

The origins of the Industrial Revolution

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Pollution from copper factories in Cornwall, England, during the Industrial Revolution. Engraving from History of England by Rollins, 1887, private collection. Courtesy of Leemage/Corbis. Chart below taken from Cohen, Sharon.

We have learned in this course that major global changes do not happen overnight. There are usually several factors or conditions that all come together to make change possible.

This is true of the Industrial Revolution, a major change in the way the global economy worked. The Industrial Revolution changed how goods were produced and traded, and how governments supported these economic efforts.

We must be clear: humans have been manufacturing things for a very long time. However, before the Industrial Revolution began in the mid-eighteenth century, individual craftsmen and women often created products (such as cloth textiles) in their homes.

There were also some regions of the world that were better known for producing quality items for sale both at home and abroad. For example, Belgium was a center of woolen products during Europe's medieval period; India had a reputation for producing high-quality cotton fabrics; and China had long been the center of silk production. But what made production during the Industrial Revolution different?

Between 1750 and 1914, there was a global shift in how goods were manufactured. To some extent, these changes happened across the world — from Europe and the Americas to Asia. During this 164-year period, each of these regions became much more industrialized.

In their book *The Human Web*, historians J. R. and William H. McNeill argue that several factors made the Industrial Revolution possible. First, vast amounts of energy were unleashed, in the form of burning fossil fuels, like coal. Capital (money) was becoming more concentrated. Certain people and companies were becoming richer, and able to create large businesses. Finally, trade connections were growing stronger through transportation innovations such as canals and turnpikes (like early highways), and later, steamships. More efficient transportation helped transform the production and distribution of goods — especially in the Northern Hemisphere. All of these factors – fossil fuels, money to invest in innovations, and advances in transportation – were present in Europe, the Americas, and Asia.

For example, coal was mined in Europe, East Asia, and North America. According to the McNeills, “Song China had used [coal] on a large scale in its iron industry. London had burned coal for home heating from at least the thirteenth century.” (231) The northeastern United States and central China had many waterways that provided cheap transportation. And throughout the sixteenth and seventeenth centuries, hundreds of galleons (large sailing ships) loaded with goods and raw materials made the journey from South America to China, providing China with plenty of capital.

Yet, the Industrial Revolution began in Great Britain. Why? And why did it happen in the eighteenth and nineteenth centuries? What changed in Europe and particularly in Great Britain that created the ideal Goldilocks Conditions for such a dramatic change in how people produced goods and services?

Sugar plantations as a blueprint for industrialization

One change was how Europeans thought of labor: the work that was done. The ways people worked were changing drastically, first in the Americas and later all over the world.

We can see this in the development of the sugar industry on the Caribbean islands and Brazil. Producing sugar was a hot, noisy industry that required intense labor and had to stick to a strict timeline.

Not only that, but it required a large initial investment of money to build sugar plantations and mills. Sugar production also required cheap labor.

Historians Kenneth Pomerantz and Steven Topik make the argument that “the scale, complexity, and social organization of the sugar mills,” made them the first modern factories and therefore, a blueprint for other factory systems. (227)

There were two main factors that made sugar mills unique for their time. The first was strict time schedules. Once the sugar cane was cut, it had to be processed quickly to prevent the cane from rotting. Since the sugar mills had to process the cane quickly, laborers in the mills had to work around the clock. Every step of the production process was designed to maximize the amount of sugar produced.

The second factor was the treatment of workers. In sugar production, the workers were mostly slaves. They were seen as interchangeable parts within the process, like parts in a machine. This blueprint for mass production would eventually be adapted to a number of different industries around the world.

Cotton, coal, colonies, and cheap labor

It's important to consider how labor changed during the Industrial Revolution. Still, this doesn't answer the question of how the Industrial Revolution came about and why it started in Great Britain. Great Britain did not grow sugar cane. It didn't have a large slave population either.

Yet it did have three key features that transformed the British economy: access to raw materials, trade routes, and cheap labor. However, Great Britain still needed something else to bring these factors together.

Look at the chart on global manufacturing output below. This chart shows how much stuff each country was producing by 1750. We can see that at this point, Great Britain — and all of Europe in fact — was far behind Asia in terms of goods produced.

Manufacturing Output: 1750

China	32.8%
India	24.5%
Europe (not including Great Britain)	21.2%
Asia (not including China and India)	12.7%
America and Africa	6.8%
Great Britain	2.0%

We know, though, that by the late eighteenth century and through the nineteenth century, Great Britain became the leader in the production and trade of manufactured goods. Clearly, Great Britain had to make a big leap in order to catch up with Asian production.

One major reason Europe manufactured less than Asia during this time was that Europeans did not wear cotton clothing. Most Europeans wore either wool or cloth made from flax. This was not the case in Africa or Asia, where cotton and silk were preferred.

In order to compete in the global economy, Great Britain decided to get into the cotton business. This was not as easy as it sounds. However, the British already had a few advantages: colonies in North America, the Caribbean, and India; extensive trade routes between these colonies; and access to raw materials, in particular cotton and coal.

The majority of Great Britain's cotton came from the American South. In 1861, just before the U.S. Civil War, Great Britain purchased more than half of the cotton the American South produced. (Pomerantz and Topik, 230) Great Britain bought cotton from Egypt and India, too, knowing the Civil War would disrupt trans-Atlantic trade. The mills in Britain needed raw cotton to keep working.

Because Great Britain was a part of extensive exchange networks at this time, it also had the ability to ship manufactured cloth around the world. Looking at the chart below, we can see a huge acceleration in raw cotton imports and manufactured cotton textile exports.

