afford life insurance if their condition were known? The underlying fear for this family and others with genetic conditions was whether they would be treated fairly if their genetic fingerprints became public.

The debate over whether advances in human genome sequencing and genetic research outweigh the risks or harms will continue for years. What is clear is that our scientific understanding of the human body and its makeup has changed, and significant technological innovations are on the horizon. What is not clear is who, if anyone, can manage these changes to better ensure the improvement of the quality of our lives and society.

### Biotechnology and Stem Cell Research

Complementing the discovery of DNA sequencing were numerous medical breakthroughs in the area of regenerative medicine. **Tissue engineering**, the growth of tissue in a laboratory dish for experimental research, and **stem cell research**, research on nonspecialized cells that have the capacity to self-renew and to differentiate into more mature cells, were two such breakthroughs. Both offered the promise that failing human organs and aging cells could be rejuvenated or replaced with healthy cells or tissues grown anew. While the promise of immortality may be overstated, regenerative medicine provided a revolutionary technological breakthrough for the field of medicine.

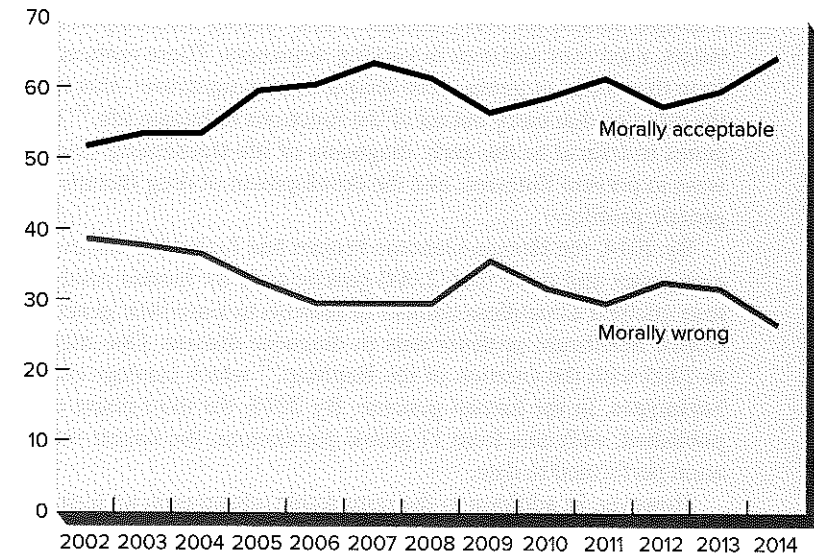
Stem cell research spilled over from the laboratories into the public arena as citizens weighed in on the issue, often with strong religious opinions affecting their viewpoints. As shown in Figure 11.4, public approval of stem cell research increased in the United States since 2002 and in 2014 was at its highest approval rating—65 percent believed stem cell research is morally acceptable; whereas only 27 percent, the lowest since 2002, believed it is morally wrong.

<sup>26</sup> "Genetic Secrets of Malaria Bug Cracked at Last" *The Wall Street Journal*, January 18, 2002, pp. B1, B6.

<sup>27</sup> For more information, see [hapmap.ncbi.nlm.nih.gov](http://hapmap.ncbi.nlm.nih.gov).

**FIGURE 11.4**  
**Number of**  
**Americans Morally**  
**in Favor of Stem**  
**Cell Research versus**  
**Opposed, from 2002**  
**to 2014**

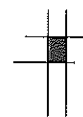
Source: "Stem Cell Research: Gallup Historical Trends," Gallup Research Group, May 2014, [www.gallup.com](http://www.gallup.com).



Supported by private and government funding, hundreds of biotechnology companies and university laboratories were actively pursuing new approaches to replace or regenerate failed body parts. New discoveries were occurring quickly. Some promising breakthroughs included the following: researchers were able to insert bone-growth factors or stem cells into a porous material cut to a specific shape, creating new jaws or limbs; genetically engineered proteins were successfully used to regrow blood vessels that might repair or replace heart valves, arteries, and veins; and the process to regrow cartilage was used to grow a new chest for a boy, and a human ear was grown on a mouse.

