

# THE STATE OF

# AMERICAN

Don't be fooled by the rhetoric: Factory work isn't part of the past. Manufacturing is a vital part of today's economy. **BY ALAN S. BROWN**

**T**he data, as it is usually presented, is stark: 70,000 factories have closed in the United States since 2000. In that time, the country has lost one-third of its manufacturing jobs. In every year this century, more factories have closed than have opened.

Those numbers don't necessarily tell the full story. Michael Hicks, director of the Center for Business and Economic Research at Ball State University in Muncie, Ind., says the job losses are the flip side of factory efficiency. His analysis shows that production is higher than ever, and he argues that increased productivity, largely through automation, was responsible for 88 percent of all job losses.

"Had we kept 2000-levels of productivity and applied them to 2010-levels of production, we would have required 20.9 million manufacturing workers," he argued. "Instead, we employed only 12.1 million."

Indeed, U.S. manufacturing remains strong and diverse. The value added by U.S. manufacturers, \$2.2 trillion in 2017, trails only China and is twice as large as third-ranked Japan. The sector, by itself, is larger than the entire economies of Brazil, Canada, Russia, or South Korea.

Even so, many experts are alarmed by the relative decline in manufacturing. They include Robert Atkinson, an economist

who founded the Information Technology and Innovation Foundation (ITIF), a top think tank for science and technology policy.

Atkinson believes that predatory trade policies—government investment, subsidies, tax incentives, and protected home markets—give companies from China and other emerging economies an unfair advantage against the United States and nations with more open borders.

Atkinson claims that scholars like Hicks overstate the production of computers and electronics, which measure output by chip processing speeds rather than unit production. Subtract computers and U.S. productivity rose a dismal 0.5 percent annually between 2007 and 2016—while output in many manufacturing sectors declined.

A recent analysis by McKinsey Global Institute, *Making It in America: Revitalizing U.S. Manufacturing*, also sees cause for alarm. That report found that if you subtracted out computers, pharmaceuticals, and medical devices from U.S. manufacturing data, value-added output has changed little in 15 years.

When politicians present the dire manufacturing data, they often couple it with promises to restore the sector to its former state of prominence—and to bring back the millions of lost factory jobs. In today's interconnected economy, however, that might prove too heavy a lift for even the most dedicated leader.

## DRILLING DOWN INTO MANUFACTURING

While manufacturing today accounts for only 12 percent of the U.S. economy and employs just 9 percent of American workers, the sector consistently punches above its weight in terms of impact. Manufacturing, for instance, generates 35 percent of America's productivity growth, 60 percent of its exports, 55 percent of its patents, and 70 percent of private sector R&D. It employs more than 30 percent of its engineers.

And even those numbers understate the true impact of manufacturing on the economy. The data often fails to count jobs created by manufacturers as manufacturing jobs.

For example, while many firms have outsourced their production overseas and are now considered "non-manufacturing companies," they keep their design, engineering, marketing, service, and supply chain logistics management in the U.S. At the same time, established manufacturers outsource services—everything from design and engineering to security and cafeteria services. In spite of their obvious contribution to the manufacturing sector in the U.S., government statistics do not count those types of workers as manufacturing employees.

What's more, the line between selling goods and providing services is becoming blurred. Many

manufacturers have traditionally sold their products with bundled services, such as extended warranties or extended maintenance and repair coverage. Thanks to cheaper digital sensors and wireless industrial internet, they can offer more value-added services, like quality monitoring and predictive maintenance.

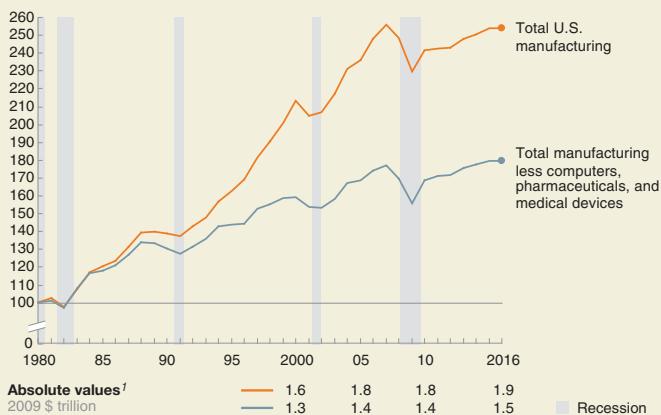
The Organization for Economic Co-operation and Development, estimated that services accounted for one-third the total value of products sold by U.S. manufacturers in 2011. Advances such as the industrial Internet of Things promise to make these service offerings even more common. Yet few of these services are captured by manufacturing statistics.

