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AMERICAN FACTORIES DEMAND WHITE-COLLAR EDUCATION FOR BLUE-COLLAR WORK

Within three years, U.S. manufacturing workers with college degrees will outnumber those without

By Austen Hufford
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College-educated workers are taking over the American factory floor.

New manufacturing jobs that require more advanced skills are driving up the education level of factory workers who in past generations could get by without higher education, an analysis of federal data by The Wall Street Journal found.

Within the next three years, American manufacturers are, for the first time, on track to employ more college graduates than workers with a high-school education or less, part of a shift toward automation that has increased factory output, opened the door to more women and reduced prospects for lower-skilled workers.

"You used to do stuff by hand," said Erik Hurst, an economics professor at the University of Chicago. "Now, we need workers who can manage the machines."

U.S. manufacturers have added more than a million jobs since the recession, with the growth going to men and women with degrees, the Journal analysis found. Over the same time, manufacturers employed fewer people with at most a high-school diploma.

Employment in manufacturing jobs that require the most complex problem-solving skills, such as industrial engineers, grew 10 percent between 2012 and 2018; jobs requiring the least declined 3 percent, the Journal analysis found.

At Pioneer Service Inc., a machine shop in the Chicago suburb of Addison, Ill., employees in polo shirts and jeans, some with advanced degrees, code commands for robots making complex aerospace components on a hushed factory floor.

That is a far cry from work at Pioneer in the 1990s, when employees had to wear company uniforms to shield their clothes from the grease flying off the 1960s-era manual machines used to make parts for heating-and-cooling systems. Pioneer employs 40 people, the same number in 2012. Only a handful of them are from the time when simple metal parts were machined by hand.

"Now, it's more tech," said Aneesa Muthana, Pioneer's president and co-owner. "There has to be more skill."

Pioneer, which makes parts for Tesla vehicles and other luxury cars, had its highest revenue last year, Ms. Muthana said. The company's success mirrors that of other manufacturers that survived the financial crisis.

Improvements in manufacturing have made American factories more productive than ever and, despite recent job growth, require a third fewer workers than the nearly 20 million employed in 1979, the industry's labor peak.

Manufacturers added 56,000 jobs this year compared with 244,000 jobs through this time last year. Automation and competition from lower-wage countries have contributed to declining U.S. manufacturing jobs.

Specialized job requirements have narrowed the path to the middle class that factory work once afforded. The new, more advanced manufacturing jobs pay more but don't help workers who stopped schooling early. More than 40 percent of manufacturing workers have a college degree, up from 22 percent in 1991.

"The workers that remain do much more cognitively demanding jobs," said David Autor, an economics professor at MIT.

Looking ahead, investments in automation will continue to expand factory production with relatively fewer employees. Jobs that remain are expected to be increasingly filled by workers from colleges and technical schools, leaving high-school graduates and dropouts with fewer opportunities. Manufacturing workers laid-off in years past also will see fewer suitable openings.

"It's just not the case that bringing back manufacturing will be good for low-and-middle-skill workers," said Mr. Hurst, who along with colleagues have studied the increasing demands of factory workers.

Robot wranglers

Advantage Conveyor Inc. in Raleigh, N.C., spent more than \$2 million over the past decade on machines that cut and bend metal and plastics for the conveyor belts it builds. New machines allow technicians to make more parts per worker compared with the era when employees fashioned parts by hand.

Some of the workers were reassigned; others were laid off. "All of that menial labor moved to skilled labor," said Vann Webb, company president. "You virtually have to have a two-year degree to work in our shop."

Joshua Dallons, 28 years old, had hoped to become a nuclear engineer, but juggling college classes and a 30-hour-a-week grocery job was too much.

"I had that crisis," Mr. Dallons said. "Do I want to keep pursuing engineering, or do I want to pursue this sort of job where I can quickly get into the field and quickly start making money?"

He decided to complete a training program in welding and was hired by Advantage in 2014. Mr. Dallons now works at a computer, designing conveyor layouts. He makes more than \$25 an hour.

Large manufacturers also are tilting their workforce toward higher skilled, educated employees. Around 70 percent of new hires this year at Honeywell International Inc.'s aerospace business have at least an associate degree, said Darren Kosel, a Honeywell plant manager.

The company isn't a place for factory workers who want to just punch in and punch out every day, Mr. Kosel said: "If you want to be one of those people, you won't be successful here."

At a Caterpillar Inc. plant in Clayton, N.C., investments in technology help a single shift of workers produce the small-wheel loaders that four years ago would have taken two shifts.