By 2012, stem cell research continued to make significant progress. A notable breakthrough occurred when Chinese scientists developed a safe and easy way to produce stem cells, raising hopes for treating a range of diseases. By using a mixture of very small molecules to chemically reprogram the adult stem cells, scientists said they could become as versatile as embryonic stem cells, which was controversial since they were taken from human embryos.<sup>28</sup>

The controversies that emerge over scientific breakthroughs from advancements in technology—GM food production, the sequencing of the human genome, and stem cell research—raise serious ethical and social issues. How to maximize the benefits to individuals and society yet minimize or eliminate the negative consequences regarding these technological developments must continue to be addressed, as new innovations appear on the horizon.

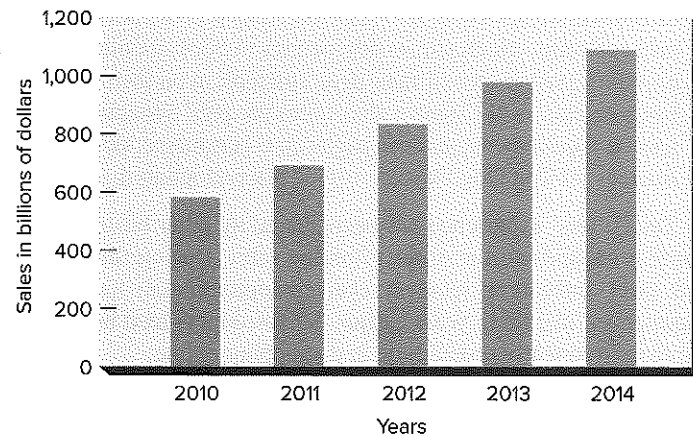


## The Role of Technology in Business

Not only is technology intertwined in our personal lives but has also infiltrated how business is done. Today, every aspect of business is influenced by technology—the distribution and sale of products; how businesses are created, formed, and sustained; the business–employee

<sup>28</sup> "Scientists Develop Safe and Easy Way to Make Stem Cells," *Medical News Today*, July 19, 2013, [www.medicalnewstoday.com](http://www.medicalnewstoday.com).

**FIGURE 11.5**  
Global E-Business  
Sales Growing



relationship, whether human or mechanical employees; and other business elements. It has created great opportunities for businesses, but serious ethical and social challenges also have emerged. This section will explore some ways in which emerging technologies have presented both opportunities and challenges for business, and ultimately society. We will discuss three specific topics at the intersection of business, technology, and society: e-business, the transformation of business models, and the use of robotics.

### E-Business

During the information and semantic phase of technological development, shown in Figure 11.1, electronic business exchanges between businesses and between businesses and their customers emerged. These electronic exchanges, generally referred to as **e-business**, consist of buying and selling goods and services between businesses, organizations, and individuals electronically; that is, via Internet-based systems. During the past decade, e-business revenue increased at a fast pace, as shown in Figure 11.5, and more than that of traditional, or nonelectronic, business. E-business revenues were predicted to continue to rise significantly through 2018, fueled by consumers in emerging markets.

In the United States, online sales topped \$300 billion in 2014 and were projected to rise through 2017 to nearly \$450 billion. Sales made through mobile devices rose from nearly \$25 billion in 2012 to more than \$60 billion in 2014, with mobile sales projected to be more than \$114 billion by 2017.<sup>29</sup> E-business has become a way of life, from large companies and smaller start-up businesses to individuals interested in shopping online. As technology became more affordable and easier to use, small and medium-sized businesses committed investment dollars to e-business and technology systems.

### Transforming Prevailing Business Models

Businesses, especially small-sized companies, discovered that adopting new technology could save them money in the long run and give them a competitive edge over rivals by enabling them to add new services and operate more efficiently, as the following example shows.

