

## Chapter

# 11 Industry and Manufacturing



Why are most potato chips manufactured near their consumers? Page 401



Why are most fabrics made in Asia? Page 411

### KEY ISSUE 1

#### Where Is Industry Distributed?



#### Factories Past and Present p. 395

Much of the world's industry is clustered in three regions.

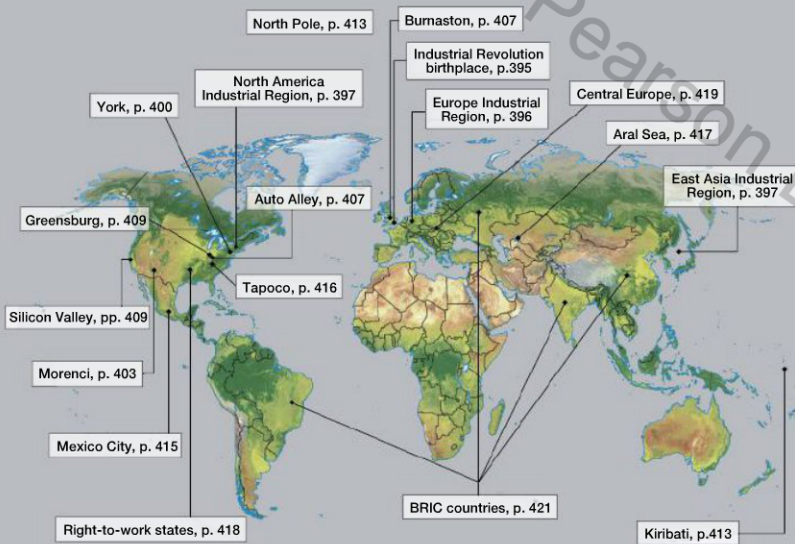
### KEY ISSUE 2

#### Why Are Situation and Site Factors Important?



#### Factors of Production p. 398

Geographers can explain reasons for the location of factories.



▲ Foxconn may not be a familiar brand name, but it is the world's largest manufacturer of electronic components. Owned by Hon Hai Precision Industry Co., Foxconn is the largest exporter of products from China. Its largest main factory in Shenzhen, China, employs several hundred thousand people. Foxconn has become the world's dominant electronics manufacturer because it does the actual manufacturing for several well-known products, including the iPad, iPhone, Kindle, PlayStation 3, and Xbox 360. Geographers study why a company like Apple, which is based in the United States, chooses to have its products made by another company in another country.

### KEY ISSUE 3

**Where Does Industry Cause Pollution?**



### Factories Clean and Dirty p. 412

Some factories pollute our air, land, and water.

### KEY ISSUE 4

**Why Are Situation and Site Factors Changing?**



### Industry on the Move p. 418

Manufacturing is expanding into new regions.



## Introducing

# Industry and Manufacturing

The title of this chapter refers to the manufacturing of goods in a factory. The word *industry* is appropriate because it also means persistence or diligence in creating value. A factory utilizes a large number of people, machinery, and money to turn out valuable products.

In the previous chapter, we looked at agriculture, practiced throughout the inhabited world because the need for food is universal. Industry is much more highly clustered in *space* than is agriculture. In this chapter, we look at the *regions* where factories are located and why. A particular *place* may be well suited or poorly suited for industry, depending on the distinctive characteristics of land, labor, and capital there.

Geographers also recognize that *connections* with the rest of the world are critical in determining whether a particular place is suitable for industry. Two connections are critical in determining the best location for a factory: where the markets for the product are located and where the resources needed to make the product are located.

The invention most important to the development of factories was the steam engine, patented in 1769 by James Watt, a maker of mathematical instruments in Glasgow, Scotland (Figure 11-1). Watt built the first useful steam



▲ **FIGURE 11-1 JAMES WATT'S STEAM ENGINE** This Watt steam engine in Wolverhampton, England. Steam injected in a cylinder (inside the brick housing) pushes a piston attached to a crankshaft that drives machinery (right side of engine).

engine, which could pump water far more efficiently than the watermills then in common use, let alone human or animal power. The large supply of steam power available from James Watt's steam engines induced firms to concentrate all their process steps in one building attached to a single power source. Watt's engine and other inventions enabled the United Kingdom to become the world's dominant industrial power during the nineteenth century.

