

## Topic 5.5 — Technology of the Industrial Age

### Standards Alignment

AP Theme	Learning Objective	Key Concept
Technology and Innovation (TEC) Human adaptation and innovation have resulted in increased efficiency, comfort, and security, and technological advances have shaped human development and interactions with both intended and unintended consequences.	<b>Unit 5: Learning Objective F</b> – Explain how technology shaped economic production over time.	<b>KC-5.1.I.B</b> The development of machines, including steam engines and the internal combustion engine, made it possible to take advantage of both existing and vast newly discovered resources of energy stored in fossil fuels, specifically coal and oil. The fossil fuels revolution greatly increased the energy available to human societies.
		<b>KC-5.1.I.E</b> The “second industrial revolution” led to new methods in the production of steel, chemicals, electricity, and precision machinery during the second half of the 19th century.
		<b>KC-5.1.IV</b> Railroads, steamships, and the telegraph made exploration, development, and communication possible in interior regions globally, which led to increased trade and migration.

### Learning Objectives

By the end of this lesson students should be able to:

- Explain how new energy sources transformed industrial production.
- Identify technologies that emerged during the Second Industrial Revolution.
- Describe how transportation and communication technologies changed global trade.
- Analyze how technological innovation increased economic productivity.

### Lesson Overview

The Industrial Age was driven by technological innovation. New machines allowed factories to produce goods faster and in greater quantities than ever before. These technologies relied heavily on fossil fuels such as coal and oil, which provided far more energy than earlier sources like human or animal labor.

The development of the steam engine allowed factories, ships, and railroads to operate more efficiently. Later innovations, such as the internal combustion engine and electrical power, expanded industrial production even further during the Second Industrial Revolution.

At the same time, transportation and communication technologies reshaped the global economy. Railroads, steamships, and telegraph lines connected distant

regions and made trade and migration easier. These innovations helped create a more interconnected global economy.

### Essential Vocabulary

- **Steam Engine**  
A machine that uses steam power to move machinery or vehicles.
- **Internal Combustion Engine**  
An engine that produces power by burning fuel such as oil or gasoline.
- **Second Industrial Revolution**  
A period of rapid technological development in the late 1800s involving steel, electricity, and chemicals.
- **Telegraph**  
A communication system that sends messages over long distances using electrical signals.
- **Fossil Fuels**  
Energy resources such as coal and oil formed from ancient organic materials.

### Background Reading

Technological innovation was central to the Industrial Revolution. One of the most important inventions was the **steam engine**, which allowed factories to operate machines using steam power rather than water or human labor. Steam engines were also used in locomotives and ships, greatly improving transportation and trade.

During the late nineteenth century, the **Second Industrial Revolution** introduced new technologies. Advances in steel production made it possible to build stronger machines, bridges, and railroads. New chemical industries produced fertilizers, dyes, and medicines. Electricity began to power factories and urban infrastructure.

Transportation and communication technologies also transformed global interactions. Railroads connected inland regions to ports and markets, while steamships allowed goods and people to move across oceans more efficiently. The telegraph made long-distance communication almost instantaneous, helping businesses coordinate trade and investment around the world.

### Primary Sources

#### Primary Source 1

##### Samuel Smiles — *Self-Help* (1859)

Source: Fordham University Internet History Sourcebook

<https://sourcebooks.fordham.edu/mod/1859smiles.asp>

The progress of modern industry has been made possible by the power of machinery. Steam engines drive the machines of factories, move ships across oceans, and pull trains across continents. These inventions have greatly increased the productive capacity of human labor.

Machines have enabled workers to produce far greater quantities of goods than was possible in earlier generations. The application of scientific knowledge to manufacturing has transformed industry and improved the efficiency of production.

As technology continues to develop, societies gain new opportunities for economic growth and prosperity. Industry powered by machinery has therefore become a defining feature of modern civilization.

### Source Analysis Questions

1. Identify ONE technological development mentioned in the passage.
2. Explain ONE way machinery increased economic productivity.
3. Describe ONE broader economic change resulting from these technologies.

### Primary Source 2

#### Samuel Morse — Telegraph Demonstration Message (1844)

Source: National Archives <https://www.archives.gov/education/lessons/telegraph>

What hath God wrought! These words were transmitted by electric telegraph between Washington and Baltimore, marking the beginning of a new era in communication. Messages that once required days or weeks to travel long distances can now be sent almost instantly.

The telegraph has the potential to transform commerce, government, and daily life. Information about markets, politics, and events can now move quickly between distant regions.

By connecting cities and countries through communication networks, the telegraph opens new possibilities for cooperation and economic coordination across great distances.

### Source Analysis Questions

1. Identify ONE technological innovation described in the passage.
2. Explain ONE way this technology changed communication.
3. Describe ONE economic impact of faster communication.

### Major Technologies of the Industrial Age

Technology	Approximate Period	Impact on Production
Steam Engine	Late 1700s	Powered factories, trains, and ships
Railroads	1800s	Allowed rapid transport of goods and workers
Telegraph	Mid-1800s	Enabled fast long-distance communication
Steel Production	Late 1800s	Improved infrastructure and machinery
Internal Combustion Engine	Late 1800s	Powered automobiles and industrial machines

### Change, Continuity, and Comparison

#### Change

- Fossil fuels dramatically increased available energy.
- Industrial technologies expanded global trade networks.
- Communication became faster through telegraph systems.

## Continuity

- Industrial production continued to rely on natural resources.
- Economic inequalities persisted despite technological progress.

## Comparison

Earlier production depended largely on human or animal labor, while industrial production relied increasingly on machines powered by fossil fuels.

## Key Takeaways

- Steam engines allowed factories and transportation systems to expand.
- Fossil fuels greatly increased the energy available for industrial production.
- The Second Industrial Revolution introduced electricity, steel, and chemical industries.
- Railroads, steamships, and telegraphs improved transportation and communication.
- Technological innovation helped create a global industrial economy.

## Practice Activity

Answer each question in **2–3 sentences**.

- Identify ONE technological innovation that increased industrial production during the nineteenth century.
- Explain ONE way transportation technology influenced global trade.
- Explain ONE way communication technology influenced economic activity.

## Primary Source Citations

Samuel Smiles, *Self-Help* (1859)

Fordham University Internet History Sourcebook

<https://sourcebooks.fordham.edu/mod/1859smiles.asp>

Samuel Morse Telegraph Message (1844)

U.S. National Archives

<https://www.archives.gov/education/lessons/telegraph>