When a computer programmer offered to create a custom package for Top Dog Daycare, owners Joelle and Tom Hilfers were shocked but agreed to take the plunge, on a payment plan. Three years and nearly \$30,000 in technology investments later,

<sup>29</sup> Data from "E-Commerce / Online Sales Statistics," *Statistic Brain Research Institute*, October 9, 2014, [www.statisticbrain.com](http://www.statisticbrain.com); and, "Quarterly Retail E-Commerce Sales, 4th Quarter 2014," *U.S. Census Bureau News*, February 17, 2015, [census.gov](http://census.gov).

the Hilfers do not know how they ever survived without the company's K-9 Connect software, which allows dog owners to book appointments online, view their accounts, post photos of their pets, and look in on them during the day through a live web cam. K-9 Connect also stores the pets' vaccination records, meal plans, and special requirements and has pages on e-commerce, dog training, and dog grooming. Business at Top Dog Daycare tripled after adopting the computerized system.<sup>30</sup>

The Hilfers' experience has been shared by other businesses as they switch from traditional brick-and-mortar stores to online sales. During the 2013 holiday shopping season, U.S. brick-and-mortar retailers received approximately half of the holiday foot traffic they experienced just three years earlier. As consumers lead busier and more active lives, they are more frequently researching and shopping online.

Amazon, the world's leader in online shopping, had its best season to date in 2013, with more than 36.8 million items ordered worldwide on Cyber Monday alone (three days after the traditional Black Friday shopping day—the day after Thanksgiving in the United States). Alibaba, China's online retail leader, sold more than 30 billion renminbi, or about \$5 billion, worth of goods on Singles' Day. This “shopper's holiday” is celebrated on November 11 (since this day has four 1's, or singles) and targets young Chinese men and women who are single and lamenting or toasting their unmarried status. Online shopping is obviously big business and the dramatic growth of online purchases reflects on how shoppers' actions have changed causing businesses to change as well.<sup>31</sup>

Seventy-one percent of shoppers expect to view in-store inventory online and 50 percent want to be able to buy online and pick up their purchases at a brick-and-mortar store. Smartphones are also changing how businesses must accommodate consumers. According to a Forrester Research survey, 38 percent of consumers used their mobile devices to check inventory availability while on their way to a store and 34 percent used a mobile device to research products while in a store.

These new trends gave rise to the notion of **omnichannel**, the idea that every distribution channel must work together to deliver a unified and consistent customer experience. Businesses are adjusting and attempting to serve the multiple needs of their consumers.

Amazon is building dozens of “fulfillment centers,” brick-and-mortar stores located in major cities to have high-demand products close enough to consumers for same-day or next-day delivery. Brick-and-mortar stores, such as those operated by Apple or Verizon, understand that customers can find out about inventory on their phones before coming to the store. Retailers are focusing more on providing technical assistance for their customers in the stores, equipping employees with tablets or mobile technology to check inventory at other stores, locate complimentary accessories, or enable faster payment of items ordered.<sup>32</sup>

As technology changes the shopping experiences for customers, businesses, too, must understand how they need to change to accommodate and better serve their customers.

## The Use of Robotics at Work

Another area where technology has made a significant impact on business is the development of robotic engineering and the increased availability of robots. Initially, robots were used in

<sup>30</sup> See the company's website at [topdogdaycare.net](http://topdogdaycare.net).

<sup>31</sup> “Retail in Crisis: These Are the Changes Brick-and-Mortar Stores Must Make,” *Forbes*, February 12, 2014, [www.forbes.com](http://www.forbes.com); and “Online Shopping Marathon Zooms off the Blocks in China,” *The New York Times*, November 11, 2013, [www.nytimes.com](http://www.nytimes.com).

<sup>32</sup> “Retail in Crisis: These Are the Changes Brick-and-Mortar Stores Must Make,” *Forbes*, February 12, 2014, [www.forbes.com](http://www.forbes.com).

high-risk situations, such as bomb detection or handling toxic chemicals, but as they have become more affordable and smarter, they have generated new opportunities for businesses.

A new breed of machines, called *collaborative machines*, were designed to work alongside people in close settings and changed how many small manufactures did business. Priced as low as \$20,000, manufacturers, toy makers, and other businesses are using these machines to increase overall productivity and lower labor costs.