Until the late twentieth century, industry was still highly clustered in a handful of communities within a handful of developed countries, but industry has diffused to many communities in many developing countries. The United States lost one-third of its manufacturing jobs during the first decade of the twenty-first century.

Today, as countries seek to counter the trend toward deindustrialization, government officials everywhere recognize the powerful role of industry in the economic health of a community. Communities around the world view manufacturing jobs as a special asset, and they mourn when factories close and rejoice when they open. To attract and retain factories, government officials offer financial support that, when scrutinized by independent analysts, is considered excessive.

Transnational corporations operate at a global *scale* for the distribution of markets and resources. Raw materials may be collected from many places, sent to factories located in several other places for a succession of specialized manufacturing procedures, and shipped to consumers located in yet other places.

- **KEY ISSUE 1** looks at *where* industry originated and diffused, as well as its current distribution.
- **KEY ISSUE 2** examines factors underlying *why* industry is distributed in a distinctive pattern. Factors relate to a combination of the unique characteristics of a place and the connections between places.
- **KEY ISSUE 3** looks at environmental issues generated by industry, especially of air, water, and land.
- **KEY ISSUE 4** looks at changes in the factors resulting in changes in distribution. Until the late twentieth century, industry was still highly clustered in a handful of communities within a handful of developed countries, but industry has diffused to many communities in many developing countries. With *globalization* of competition to attract new industries—or, in many places, to retain existing ones—each place possesses distinctive location characteristics. Geographers identify the *local diversity* in assets that enables some communities to compete successfully for industries, as well as handicaps communities must overcome to retain older companies.

## KEY ISSUE 1

# Where Is Industry Distributed?

- The Industrial Revolution
- Industrial Regions

The modern concept of industry—meaning the manufacturing of goods in a factory—originated in northern England and southern Scotland during the second half of the eighteenth century. From there, industry diffused to Europe and to North America in the nineteenth century and to other regions in the twentieth century.

## The Industrial Revolution

The **Industrial Revolution** was a series of improvements in industrial technology that transformed the process of manufacturing goods. Prior to the Industrial Revolution, industry was geographically dispersed across the landscape. People made household tools and agricultural equipment in their own homes or obtained them in the local village. Home-based manufacturing was known as the **cottage industry** system.

The catalyst of the Industrial Revolution was technology, with several inventions transforming the way in which goods were manufactured, beginning with the steam engine, an example of which is shown in Figure 11-1. The revolution in industrial technology created an unprecedented expansion in productivity, resulting in substantially higher standards of living. In Chapter 2, the Industrial Revolution was cited as a principal cause of population growth in stage 2 of the demographic transition.

The term *Industrial Revolution* is somewhat misleading:

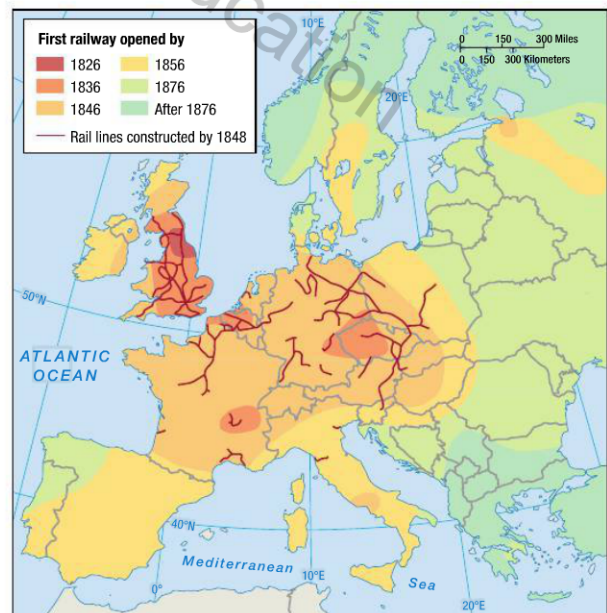
- The transformation was far more than industrial; it resulted in new social, economic, and political inventions, not just industrial ones.
- The changes involved a gradual diffusion of new ideas and techniques over decades rather than an instantaneous revolution.

