

THE INDUSTRIAL REVOLUTION

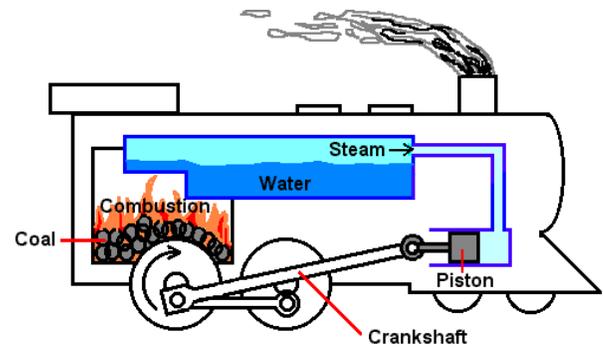
Why This Unit?

In 1750, China's share of world manufacturing output was 32.8 percent, while Europe's was 23.2 percent. Together, India and China accounted for 57.3 percent of world manufacturing output, and if the rest of Asia is included, the total jumps to 70 percent. Most of the manufacturing was in cotton and silk textiles, which became the basis for industrialization in Britain. Once started, Britain's adoption of steam-powered mechanical manufacturing changed the production capacity globally. It enormously increased the capacity of some groups, mostly the British at first, to produce goods and services. It greatly altered the distribution of wealth and poverty around the world and engendered new attitudes towards nature and society. The fossil fuel revolution was a revolution in the use of coal, which transformed the world's energy regime from one based on biomass (wood) and animal muscle to one increasingly dependent on fossil fuels. Early in the era, the steam engine harnessed coal power, which vastly expanded the amount of energy per capita available to humans. Steam-powered industry first became established in Britain, but the Industrial Revolution was a global event. It happened to the whole world in the eighteenth and nineteenth centuries, though in different ways and at different moments.

The Historical Context

In the first phase of the Industrial Revolution (1750-1840), entrepreneurs and workers, mainly in Britain, harnessed coal and steam power to drive industrial machinery. This technology vastly increased production. Railroad construction propelled coal and steel industries and facilitated the expansion of domestic and international markets that helped form the modern world economy. Colonies of European powers and many other rural regions of the world produced raw materials for export to manufacturing centers, which sold them finished goods. Thus, the societies that produced "primary materials" participated in the Industrial Revolution by supplying commodities, including food, that the industrializing regions had to have. At the beginning of the era, sugar was the world's most important commercial crop, but in the 1830s cotton replaced it, owing to the mechanization of production and establishment of a global cotton market. Britain did not produce any raw cotton but rather

imported it at advantageous prices from India, Egypt, and the southern United States. British manufacturers then mass-produced cotton textiles using machines, and they inundated the world market with cotton products. For British business people, this was good liberal practice because the market was allowed to determine whether Indians bought local or European cotton textiles. The market, however, drove down prices in India and thereby destroyed the livelihood of local spinners and weavers there during the first phase of the industrialization process.



Lesson 1 — The Steam Engine

Introduction

In 1800, British miners produced about 10 million tons of coal, which was 90 percent of the world's output. In this lesson, students will learn why British miners were working so hard to get coal out of the ground. The lesson also will focus on the reasons for the British development of steam power. It will also ask students to compare the use of coal for manufacturing in Great Britain with the types of energy used in China and India in 1800, when those regions continued to dominate manufacturing globally. Finally, the lesson will explore the connection between steam power for manufacturing and steam power for railroads and ships. Since ancient times, peoples of Afroeurasia have created a variety of designs and uses of water and steam power for grinding grain, mechanically moving objects, and manufacturing. The "engine science" developments in England and Scotland in the seventeenth through the nineteenth centuries dramatically changed the use of steam power by simultaneously applying it to manufacturing and transportation.

Figure 1.1 – The Evolution/Effect of Steam Engines

1698 - English engineer Thomas Savery gained a royal patent for an apparatus that was able to draw water up by suction to a height of approximately 26-28 feet owing to the action of atmospheric pressure and the condensation of steam, which was created by heating water with coal within the closed vessel. He successfully advertised his water pumping steam engine to owners of coal mines in his region of England where deepening mines kept filling with water.

1700 - 2.7 million tons of coal were mined in Britain

1712 - English blacksmiths Thomas Newcomen and John Calley improved Savery's steam engine by combining a cylinder with a water pump powered by a rocking piston.

1736 - British inventor Jonathan Hull gained a royal patent for his steam tugboat design.

1750 - 4.7 million tons of coal were mined in Britain.

1763 - Scottish instrument-maker and engineer James Watt improved a Newcomen steam engine by cooling the used steam in a condenser separate from the main cylinder. John Roebuck, the owner of a Scottish ironworks, provided financial backing for Watt's project. By 1769, 2,500 steam engines were being used to pump water out of coal mines in Britain.

1785 - English Anglican minister and inventor Edmund Cartwright patented the first steam power loom and set up a factory in Doncaster, England to manufacture cotton cloth.

1788 - Englishmen William Symmington and Patrick Miller built a paddle steamboat using the Watt steam engine.

1797 - 900 cotton mills were operating across Britain.

1800 - 10 million tons of coal were mined in Britain.

1814 - 5 steam-powered ships operated in British waters.

1820 - 34 steam-powered ships operated in British waters.

1825 - First steam engine railway used to transport passengers, iron, and other goods in Britain.

1830 - A few dozen miles of railroad track existed in Britain

1835 - 106,000 power looms operated in England.

1840 - Britain was exporting 200 million yards of cotton textiles to other European countries and 529 million yards of cotton textiles elsewhere in the world.

1840 - 4,500 miles of railroad track existed in Britain.

1840 - 1,325 steam vessels operated in Britain

1850 - 50 million tons of coal were mined in Britain.

1850 - 23,000 miles of railroad track existed in Britain

Figure 1.2 – Iron Production

Date (AD)	Country or Region	Iron Production (tons per year)
1078	China	125,000
1500	Europe (-Russia)	60,000
1740	Britain	17,000
1750	China	200,000
1750	India	200,000
1750	Europe (+Britain, -Russia)	200,000
1793	Russia	202,000
1806	Europe (+Britain, -Russia)	700,000
1806	Britain	248,000
1806	France	200,000

Figure 1.3 – Textile Production and Trade in India and Great Britain 1760-1830

Date (AD)	Raw cotton consumption in Great Britain (millions of lbs.)	Exports of cotton textiles from Great Britain (British sterling)
1760-69	3.5	£227
1820-29	166.5	£25,375

Date (AD)	British imports of cotton piece goods from India (British sterling)	Exports of cotton textiles from Great Britain (British sterling)
1772-74	£697	£221
1824-26	£363	£17,375