

As we end this rocky year, we are heartened by taking a historical view. Historians tell us that over the last two centuries, major technological revolutions have ridden waves of boom and bust, only to rebound with periods of sustained build-out. This pattern has played out in the steel and rail industries as well as others. If history is any guide, the Internet revolution is on track for decades of growth and has yet to see its most rewarding years.

1. birth. *At the beginning of a major technological era, enabling technologies emerge and are eagerly welcomed as revolutionary. Excitement builds as technological pioneers crowd into the field and innovations flourish. In some cases, early investors make extraordinary profits, fueling speculation, chaos and investment mania, even “irrational exuberance.”*

2. turbulence. *Overinvestment and overcapacity burst the bubble of the new technology’s progress. Sometimes linked to a slowing economy, stock prices drop and even crash. Some investors lose everything; some companies fold. Investment halts as financiers retrench. Observers may declare the technology dead. But the story is by no means over.*

3. build-out. *Confidence returns. Real value emerges. Missing components of the technology are put in place, leading to full implementation. The technology penetrates the economy as other industries organize around it and businesses adjust to take full advantage of it. Sustained investment yields robust returns. The technology becomes the driving engine of the economy.*

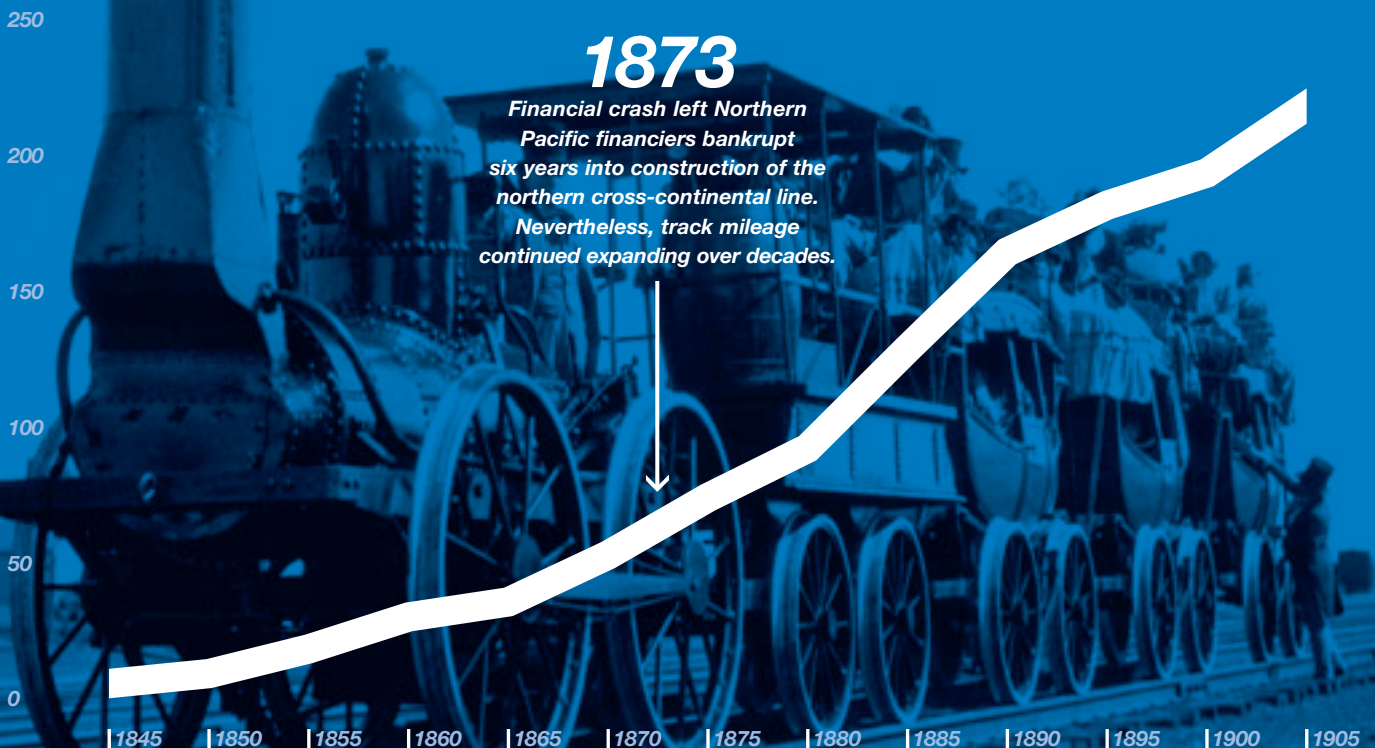
The rail revolution

1. birth. In 1828, construction began on the first U.S. steam rail line, the Baltimore & Ohio. American innovations—more powerful locomotives and cost-effective wooden rails—soon fueled a boom. States invested heavily in rail infrastructure, and business leaders lobbied for railway links between key cities.