The Harley-Davidson Inc. 's engine plant in Milwaukee has robotic arms to ferry motorcycle pieces, taking over the tough, repetitive work formerly done by employees, said plant manager Chuck Statz. The machines have made the workplace safer, he said, mirroring a national trend. In 2018, factory workers were hurt at half the rate as in 2003.

Harley-Davidson employed 2,200 unionized manufacturing workers in 2018, 400 fewer than in 2014, which the company attributed to several factors. Caterpillar reported that it had 10,000 unionized workers at the end of 2018, down from 15,000 in 2007. During the same period, the equipment maker's revenue climbed 20 percent.

A recent search of all Caterpillar's U.S. job posts show that more than four in five require or prefer a college degree. A majority of the company's production jobs called for a degree or specialized skill.

High risk

Ms. Muthana faced a hard choice in 2012: whether to invest millions of dollars in automated manufacturing and training, or to retire and close Pioneer, the company her uncle started 30 years ago.

In the old days, the factory's oil-sputtering machines were adjusted by two dozen workers wielding foot-long wrenches. At the end of their shifts, they were covered in grease and metal shavings.

Pioneer's biggest clients, makers of heating and cooling systems, switched to cheaper foreign suppliers. Business fell 90 percent in one year. And the company owed more to suppliers than its outstanding orders could cover.

Ms. Muthana sat in the company parking lot on October 15, 2012, looking at the cars of her employees. "If I closed my doors, where were they going to go?" she recalled thinking.

Rather than close the plant, she hired Pioneer's first salespeople. They found vehicle makers that needed complex metal components that Pioneer could make more profitably than the parts for heaters and air conditioners.

The problem was that Pioneer's old machinery couldn't make the parts fast enough. So Ms. Muthana sought machines that could be programmed to precisely cut and drill the intricate parts in a single operation.

Pioneer had little experience with such advanced equipment, Ms. Muthana said, but she persuaded suppliers to help her install and set up the machines, as well as train employees to use them.

"We put a lot of money on her floor at one time with minimal guarantees that we were going to get that money back," said Dave Polito, owner of her main machine supplier. Ms.

Muthana said she has now spent more than \$6 million on new technology, largely for machines and software.

The machines can make one complex part every six minutes, compared with 45 minutes of work on multiple machines once needed to produce a single part. Learning how wasn't easy for longtime Pioneer employees.

Fernando Delatorre, who operated the older machines at Pioneer for 14 years, struggled to memorize the codes used to program the new machines.

"I wasn't into computer things, learning all these numbers," said Mr. Delatorre. He earned \$16.50 an hour when he left Pioneer in 2017 for a construction job that paid more.

For Ms. Muthana, losing or firing longtime employees was the toughest part of her factory's transition. About 10 of the company's 40 workers remained. Just one of them operates a special grinder that hasn't been computerized.

"I saved those jobs, and I gave them the opportunity," she said, "but then most of the team is no longer here anyway."

On a recent morning, Pioneer workers inspected parts that the automated equipment had made on their own overnight. They took digital measurements to make sure the parts matched customer specifications. A screen overhead detailed how efficiently each machine was operating.

A yellow light on one machine caught the eye of technician Stacy Czyzewski. A cutting tool was due to be replaced. She opened the machine's enclosure, which seals in the oil and metal scraps. Using a small Allen wrench, she popped out the worn part and replaced it.

She punched codes on the machine's keypad from memory and marked the repair on her iPad. Ms. Czyzewski wiped her hands on a towel. Her black polo shirt, emblazoned with Pioneer's logo, was spotless.

Ms. Czyzewski had previously worked five years cleaning equipment at an Altria Group Inc. chewing tobacco plant. When it closed in 2017, a grant helped Ms. Czyzewski pay for a four-month training program where she learned to operate the machines used at Pioneer.

In a room at the center of the Pioneer factory, Rachith Thipperri converts customer orders into 3-D blueprints that are used to program machines. He started work at Pioneer as an intern while studying for a master's degree in mechanical engineering at the University of Illinois at Chicago. Mr. Thipperri saw a future in the modern American factory.

"There are people who are stuck in old manufacturing," he said, "but there is also this innovative and growth aspect of it."

Production workers at Pioneer start at \$14 an hour and rise to \$27 an hour with experience. Before investing in modern machinery, worker pay started near minimum wage, which was \$8.25 an hour around the time the company was transforming in 2010.

Inspirational inscriptions decorate the walls of the Pioneer factory. "The most dangerous words are we've always done it that way," one said. The boss has lunch with her 40 employees each quarter. Half are women.

Ms. Muthana attends college career fairs to find workers with skills and a desire to learn. "I'm willing to give you the opportunities," she said. "But if you're not willing to change, and you're not willing to get out of your comfort zone, there's nothing I can do."