

# Quantifying the Skills Gap:

For Engineering and  
Skilled Workers in NE  
Ohio Manufacturing

Executive Summary



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Primary Coordinators of Project:  
ConxusNEO and MAGNET

Research provided by  
Shanahan Resources, Inc.

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

### Funded By:



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**Ohio**

**Manufacturing  
Extension Partnership**

# Executive Summary: Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

Labor Market Data Analytics + Employer Feedback = Strategic Intelligence for Workforce Development Leaders

## I. Project

This project is a collaborative effort of community colleges and industry intermediaries acting as co-funders. The overall purpose of this investigation is to identify opportunities for greater alignment of postsecondary manufacturing technology education and training with industry needs. Just as important is the need for more responsive delivery models like boot camps considering the demand for workers from manufacturers which is rapidly changing. Engineering and skilled manufacturing workers now need the knowledge, skills, and work experiences that employers reveal in online job postings. This report documents the region's skills gap for new hires, including insight into the need for upskilling industries' current, experienced workers.

Shanahan Resources, Inc., was commissioned to document the nature and nuance of current gaps between demand and supply of engineering and skilled workers in the regional labor market. From similar investigations in regions in other states, consistent findings reveal that while gaps are large:

- Not all engineering or manufacturing occupations have a gap, and some have more intense gaps than others. Gap analysis is shown at two levels of education credentials: Bachelors and above, and Associates or certificate postsecondary credential.
- Not all Engineering or Manufacturing Technology programs (CIPs) are equally effective at preparing students for every occupation in their respective career path.

Using the methodologies developed by Burning Glass Technologies, it is possible to determine which occupations are experiencing the most intense gaps and what education and training programs have the best potential to impact the gap by increasing the supply of completers with specific knowledge and skills employers now want: This varies among occupations.

This investigation applies the latest data analytics to pinpoint skill gaps by breaking them down by occupation, level of education, and prior work experience. This provides hard data with which to sharpen discussions on alternative actions for employers and educators to consider.

Funding partners are:

Community Colleges: Cuyahoga Community College; Lorain County Community College; and Stark State College

Industry Intermediaries: MAGNET, ConxusNEO, and RITE

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

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### II. Purpose and Goal

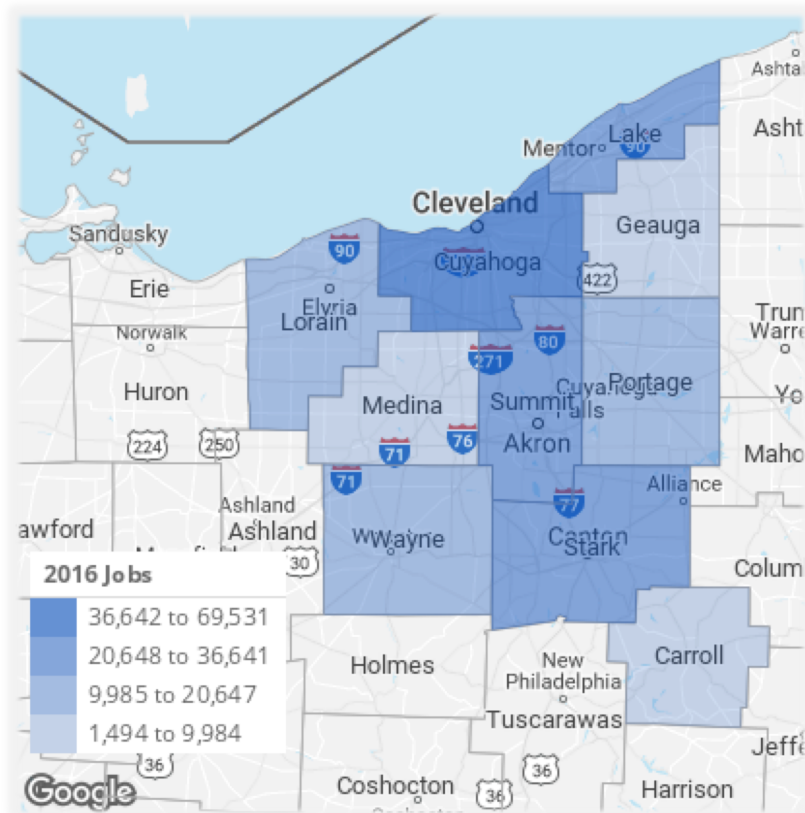
Numeric skill gaps between supply and demand results in employers recruiting outside the region. *Ideally, manufacturers should be able to satisfy hiring needs from job seekers already living in the region*, especially when hiring skilled workers. Many employers report little difficulty filling positions when successfully recruiting from outside the local region. These workers either commute daily into, or relocate to, NE Ohio.

