

Chapter 1

The Industrial Revolution

The word 'revolution' implies a dramatic change, and is usually used to describe a political event like our rejection of England's rule. The term also can also be used to describe an economic upheaval. In an 'industrial revolution' there is a dramatic change from a society in which most people live on farms to one where most people live in towns or cities. For example, when George Washington was president the vast majority of Americans (some 90%) made their living by tilling the soil, and some two hundred years later, fewer than 3% were farmers.

Sometime between the year 1800 and 2000, the U.S. experienced an industrial revolution that caused numerous changes in the ways people thought, earned their living, dressed, traveled, related to one another, and spent their free time. It is difficult to point to the exact years in which these changes took place. Most historians, however, would agree that the smaller changes occurred slowly during the 1790's, picked up during the years before the Civil War, and gathered speed after the War. By 1920 the U.S. had completed its change from a nation of farmers to an industrialized society.

Advantages of Having an Industrial Revolution

It is easy to see the advantages an industrial revolution can bring. Imagine not having electricity, running water, or a car. Imagine walking 10 miles to a one-room school, wearing clothes that were made at home, and having a fireplace your only source of heat. These were just a few hardships faced by our pre-industrial, colonial ancestors. Today, countries that have not gone through an industrial revolution typically have an infant death rate approaching 20%, a life expectancy under 50 years of age, a diet that can't insure good health, and a per person income of less than the amount of money an American high school student and his/her date might spend on their senior prom. People who live in non-industrial countries such as Bangladesh and Haiti, Nigeria or Algeria typically can't read or write, have at least one child die before the age of five, never see a doctor, and seldom get enough to eat. People who live in the most industrial nations have far different lives that often include homes with central heating, cars with air conditioning, one or more computers, several TV's, and a dishwasher. Even many of the poorest Americans eat meat several times a week and have access to minimum health care, electricity and indoor plumbing. Such are the great advantages of living in a country that has been through an industrial revolution.

What is Necessary to Have an Industrial Revolution?

Industrial revolutions don't just happen. To have an industrial revolution a country must have at least seven different things:

- Natural resources such as fertile soil, coal, and iron ore;
- Basic inventions such as the telegram and electric generators;
- A transportation system, called an infrastructure, that includes roads and railroads;
- A large working force;
- A surplus of money to invest;
- Men or women of talent, ambition, and energy, with administrative abilities;
- A favorable government policy.

% of World's Industrial Production		
Country	1870	1914
US	23.3	35
Germany	13.2	15.7
UK	31.8	14
France	10.3	6.4
Russia	3.7	5.3

Raw Materials, Inventions and Workers in the US

England was the first country to industrialize, but others in Europe -- namely France and Germany -- soon followed. Across the Atlantic Ocean, the United States was also beginning to stir. Always rich in natural resources, the former English colonies were blessed with a huge supply of fertile land. Dense forests throughout the country provided wood for building and heating. In the Northeast many swift rivers provided the power to turn water wheels. Huge deposits of coal were discovered in the Allegheny Mountains around the time of the Civil War. The mighty Mesabi Mountain Range in Minnesota was a source of the ore needed to make iron and steel. Rich deposits of copper were found in the West. Reserves of crude oil were discovered in Pennsylvania and Ohio, and when these ran out they were found in Oklahoma and Texas. The United States was truly a land of plenty.

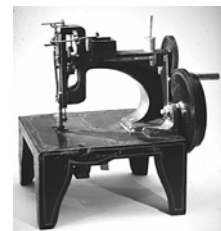


Known for the cotton gin, Eli Whitney's application of the principle of interchangeable parts was equally important

Although the technological basis for our industrial revolution was created in England, it was not long before Americans added to the world's list of important inventions. Eli Whitney brought the famous cotton gin into existence in 1791 and revolutionized the South's plantation system. Twenty years later he showed the world how to make rifles by creating *interchangeable parts*. He made each of the different parts of the rifle, the stocks, triggers, rifle barrels, etc. exactly the same. A trained worker could pick any part from a series of piles and assemble them into a working gun.

Another famous inventor, James Watts, brought us the steam engine which was first used in factories in England. Robert Fuller, an American, revolutionized water transportation by attaching a steam engine to paddle wheels and was able to send ships 'steaming' up America's rivers. Not long afterwards, Watts's basic invention was mounted on wheels giving birth to the first American railroad. The Baltimore and Ohio, started in 1828 about the same time that the British began building their own railroad. Many minor inventions were needed to make the railroad safe and efficient -- the cowcatcher (inventor unknown) and George Westinghouse's air break among them. Railroad mileage in the U.S. expanded quickly in the 1840's and reached 30,000 miles by 1860.

Many other American inventors contributed to the industrialization of the US as well as Western Europe. Elias Howe invented the sewing machine in 1846 and Isaac Singer perfected it. An African-American by the name of Jan Mezingar made one that could sew the sole to the top of a shoe. Samuel Morse's creation of the code that bears his name was responsible for the telegraph; and a man named Colt revolutionized warfare by designing a pistol with a spinning cylinder capable of firing six bullets in a matter of seconds. In 1839 Charles Goodyear turned springy rubber into hardened surfaces by a process called vulcanization. In the 1850's an American, William Kelly, invented a process (identical to one credited to the Englishman, Harry Bessemer) for turning molten iron into steel by blowing air through it. By 1860, the U.S. Patent Office had granted 36,000 applications, and by 1890, the number was an astounding 440,000.



