Exploring Ohio’s Pipeline of Manufacturing Workers

Summary of Key Findings

The U.S. manufacturing industry is experiencing a resurgence and faces a growing need for highly skilled workers. Recent reports project that demand for highly skilled manufacturing workers will outpace supply in coming years, and this shortage may grow as the U.S. manufacturing industry grows and its labor needs shift. Additionally, manufacturing has traditionally employed a largely white and male workforce, and there is growing interest in bringing a more diverse set of workers into manufacturing.

To identify promising strategies to expand the supply of highly skilled manufacturing workers and meet employers’ growing skill demands, a group of RAND researchers examined the pipeline between Ohio’s postsecondary education system and manufacturing employment in Ohio. The researchers also explored the extent to which workers with manufacturing-related credentials are not entering Ohio’s manufacturing industry.

KEY FINDINGS

- Many patterns in the Ohio manufacturing workforce mirror those of the U.S. manufacturing workforce.
- The number of students pursuing manufacturing-related education in Ohio’s public postsecondary institutions has increased in recent years.
- Manufacturing-related credentials are disproportionately earned by white men in Ohio.
- Fewer than 40 percent of students with a manufacturing-related credential from a public Ohio postsecondary institution work in Ohio manufacturing one year after completing the credential.
- Wages in other industries are unlikely to be a major reason Ohio students with manufacturing-related credentials are not entering Ohio’s manufacturing industry.
- Among the 2013 population of Ohio’s full-time manufacturing workers, 77 percent were still employed in manufacturing in 2016 and 63 percent were still employed in manufacturing in 2019.
- Sixty-four percent of these workers entered manufacturing from a job in another Ohio industry, and 11 percent entered from an Ohio postsecondary institution.
- Eleven percent of workers who entered Ohio manufacturing between 2007 and 2013 pursued some education between 2013 and 2019, but only one-third of them pursued manufacturing-related education.
related skills or credentials forgo work in the industry. This research brief summarizes the education and employment patterns revealed by the research.

**Methodology**

The research team focused on Ohio because that state has one of the largest manufacturing industries in the United States and, as a result, can be instructive for understanding the challenges and opportunities that workers, employers, and educational institutions in the industry face. In addition, Ohio has detailed administrative data that link postsecondary education and employment records, which allowed the research team to “follow” students from education to the workforce and vice versa.

Specifically, the researchers used administrative data from the Ohio Longitudinal Data Archive (OLDA) to describe education and employment patterns in Ohio between 2006 and 2019. These data cover public postsecondary institutions in Ohio, including community colleges, four-year colleges, and Ohio Technical Centers. The wage data are based on employment in Ohio in jobs covered by the state’s unemployment insurance system. The researchers also drew on data from the American Community Survey to compare the Ohio manufacturing workforce with the manufacturing workforce in the rest of the United States.

Additional details on the data and analysis samples used in the research are provided in the authors’ research report, *Strengthening the Manufacturing Workforce in Ohio*.

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**Key Findings**

The researchers found that, in general, many patterns in the Ohio manufacturing workforce mirror those of the U.S. manufacturing workforce. Both nationally and in Ohio, male and white workers make up the majority of the manufacturing workforce, and women are more underrepresented in manufacturing than in other industries. This highlights potential for drawing more women into the sector. In addition, in both Ohio and the rest of the United States, male and white workers in manufacturing have higher earnings than female workers and workers of color in the industry. However, manufacturing workers in Ohio are less likely than manufacturing workers in the rest of the United States to have a four-year college degree, which highlights some potential for increasing education levels among the state’s manufacturing workers.

The number of students pursuing manufacturing-related education in Ohio’s public postsecondary institutions has increased in recent years. This growth has been concentrated in four-year programs and, to a lesser extent, Ohio Technical Centers. The number of students earning an associate degree in manufacturing-related fields has also been increasing.

Manufacturing-related credentials are disproportionately earned by white men in Ohio. Among individuals who complete a manufacturing-related credential in Ohio, more than 80 percent are white, and more than 85 percent are male. However, some of the growth in enrollments in recent years has been due to an increase in female and Asian students in four-year manufacturing-related programs. Black students disproportionately enroll in shorter-term programs. Thus, expanding the diversity of students in manufacturing-related programs may be important for expanding the diversity of the manufacturing workforce.

