



# The Beginnings of Industrialization

## MAIN IDEA

### SCIENCE AND TECHNOLOGY

The Industrial Revolution started in England and soon spread to other countries.

## WHY IT MATTERS NOW

The changes that began in Britain paved the way for modern industrial societies.

## TERMS & NAMES

- Industrial Revolution
- enclosure
- crop rotation
- industrialization
- factors of production
- factory
- entrepreneur

**SETTING THE STAGE** In the United States, France, and Latin America, political revolutions brought in new governments. A different type of revolution now transformed the way people worked. The **Industrial Revolution** refers to the greatly increased output of machine-made goods that began in England in the middle 1700s. Before the Industrial Revolution, people wove textiles by hand. Then, machines began to do this and other jobs. Soon the Industrial Revolution spread from England to Continental Europe and North America.

## Industrial Revolution Begins in Britain

In 1700, small farms covered England's landscape. Wealthy landowners, however, began buying up much of the land that village farmers had once worked. The large landowners dramatically improved farming methods. These innovations amounted to an agricultural revolution.

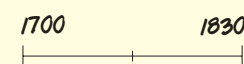
**The Agricultural Revolution Paves the Way** After buying up the land of village farmers, wealthy landowners enclosed their land with fences or hedges. The increase in their landholdings enabled them to cultivate larger fields. Within these larger fields, called **enclosures**, landowners experimented with more productive seeding and harvesting methods to boost crop yields. The enclosure movement had two important results. First, landowners tried new agricultural methods. Second, large landowners forced small farmers to become tenant farmers or to give up farming and move to the cities.

Jethro Tull was one of the first of these scientific farmers. He saw that the usual way of sowing seed by scattering it across the ground was wasteful. Many seeds failed to take root. He solved this problem with an invention called the seed drill in about 1701. It allowed farmers to sow seeds in well-spaced rows at specific depths. A larger share of the seeds took root, boosting crop yields.

**Rotating Crops** The process of **crop rotation** proved to be one of the best developments by the scientific farmers. The process improved upon older methods of crop rotation, such as the medieval three-field system. One year, for example, a farmer might plant a field with wheat, which exhausted soil nutrients. The next year he planted a root crop, such as turnips, to restore nutrients. This might be followed in turn by barley and then clover.

### TAKING NOTES

**Following Chronological Order** On a time line, note important events in Britain's industrialization.



► An English farmer plants his fields in the early 1700s using a seed drill.



Livestock breeders improved their methods too. In the 1700s, for example, Robert Bakewell increased his mutton (sheep meat) output by allowing only his best sheep to breed. Other farmers followed Bakewell's lead. Between 1700 and 1786, the average weight for lambs climbed from 18 to 50 pounds. As food supplies increased and living conditions improved, England's population mushroomed. An increasing population boosted the demand for food and goods such as cloth. As farmers lost their land to large enclosed farms, many became factory workers. **A**

**Why the Industrial Revolution Began in England** In addition to a large population of workers, the small island country had extensive natural resources. **Industrialization**, which is the process of developing machine production of goods, required such resources. These natural resources included

- water power and coal to fuel the new machines
- iron ore to construct machines, tools, and buildings
- rivers for inland transportation
- harbors from which merchant ships set sail

In addition to its natural resources, Britain had an expanding economy to support industrialization. Businesspeople invested in the manufacture of new inventions. Britain's highly developed banking system also contributed to the country's industrialization. People were encouraged by the availability of bank loans to invest in new machinery and expand their operations. Growing overseas trade, economic prosperity, and a climate of progress led to the increased demand for goods.

Britain's political stability gave the country a tremendous advantage over its neighbors. Though Britain took part in many wars during the 1700s, none occurred on British soil. Their military successes gave the British a positive attitude. Parliament also passed laws to help encourage and protect business ventures. Other countries had some of these advantages. But Britain had all the **factors of production**, the resources needed to produce goods and services that the Industrial Revolution required. They included land, labor, and capital (or wealth).

## Inventions Spur Industrialization

In an explosion of creativity, inventions now revolutionized industry. Britain's textile industry clothed the world in wool, linen, and cotton. This industry was the first to be transformed. Cloth merchants boosted their profits by speeding up the process by which spinners and weavers made cloth.

**Changes in the Textile Industry** As you will learn in the feature on textile technology on page 285, by 1800, several major inventions had modernized the cotton industry. One invention led to another. In 1733, a machinist named John Kay made a shuttle that sped back and forth on wheels. This flying shuttle, a boat-shaped piece

### MAIN IDEA

#### Recognizing Effects

**A** How did population growth spur the Industrial Revolution?

# Global Impact: Revolutions in Technology

## Textiles Industrialize First

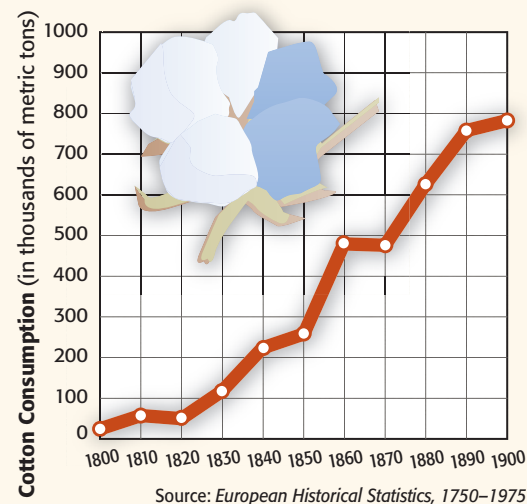
The Industrial Revolution that began in Britain was spurred by a revolution in technology. It started in the textile industry, where inventions in the late 1700s transformed the manufacture of cloth. The demand for clothing in Britain had greatly increased as a result of the population boom caused by the agricultural revolution. These developments, in turn, had an impact worldwide. For example, the consumption of cotton rose dramatically in Britain (see graph at right). This cotton came from plantations in the American South, where cotton production skyrocketed from 1790 to 1810 in response to demand from English textile mills.