# MANUFACTURING

2018

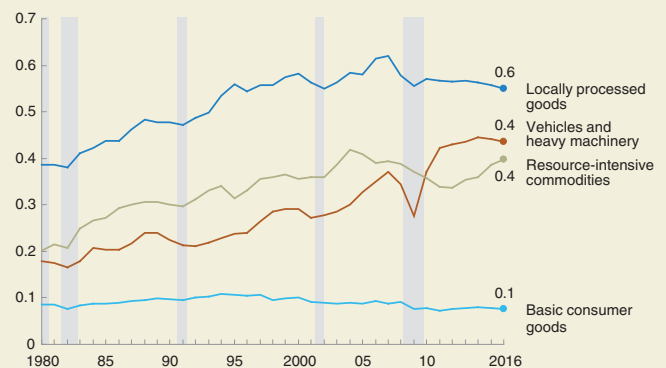
## REAL VALUE ADDED IN U.S. MANUFACTURING IS NO HIGHER TODAY THAN IT WAS A DECADE AGO

The sector's real value added is sharply lower when tech products, pharmaceuticals, and medical devices are excluded  
Index: 100 = 1980



## SOME SEGMENTS HAVE POSTED REAL DECLINES OVER 15-20 YEARS

2009 \$ trillion



1 Absolute values prior to 2000 are not displayed due to distortions in the available data.  
SOURCE: BEA; Moody's; McKinsey Global Institute analysis



Chinese workers assemble electronic components at the Taiwanese technology giant Foxconn's factory in Shenzhen, China.  
Photo: Getty

## COMPETITIVENESS

The plight of the American factory town is often contrasted with that of China's manufacturing hubs, where whole cities can be turned over to supplying parts for one industrial sector. How can the U.S. compete with that?

Quite well, actually.

In a January 2017 study, *Honing U.S. Manufacturing's Competitive Edge*, Harold Sirkin, a managing director at Boston Consulting Group, found U.S. and Chinese costs virtually even. According to Sirkin, wages adjusted for productivity have risen in China while remaining flat in the U.S. Meanwhile, U.S. industrial electricity and natural gas dropped sharply. Other U.S. strengths include a stable dollar, efficient logistics, ease of doing business, and markets undistorted by corruption.

McKinsey's *Making It in America* paints a similar picture. While the U.S. manufacturing has eroded in some areas, it remains a leader in innovation, application of digital technologies, and the ability to attract and retain top talent.

So if all this is true, why are factories and jobs not flowing back to the United States?

China's thriving industrial ecosystem is built to scale up consumer products for mass production. According to a 2013 MIT study, *Production in the Innovation Economy*, Western innovators frequently turn to Chinese partners to scale up prototypes, re-engineer mature products to reduce production costs, and tap local innovations in design and manufacturing.

While the U.S. remains a leader in low-volume production for prototypes, its ability to

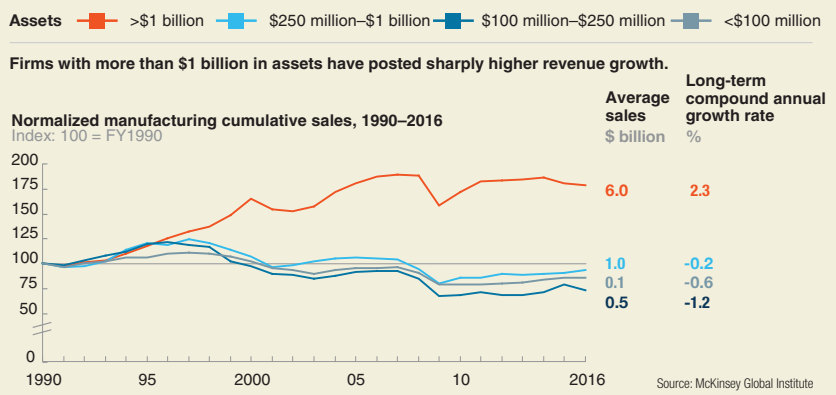
scale up new products has been hollowed out since the turn of the century.

The robust industrial ecosystem found in China has been devastated by a winner-take-all mentality in the United States.