Fewer than 40 percent of students with a manufacturing-related credential from a public Ohio postsecondary institution work in Ohio manufacturing one year after completing the credential. Figure 1 depicts this share of students by credential type. Some of this attrition occurs because students are not employed in Ohio, but, even among students who work in Ohio, fewer than 50 percent of students earning each level of credential work in manufacturing. This drop-off is larger for women and individuals from underrepresented minority
backgrounds. Nevertheless, manufacturing is the most common industry of employment for those with a manufacturing-related credential. Although there is no major industry to which students are being diverted, understanding the factors that influence whether students enter manufacturing or other industries may offer clues for how to retain them in the manufacturing pipeline.

Wages in other industries are unlikely to be a major reason Ohio students with manufacturing-related credentials are not entering Ohio’s manufacturing industry. Students who enter manufacturing in Ohio in their first year after completing a manufacturing-related credential earn higher wages than Ohio students with manufacturing-related credentials who enter other industries, and this wage gap persists for at least five years.

Wage disparities within the industry exist in terms of race and gender. Male and white workers with manufacturing-related credentials receive higher wages than their non-male, non-white counterparts at each education level. Some of this disparity is explained by the industries in which people work; for instance, earnings disparities between men and women are smaller among workers who are employed in manufacturing. However, industry of employment and education level do not fully explain the gender and racial wage gaps in Ohio.

The size of Ohio’s manufacturing workforce has shrunk somewhat since the Great Recession but has been relatively stable in recent years. Median wages and the share of female workers have also been mostly stable over time.

Among the 2013 population of Ohio’s full-time manufacturing workers, 77 percent were still employed in manufacturing in 2016 and 63 percent were still employed in manufacturing in 2019. The most common path for those who exited manufacturing was leaving Ohio’s full-time workforce (14 percent in 2016 and 25 percent in 2019), although 9 percent (in 2016) and 12 percent (in 2019) left for a full-time job in another industry in Ohio. Women and workers with lower wages were more likely to leave manufacturing for another industry than men or higher-wage workers. Workers who left manufacturing experienced higher wage growth than those who stayed, so wages may be important for retention. However, women do not appear to leave for higher wages.

The researchers also examined pathways into the manufacturing workforce among recent entrants to Ohio’s workforce. Sixty-four percent of these workers entered manufacturing from a job in another Ohio industry, and 11 percent entered from an Ohio post-secondary institution. These numbers highlight that movement from other industries into manufacturing is important for bolstering the pipeline of manufacturing workers and that education is not currently a major pipeline.

Finally, the research team examined upskilling. Eleven percent of workers who entered Ohio manufacturing between 2007 and 2013 pursued some education between 2013 and 2019, but only one-third of them pursued manufacturing-related education. While men and women pursue education at similar rates, men are more likely than women to enroll in manufacturing-related programs. Degree-completion rates are higher for the Ohio manufacturing workers who enroll in manufacturing programs than for those who enroll in other programs, and workers who enroll in manufacturing programs go on to earn higher wages than those who enroll in other types of programs. Thus, there may be potential to focus more on upskilling of the manufacturing workforce, especially for women or lower-skill workers.

**FIGURE 1**

Percentage of Students in Manufacturing-Related Programs Employed in Ohio Manufacturing One Year After Earning Credential

<table>
<thead>
<tr>
<th>Percentage employed in Ohio manufacturing</th>
<th>Credential type</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Ohio Technical Center</td>
</tr>
<tr>
<td>80</td>
<td>Certificate</td>
</tr>
<tr>
<td>60</td>
<td>A.A.</td>
</tr>
<tr>
<td>40</td>
<td>B.A.</td>
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</tbody>
</table>

SOURCE: Features OLDA data from Ohio higher educational records linked to data on employment for workers employed in jobs covered by Ohio’s unemployment insurance from 2006 to 2021.
Recommendations

The research highlighted four key areas for improving retention and diversity in the pipeline of manufacturing workers and drawing in new manufacturing workers.