Panek Precision, founded in 1945 as a small, precision machine shop in Northbrook, Illinois, uses robots to place metal pieces into cutting machines and remove the parts after the cutting is completed. A job difficult for a human employee because of its tediousness, robots can accomplish the tasks quickly, effectively, and less expensively than machine operators paid \$16.50 per hour. The robot doubled the output of a human worker “because robots work overnight and don’t take a lunch break and they just keep going,” said Panek Precision’s president.<sup>33</sup>

Robots have found their way into other types of work. They can replace workers who could be injured from doing the work previously assigned to humans. “It’s gotten easier to substitute machines for many kinds of labor. We should be able to have a lot more wealth with less labor,” explained economist Erik Brynjolfsson.<sup>34</sup>

Another technological breakthrough is in the use of driverless cars. Google announced that a specially equipped fleet of driverless Toyota Prius cars had safely traveled more than 1,000 miles in the United States. Rio Tinto, a global mining company, used self-driving trucks and drills that need no human operators at its iron ore mines. Automated trains carried the ore to a port 300 miles away.

However, the spread of robots in the workplace posed a clear threat to workers’ employment. Gartner, Inc., a technology research firm, predicted that one-third of all jobs would be lost to automation within a decade. Within two decades, economists at Oxford University forecast, nearly half of the current jobs would be performed by machine technology. In the United Kingdom, economists predicted that 10 million jobs would be taken over by computers and robots over the next 20 years. They said that people earning less than £30,000, or about \$46,000, a year were most likely to see their jobs eliminated.

In the crosshairs are middle-class workers such as clerks and bookkeepers. Today’s computers can conduct legal research, write stock reports and news stories, and translate conversations. At banks, machines can produce government-required documents to flag potential money laundering—all work done by humans a short time ago. Banks using automated teller machines (ATMs) spread quickly throughout the United States from the 1980s to today. In 1985, there were 484,000 bank tellers in the United States; by 2014, this number had fallen to 361,000, a drop of more than 25 percent.<sup>35</sup>

Others argue that robots and advanced technology might actually increase labor demand, especially for low-skilled laborers. The presence of technology might allow low-skilled workers to perform tasks previously assigned only to high-skilled employees. “Employees gain much critical knowledge about new technologies through experience on the job and such learning often does not require a high degree of education,” according to scholar James Bessen. Whether technology creates more or fewer jobs remains to be seen, but the impact of technology through robotics is undeniably profound.

<sup>33</sup> “Robots Work Their Way into Small Factories,” *The Wall Street Journal*, September 17, 2014, [online.wsj.com](http://online.wsj.com).

<sup>34</sup> “What Clever Robots Mean for Jobs,” *The Wall Street Journal*, February 24, 2015, [www.wsj.com](http://www.wsj.com).

<sup>35</sup> *The Wall Street Journal*, February 24, 2015, *ibid*; “High Tech and Robots Can Create More Low Skilled Jobs, Not Just Destroy Them,” *Forbes*, March 23, 2014, [www.forbes.com](http://www.forbes.com); and “Ten Million Jobs at Risk from Advancing Technology,” *The Telegraph*, November 10, 2014, [www.telegraph.co.uk](http://www.telegraph.co.uk).

## Ethical Challenges Involving Technology

With each new technological innovation comes the important ethical question: *Should* we develop and offer the new application? At present, many inventors, computer programmers, and business managers appear only to be asking: *Can* we develop and offer the new application? Both questions are paramount as technology continues to influence individuals, businesses, and society interactions in the world in which we live. Some of the most profound ethical issues involve privacy and free speech.

### The Loss of Privacy

Jeffrey Hancock, a Cornell University professor, warned of the increased potential for privacy invasion due to technology: “This is a new era. I liken it a little to when chemistry got the microscope.”<sup>36</sup> Individuals are indeed under a technology microscope with vast amounts of data collected each minute and available to be analyzed in great detail, sometimes by people with the individuals’ interests in mind, such as marketers, job recruiters, and loan grantors, but also by others who have criminal motives. Others warn that individuals, especially the newest generation, are willing to give up this expectation of privacy. According to Richard Clarke, former senior White House cybersecurity adviser:

“Over time there will be few people who recall pre-Information Age privacy, more people who will have grown up with few expectations of privacy. While a backlash against the erosion of privacy is possible, it is more likely that people acting on their fear of big government and big corporate data will be a minority.”<sup>37</sup>

Invasions of individual privacy come from many different directions. Automobiles are becoming smarter, with global positioning systems, Internet connections, data recorders, and high-definition cameras. While automakers say they are only responding to consumer demands for more technology, the new technologies increase the number of people with access to this data. In 2014 a law was introduced in the United States that would require car owners to control the data collected on the in-car device called the *event data recorder*, commonly known as a black box. The legislation was spurred by the clash over the use of personal data by law enforcement agencies and insurance companies, seeking to use the information against the car owners.