The goal of regional workforce (talent) development, therefore, is to quicken the pace of efforts to attack skill gaps by increasing and improving the supply of local workers. Can higher education and vocational and technical training institutions in NE Ohio play a greater role to increase the numbers of qualified job applicants? Can they be of more strategic and tactical help to equip emerging and incumbent workers with

the skills and credentials employers now want? Can completers be connected with jobs in real time?

The public investment into our postsecondary education resources is too great to ignore when addressing skills gaps. It is vital to determine just how to position these public resources in ways that enable them to succeed in creating better alignment.

**A major part of what is needed is an ability to quantify the skills gap for jobs most critical to the manufacturing sector in NE Ohio.**



## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

*This investigation aims to identify the occupations/ jobs in demand where manufacturing employers find it difficult to fulfill hiring quotas for engineering and skilled workers already living in the region. The purpose of this investigation is to pinpoint opportunities to create greater alignment of NE Ohio's postsecondary education and training programs with the skills and jobs manufacturing employers demand. This means restructuring learning outcomes of Engineering and Manufacturing programs with a laser-focus on the knowledge and skills need workers need as manufacturers embrace technological change. Just as important is the need for more responsive delivery models like boot camps that quicken the pace of new workers in the labor market. Both approaches are vital and warrant major investment of time and resources.*

The primary focus of this investigation is on NE Ohio's manufacturing sector and jobs directly or indirectly supporting production. This includes occupational families of **Engineering; Installation, Maintenance, & Repair; and Production**.

### III. Top Findings & Conclusions

*This study investigates the role of manufacturing in supporting the NE Ohio economy, past and future. It provides wide-ranging, yet in-depth, insights based on an equally deep-dive into supply and demand of talent in the 10-County NE Ohio labor market. It also documents the region's skills gap for new hires by manufacturing for engineers and manufacturing technology workers, including insight into the need for the upskilling of industries current, experienced workers.*

Manufacturers with job openings for **Engineering and Skilled Manufacturing** workers face a skills gap in NE Ohio's labor market. This study provides hard data to drive discussions on where gaps exist; which jobs employers seek job experience more than education and training as evidence of skills; and which postsecondary career and technical education programs best prepare students with the skills employers seek.

Until now, NE Ohio has had no hard data capable of assessing the nature and degree of poor alignment of existing programs and a gap that worsens due to learning outcomes failing to keep pace with changing employer skill requirements. Gaps are assumed on the basis of large numbers of jobs in demand, and anecdotal evidence from employers of their difficulty in hiring from within the region, and maybe from elsewhere.

#### PROFILE OF NE OHIO'S MANUFACTURING SECTOR AND OCCUPATIONAL NEEDS

##### How Important is Manufacturing to the NE Ohio Economy?

Using volume of output, many market segments of manufacturing are doing well, and some are growing jobs in NE Ohio. Manufacturing jobs are expected to remain level from now through 2022.

Half of all manufacturing jobs in 2016 were in manufacturing operations with growing workforces.

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

Overall, these specific manufacturing industries and product markets, in many cases are not the traditional backbone of the NE Ohio economy; and are expected to add jobs in NE Ohio (3.1% by 2022) at slightly greater than will occur in the nation for the same industries.

- Computer and Electronic Products
- Food Manufacturing
- Machinery
- Chemical
- Transportation Equipment

In addition:

- The diversification of market segments adds some economic stability for the manufacturing sector.
- In total, nearly 40,000 jobs in 2016 (about one in five of all jobs in manufacturing) are from these growing markets of manufactured goods and services.
- While the percent of job growth is minor, expected gains number in the hundreds in each case. The dominance of products in advanced manufacturing is clear.