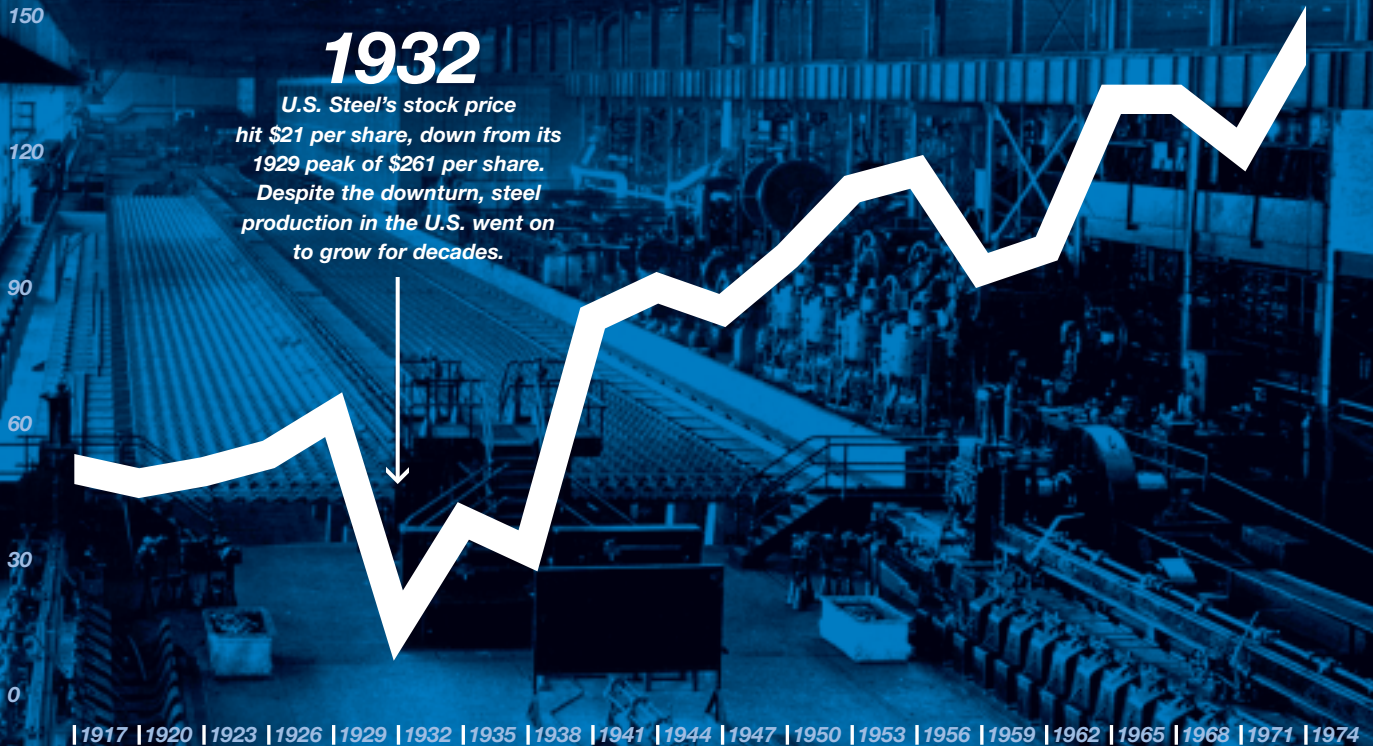
2. turbulence. Railroad speculation contributed to the depression of 1859, with many investors losing large sums. Rampant cost overruns and nationwide mania over the building of the transcontinental railroad, completed in 1869, left major rail financier Jay Cooke & Co. bankrupt by 1873.

3. build-out. Extended rail construction in the 1870s and 1880s facilitated the nation's industrialization and the growth of the West. Hardier steel rails replaced wood, locomotives improved, and a standard-gauge width was adopted, allowing nationwide uniformity of tracks and cars. By 1900, railroads owned 193,000 miles of track covering the United States, more than 10 times the mileage built in the railroad's earlier heyday in the mid-1850s.

U.S. railroad track miles *In thousands*



U.S. production of steel *In millions of tons*



Source: American Iron and Steel Institute, 2001

The steel revolution

1. birth. By the 1870s, innovative process technologies enabled mass production of low-cost steel. In the 1880s, with ongoing investment and cost management led by Andrew Carnegie, growing demand for steel rails made the United States the world's largest steel producer.