Smartphones are another common device that can capture vast amounts of information. Who should have access to this information? In 2014, Apple and Google announced that they were creating a new operating system for smartphones that would prevent law enforcement agencies from retrieving the data stored on a locked phone, such as photos, videos, and contacts. Apple acknowledged that it could still be required to hand over such data to law enforcement agencies if their users had backed it up on the company’s iCloud servers. In addition, the police can access some iPhone data without Apple’s help, because phone companies keep call logs, and Apple does not control data collected by third-party apps. But, can this information be accessed to better serve people?<sup>38</sup>

Fan Zhang, the owner of Happy Child, a trendy Asian restaurant in downtown Toronto, knows that 170 of his customers went clubbing last month, 250 went to the

<sup>36</sup> “As Data Overflows Online, Researchers Grapple with Ethics,” *The New York Times*, August 12, 2014, [www.nytimes.com](http://www.nytimes.com).

<sup>37</sup> “Will Privacy Be a Thing of the Past?” *The Wall Street Journal*, July 8, 2014, [blogs.wsj.com](http://blogs.wsj.com).

<sup>38</sup> “The Next Data Privacy Battle May Be Wages Inside Your Car,” *The New York Times*, January 10, 2014, [www.nytimes.com](http://www.nytimes.com); and “New Level of Smartphone Encryption Alarms Law Enforcement,” *The Wall Street Journal*, September 22, 2014, [online.wsj.com](http://online.wsj.com).

gym, and 216 came into town from nearby Yorkville, an upscale neighborhood. He accessed this information without his customers' knowledge or permission. As a client of Turnstyle Solutions, a Toronto company that has placed sensors in about 200 businesses within a one-mile radius of downtown Toronto, Zhang can track individuals as they move about in the city. These sensors can track individuals anywhere as long as their Wi-Fi is turned on. Zhang said that he wants the information to better serve his customers, with special promotions or changes in his restaurant's menu.<sup>39</sup>

Ethical challenges on how this information is collected and analyzed are becoming increasingly salient.

### Free Speech Issues

Another important ethical issue arising through the advances in technology involves free speech. As discussed in Chapter 5, individuals have certain ethical rights, including the right to free speech. However, this right is not absolute and must be weighed against its consequences for the community. For example, an individual is not permitted to yell "fire" in a crowded movie theater, even though some might see this as an expression of free speech, since the potential harms caused by panicked moviegoers outweighs the right of free expression. The issue of free speech was at the core of *Elonis v. United States*, a case scheduled to be heard by the U.S. Supreme Court in 2015.

Anthony Elonis was accused of threatening his estranged wife based on a series of Facebook posts. Elonis likened the posts to Eminem's Grammy-winning songs "Kim" and "Kill You," which included threats of violence. He argued that he was only venting frustration after a run of personal setbacks, including the collapse of his marriage and loss of his job. He thought, like the artist Eminem, that he was just expressing his thoughts to a crowd, those accessing his Facebook page, as the singer had to his concert audience. The Justice Department argued that Elonis's posts indicated a "clearly sinister meaning of a threat" and were meant as expressions of his intent to harm his wife. The Supreme Court overturned Elonis' earlier conviction arguing that criminal threats cannot be based solely on whether a reasonable person would regard communications posted on social media or elsewhere as threatening.<sup>40</sup>

Other free speech issues have appeared recently, such as the *Yelp, Inc. v. Hadeed Carpet Cleaning, Inc.* case. Joe Hadeed, owner of a carpet cleaning company, argued that his business dropped 30 percent after two negative posts appeared on Yelp, a social media site where individuals can post reviews about businesses or read reviews posted by others. According to the Federal Trade Commission, they received more than 2,000 complaints about Yelp from 2008 through 2014. Most of the complaints were from small businesses, like Hadeed's, that claimed to have received unfair or fraudulent reviews. Others argued that Yelp had attempted to intimidate owners. "I was contacted by a Yelp salesperson to advertise, which I declined, and since have only had negative posts in their site," said a business owner from New Jersey.<sup>41</sup> These issues raised the ethical and legal question whether anyone can post anything they want on a social media site, even if untrue or unsubstantiated and negative consequences occur due to the posting. In some cases it appears acceptable, but not in other situations.