### What are the Jobs in the Growth Industries?

**Importance of Production and Maintenance Workforce:** Not surprising, 52% of all jobs in 2016 were for *Production* workers. These workers are directly involved in the production of goods and manufacturing services. It represents a wide range of specific jobs ranging from *Production Manager* to *Helpers*, with some occupations specific to the product being produced, or the production process itself. *The overall average of \$16 per hour provides full time workers with a living wage, depending on family size.*

*Engineers and Engineering Technologists/ Technicians* are critical in design and development of new and improved products and more efficient production and distribution systems.

*Installation, Maintenance and Repair* workers are critical to implementing and sustaining production systems and equipment.

*These three occupational groups play vital roles in NEO's growing segments of manufacturing and are the focus of the remainder of this investigation. We now know the relative importance of the wide range of occupations and jobs in the three occupational groups most critical to supporting the growth of the region's manufacturing sector, and in what industries and specific markets job growth will most likely occur in the next seven years.*

**The challenge to providing actionable strategic information to quantify the skills gap has always been two-fold:**

- The need for a deeper understanding of skills in short supply for occupations in great demand
- A clear way to quantify sources of job seekers to fill open positions by occupations.

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

Even more important is the lack of effort to identify and enumerate the supply of qualified workers compared to demand now and in the recent past.

Both require a different approach to quantifying the skills gap. The focus is shifted from economic and industry trends to the dynamics of the labor market where employers and job seekers attempt to connect in real time.

*It is also not evident from how economic scenarios of manufacturing growth are dependent on industry adaptation and utilization of new manufacturing technology, especially what are called ‘disruptive technologies’: how will new technologies driven by automation, robotics and Artificial Intelligence impact the emerging demand for workers in terms of job assignments and skills.*

- *How different will the occupational profile of NEO’s manufacturing appear in the next few years?*
- *How different will the skill sets appear for traditional jobs in manufacturing?*

For example, long-term trends reveal that *Production* jobs are a smaller and smaller share of all jobs in manufacturing—mainly the result of increased productivity. More so than off-shoring of production, this is a result of increased automation of routine tasks and responsibilities previously performed by them. Past trends in adding workers by occupation are not a good indication of what employers choose to hire now and going forward.

This report tackles these issues head-on.

### USING ONLINE JOB POSTINGS AS INDICATOR OF “INTENT TO HIRE”

Based on online ads active at some point in 2016, the Production occupations had the most posts placed by manufacturing. In NEO, the online posting of jobs by manufacturers is for Production Workers (44%).

The largest number of postings for individual occupations by manufacturers are:

- *Production Workers* (a title that combines a range of specific O\*Net titles such as Assemblers; Pattern Makers; Glass Blowers; etc. see Attachment)
- *Maintenance Technician; Manufacturing Machine Operator* (a title that combines a large of very specific O\*Net titles such as Setters, Operators, and Tenders of specific types of machines to manufacturer a range of product types. See Attachment)
- *Production Supervisor*
- *Machinists.*

Ads for *Engineers* accounts for 28% of all jobs posted by manufacturers. Mechanical and Manufacturing Engineers are the types of engineering expertise in demand. Demand for *Engineering Technologists/Technicians* is very anemic, by contrast.

Largely, these same occupational titles were used in the 2016 MAGNET survey of manufacturers throughout the 18-county Jobs Ohio Region of NE Ohio. While not entirely comparable, the most employer responses selected *Machine Operator* as the most in demand. Job postings analysis which includes a large cross-section

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

of employers in the region supports the survey responses for many of the small number of occupations included in the survey.

- Assembler (Production Worker)
- CNC Operator/ Machinist
- Maintenance Technician
- Engineers
- Supervisor

Welders, however, seldom appear in online job postings throughout the region.

To better understand why some occupations were identified by employers as in demand, the responses for each occupation were linked with the type of manufacturing. *Machine Operator*, for example, was identified as in demand by precision processes, process manufacturing in general, metal fabrication and plastics fabrication.

- *CNC Operator/ Machinists* is only in demand by precision manufacturing processes.
- *Engineers and Technicians* is only in demand by Original Equipment manufacturers and Electronic Components producers.

