of the product, workers must be hired. Second, people who were already purchasing the product don't have to pay as much for it. That gives them more money to spend on other things, increasing the demand for other products. This, too, results in job creation. Finally, there is an additional effect, not illustrated in the figure. Some people must be employed designing, creating, and servicing the automated devices themselves.

Consider the automation of stock exchanges. In the past, shares of securities were bought and sold on the floors of stock exchanges by people employed as floor brokers. Today, electronic systems handle most of these transactions, and electronic trading has made transactions quicker and less expensive. Although electronic trading has greatly decreased the number of people employed as floor brokers, the number of shares being traded has increased sharply, and employment in the securities industry has continued to rise (except during recessions) [11]. New kinds of jobs have been created. For example, securities firms have hired mathematicians and computer scientists to develop sophisticated automated trading systems.

WORKING LESS, MAKING MORE

Martin Carnoy disputes the notion that people are working longer hours now than they used to. "Workers today," he writes, "work much less than those of a century ago, produce more, earn substantially more, and have access to a greater variety of jobs. Technology displaced workers but also contributed to a much higher labor productivity and the production of new products, which helped create new jobs, economic growth, and higher incomes" [12].

10.2.3 Effects of Increase in Productivity

Productivity in the United States doubled between 1948 and 1990. Juliet Schor asks us to consider what our society could have done with this dramatic increase in productivity. We could have maintained our 1948 standard of living and gone to a four-hour work day, or a six-month work year. Or every worker could be taking every other year off with pay. Instead of taking the path of working less, the average work week actually rose slightly. As a result, Americans in 1990 owned and consumed twice as much as in 1948, but had less free time in which to enjoy these things [9].

AMERICANS WORK LONG HOURS

American society is remarkable for how hard its citizens work. The number of hours worked per year in the United States is significantly higher than the number of hours worked in France or Germany. It also appears modern Americans work harder than the ancient Greeks, Romans, or Western Europeans of the Middle Ages. According to Juliet Schor, "The lives of ordinary people in the Middle Ages or Ancient Greece and Rome may not have been easy, or even pleasant, but they certainly were leisurely" [9]. In the mid-fourth century, the Roman Empire had 175 public festival days. In medieval England, holidays added up to about four months a year; in Spain, five months; in France, six months. "There is considerable evidence of what economists call the backward-bending supply curve of labor—the idea that when wages rise, workers supply less la-

and Tsinghua University have been actively involved in the development of the Open64 optimizing compiler [58].

More evidence of global competition comes from the annual Association for Computing Machinery International Collegiate Programming Contest. When the contest began 29 years ago, only schools from North America and Europe competed. In 2011, more than 8,000 teams from 88 countries entered the contest. No American team has placed first since Harvey Mudd College in 1997. In the five-year period from 2007 to 2011, all of the winning teams were from universities in China, Russia, or Poland, and of the 50 teams placing in the top ten during this same time period, only five were from the United States [59].

During the deep recession of 2008 and 2009, American corporations like Microsoft, General Electric, JP Morgan Chase, and Best Buy continued "offshoring" white-collar jobs to India and other countries in order reduce their cost of doing business [60].

10.5 The Digital Divide

The digital divide refers to the situation where some people have access to modern information technology while others do not. The underlying assumption motivating the term is that people who use telephones, computers, and the Internet have opportunities denied to people without access to these devices. The idea of a digital divide became popular in the mid-1990s with the rapid growth in popularity of the World Wide Web.

According to Pippa Norris, the digital divide has two fundamentally different dimensions. The global divide refers to the disparity in Internet access between more industrialized and less industrialized nations. The social divide refers to the difference in access between the rich and poor within a particular country [61].

10.5.1 Evidence of the Digital Divide

GLOBAL DIVIDE

There is plenty of evidence of what Norris calls the global divide. One piece of evidence is the percentage of people with Internet access (Figure 10.9). In 2011, about 2.1 billion people, representing about 30 percent of the world's population, had access to the Internet. Access to the Internet in North America, Oceania/Australia, and Europe was significantly above this average, while access in Asia and Africa was well below this average. Only about 11 percent of the population—1 out of every 9 persons—had Internet access in Africa in 2011 [62].

What is hampering Internet development in less technologically developed countries?

1. *Often there is little wealth.*

   In many of these countries there is not enough money to provide everyone in the country with the necessities of life, much less pay for Internet connections.

2. *Many of these countries have an inadequate telecommunications infrastructure.*

For example, less than 5 percent of the people in the African nations of Burundi, the Central African Republic, Chad, Comoros, Eritria, Ethiopia, Guinea, Malawi, Niger, Rwanda, and Sierra Leone subscribe to a telephone service [63]. Many poor people have no access to newspapers, radio, or television [61].

3. *The primary language is not English.*

   English is the dominant language for business and scientific development, giving English-speaking countries a comparative advantage with respect to competing in the global marketplace.

4. *Literacy is low, and education is inadequate.*

   Half of the population in poorer countries has no opportunity to attend secondary schools. There is a strong correlation between literacy and wealth, both for individuals and for societies [27].

5. *The country's culture may not make participating in the Information Age a priority* [64].

SOCIAL DIVIDE

Even within wealthy countries such as the United States, the extent to which people use the Internet varies widely according to age, wealth, and educational achievement. Pew Internet polled Americans to find out how many made use of the Internet in the year 2008. Online access varied from 93 percent of 12–17-year-olds to 27 percent for those 76 and over [65]. A 2011 study revealed that fully 96 percent of adults living in households

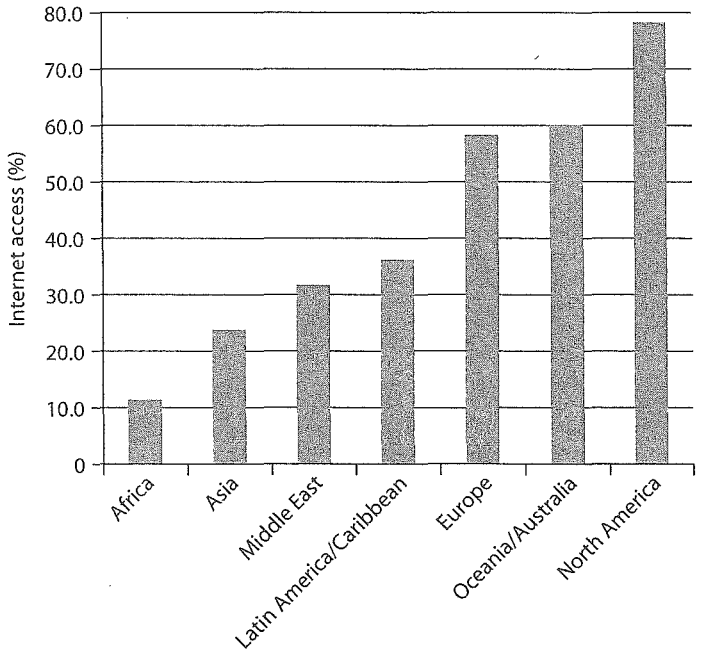

FIGURE 10.9 Percentage of people with Internet access, by world region.