2. turbulence. In the 1920s, steel makers added capacity to meet projected demand for the auto industry. Instead, due to the Great Depression, the U.S. steel industry crashed along with the rest of the economy. U.S. production plummeted from 61 million tons in 1929 to 15 million tons in 1932.

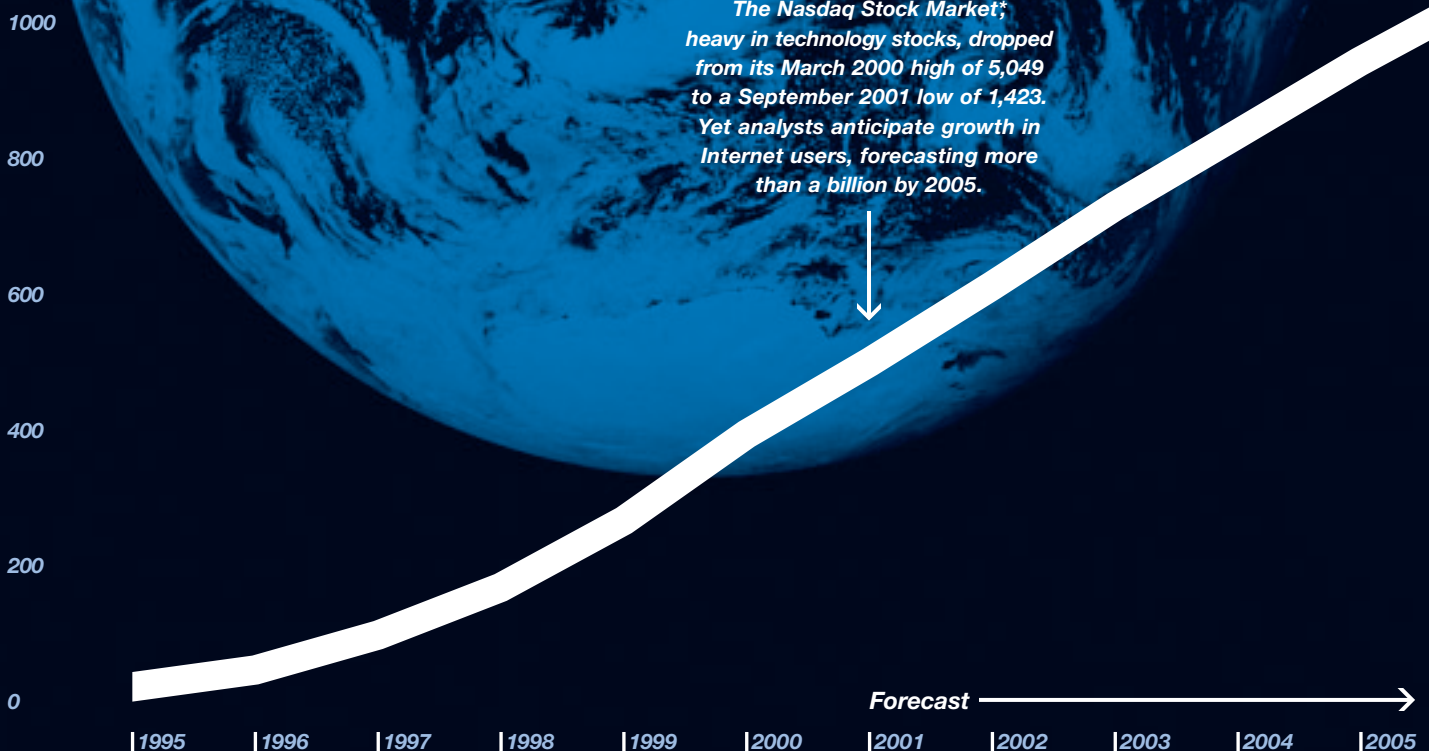
3. build-out. The steel industry continued to grow, with further investment and deeper expansion into industries such as auto, construction and ship-building. The older Bessemer process was modified to use pure oxygen instead of air, increasing efficiency in production and setting the stage for extended strong output across the industry. By the mid-1970s, U.S. annual steel production was nearly 10 times 1932 levels.

The Internet revolution

1. birth. The invention of the integrated circuit was the first of a series of defining innovations that ultimately fueled the Internet revolution. Excitement over powerful microprocessors, PCs, software and the emerging Internet economy all contributed to the high-tech boom of the 1990s.

2. turbulence. In 2000 and 2001, as many dot-coms failed to turn a profit, investor confidence slipped, triggering meltdowns throughout the technology sector. Nasdaq* stocks lost 70% of their value. Facing excess capacity, many companies cut back on their information technology expenditures, and the semiconductor industry entered its worst downturn ever.

Worldwide Internet users In millions



3. *build-out* >