*Production Worker* and *Manufacturing Machine Operator* were the most often posted jobs throughout 2016. Typically, these are not skilled jobs, and often do not meet the criteria set for middle-skill jobs.

- Computer or IT skills are almost totally missing from ads for these two ‘factory’ jobs. Little evidence that the posted jobs require measuring or use of math. The implication is that these workers will not be working with digitized information, systems or controls.
- These job ads stipulate a mean salary of \$32,600 which falls short of a living wage; require no prior experience; and only a high school credential is required.

The remainder of *Production Occupations* are more likely ones where employers face a shortage of skilled job seekers, based on education and training or prior job experience. These posts account for just over 2,000 ads placed by manufacturers and where a skills gap might exist in NEO.

### Demand for Engineering Workers is Mostly from Manufacturing

Six of ten job postings for engineers and engineering technologists are from manufacturers.

Five occupations have 55% or more ads from Manufacturers.

- *Manufacturing Engineers* top the list with 90% from the Manufacturing sector.
- *Industrial, Chemical/ Process, and Validation Engineers* also appear more often from Manufacturing firms.
- All Technologist/ Technician jobs posted typically are from other industry sectors. Only *Manufacturing/ Production Technician* has half of all ads from the manufacturing sector.



## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

Potentially middle-skill jobs critical to manufacturing are those in *Installation, Maintenance and Repair*.

- *Maintenance Technician* accounts for exactly half of all these jobs posted. Almost all captured by adding *Maintenance/ Service Supervisor* and *Field Service Technician*.
- Hiring new workers for any of these occupations might be difficult for manufacturers, depending on specific skills training and prior work experience preferred by employers and the availability of appropriate postsecondary skills training within NE Ohio.

Currently most of NE Ohio jobs in the region are from industries other than manufacturing.

### JOBS IN-DEMAND OUTNUMBER QUALIFIED JOBSEEKERS = SKILLS

If NE Ohio postsecondary career education and training providers are to align technical programs with employer demand, it is important to have hard data on occupations with a skills gap, and a grasp on level of education and prior work experience employers seek, and specific programs that best prepare students to perform well on the job. ***Demand is only half of a story about skills gaps.***

If employers are to find qualified applicants who already live in the region, individuals who live here are either already employed with several years of work experience, or are emerging from the region's postsecondary career and technical education and training providers having recently completed a relevant degree or certificate.

The primary difference between these two sources of potential qualified applicants is prior work experience. To be considered qualified by employers, experienced and non-experienced workers need have appropriate education and training completed.

### Quantifying Supply of Qualified Workers: Varies with Prior Work Experience and Education Requirements of Employers

Even for the same occupation, job ads might be seeking senior-level, experienced mid-level, or less experienced entry-level applicants. This depends on the nature and level of responsibility of positions in which they consider hiring.

### Education Credentials Advertised in Job Postings

Not surprisingly, the ads for skilled manufacturing job often are silent about educational requirements. Forty-two percent of all ads for *Production* jobs have no information about educational requirements; even a higher (49%) of ads for *Maintenance, Installation and Repair* workers lack information about education needed. This figure is seventy-nine percent for engineers and engineering technology/ technician jobs stipulate education expectations of employers.

The data capture what employers say is the minimum and/or preferred level of education they want for each group of job postings: *Production and Maintenance, Installation, and Repair*.

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

### Skilled Workers:

- **High school or vocational training for Skilled Jobs:** In most cases, technical training is preferred in addition to a high school credential. This is only waived for job seekers with evident job experience where skills were developed.
- **Associate degree for Skilled Jobs:** These percentages reflect the reality that employers prefer applicants that have completed an Associate's degree over vocation training certificates. This is more prevalent for the positions posted in *Maintenance, Installation and Repair*. This is likely due to *Maintenance Technician* and *Maintenance Service Supervisor* accounting for most of the job postings.
- **Bachelor's degree for Production Jobs:** Employers prefer a Bachelors for 27% of Production jobs posted. This likely is the result of the larger number of postings for *Production Supervisor or Manager* and other jobs requiring greater levels of technical skills.

### Prior Work Experience Advertised in Job Postings

Prior work experience is important because it reflects how employers differentiate between newly-trained job seekers with no prior work experience who can apply for their entry-level jobs and mid-level jobs where several years of prior job experience is required, regardless of their training.