Nonetheless, the term is commonly used to define the process that began in the United Kingdom in the late 1700s. Among the first industries impacted by the Industrial Revolution were:

- **Iron.** The first industry to benefit from Watt's steam engine was the iron tool industry. The usefulness of iron had been known for centuries, but it was difficult to produce because ovens had to be constantly heated, something the steam engine could do.
- **Coal.** Wood, the main energy source prior to the Industrial Revolution, was becoming scarce in England because it was in heavy demand for construction of

ships, buildings, and furniture, as well as for heat. Manufacturers turned to coal, which was then plentiful in England. It became the principal source of energy to operate the ovens and the steam engines.

- **Transportation.** First canals and then railroads enabled factories to attract large numbers of workers, bring in bulky raw materials such as iron ore and coal, and ship finished goods to consumers (Figure 11-2).
- **Textiles.** Textile production was transformed from a dispersed cottage industry to a concentrated factory system during the late eighteenth century. In 1768, Richard Arkwright, a barber and wigmaker in Preston, England, invented machines to untangle cotton prior to spinning. Too large to fit inside a cottage, spinning frames were placed inside factories near sources of rapidly flowing water, which supplied the power.
- **Chemicals.** The chemical industry was created to bleach and dye cloth. In 1746, John Roebuck and Samuel Garbett established a factory to bleach cotton with sulfuric acid obtained from burning coal. When combined with various metals, sulfuric acid produced another acid called vitriol, which was useful for dyeing clothing.
- **Food processing.** In 1810, French confectioner Nicolas Appert started canning food in glass bottles sterilized in boiling water. Canned food was essential to feed the factory workers who no longer lived on farms.



▲ **FIGURE 11-2 DIFFUSION OF THE INDUSTRIAL REVOLUTION** The construction of railroads in the United Kingdom and on the European continent reflects the diffusion of the Industrial Revolution. Europe's political problems impeded the diffusion of the railroad. Cooperation among small neighboring states was essential to build an efficient rail network and to raise money for constructing and operating the system. Because such cooperation could not be attained, railroads in some parts of Europe were delayed 50 years after their debut in Britain.



## Industrial Regions

### Learning Outcome 11.1.1

Describe the locations of the principal industrial regions.

Industry is concentrated in three of the nine world regions discussed in Chapter 9 regions of the world: Europe (Figure 11-3), North America (Figure 11-4), and East Asia (Figure 11-5). Each of the three regions accounts for roughly one-fourth of the world's total industrial output. Outside these three regions, the leading industrial producers are Brazil and India.

### EUROPE'S INDUSTRIAL AREAS

Major industrial areas in Europe include:

- The **United Kingdom** dominated world production of steel and textiles during the nineteenth century. These industries have declined, but the country has attracted international investment through new high-tech industries that serve the European market.
- The **Rhine-Ruhr Valley** has a concentration of iron and steel manufacturing because of proximity to large coalfields. Rotterdam, the world's largest port, lies at the mouth of several branches of the Rhine River as it flows into the North Sea.
- The **Mid-Rhine** is Europe's most centrally located industrial area. Frankfurt is a financial and commercial center and the hub of Germany's transport network. Stuttgart specializes in high-value goods that require skilled labor. Mannheim, an inland port along the Rhine, has a large chemical industry that manufactures synthetic fibers, dyes, and pharmaceuticals.



**▲ FIGURE 11-3 EUROPE'S INDUSTRIAL AREAS** Europe was the first region to industrialize during the nineteenth century. Numerous industrial centers emerged in Europe as countries competed with each other for supremacy.

