Evolving Workforces

Business Insights | Closing Manufacturing's Skills Gap

Automation & the Manufacturing Workforce, Part 3 of 3

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CBRE

This is the third in a three-part series on automation and the manufacturing workforce. This article examines why the shortage of technical talent is constraining automation and how upskilling, apprenticeships and industry partnerships can help manufacturers build the workforce they need.

Read Part 2 of the series here: The Manufacturing Jobs Growing in the Age of Automation

For manufacturers, buying robots is easy. But finding the people to run them is difficult, and it's slowing automation investment across the sector.

Modern manufacturing's labor shortage extends across a wide range of highly skilled roles, including controls, mechatronics, programmable logic controller programming and data analysis. Demand for these roles is rising faster than employers or schools can accommodate, since most training programs are designed for traditional manufacturing facilities.

Manufacturers, educators and policymakers need to understand why this gap exists and how to close it. Doing so will shape manufacturing competitiveness over the next decade.

What's Driving Manufacturing's Skills Gap?

Manufacturers consistently cite workforce availability as one of the top operational challenges, due to a limited labor pool with the right technical skills.

Total manufacturing employment in the U.S. declined to 12.65 million in 2025 from 12.84 million in 2023, according to Occupational Employment and Wage Statistics program estimates. During that same period, manufacturing's share of U.S. employment fell to 8.1% from 8.5%. Meanwhile, the number of manufacturing workers retiring is outpacing the pipeline of technically trained replacements.

Two dynamics are driving this gap:

- **Sector misperception:** Young workers' perception of manufacturing is often misguided. Many of them view manufacturing as particularly dangerous, low-skill work, despite its transformation into a highly automated, technology-driven industry. According to research from Deloitte and the Manufacturing Institute, these outdated perceptions are a significant contributor to ongoing workforce shortages. Dispelling that misperception will take sustained outreach, education partnerships and direct exposure to modern production environments.
- **Outdated workforce training:** Most community training programs were developed for manufacturing processes that no longer exist. Programs designed to produce line workers don't produce robotics technicians. Community colleges and technical schools have been updating curricula, but effective programs require serious capital investment in equipment, instructor recruitment and sector partnerships.

The Thin Pipeline of Highly Skilled Workers

The pipeline for skilled manufacturing workers is slowly improving, but there's still a long way to go.

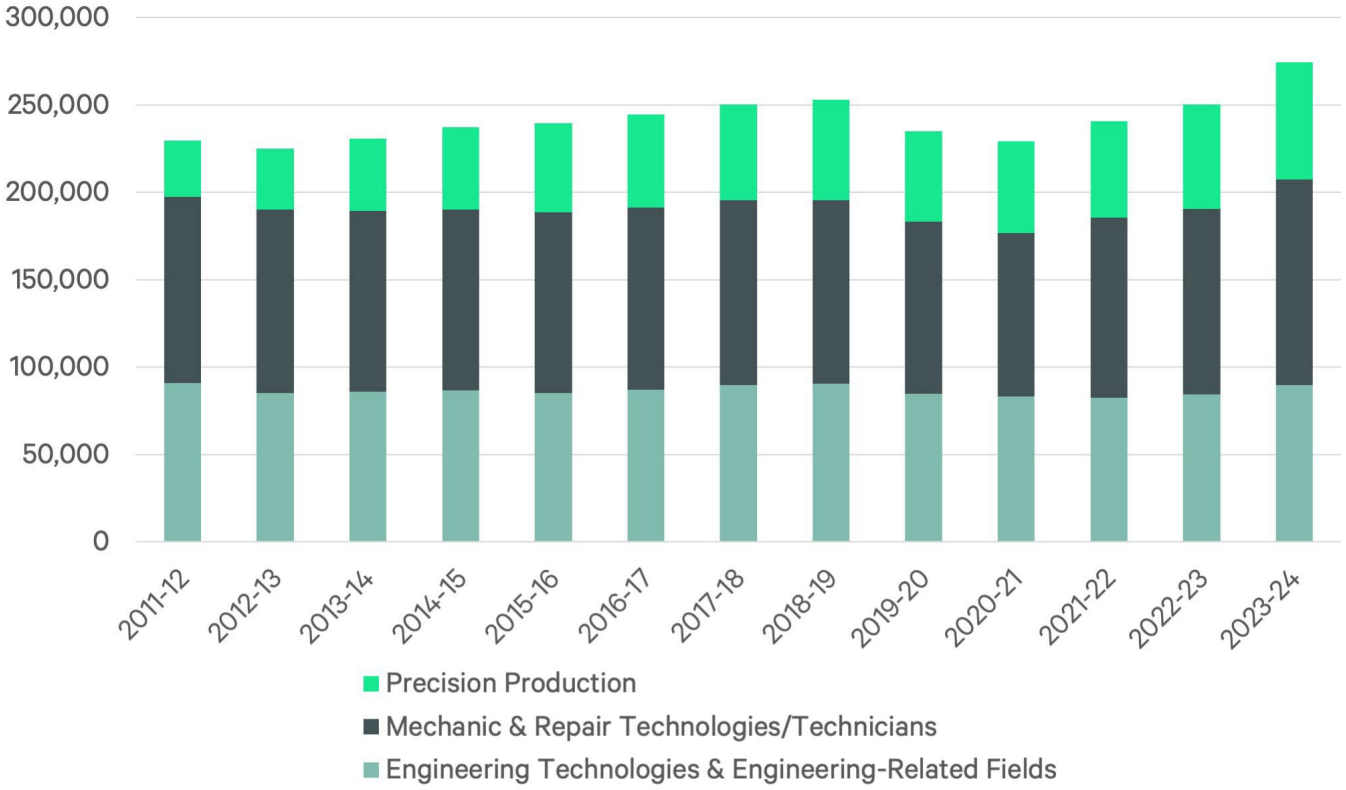
In 2020, postsecondary institutions awarded nearly 235,000 degrees and certificates in engineering technologies, mechanic and repair technologies and precision production, according to the U.S. Department of Education's National Center for Education Statistics. By 2024, that number rose to nearly 274,000, following a brief decline due to campus lab closures during the pandemic.