Clearly, employers with job openings within the three types of occupations being researched have different ratios of entry- to mid-level needs.

- **Production Jobs:** 42% of ads stipulate little to no prior work experience necessary (0 to 2 years of prior work experience).
- **Maintenance, Installation, & Repair Jobs:** 40% of all ads are at the entry-level.
- **Engineers and Technologists/ Technicians:** the majority of ads want experienced workers regardless of strict requirements on education levels in appropriate majors.

### EMPIRICAL DEFINITION OF SKILLS GAP FOR ENTRY-LEVEL JOBS

"Individuals emerging from manufacturing technology education and training programs" is the best way to define a pool of potential job seekers with skills acquired through formal education rather than from work experience.

*Supply of workers for entry-level jobs*  
*Entry-level jobs are the best prospects for recent college grads, most of whom will not come with significant prior work experience.*

Guide to Identifying Labor Market Supply	
Prior Work Experience	Minimum Level of Education Credential
	Bachelors and Above    Less than a Bachelors
	Source of Supply
0 to 2 Years	Recent Completers of Education & Training
3 to 5 Years	Experience Workforce

A skills gap analysis between demand and supply focuses on demand for entry-level hires. To determine supply, we analyze the annual supply of grads from programs that imbue completers with skills employers now demand. The best single source of comprehensive data on completers by program is known as IPEDs.

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

**THE QUESTION IS: ARE THERE ENOUGH GRADUATES FROM NE OHIO YEAR TO MEET THE DEMAND FOR ENTRY-LEVEL DEMAND FOR MANUFACTURING TECHNOLOGY AND ENGINEERING WORKERS? IF NOT, WHICH SPECIFIC OCCUPATIONS HAD THE LARGEST NUMERIC GAP?**

- The NE Ohio Skills Gap between demand and supply analysis focused **only** on demand for **entry-level** new hires.
- Supply is the annual supply of grads from programs that imbue completers with skills employers now demand. NE Ohio postsecondary education and training organizations are the source of grads.

The gap can be one of quantity (grads) or quality (specific major), or both.

When asked in the MAGNET survey where is their greatest need when hiring new workers, given the alternative answers shown in the table, “Employees with Technical Training and Experience” was the response most often given.

A far second was “Entry-level employees”.

It is not surprising that employers are seeking to hire job seekers with both the technical training to perform on the job but also prior work experience.

This corresponds closely with data showing that even in skilled job ads, employers are seeking to fill mid-level, not entry-level positions.

The importance of these findings is that very different strategies are needed by educators if they are to help with providing experienced workers with the additional education needed to prepare them for these jobs in NE Ohio manufacturing.

### SKILLS GAP AT BACHELORS LEVEL

*Typically, bachelor degrees are required or preferred by employers for Engineer jobs.*

The findings are clear: only certain Engineer occupations have greater job openings for entry-level workers than NE Ohio are graduating annually from engineering programs Top on the list is *Mechanical Engineer*; it is followed by *Electrical*, *Civil*, and *Industrial Engineers*. Last on the list is *Manufacturing Engineer*.

In all, the demand for entry-level engineers in 2015 was **1029** while the graduates during the same year from NE Ohio engineering programs totaled only **290**.

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

Clearly a substantial under supply of graduates in engineering are emerging from higher education. This would be the case even if all grads were employed in NEO.

### A Bachelor Degree for Factory Floor Workers?

A shortage of Bachelors awarded in programs that prepare them for a few jobs in *Production* or *Maintenance, Repair, & Installation* occupations appears to exist. *Quality Inspector/ Technician* has the largest numerical gap. *Production Supervisor* is second and both jobs have more postings wanting a Bachelors than will accept a Certificate or Associate Degree.

Only discussion with employers can provide further insight into what level of education versus skills training applies and why, what specific skills and knowledge is developed during completion of either an Associate or Bachelors program, and what specific program of study can best prepare students. No programs are being offered at the Bachelors level with these jobs in mind.