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- The **Po Basin** has attracted textiles and other industries because of two key assets, compared to Europe's other industrial regions: numerous workers willing to accept lower wages and inexpensive hydroelectricity from the nearby Alps.
- **Northeastern Spain** was Europe's fastest-growing manufacturing area during the late twentieth century. Spain's leading industrial area, Catalonia, centered on the city of Barcelona, is the center of Spain's textile industry and the country's largest motor-vehicle plant.
- **Moscow** is Russia's oldest industrial region, centered around the country's capital and largest city.
- **St. Petersburg**, Russia's second-largest city, specializes in shipbuilding and other industries serving Russia's navy and ports in the Baltic Sea.
- The **Urals**, contain the world's most varied collection of minerals. Proximity to these minerals has attracted iron and steel, chemicals, machinery, and metal fabricating plants.
- **Volga** is the region containing Russia's largest petroleum and natural gas fields. To the northeast, the Ural mountain range contains more than 1,000 types of minerals, the most varied collection found in any mining region in the world.
- **Kuznetsk** is Russia's most important manufacturing district east of the Ural Mountains, with the country's largest reserves of coal and an abundant supply of iron ore.
- **Donetsk**, in Eastern Ukraine, has one of the world's largest coal reserves.
- **Silesia**, Europe's most rapidly growing industrial area, takes advantage of a skilled but low-paid workforce and proximity to wealthy markets in Western Europe.

### NORTH AMERICA'S INDUSTRIAL AREAS

Major industrial areas in North America include:

- **New England** was a cotton textile center in the early nineteenth century. Cotton was imported from southern states, and finished cotton products were shipped to Europe.
- The **Middle Atlantic** is the largest U.S. market, so the region attracts industries that need proximity to a large number of consumers and depend on foreign trade through one of this region's large ports.
- The **Mohawk Valley**, a linear industrial belt in upper New York State, takes advantage of inexpensive electricity generated at nearby Niagara Falls.
- **Pittsburgh-Lake Erie** was the leading steel-producing area in the nineteenth century because of its proximity to Appalachian coal and iron ore.



**FIGURE 11-4 NORTH AMERICA'S INDUSTRIAL AREAS** Industry arrived a bit later in North America than in Europe, but it grew much faster in the nineteenth century. North America's manufacturing was traditionally highly concentrated in the northeastern United States and southeastern Canada. In recent years, manufacturing has relocated to the South, lured by lower wages and legislation that has made it difficult for unions to organize factory workers.

## ASIA'S INDUSTRIAL AREAS

Major industrial areas in Asia include:

- **Japan** became an industrial power in the 1950s and 1960s, initially by producing goods that could be sold in large quantity at cut-rate prices to consumers in other countries. Manufacturing is concentrated in the central region, between Tokyo and Nagasaki.
- **China** has the world's largest supply of low-cost labor and is the world's largest market for many consumer products. Manufacturers cluster in three areas along the east coast: near Guangdong and Hong Kong, in the Yangtze River valley between Shanghai and Wuhan, and along the Gulf of Bo Hai, from Tianjin and Beijing to Shenyang.
- **South Korea** followed Japan's lead in focusing on export-oriented manufacturers. The country is a leading producer of ocean-going ships. Manufacturing is centered along the rim of the country between the capital and largest city Seoul and Busan, the largest port.



**FIGURE 11-5 EAST ASIA'S INDUSTRIAL AREAS** East Asia became an important industrial region in the second half of the twentieth century, beginning with Japan. Into the twenty-first century, China has emerged as the world's leading manufacturing country by most measures.

- The **Western Great Lakes**, centered on Chicago, is the hub of the nation's transportation network and is now the center of steel production.
- **Southern California** is now the country's largest area of clothing and textile production, the second-largest furniture producer, and a major food-processing center.
- **Southeastern Ontario**, Canada's most important industrial area, is central to the Canadian and U.S. markets and near the Great Lakes and Niagara Falls.

### CHECK-IN: KEY ISSUE 1

#### Where Is Industry Distributed?

- ✓ The Industrial Revolution was a series of improvements that transformed manufacturing. Most of the improvements occurred first in the United Kingdom.
- ✓ The world's three principal industrial regions are Europe, North America, and East Asia.