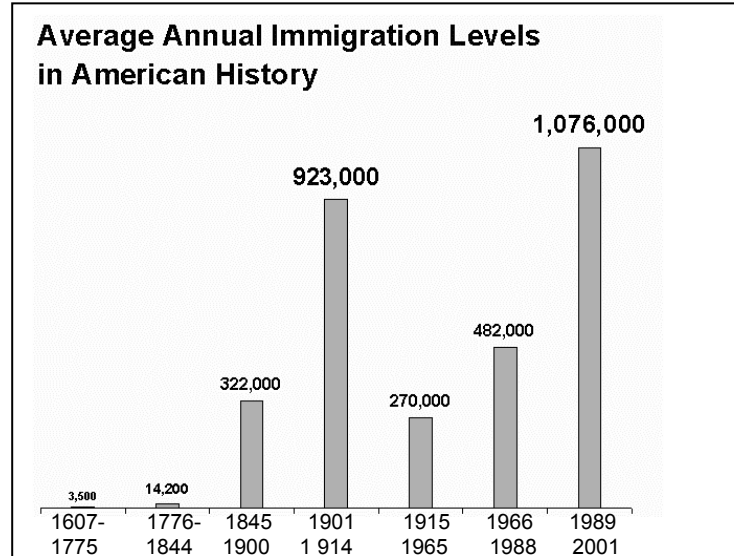
An American named Cyrus McCormick invented the reaper to harvest wheat, oats, barley, and other grains. Other inventions by Americans that helped shape our modern world include the electric light bulb, the phonograph, and motion pictures by the great Thomas Edison; the telephone by Alexander Graham Bell; and the airplane by the Wright brothers. Of equal significance was Henry Ford's method of

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the moving assembly line. He made his Model T car so inexpensive that the average American workingman could afford to buy one.

The working force for America's Industrial Revolution came from two sources. First, such inventions as the mechanical reaper made it possible for hundreds of thousands of people to leave their farms and move to the city. In cities they found jobs in the new factories and offices built during this industrial age. Women found work as typists, salespersons, and clerks, as well as in the then more traditional fields of teaching and nursing. By 1900 there were a total of 5 million women working outside of their homes, 17% of the work force. Their pay was barely half the amount paid to men. Over 1.7 million children under sixteen years of age had also entered the workforce by 1900 and were paid even less than women were.¹



Meanwhile, millions of immigrants left England, Germany, Italy, Poland, Romania, Russia, Greece, and dozens of other countries and came to the United States where they hoped to find jobs created by the Industrial Revolution.

The Infrastructure and Capital



The famous "East meets West" photo taken at Promontory Summit, Utah, May, 10, 1869

performed heroically. They were often lowered down mountains in straw baskets to plant dynamite charges and sometimes killed in the blasts. In the winter they slept huddled under snow tunnels which frequently collapsed. Harassed or ignored by white workers, they nevertheless out-worked and out-produced their better-paid European counterparts. Millions of dollars and over 400,000,000 acres of land

The infrastructure that included, first and foremost, a system of transportation was also developed during the industrial revolution. By the time of the Civil War there were already 30,000 miles of railroads spanning America. This was just a start. A full 200,000 miles of railroads were built between 1865-1910. Steel rails covered the country, connecting East to West, North to South, and all regions in between. Certain captains of industry like Cornelius Vanderbilt and James J. Hill played leading roles in this feat. The most notable accomplishment was completing the transcontinental railroad in 1869 with the pounding in of the famous golden spike into the ground where the eastward and westward bound track met. The Chinese laborers, who were mostly responsible for the work on the Western terminal of that railroad,

¹ The Federation for American Immigration Reform, Issue Brief ,Washington, DC, 2001

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were granted to the corporations that built these railroads, and the roads, built in haste, had to be reinforced and replaced to make travel safe. The railroads, of course, made further industrialization possible because they connected buyers with producers and factories with the sources of their raw materials.

And then of course there was money! Nothing of great importance happens without it. The American industrial revolution was financed by two sources. First, profits from previous commerce, such as New England's famous 'China trade' of the 1840's and later from the profits made by industrialists like Andrew Carnegie and John D. Rockefeller. Second, investors from foreign countries, particularly England, played a major role in financing our industrial revolution by investing over 500,000,000 dollars before the Civil War. Outsiders were attracted by the possibilities of earning great amounts of money. A stable society and the rule of law, in addition to an ever-expanding economy, gave investors a reasonable chance of making large profits.

Entrepreneurs

The Industrial Revolution in the U.S. may never have occurred without the contributions of a relatively small group of energetic men who devoted their intelligence, daring, energy, and administrative abilities to the purpose of making money by creating huge industrial empires. Though it is impossible to name them all, a few thumbnail sketches of such business tycoons is possible.