NE Ohio Manufacturing & Engineering Occupations: Entry-level Ads Are More Than Twice the Number of Grads with Bachelors, Year 2015			
Entry-level = 0 to 2 Years of Work Experience			
Grads from Bachelors Programs in Ratio to Openings Preferring a Bachelors			
BGTOcc		Numbers Gap	
		Jobs Postings	Annual Grads
Under Supply of Graduates from Bachelors Programs			
	Engineering		
17-2141.00	Mechanical Engineer	244	50
17-2071.00	Electrical Engineer	185	17
17-2051.00	Civil Engineer	153	49
17-2112.00	Industrial Engineer	103	71
17-2199.04	Manufacturing Engineer	96	53
17-3013.00	Mechanical / Electrical Drafter	62	0
17-2131.00	Materials Engineer	51	30
17-2111.00	Health and Safety Engineer	39	3
17-3019.00	CAD Designer / Drafter	34	0
17-3023.00	General / Electrical Engineering Technician	31	11
17-2061.00	Hardware Engineer	30	6
	Total	1029	290
	Production		
51-9061.00	Quality Inspector / Technician	137	0
51-1011.91	Production Supervisor	92	9
51-9012.92	Manufacturing Machine Operator	32	0
51-4041.91	CNC Operator	6	1
51-4012.00	CNC Programmer	4	2
51-4111.00	Tool and Die Maker	2	0
51-9011.00	Chemical Operator	1	0
	Total	274	12
	Installation/Maintenance and Repair		
49-9062.00	Biomedical Equipment Technician	3	0
49-2094.00	Electrical Tester / Technician	9	7
49-2091.00	Avionics Technician	2	0
49-2022.00	Satellite / Broadband Technician	3	0
49-1011.00	Maintenance / Service Supervisor	55	9
	Total	72	16

# Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

## SKILLS GAP AT CERTIFICATE/ ASSOCIATE LEVEL

Jobs for *Engineering Technologists/ Technicians; Production; and Maintenance, Repair & Installation* are experiencing shortages in supply of completers from certificate or Associate degree programs designed to prepare students for these jobs.

Interpreting the results of matching supply of completers with jobs in demand that are entry-level (which is most) is more complicated when employers a high school credential is minimally acceptable.

The more skilled these jobs are, the more technical education and training is needed by applicants. This can be completed during or after high school; even completed at adult career centers as non-credit credentials.

Prior work experience of three or more years is stipulated in job ads almost half the time, however, for these occupations. This may be how

employers are ensuring that skilled workers apply, rather than by formal training per se. Whatever the case, the skills gap analysis demonstrates greater demand for postsecondary education and training completers on an annual basis than currently are being produced within NEO.

NE Ohio: Manufacturing Occupations: Entry-level Ads Are More Than Twice the Number of Grads with High School, Certificate or Associate Degree, 2015				
Entry-level = 0 to 2 Years of Work Experience				
	Certificate/ Associate Programs Grads in Ratio to Postings for <i>Less than Bachelor's</i>			
BGTOcc	BG Occupation Title	Numbers Gap		
		Demand		Supply
		High School	Certificates/ Associate's	Total Certificates and Associates
Under supply of Certificate or Associate Degrees				
	Engineering			
17-3029.09	Manufacturing / Production Technician	95	36	24
17-3023.00	General / Electrical Engineering Technician	68	77	39
17-3013.00	Mechanical / Electrical Drafter	33	59	27
17-3027.00	Industrial / Mechanical Engineering Technician	29	9	24
17-3019.00	CAD Designer / Drafter	16	47	27
		240	229	141
19-4099.01	Quality Control Analyst	59	23	47
47-2073.00	Operating Engineer / Heavy Equipment Operator	33	0	0
	Installation, Maintenance and Repair			
49-9071.91	Maintenance Technician	980	89	34
49-3031.00	Diesel Mechanic	375	3	101
49-9071.92	Field Service Technician	124	98	59
49-2022.00	Satellite / Broadband Technician	116	24	0
49-9041.00	Industrial Mechanic	80	3	3
49-3011.00	Aircraft / A & P Mechanic	69	0	0
49-2098.00	Alarm / Security System Technician	27	7	0
49-9062.00	Biomedical Equipment Technician	20	18	2
49-2097.00	Television / Satellite Television Installer	15	7	0
49-9012.00	Controls / Valve Technician	10	6	3
49-2091.00	Avionics Technician	8	0	0
49-9044.00	Millwright	5	0	3
49-9081.00	Wind Turbine Technician	4	2	3
		1833	257	208
	Production			
51-9012.92	Manufacturing Machine Operator	1015	26	0
51-9061.00	Quality Inspector / Technician	301	36	1
51-2022.00	Electronic / Electrical Assembler	170	0	38
51-4041.00	Machinist	160	8	18
51-4041.91	CNC Operator	151	7	24
51-1011.91	Production Supervisor	112	17	7
51-4033.00	Grinder / Sharpener	55	0	0
51-4111.00	Tool and Die Maker	39	6	17
51-4012.00	CNC Programmer	28	2	12
51-9011.00	Chemical Operator	27	0	2
51-1011.92	Production Plant Manager	6	2	5
		2064	104	5h