Examine the reasons for attrition from education to employment in manufacturing, and craft related policy solutions. The majority of Ohio students with manufacturing-related credentials are not employed in Ohio manufacturing after completing their credentials, and attrition from education to employment is even greater among female and non-white students. Thus, there appears to be a much larger supply of highly skilled workers with manufacturing-related expertise than is currently being utilized by the manufacturing industry. Identifying the reasons for this attrition and ways to reduce it will be important for growing the pipeline of highly skilled workers and expanding the diversity of the workforce.

Employ targeted efforts to improve the earnings and retention of female and non-white workers. The research indicates that women are underrepresented in Ohio manufacturing relative to the Ohio workforce, and women and people of color are underrepresented in manufacturing-related education programs. Furthermore, retention is lower among women than among men, and wages are lower for women and people of color relative to male and white workers with similar education levels. More research is needed to understand the reasons for gender and racial disparities in employment, pay, and retention and ways to address them. Patterns in the data suggest that wages in other industries are likely not the only driving factor, so there may be other characteristics of manufacturing jobs that could be changed to improve retention (such as hours, work conditions, culture, and promotion opportunities). In addition, increasing the diversity of students in manufacturing-related education could help diversify the pipeline of highly skilled workers, help more workers from underrepresented minority backgrounds move into higher-paying positions, and shift the image of manufacturing away from a largely white, male workforce.

Identify ways to improve retention within the manufacturing industry, and build opportunities to combat attrition through upskilling. The research team’s analyses highlight that the industry could do more to improve retention, but it is difficult to tell why workers are leaving. Information on job features (such as hours, work conditions, culture, and promotion opportunities) may be helpful for understanding the reasons for attrition. In addition, employers may be able to combat low retention through upskilling. Upskilling rates are relatively low, so there appears to be room for improvement. Upskilling may be beneficial for workers because it is associated with pay increases and beneficial for employers because some evidence suggests that skills-based hiring is associated with higher retention. It also may be useful for women, who tend to pursue subsequent postsecondary education (i.e., subsequent to being in the manufacturing workforce) at relatively high rates but are much less likely than men to pursue manufacturing-related training.

Draw in new workers from other industries. Ohio’s manufacturing workers primarily enter the manufacturing workforce from other industries rather than directly from education. This suggests that such industries as administrative and support and waste management and remediation services (ASWMRS), retail trade, wholesale trade, and accommodation and food services could be promising areas for expanding the pipeline of manufacturing workers. Employers could do more to advertise job opportunities among these types of workers, focusing on the relative advantages of working in the manufacturing industry compared with these related industries.
Notes


2 The OLDA is a project of the Ohio Education Research Center (oerc.osu.edu) and provides researchers with centralized access to administrative data. The OLDA is managed by The Ohio State University’s CHRR (chrr.osu.edu) in collaboration with Ohio’s state workforce and education agencies (ohioanalytics.gov), with those agencies providing oversight and funding. For information on OLDA sponsors, see CHRR at The Ohio State University, Ohio Longitudinal Data Archive, data repository, undated. http://chrr.osu.edu/projects/ohio-longitudinal-data-archive.

3 We define manufacturing-related programs as those associated with the following Classification of Instructional Programs (CIP) codes: CIP code 15 (engineering technologies and technicians), CIP code 48 (precision production), and seven manufacturing-related CIP codes within CIP code 14 (engineering): mechanical engineering (14.19), electrical and electronics engineering (14.10), industrial engineering (14.35), materials engineering (14.18), construction engineering (14.33), manufacturing engineering (14.36), and polymer/plastics engineering (14.32). See *Strengthening the Manufacturing Workforce in Ohio* for a discussion of this definition.

4 Recent entrants are defined as those who entered Ohio’s workforce for the first time between 2007 and 2013. These are also the years for which the research team was best able to link higher education and employment records for individual workers.

5 The 11 percent of workers attending an Ohio postsecondary institution between 2013 and 2019 includes enrollments for all degree levels, including postbaccalaureate degrees, and the limited data the authors had on certificate enrollments.