Cornelius Vanderbilt (1794-1877), with a \$100 loan from his father, Vanderbilt began his business career by opening a local ferry service. He repaid his dad tenfold within a year. Known for his confession "I have been insane on the subject of making money all my life," Vanderbilt started in earnest by running sailboats along the Hudson River before moving up to the paddlewheel steamer. His bold business practices soon put Robert Fulton out of business and allowed him to capture the Hudson River trade halfway up to Albany. Unable to expand his license, Vanderbilt switched to the profitable coastal trade between New York and New England. In the 1850's he ran ships to Nicaragua to make money on the gold rush. Despite his unrivaled wealth, Vanderbilt switched to railroading as he approached the age of 70, gained control of the New York Central, extended its reach to Chicago, and built Grand Central Station.



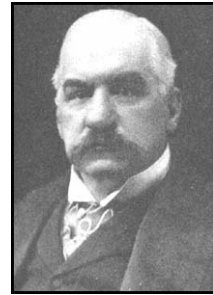
Andrew Carnegie (1835-1919), Carnegie's family left their native Scotland when Andrew was 13. He soon went to work in a cotton mill, taught himself to read, and continued to educate himself all of his life. He held a number of different jobs before learning the Morse code and finding work as private secretary to Tom Scott, director of the Pennsylvania Railroad's western division. After making several shrewd investments with Scott's help, Carnegie entered the iron and steel-making business at the age of 26. He started his own company four years later. By introducing new technology, paying careful attention to cost cutting, making careful purchases, hiring capable assistants, and employing vigorous salesmanship, Carnegie expanded his holdings to control one-fourth of the U.S. steel-making capacity. He sold his company for a personal profit of \$250,000,000 (over \$3.5 billion in year 2000 dollars) to JP Morgan who combined it with other companies to form US Steel, valued at \$1.4 billion. Believing it was wrong for a person to die rich, Carnegie devoted the rest of his life and much of his fortune to making charitable contributions.



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John Pierpont (JP) Morgan (1837-1913) For some 30 years, J.P. Morgan played a leading role in his father's investment firm before taking full control in 1890. He quickly became the world's most influential banker. He lent money to Thomas Edison, bought out Andrew Carnegie to form the world's first billion-dollar corporation, financed dozens of railroad mergers, and controlled numerous banks, mines, and insurance companies. In the 1890's he lent money to the U.S. government at a considerable personal profit in order to maintain the gold standard. He used his own money to support the stock market in 1907 and by doing so insured the value of his vast holdings. His money helped big businesses monopolize entire industries by buying out smaller companies. Morgan, however, always claimed that trust and integrity and not wealth and power were the basis for his success.



Favorable Government Policy

Finally, we come to the role of government in the American Industrial Revolution. Beginning with Alexander Hamilton's proposals for a Federal Bank, protective tariff, and support for the Whig Party's push for internal improvements, the US Government played an important part in encouraging industrial development. During the canal and railroad building frenzy of the 1820's through the 1850's, state governments did their best to encourage the development of an infrastructure. But the real assistance for industrial growth came after the Civil War when the North triumphed and was able to impose its economic priorities on the rest of the country. High protective tariffs were passed to shield American businesses from foreign competition. An open immigration policy guaranteed a plentiful supply of workers willing to labor for long hours at low wages. A sound money policy kept the currency from inflating and convinced creditors they would not be repaid with dollars of equal

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

**Cartoon reflecting widespread
belief that industrialization only
helped the very rich.**

value. Striking workers were harassed and frequently arrested by state, local, and national governments dedicated to keeping an obedient work force. Millions of dollars and acres of land were granted to corporations to encourage them to lay more railroad track than were laid in the rest of the world.

Perhaps the most important government policy regarding businesses was to leave them alone and unregulated. That way businessmen did not have to worry about government interfering with their activities and they had the freedom (within limits) to make money in any way they could. This policy was based on a belief in "laissez-faire" and "survival of the fittest," two theories that will be explained in another chapter.

Industrialization Continues

While your great grandparents were young they probably listened to old vinyl 78 rpm records which played for barely 4 minutes at a time. Automatic changers allowed them to listen for longer periods to albums and classical recordings. Later your grandparents danced to the latest tunes on the smaller 45's or listened to 33 rpm long playing recordings of classical music. Then, around the time your parents were your age, the cassette player came along, followed by the boom box. Now your generation listens to music on Ipods, 'burns' their own CD's, and shares their favorite tunes while talking to their friends on picture phones. Does anyone think that the technological revolution is over?

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Student Activities:

1. Answer each of the following as fully as you can:

- a. What is an 'industrial revolution'?
- b. Give 3 examples of life in countries that have not industrialized.
- c. Name 5 things needed to have an industrial revolution.
- d. Give 3 examples of each of the 5 things needed to have an industrial revolution.
- e. What is meant by the term 'infrastructure'?
- f. Give evidence that industrialization still continues

2. During the process of industrializing, the life of workers displaced by machines would suffer and wages may not keep up with production. What could you say to workers who are not enjoying the benefits of industrialization.