Mechanic and repair technologies degrees drove most of that recovery, with the most completions since 2020. Precision production degrees have grown fastest over the long run, with more than double the degrees awarded in 2024 than in 2012. Meanwhile, the number of engineering technologies degrees conferred have hovered between 80,000 and 90,000 per year since 2012.

Despite this growth, the 274,000 annual degree completions are only a fraction of manufacturing's 12-million-plus workforce, especially as workers retire and more technical roles are added.

Manufacturers can't afford to wait and hope the pipeline grows on its own.

Figure 1: Number of Degrees/Certifications Awarded at Postsecondary Institutions



Note: This table presents data collected from Title IV institutions in the United States.
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System.

Closing Manufacturing's Skilled-Worker Gap

To address the sector's talent shortage, manufacturers are increasingly building their own workforce. Three training models are leading the way:

- **Internal upskilling** involves training existing workers to perform higher-skill roles. The model is gaining traction for practical and reputational reasons. First, a worker with 10 years of floor experience has valuable institutional knowledge. Second, manufacturers that invest in their existing workforce show that they're dedicated to the community, which may influence local permitting and incentives.
- **Apprenticeship programs** have emerged as one of the more effective models. A manufacturer partners with a local community college or technical training center to design a curriculum around its specific equipment and processes. Participants can earn wages while they train, as well as a credential and hands-on experience with the equipment upon completion.
- **Sector partnerships** tackle workforce challenges through shared investment. In this model, multiple manufacturers in a region collectively fund training initiatives, such as community college robotics programs, spreading the cost and risk of workforce development that would be difficult for a single employer to undertake.

Each model enables the manufacturer to tailor a curriculum that produces the right candidate. Those that don't invest in training will be recruiting these candidates from a smaller labor pool and paying wages set by the manufacturers that do.

Automation ROI Depends on Workforce Planning

Ultimately, the workforce determines whether an investment in automation results in more productivity or expensive, idle equipment.

Consider the example automation scenario in the first article of this series: the $900,000 investment bought the equipment that tripled output per labor dollar, but the return hinged on the nine people running it. Automation doesn't reduce a manufacturer's dependence on workers. It concentrates that dependence in fewer people, each carrying more of the plant. A line of 23 workers can lose one and keep running. A line with three technicians can't lose two.

Site selection alone can't solve the skilled labor shortage. Modern manufacturing plants need acreage, power and access to the supply chain and customers, and those sites are rarely in the dense metros where technical talent concentrates. The best location for the plant is seldom the best location for the labor pool.

As a result, workforce planning is capital planning. If a manufacturer commits $900,000 to a line and nothing to the labor pipeline that staffs it, the three-year payback stays on the balance sheet. A robotic cell installs in months, while a technician apprenticeship takes two to four years. Manufacturers need to budget for both and start building a pipeline of skilled talent years before the equipment arrives.

Any manufacturer with sufficient capital can buy the same robots. Far fewer can staff them.