### Engineering Technologists/ Technicians

- Manufacturing/ Production Technician
- General/ Electrical Engineering Technician
- Mechanical/ Electrical Drafter

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

### *Maintenance, Repair and Installation Workers*

- Maintenance Technician
- Field Service Technician

### *Production Workers*

- Quality Inspector/ Technician
- Electronic/ Electrical Assembler
- Machinist

## WHAT EXPLAINS THE SHORTAGE OF COMPLETERS?

Across all levels of completion, *Mechanical, Electrical and Electronic, Chemical, and Civil engineering* programs produced the largest numbers in 2015.

### *Engineering Technologies/ Technicians Programs*

The large number of Associate degree grads from *Automotive Engineering Technology/ Technician* and *Electrical, Electronic, and Communications Technology/ Technician* programs account for 25% and 13%, respectively, of all awards in 2015 from *Engineering Technologies/ Technicians* programs across all levels of completions and specializations.

HVAC is the only other program with as much as 9% of all grads. Significant by their absence are programs:

- Quality Control and Safety Technologies/ Technicians
- Drafting/ Design Engineering Technologies/ Technicians
- Electromechanical Instrumentation and Maintenance Technologies/ Technicians
- Industrial Production Technologies/ Technicians

### *Mechanic and Repair Technologies/ Technicians*

Much of the supply of new talent in this sector is motor vehicle related, having nothing to do with jobs from manufacturers. Only *Electrical/ Electronic Maintenance and Repair Technology* has many certificate completers (159). This is not of much help to manufacturers seeking *Maintenance Technicians* or *Field Service Technicians*.

In general, it appears that there is little alignment between the skills training that manufacturers need and what currently is being offered in NEO.

### *Precision Production*

While the numbers of short term completers of Welding are high, little education and training is being provided despite significant demand for certain production workers as discussed.

## DO SOME MAJORS BETTER PREPARE STUDENTS FOR SPECIFIC OCCUPATIONS?

### *Manufacturing Engineer*

This is one of the engineer jobs with a numeric skills gap—too few grads from any of the engineering majors at the Bachelor's level. Do employers prefer hiring entry-level grads with a major in manufacturing

## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

engineering? If so, the problem is more than numeric; it is also qualitative. No one graduated with this major in NE Ohio during 2015.

### SKILLS GAP FOR EXPERIENCED, MID-LEVEL, WORKERS

New postsecondary completers are not the likely source of applicants for mid- and senior-level applicants.

- The supply of experienced workers with the appropriate educational credentials and evidence of needed skill sets is largely met by those already employed—employers primarily seek to hire from a pool of workers already employed, although for someone else, or promote from within.
- The supply is augmented by the ability of employers to search for workers outside of NE Ohio.
- Experienced workers are less likely to be recent graduates from NE Ohio institutions.

Producing hard data on these job seekers already in the workforce was well-beyond the scope of this investigation, but employers indicate that these positions are more difficult to fill than entry-level. There is no source of inclusive data on workers already employed and the likelihood they will apply for positions with other employers as they are posted.

By and large these individuals are not currently enrolled in career and technical education and training programs to prepare for careers in manufacturing.

The best we have is information about those employed by occupation or industry. For example, NE Ohio engineering and production and maintenance workers have some challenges when being considered as the potential pool for filling comparable mid-level roles. Too few have the technical education now needed to perform at a high level in the mid-level roles.