Since 1990, McKinsey said, manufacturers with more than \$1 billion in assets have grown U.S. revenues by more than 2 percent annually while revenues at small and midsize firms fell. One reason they fared so well was that large firms could demand lower prices from smaller suppliers or tap global markets for cheaper alternatives. As a result, U.S. domestic content in technology-driven and basic consumer products has fallen by 13 to 15 percent since 2000, depriving smaller companies of revenue.

"Significant productivity gaps have opened up between large firms and small and midsize producers that are unable to invest in new equipment and technologies," McKinsey concluded.

### LARGE MANUFACTURING FIRMS HAVE PERFORMED MUCH BETTER THAN SMALLER PLAYERS





## TRADE

The U.S. has run a trade deficit with the rest of the world since the 1990s, and that imbalance is driving policy decisions in Washington. But looking only at the bottom line can be misleading, said David Dollar, a senior fellow at the Brookings Institution. Instead, Dollar focuses on the value added at each step by each country during production.

Trade with Mexico looks different from a value-added perspective, since many of its exports contain American-made components. This reduces the real value of Mexico's whopping trade surplus with the United States, though how much is still a question. A Harvard University study found that 27 percent of the value of imports from Mexico was made up of components originally manufactured in the U.S. Another study conducted by the Organization for Economic Co-operation and Development in Paris put the number as low as 16 percent.

While multinational trade agreements like NAFTA make it easier for large companies to import low-cost components, U.S. firms do not always have equal access to trade partners' markets.

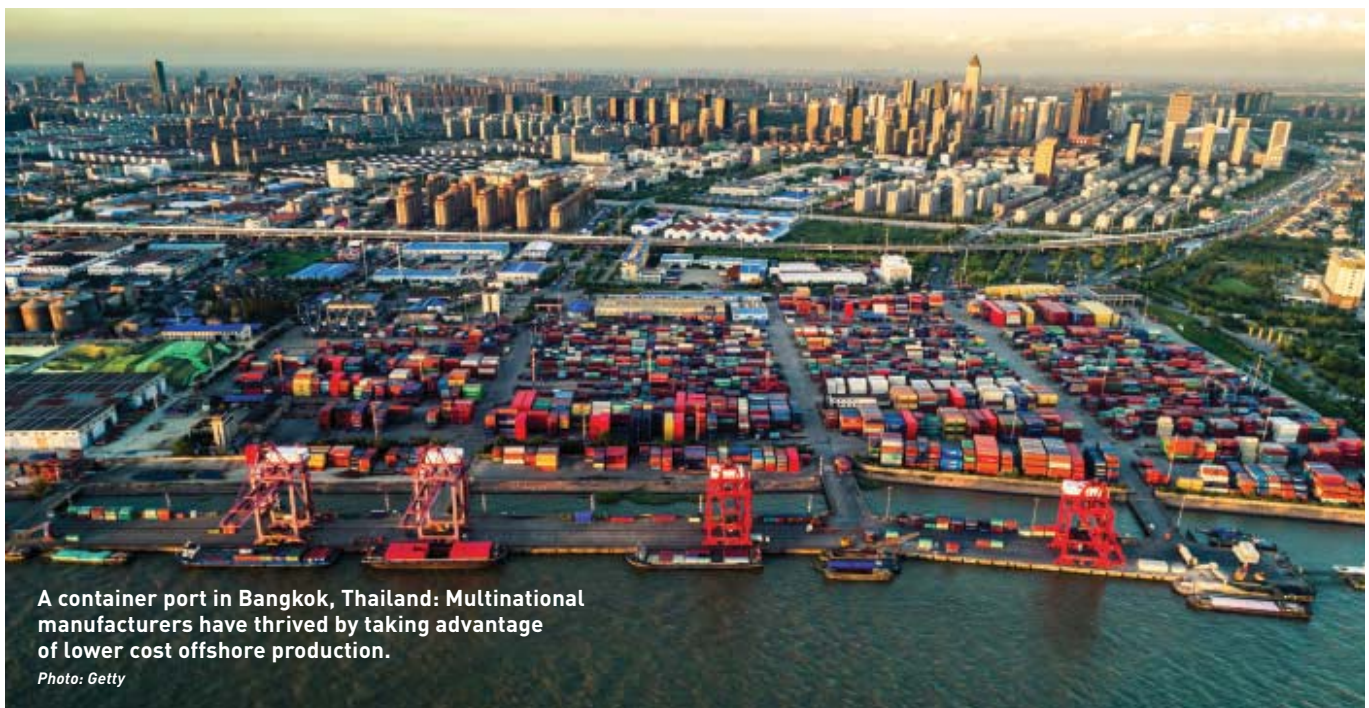
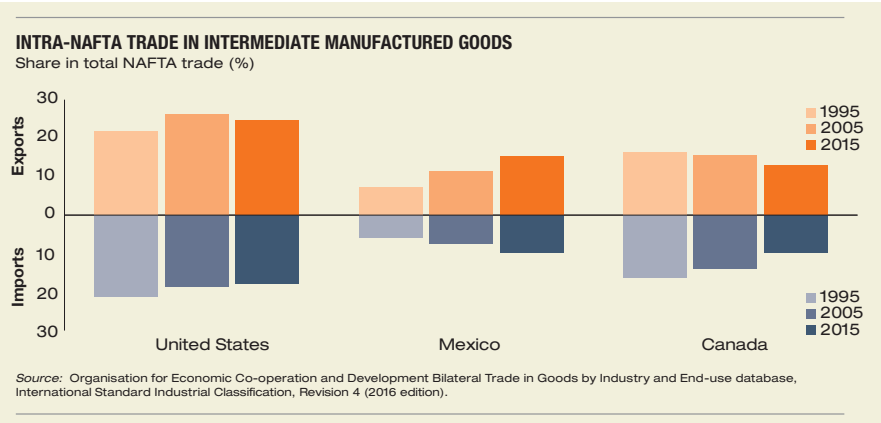
China has gone beyond mere protectionism, ITIF's Atkinson charges. It actively subsidizes chosen industries so they can lower prices and drive competitors out of business.

