
3 Technology Explosion

Early 20th century

Across the United States, the period between 1880 and 1930 was one of rapid technological advance and high rates of investment. Output per hour worked (labor productivity) rose at an unprecedented rate. A portion of the rise in productivity was taken in the form of increased leisure (fewer hours worked), but income levels also increased rapidly.

New England shared in these gains, but was not at the forefront. Indeed, the region found its key industries, textiles and shoes, challenged by competition from other parts of the country. The machinery industry continued to prosper.

New Technologies

The late 19th century saw a host of important inventions and innovations. The introduction of electricity in the 1880s brought profound changes in how people lived and conducted business. No longer were people's lives governed by the available daylight. People could work—and play—at all hours. In business, the shift to electricity altered plant layout and the organization of work. Whereas steam and waterpower had favored multistory structures, electricity allowed expansive single-story buildings with more efficient workflows. Electricity also made possible the street car, beginning the process of suburbanization.

Another development with profound implications was the automobile. This brought together the fruits of advances in many different areas—



Trolley track construction Malden, MA , 1902. (Photo courtesy of the Boston Public Library, Print Department)

the internal combustion engine, pneumatic tires, a new source of fuel. The cost of transporting both people and goods fell dramatically. People acquired much greater mobility, allowing them much greater flexibility in choosing where to work and where to live, as well as what to do with their growing leisure time.

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Yet another important advance was the ability to manufacture large quantities of high quality steel. This led to better machines and made possible new building techniques, including the skyscraper. This period also saw the growth of mass production. Very long production lines became possible as a result of improvements in the quality of manufacturing machinery, more efficient factory layouts, and eventually, continuous flow processing, whereby conveyor belts moved materials and parts to stationary workers. The ability to spread the fixed costs of plant, equipment, and other overhead over very large output volumes drove down costs. Workers' activities were much more carefully regimented in these settings, contributing to higher productivity but at some cost to workers' well-being.



Electric trolleys share the street with horse-drawn vehicles. Washington Street, Boston, 1904. (Photo courtesy of the Boston Public Library, Print Department)

Textiles and Shoes Suffer, Machinery Flourishes

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In textiles, the pace of technological advance had slowed. The tight link between the textile manufacturers and the makers of textile machinery was no longer critical, as machines changed more slowly. At the same time, the cumulative effect of years of automation had reduced the skill content of textile jobs.¹ The southern states, with much lower-cost, unskilled labor, became increasingly competitive. In the shoe industry, easy access to hides increased the competitiveness of midwestern producers.² Both industries remained very large employers in New England, but profits suffered as market share declined. Working conditions in the textile mills deteriorated, and labor strife intensified. After a boost to demand in World War I, the textile industry experienced the first of a series of collapses. The industry's competitive problems were intensified by the stresses of the Depression.

The machinery and metal fabrication industries continued to flourish. The proliferation of manufactured products fueled demand for the machinery to make them. Innovations in metalworking and the specialized nature of much machinery meant that the talents of skilled machinists remained very important. Early on, New England had developed pools of such talent in support of gun-making and the textile mills and was able to remain competitive. The industry grew in clusters of firms and facilities, often located in close proximity to major customers.

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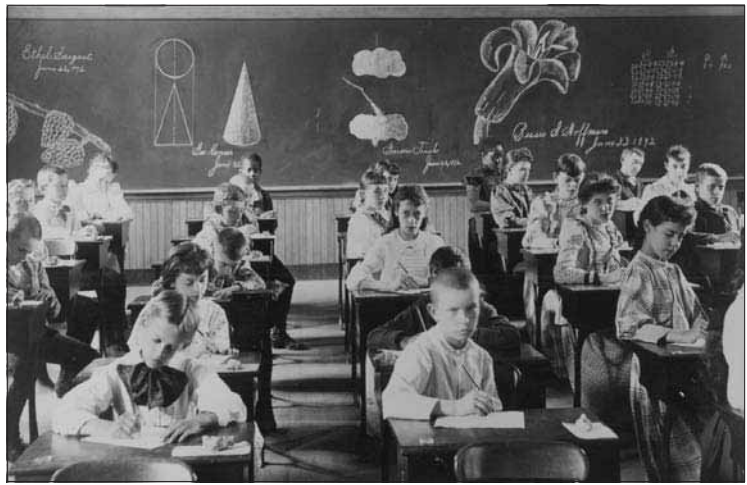
In the late 1890s, it seemed that New England might become the center of the motor vehicle industry. The Duryea Brothers of Springfield, Massachusetts, founded the first U.S. company to make motor vehicles in 1896.³ Colonel Albert Pope, the preeminent bicycle manufacturer, made some 500 electric motor vehicles in the late 1890s. Pope exited manufacturing for several years, but re-entered the automotive business on a large scale in the early 1900s.⁴ In a description of its operations published in 1907, the Pope Manufacturing Co. characterized its Hartford plant as “the largest and best equipped plant in the world devoted solely to the building of motor cars.” Shortly thereafter, during the financial panic of 1907, Pope Manufacturing defaulted on a debt and was placed in receivership.

New England auto makers are thought to have lost their early lead in automobiles partly because their manufacturing experience with electric and steam engines led them to experiment more with these power sources, while their mid-west competitors focused on the internal combustion engine. In addition, mid-western entrepreneurs who had made fortunes in lumber and mining provided capital for local auto companies.⁵ Competition was also very fierce, and many industry pioneers experienced setbacks, some temporary, some permanent. A younger, healthier Pope might have made a comeback.

Education and Public Infrastructure

This period saw important changes in education, with New England taking a pioneering role. Public schools emerged in mid 19th century New England. Free education for all was widely supported as a way to ensure that children learned civic values and that immigrant children were introduced to the prevailing culture. Horace Mann, first secretary of the Massachusetts Board of Education, also argued that educated workers were much more productive.⁶ In the early 20th century, curriculums became more practical and the fraction of young people completing high school rose dramatically.