Date	Raw cotton consumption in Great Britain	Exports of cotton textiles from Great Britain
1760 to 1769	3.5 million pounds	£227
1820 to 1829	166.5 million pounds	£25,605

Date	British imports of cotton piece goods from India	British exports of cotton from textiles
1772 to 1774	£697	£221
1824 to 1826	£363	£17,375

When we look at these two charts, we can see that within a very short time span, Great Britain went from being an importer of textiles to a major exporter of textiles.

Coal was also an important raw material that drove the Industrial Revolution. Coal allowed the textile industry to become mechanized — for machines to be used on a large scale. This ultimately allowed Great Britain to become the top manufacturer of textiles. To understand how important coal was to the Industrial Revolution, look at the information below. Here is how much coal was mined in Great Britain in that time period:

1700: 2.7 million tons

1750: 4.7 million tons

1800: 10 million tons

1850: 50 million tons

Of course, it wasn't just cotton cloth being produced from all that energy. Still, the textile industry was able to use coal to great success in the early days of the Industrial Revolution. With 50 million tons of coal burned in 1850, we can deduce that a lot of factories and industries were dependent on it at this time.

The third element needed for the Industrial Revolution in Great Britain was access to cheap labor. During the eighteenth century, the vast majority of British people lived and worked on farms. However, beginning in the late sixteenth century England began to privatize, or "enclose," public lands. Poorer people could no longer farm them.

The enclosure movement accelerated during the eighteenth century. According to historian John Merriman, between 1760 and 1815, 3,600 acts or laws by England's Parliament "enclosed more than seven million acres of land, more than one-fourth of the farmlands in England." (361) This meant that all of this land was removed from public access and use and taken over by private individuals.

Merriman also notes that after 1760, "The poorest members of the rural community lost their age-old access to lands on which they had gleaned (collected) firewood, gathered nuts and berries, and grazed animals. Before enclosure, it was said, a 'cottager' was a laborer with land; after enclosure, he was a laborer without land." (361) It was these landless laborers who would eventually become the workers of the Industrial Revolution.

Other factors needed for the Industrial Revolution

Coal and cotton were the raw materials necessary for industrialization. Great Britain had access to both. They also had colonies around the world — colonies that could provide both raw materials and markets to buy British manufactured goods. Finally, due to the enclosure movement in the late eighteenth century, Great Britain had a growing population of people moving from rural areas (countryside) to urban areas (cities) in need of employment.

As if these factors were not enough to create a revolution in manufacturing, the British had two additional reasons for industrialization: innovation and mercantilism.

One innovation that many historians point to as being the catalyst — cause — for the Industrial Revolution is the invention of the steam engine in 1698 by Thomas Savery, an English engineer. The steam engine was first used to pump water out of coal mines. However, after years of improving upon the invention, it was eventually adapted and used for tugboats (1736), paddleboats (1788), steamships (1814), and railroad engines (1825). Obviously, the steam engine helped to make transportation more efficient, but it was also used to transform the textile industry.

In the mid-1700s the first machine that could turn raw cotton into thread was created. (It was called the steam-powered spinning jenny). This machine could produce as much thread in three hours as an expert spinner could produce in 50 hours by hand, and for a lot less money. Then in 1785 the first steam-powered loom was invented. At first it made a coarse,

uncomfortable fabric that was not very desirable. That would soon change, and quickly. By 1797, there were more than 900 cotton mills operating in Great Britain. By 1835, there were more than 106,000 steam-powered looms.

What is the relationship between steam-powered machines and the price of goods and labor? Between 1800 and 1835, the wages of hand-loom weavers had dropped by 60 percent. We know that steam-powered looms became more popular during this time. We can infer that the machines (and there were a lot of them), could produce textiles a lot faster than a weaver working by hand. The second is the cost of fabric. In the same time period, the price for a piece of fabric dropped from 40 shillings to 5 shillings. This meant that textiles were being produced faster and cheaper than ever before due to the revolution in fuel, machines, and labor.

This information supports the data in the charts, which show that Great Britain's exports increased dramatically during this time period, while its imports from Asia (mostly India) declined.

However, the game changer for Great Britain in defeating global competition was mercantilism. The economic philosophy of mercantilism was quite popular during this time period. Its main premise was to create a favorable balance of trade that benefited the home country. This meant that a nation should export more than it imported in order to make sure there was more gold and silver in the treasury (basically a nation's savings account).

Great Britain achieved this economic goal by putting tariffs (taxes) on imported fabrics from India. These protective tariffs made Indian imported fabrics more expensive. The tariffs were kept in place until British manufacturers could match the quality and cheaper cost of imported Indian textiles. Once British factories achieved this goal, then the tariffs could be reduced or eliminated. But by then the damage to the Indian textile industry was already done.

The Industrial Revolution goes global

As we noted above, the conditions for the Industrial Revolution existed in a number of regions, but they first came together in Britain. Great Britain had the Goldilocks Conditions that allowed it to transform to an industrial system. However, Britain's competitive advantage would last for only a short time.

Because the Industrial Revolution brought advances in transportation and communication, ideas spread at an accelerated rate during this period. As a result, other countries picked up on what Great Britain was doing and began to transform their own economies. In the United States, New England became the early center of the textile trade due to its access to cheap energy, good transportation, and capital. The same is true for Germany and parts of Asia — with Japan becoming one of the mightiest industrial powers. By the dawn of the twentieth century, the balance of power had shifted from the traditional agrarian civilizations that had reigned for thousands of years to those nations that could industrialize the fastest.