Atkinson points to solar panels as an example. China acquired technology through commercial espionage, he charged, and

once Chinese companies could produce at scale the government blocked imports and subsidized local manufacturers. Those firms were able to drive down prices and undercut unsubsidized U.S. producers and drive them out of business. Chinese firms then bought the bankrupted U.S. firms for their technology.

As a result, China raised its share of global solar panel market from 5 percent to a whopping 70 percent today. Atkinson warns that China plans to use the same playbook to dominate advanced industries ranging from robotics and medical devices to aviation and autonomous vehicles.

Yet Atkinson prefers a strategic approach to China rather than tariffs. Tariffs work well in commodities like steel, he said. But in fast-moving technologies like solar panels, they are often "a day late and a dollar short."



## AUTOMATION

**E**conomists and consultants nearly unanimous in their belief that technology—and specifically Industry 4.0—could change manufacturing’s playing field.

Industry 4.0 is a rapidly evolving concept that brings together digital brains and manufacturing muscle. It includes everything from Internet of Things, cloud analytics, and artificial intelligence to robots, additive manufacturing, and digital simulation tools. By building a digital thread that ties manufacturing to upstream design and downstream logistics, use, and maintenance, companies hope to improve products, reduce costs, and offer entirely new services.

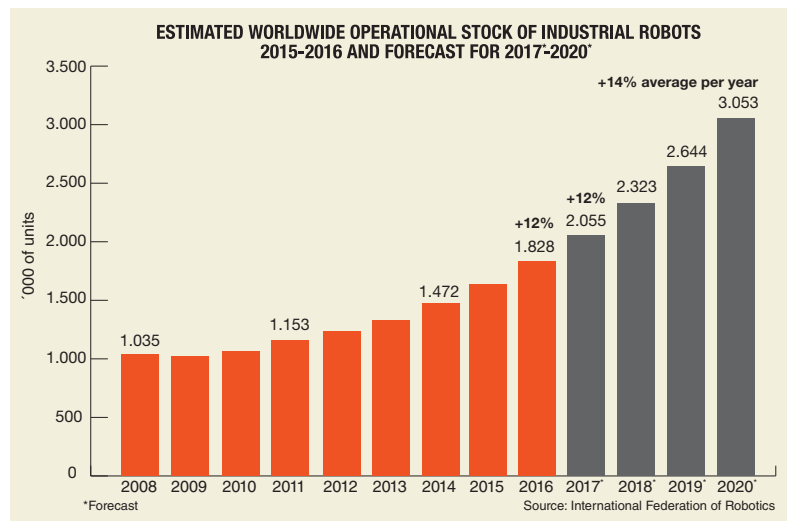
The emphasis on services is not surprising. Services account for as much as 55 percent of total sales in some industries. Rolls-Royce, for example, “leases” its turbines to airlines and analyzes data from embedded sensors to schedule preventive maintenance and minimize downtime. Swedish bearing maker SKF not only provides predictive maintenance for rotating parts, but now lets customers diagnose problems with an app. SKF uses the information from the app to improve designs, develop solutions, and offer new services.

