

TECHNOLOGY

WEEKEND EXCLUSIVE

How AI
is reshaping
American
factories

WANTED:

TECHNOLOGISTS, DATA ANALYSTS, ENGINEERS

Matt Alderton Special to USA TODAY NETWORK

At its height in 1953, manufacturing employed nearly one-third of all non-farm workers in the United States. By 2019, that number was fewer than one in 10, according to the U.S. Bureau of Labor Statistics. • Despite a mass grave of flatlined factories, however, there are signs of an American manufacturing revival. • Between 2021 and 2024, factory construction spending in the United States nearly tripled from \$81.9 billion to \$235.6 billion, according to data from Misumi Americas. In 2024, U.S. manufacturing output hit an all-time nominal record value of \$2.91 trillion. And since 2010, reshoring domestic companies and direct investments by foreign ones have generated more than 2 million manufacturing jobs in high-growth sectors like computer electronics, according to the Reshoring Initiative 2024 Annual Report.

The momentum is plain to see. Bringing to bear a meaningful renaissance of American manufacturing, however, will require a sustained commitment to innovation, the key to which is technology, said Gary Fedder, faculty director of the Manufacturing Futures Institute and professor of electrical and computer engineering at Carnegie Mellon University.

“We need to onshore more manufacturing in a globally competitive way, and that isn’t going to be done without digital technologies taking root,” he said.

Embracing automation

Manufacturing facilities today are cleaner, safer and more efficient than the unsafe factories of yore, said Fedder, who recalls visiting a massive steel plant just a few years ago.

“All the people running it were in an air-conditioned office with a big glass wall looking out over the steel,” he said. “There was hardly anyone out on the floor.”

In a matter of years, that kind of factory could be commonplace, Fedder predicts, citing physical AI and digital twins as key enablers. The former includes dexterous robots that can perform dull or dangerous physical tasks on factory floors while the latter encompasses digital models of facilities and processes that help manufacturers optimize operations in real time, using sophisticated diagnostics and simulations.

The result is a new level of automation that

will make manufacturing better and more efficient, said Thomas Kurfess, executive director of the Georgia Tech Manufacturing Institute. “Automation is going to help us improve cost, time to delivery, quality and production levels,” he said.

Leading by example

Although ubiquitous digital transformation of U.S. manufacturing could take years, perhaps even decades, early adopters already are demonstrating what’s possible.

Among them is consulting giant Deloitte, which manufactures educational STEM rover kits at its “Smart Factory @ Wichita” facility in Kansas.

Designed to showcase manufacturing innovations for Deloitte’s clients and prospects, it uses AI, robots, computer vision, digital twins and other technologies to assess equipment, optimize production processes, inspect products for defects, simulate operational changes before implementing them and more, said Tim Gaus, leader of Deloitte’s smart manufacturing business.

Another manufacturing innovator is pharmaceutical company Bristol Myers Squibb.

At its facility in Devens, Massachusetts, it manufactures complex biologics with the help of AI and other digital technologies, according to Karin Shanahan, executive vice president and chief supply chain and operations officer. Using

technology to collect, analyze and act upon manufacturing data has helped the company shorten launch timelines, increase production and reduce carbon emissions, Shanahan said.

Milliken & Company – which makes flooring, textiles, chemicals and medical products at factories worldwide – is yet another manufacturing innovator.

“By combining machine sensors with AI, we can continuously monitor equipment health, detect subtle changes in performance before they become failures and prescribe actions to mitigate issues before they create downtime,” said Michael Brown, executive vice president of operations.

“While that may sound like a maintenance story, the impact is much broader. When equipment operates more reliably, product quality is more consistent, production interruptions are reduced and teams can spend less time reacting to problems and more time improving the process.”

What about workers?

Automation and digital transformation aren’t eliminating manufacturing jobs – they’re changing them, according to Shanahan. “The factory worker today compared to the factory worker of 20 years ago ... spends a lot more time interacting with the manufacturing process through their computer versus turning valves and plugging things into equipment,” she said.

Instead of fabricators and line workers, manufacturers need technologists, data analysts and engineers.

“Machines and technology can provide information, automate tasks and identify patterns. However, people still bring judgment, creativity, experience and leadership. Those capabilities are extremely difficult to replicate. And they are becoming more important, not less,” said Milliken’s Brown.

Manufacturing’s ability to leverage the best of humans and machines simultaneously will make it a main character in the next chapter of America’s innovation story, Brown said.

“Many of the biggest challenges ahead,” he added, “will require advanced manufacturing capabilities. Ideas matter, but the ability to make those ideas real matters just as much.”