► John Kay's flying shuttle (below) speedily carried threads of yarn back and forth when the weaver pulled a handle on the loom. The flying shuttle greatly increased the productivity of weavers.



▲ Flying shuttle

### British Cotton Consumption, 1800–1900



### Patterns of Interaction

*Technology Transforms an Age: The Industrial and Electronic Revolutions*

Inventions in the textile industry started in Britain and brought about the Industrial Revolution. This revolution soon spread to other countries. The process of industrialization is still spreading around the world, especially in developing countries. A similar technological revolution is occurring in electronics today, transforming the spread of information around the world.

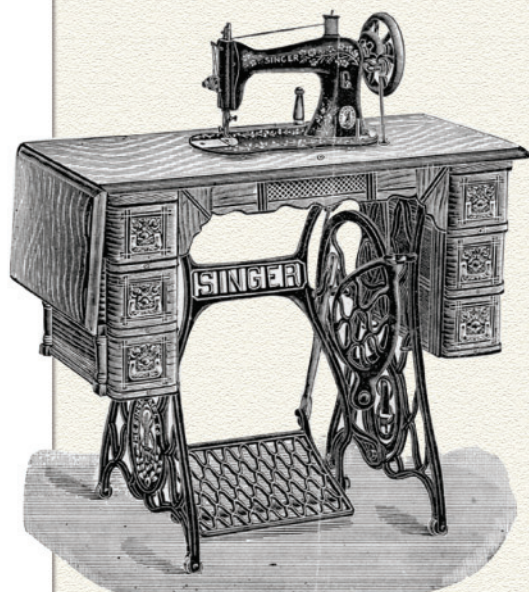
### Connect to Today

**1. Synthesizing** How might the technological innovation and industrialization that took place in the textile industry during the Industrial Revolution have provided a model for other industries?

See Skillbuilder Handbook, Page R21.

**2. Recognizing Effects** Research the textile industry today to learn how it has been affected by new technology, including computerization. Prepare a two-paragraph summary on the effects of the new technology.

## History *in* Depth



### Inventions in America

In the United States, American inventors worked at making railroad travel more comfortable, inventing adjustable upholstered seats. They also revolutionized agriculture, manufacturing, and communications:

- 1831** Cyrus McCormick's reaper boosted American wheat production.
- 1837** Samuel F. B. Morse, a New England painter, first sent electrical signals over a telegraph.
- 1851** I. M. Singer improved the sewing machine by inventing a foot treadle (see photograph).
- 1876** Scottish-born inventor Alexander Graham Bell patented the telephone.

#### INTEGRATED TECHNOLOGY

**INTERNET ACTIVITY** Create a photo exhibit on American inventions of the 19th century. Include the name of the inventor and the date with each photograph. Go to [classzone.com](http://classzone.com) for your research.

of wood to which yarn was attached, doubled the work a weaver could do in a day. Because spinners could not keep up with these speedy weavers, a cash prize attracted contestants to produce a better spinning machine. Around 1764, a textile worker named James Hargreaves invented a spinning wheel he named after his daughter. His spinning jenny allowed one spinner to work eight threads at a time.

At first, textile workers operated the flying shuttle and the spinning jenny by hand. Then, Richard Arkwright invented the water frame in 1769. This machine used the waterpower from rapid streams to drive spinning wheels. In 1779, Samuel Crompton combined features of the spinning jenny and the water frame to produce the spinning mule. The spinning mule made thread that was stronger, finer, and more consistent than earlier spinning machines. Run by waterpower, Edmund Cartwright's power loom sped up weaving after its invention in 1787. **B**

The water frame, the spinning mule, and the power loom were bulky and expensive machines. They took the work of spinning and weaving out of the house. Wealthy textile merchants set up the machines in large buildings called **factories**. Factories needed waterpower, so the first ones were built near rivers and streams:

#### PRIMARY SOURCE

A great number of streams . . . furnish water-power adequate to turn many hundred mills: they afford the element of water, indispensable for scouring, bleaching, printing, dyeing, and other processes of manufacture: and when collected in their larger channels, or employed to feed canals, they supply a superior inland navigation, so important for the transit of raw materials and merchandise.

**EDWARD BAINS**, *The History of Cotton Manufacture in Great Britain* (1835)

England's cotton came from plantations in the American South in the 1790s. Removing seeds from the raw cotton by hand was hard work. In 1793, an American inventor named Eli Whitney invented a machine to speed the chore. His cotton gin multiplied the amount of cotton that could be cleaned. American cotton production skyrocketed from 1.5 million pounds in 1790 to 85 million pounds in 1810.

#### MAIN IDEA

#### Summarizing

**B** What inventions transformed the textile industry?