Embedded intelligence could bring manufacturers closer to their customers, making it more difficult for other nations to compete on price alone.

It sounds great, but Industry 4.0 is not an off-the-shelf technology. Major software companies are still gearing up to deliver on its promise, while large corporations are struggling to weld what are now discrete digital technologies into something resembling a coherent system.

Yet smaller firms will not be priced out of the market forever. Digital technology has a way of raising value while forcing down prices. Consider, for example, the evolution of computers. Once, giant mainframe computers cost millions of dollars and required climate controlled rooms. Today, we carry the same computing power in our smartphones.

The same thing is happening to robots, which were once expensive, difficult to program, and too dangerous to work around. Newer robots are smarter, cheaper, safer, and more flexible. Industry 4.0 is using the same recipe—better software running on cheap, mass-produced chips and off-the-shelf hardware—to push down the cost of plug-and-play IoT sensors, on-demand cloud analytics, and additive metal manufacturing.







Manufacturing jobs require advanced degrees or skills. Even on the factory floor, workers increasingly need computer and analytical skills to manage highly instrumented machinery.

## JOBS

The manufacturing workforce pipeline used to run directly from high school graduation ceremonies to the factory floor. That connection has been severed, probably for good. Ball State's Hicks analyzed job data since 2000 and found that manufacturing jobs held by non-college graduates declined nearly 45 percent.

Over the same period, however, manufacturing jobs held by college graduates rose almost 17 percent.

"That means in net, all the new jobs and almost all the replacement jobs in manufacturing are going to college graduates," Hicks said. "That trend also accelerated during the Great Recession."

Boston Consulting Group's Sirkin analyzed manufacturing jobs by dividing them into skilled workers—college-educated professionals and such trades as machinists and welders—and low skill labor. Between 2003 and 2014, Sirkin found the number of skilled employees rose modestly while unskilled laborers fell by near 3 million workers, or 20 percent.

Over the next decade, Sirkin predicts U.S. manufacturers will hire 280,000 IT specialists, 150,000 R&D professionals, 90,000 robotics coordinators, 70,000 logistics specialists—but only 30,000 production workers.

Even on the shop floor, the nature of the work will require employees with higher skill levels. Instead of tending one machine and monitoring its output, Sirkin explained, future machine operators will need to know how to work with computers to monitor several machines at a time and use automated tools to diagnose and resolve quality issues.

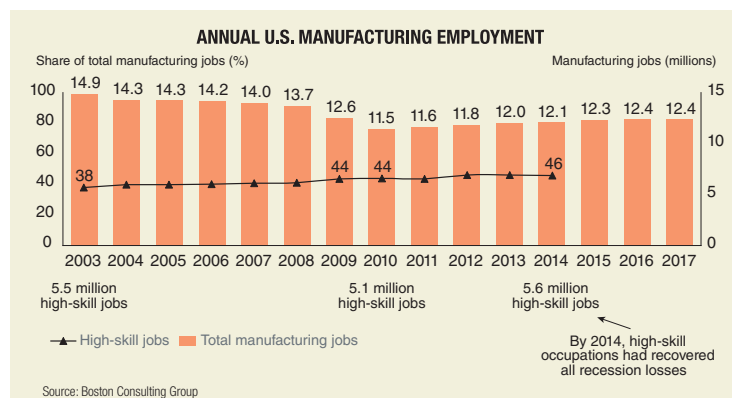
This calls for critical-thinking, problem-solving, time-management, and decision-making skills that were rarely required

by line workers in the past. Creating programs to teach those skills will be critical to U.S. competitiveness in the future.

For low-skill workers, the prospects are not great.

As McKinsey points out, real wages for production workers have risen by only 0.1 percent annually, and have declined in some distressed industries. While manufacturing still has

good jobs, some positions barely pay subsistence wages. One-half of manufacturing's 1.2 million temporary workers and one-third of all production workers, rely on food stamps or other federal assistance programs to make ends meet. Even if high school graduates do land manufacturing jobs, those jobs are increasingly less likely to lead to middle-class lifestyles. **ME**



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