Too few females currently are employed in these jobs. Most jobs are held by White Males. Lack of females and persons of color, relative to their overall presence in the workforce likely suggest barriers to entry into manufacturing careers; the region's industry is to make full use of NE Ohio's current working age population.

Employers have tired of competing with one another for NE Ohio experienced workers and have increased efforts to [promote from within](#) by identifying high performing workers who started in entry level jobs and created ways to get them the additional skills required to succeed in mid-level openings.

Imagine what is possible if we had a regional approach to do the same thing, and employers to partner with each other and with higher education to tweak curriculum and the use of fast-track programs to provide workers added skills needed to advance in their careers. This can be through either additional education or work experiences built around shared employer needs.

The future is ripe with opportunities to change behaviors and address employer pain point through collaborative efforts and concrete action.

# Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

## ADVANCES IN TECHNOLOGY AND THE IMPACTS ON MANUFACTURING

The digital revolution and Industrial 4.0 presents both opportunities and challenges to manufacturing globally. Digital manufacturing centers around a computer system. It requires quantity and quality computer systems in manufacturing plants. It has the same goals as computer-integrated manufacturing (CIM), flexible or lean manufacturing, and design for manufacturing (DFM). The main difference is that digital manufacturing was evolved for use in the computerized world.<sup>1</sup>

### Are these technologies already being adopted by manufacturers in NE Ohio?

In December 2016, MAGNET released the results of a survey of 309 manufacturing leaders across the 18-county Jobs Ohio region of NE Ohio.<sup>2</sup> Questions asked included the impacted by disruptive technologies. Companies responding to the survey spanned the range of manufacturing types and size of company.

“The majority of respondents indicated their company launched a new product or service in the last year (58%), use automation (57%), has an ERP system (55%) and understands cybersecurity (54%). Less than 20% of respondent companies use 3D printing or a lot of automation.”<sup>3</sup>

In addition

- Only 35% “use digital manufacturing, internet of things, connected machines, or similar technologies on the shop floor today”.
- Only 15% use a lot of automation; and 18% use 3D/ Additive printing of components or finished products.
- However, 50% acknowledge they could use more automation.

Certainly, the extent to which NE Ohio firms are embracing disruptive technology depends on the nature of the manufacturing process and products/ services produced. As shown earlier, NE Ohio remains a mix of traditional versus advanced manufacturing enterprises.

Overall, these responses by manufacturers are like those found nationally through comparable surveys by Price-Waterhouse and the Manufacturing Institute. So why are manufacturers not more aggressive?

In their report, *Automation and Future of Work*, McKinsey reports:

“...we estimate it will take decades for automation’s effect on current work activities to play out fully. While the effects of automation might be slow at a macro level within entire sectors or economies, they could be quite fast at a micro level, for an individual worker whose activities are automated, or a company whose industry is disrupted by competitors using automation.”<sup>4</sup>

<sup>1</sup> [https://en.wikipedia.org/wiki/Digital\\_manufacturing](https://en.wikipedia.org/wiki/Digital_manufacturing)

<sup>2</sup> MAGNET and The Corporate University of Kent State University, *Summary Report MAGNET Manufacturing Survey*, December 2016

<sup>3</sup> Ibid, p. 7

<sup>4</sup> Ibid, p.



## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing

For the Cleveland MSA, what are the occupations most likely to be negatively impacted by automation of manufacturing technology?

Using research published late 2016:

Risk estimates are based on the probability that jobs in an occupation will be automated within the next 20 years.

- High risk of automation: The top quartile of scores ex: CNC Operators
- Medium risk of automation: The third quartile of scores ex: Machinists
- Low risk of automation: The bottom two quartiles of scores ex: CNC Programmers

Production occupations are the most to be impacted. Most manufacturing production jobs are at high risk. Only Production Supervisors is unlikely to be lost as automation of manufacturing operations advances.

Maintenance Occupations in manufacturing have a medium chance of job losses due to automation. And, only certain Engineering Technician level jobs have a medium chance of being negatively impacted. Mostly, drafters and electrical/electronic technicians.

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## Skills Gap for Engineering and Skilled Workers in NE Ohio Manufacturing