<sup>39</sup> "What Secrets Your Phone Is Sharing about You," *The Wall Street Journal*, January 13, 2014, [online.wsj.com](http://online.wsj.com).

<sup>40</sup> "In Social-Media Era, When Is Free Speech Illegal?" *The Wall Street Journal*, November 23, 2014, [online.wsj.com](http://online.wsj.com); and "Supreme Court Overturns Conviction for Threats on Facebook," *The Wall Street Journal*, June 1, 2015, [www.wsj.com](http://www.wsj.com). Also see *Elonis v. United States* at [www.scotusblog.com/case-files/cases/elonis-v-united-states](http://www.scotusblog.com/case-files/cases/elonis-v-united-states).

<sup>41</sup> "Yelp Reviews Brew a Fight over Free Speech vs. Fairness," *The Wall Street Journal*, April 2, 2014, [online.wsj.com](http://online.wsj.com).

Summary

- Technology is the practical application of science and knowledge that is rapidly changing and spreading across societies.
- Technology has exponentially increased our ability to communicate with others around the world through the Internet, e-mail, mobile phones, and social networking.
- Technology has changed how businesses offer, sell, and account for their goods and services in the global marketplace through e-business, transforming traditional business practices, and the use of robotics.
- The use of technology often raises important ethical questions, such as the protection of an individual's privacy or the proper use of the right to free speech.
- Genetically modified foods, sequencing the human genome, biotechnology, and stem cell research carry great promise for individuals in society, but have also raised serious concerns.

Key Terms

|                                 |                        |                         |
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Internet Resources

|                               |                                                                     |
|-------------------------------|---------------------------------------------------------------------|
| www.antiphishing.org          | Anti-Phishing Working Group                                         |
| www.improveagriculture.com    | A Place to Learn about Sustainable Agriculture                      |
| www.bio.org                   | Biotechnology Industry Organization                                 |
| www.digitaldividenetwork.org  | Digital Divide Network                                              |
| www.ecommercetimes.com        | E-Commerce Times                                                    |
| www.eff.org                   | Electronic Frontier Foundation                                      |
| genomics.energy.gov           | Genome Projects of the U.S. Department of Energy, Office of Science |
| isscr.org                     | International Society for Stem Cell Research                        |
| www.internetsociety.org       | Internet Society                                                    |
| socialmediatoday.com          | Social Media Today                                                  |
| www.whatisocialnetworking.com | Social Networking                                                   |
| www.statisticbrain.com        | Statistic Brain Research Institute                                  |

Discussion Case: *How Safe Is Your Personal Information?*

Technological advances have resulted in profound changes in society. One of the greatest transformations is the collection, storage, and use of personal information. Access to personal information originates from many different sources, often without the individual being fully aware of it. Businesses may endeavor to use this information to recruit strong

employee applicants, offer more attractive products or services to prospective consumers, package desirable investment options to potential investors, and so on.

But, the risk that this information will fall into the wrong hands or be used for criminal purposes is ever present. In August 2014, the Department of Homeland Security announced that breaches of company safeguards meant to protect personal information had occurred at more than 1,000 American businesses already that year. This situation was so dire that some security analysts said that it had become the exception if businesses' information systems had *not* been compromised.

Criminals had become astonishingly adept at breaking into company records. They had learned how to scan corporate information systems for remote access opportunities—a vendor with remote access to a company's system, for example, or employees with the ability to work remotely—and then deploy computers to guess their usernames and passwords until they found a working combination. They used these footholds to virtually crawl through corporate networks until they gained access to in-store cash register systems. From there, they collected payment card data and sent it back to their servers, often outside the United States. Millions of American consumers' payment card details were allegedly sold on the black market to criminals all over the world. Some of the more significant break-ins are described below.