College-level education also expanded, with more emphasis placed on science and engineering. Previously, the curriculum had been devoted to the liberal arts. Clark University, founded in 1889 in Worcester, Massachusetts, was one of the



Grade seven, Putnam School, Boston, 1892. (Photo courtesy of the Boston Public Library, Print Department)

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Shop class at the Dwight School, 1892. (Photo by A. H. Folsom, courtesy of the Boston Public Library, Print Department)



Playing ball in a tenement alley, 1909.
Photograph by Lewis H. Hine.
(Photo courtesy of George Eastman House)

first to emphasize scientific research.⁷ MIT, founded as a land grant university in 1861, quickly became a source of engineers and scientists. Existing institutions, notably Harvard, also began to stress research and more professional courses.

Advances in science led to better understanding of disease transmission. Large public investments were made in water supply and sanitation systems. Mortality was greatly reduced.

Large investments were also made in transportation systems—street cars, subways in Boston, roads to support the automobile, and airports. The landscape was transformed.

Standards of Living at the Turn of the 20th Century

At the turn of the 20th century, families were more likely to live in industrial cities and towns and to work in manufacturing, rather than to live on farms and work as farmers. Some rented, but those who could afford to buy usually did so. Houses had running water and a water closet. They had gas lamps. They were heated by coal and were much warmer than previously. Carpets, draperies, and upholstered furniture were prevalent. Family members had many items of apparel, both purchased and home-made. Children had toys. The family had a pet. Food was purchased. The family may have had help with laundry and other chores.⁸

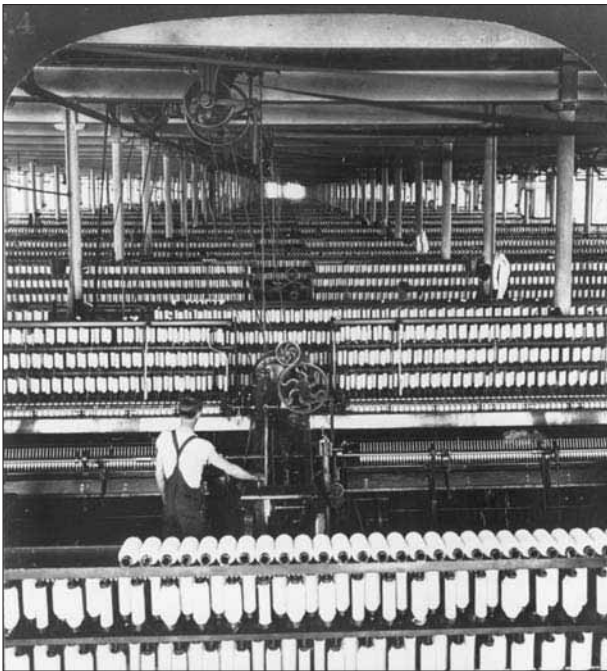
While industrialization and advances in transportation brought a great array of products within reach of the typical household, life for those who worked in the factories was hard. The workweek averaged 55 to 60 hours. Work was monotonous and highly regimented. Accidents were common. Periodic economic downturns resulted in unemployment and loss of income. Whereas the farm households of prior generations might have been able to get by in hard times, raising their own food and making their own clothes and implements, factory workers depended on employment to support themselves and suffered greatly during business slowdowns.

The organized labor movement arose in response to the conditions facing factory workers. Workers banded together to demand improvement. Some employers began to change their labor practices to smooth out the production cycle and provide at least valued workers with greater job security. Governments began to pass laws to protect workers, limiting hours and providing compensation to the injured.

Summary

The pace of economic growth was very rapid in the years around the turn of the 20th century. Rapid technological change and high rates of investment in physical capital fueled the growth. Technological advances in different areas were combined to produce new products and new systems that had profound consequences for the ways in which people lived. Although individual initiative and luck continued to play important roles, the pursuit of technological advances became more formalized in universities and businesses. This was the age of mass production; where possible, tasks were finely divided and production runs were very long. Costs fell sharply, bringing more and more products within the reach of more and more people.

People had more leisure and more varied leisure activities. New forms of lighting lengthened the day. However, the movement from farm to factory left workers vulnerable to employment disruptions. New institutions emerged to address workers' problems. The landscape was transformed by industrialization and later by suburbanization.



Cotton mill, 1910, Adams, Massachusetts.
(Photo courtesy of Library of Congress, Prints and Photographs Division,
[reproduction number, e.g., LCZ6221762916106])



Taking tea, 1901–1904. (Photo courtesy of Pocumtuck Valley Memorial Association, Memorial Hall Museum, Deerfield, Massachusetts)

Endnotes

¹ Rosenbloom in *Engines of Enterprise*, pp. 160-165, and John S. Hekman, "What Attracts Industry to New England," *New England Economic Indicators*, December 1978.

² Rosenbloom in *Engines of Enterprise*, p.166.

³ http://www.aaca.org/history/cars_19th.htm

⁴ For information on Pope's involvement with motor vehicles see Stephen B. Goddard, *Colonel Albert Pope and His American Dream Machines*, (MacFarland & Company, Inc., 2000).

⁵ John E. Jackson, "Economic Development in Michigan: Choosing an Economic Future," in *The New Economic Role of American States: Strategies and Institutions for a Competitive World Economy*, ed. R. Scott Fosler, (Oxford University Press, 1988).

⁶ Temin in *Engines of Enterprise*, pp. 140-141.

⁷ Rosenbloom in *Engines of Enterprise*, pp. 170-171.

⁸ Larkin, New England Economic History Museum Schematic Design Report.