- At Home Depot, the nation's largest home improvement retailer, 56 million credit card accounts were compromised and 53 million e-mail addresses were exposed. Cybercriminals targeted the firm's 7,500 self-checkout lanes, since these terminals were clearly referenced in their computer systems as payment terminals. Analysts believed that the intruders went undetected as they moved around Home Depot's systems during regular daytime business hours and designed their malware to collect data, transmit it to an outside system, and then erase its tracks before the company's detection systems could discover the attack.
- At Target, a global retailer with revenues approaching \$100 billion annually, an estimated 40 million shoppers' information was exposed. More than 17 million new credit cards had to be reissued following the attack, at an estimated cost of more than \$200 million to the financial institutions involved.
- Anthem, one of the nation's largest health insurers, had up to 80 million records accessed by cybercriminals; these included Social Security numbers, birthdays, physical and e-mail addresses, employment information and income data for customers and employees, including the company's own chief executive. Anthem officials became aware of the breach when one of their senior administrators noticed that someone was using his identity to request information from the company's database. "This is one of the worst breaches I have ever seen," said Paul Stephens, director of Privacy Rights Clearinghouse.
- A cyberattack at Japan Airlines, one of the Japan's two largest airlines, exposed the personal information of more than 750,000 members of their frequent-flier program. The stolen data included names, genders, birth dates, addresses, e-mail addresses, and places of work. The company noticed that their customer information systems were running slowly for a few days; it later estimated that 190,000 customers' data were stolen during this time.
- Twitter, the online social networking service, announced that data for 250,000 of its users were vulnerable after it detected unusual access patterns and discovered their systems had been compromised. Accessed were usernames, e-mail addresses, and encrypted passwords. Some believed that the company's systems were entered through a well-publicized vulnerability in Oracle's Java software, a system installed on more than 3 billion devices.

As these examples show, various weaknesses in companies' software systems can leave customers' information vulnerable to theft (although most credit card companies have fraud protection programs that eliminate any liability for their customers when their cards are fraudulently used). Many companies were deeply worried about the growing risks of cyberattack, and major financial institutions wanted to minimize their potential liability from the fraudulent use of customer data.

How could these companies better protect themselves and their customers? Some firms realized they needed to upgrade security measures within their computer systems to limit access by vendors at remote sites and to require employees working off-site to better secure their computers or other devices with more complex and more difficult-to-detect passwords.

Another possible protection afforded to customers was to upgrade credit and debit cards, using technology first developed and adopted in Europe. So-called EMV cards (for Europay-MasterCard-Visa, the companies that first backed this new technology), easily recognized by their gold, square symbols, were designed to be inserted into a card payment terminal, where they stayed until the transaction was completed. EMVs were more secure, since they were embedded with a special chip that made it harder to access information than from the magnetic strip used on most cards in the United States. EMV cards also created a unique code for each transaction, making them more difficult to counterfeit than striped cards.

Credit card networks embraced the new technology and established October 2015 as the deadline for most U.S. retailers to upgrade their payment systems to accommodate EMV cards. Merchant Warehouse, which processed credit and debit card transactions for 80,000 U.S. merchants, reported however that only 60 percent of its clients' locations would be able to meet that deadline. A major reason for the delay was cost, estimated to be between \$500 and \$1,000 per payment terminal.

Some big retailers, including Walmart, Kroger, and Target, were aggressive in their upgrades and expected to meet the deadline. "We saw the fact that it was being implemented in the U.K. and many other countries around the globe; we saw the fraud decrease once this solution was implemented," said a Walmart financial executive. By 2015, all of the 4,838 Walmart stores, including Sam's Clubs, had the chip-based hardware in place and nearly 1,000 had turned it on.

Another concern was the cost of creating and distributing these new cards. By 2014 about 1 billion credit and debit cards were in use in the United States, but just 20 million chip cards had been issued, according to Smart Card Alliance. The new cards could cost up to \$2 each, compared to pennies for the magnetic-strip cards. With some financial institutions issuing millions of cards, the investment was in the tens of millions of dollars.

The increasing costs for security raised an important issue: Who should pay for protection against cyberattacks? Should it be the retailers or the banks? Predictably, banks said retailers should pay to reissue the new and safer cards after a security breach in which the retailer had been at fault. Retailers countered by saying that banks should take steps to keep cards secure so they cannot be corrupted. This debate made its way to the U.S. Congress, where lawmakers began to examine the issue at a Senate banking committee hearing on data security issues.

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