MANUFACTURING WORKS

Building a Strong Manufacturing Workforce in Greater Cleveland

Career-Technical Education as an Essential Resource

May 2019

About Manufacturing Works

At Manufacturing Works, we envision a prosperous, inclusive manufacturing community in Greater Cleveland. For over 30 years our work has been a leading force to strengthen manufacturing—the foundation of our healthy neighborhoods that fuels the economy. We provide expertise and resources that assist manufacturers in understanding and adapting to fast changing trends in technology, talent, and organizational leadership. Manufacturing Works connects leaders to each other and engages them in their communities. The economic impact achieved through Manufacturing Works' efforts with these programs is felt beyond the Cleveland area. Our work resonates throughout regional and state economies. We lead, we connect, we partner.

Contact
4855 W. 130th Street
Cleveland, OH 44135-5137
216.588.1440

About the Authors

New Growth Group is a workforce consulting group that mobilizes businesses and communities to solve workforce challenges. The organization has provided strategic planning, grant and resource development, operations support, and evaluation and analytics to over 100 workforce agencies, colleges, philanthropies, and nonprofit organizations in 21 states and Washington D.C.

MJ Crocker & Associates is a consulting business founded in 2016 led by Dr. M. Judith Crocker. The organization provides services to mitigate workforce development challenges. With over 30 years of experience in workforce and education programming, the organization works with educators and employers to develop and implement solutions.

Thank you to the Fred A. Lennon Charitable Trust for making this report possible and members of the Advisory Task Force for their input on the findings.

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Executive Summary

Northeast Ohio's manufacturing sector is evolving into a new industrial era, and there are serious growing pains as a result. The digitization of production is transforming the way goods are produced as the manufacturing industry enhances already-computerized production systems with smart, autonomous, and interconnected systems driven by big data and advanced technology. However, this transformation is not uniform as many regional manufacturers still use traditional forms of production which require hands-on skills. Companies are puzzling through how best to bring these new technologies into their environments in order to compete, and one of the biggest issues is attracting and retaining the skilled workers prepared with both the new technical and traditional skills needed to succeed in this changing environment. Finding or training the workers that can thrive in these dynamic conditions has become a major pain point for regional businesses.

Recognizing the need to explore sources of talent throughout the region to meet the current and shifting needs of manufacturers, Manufacturing Works, with funding from The Fred A. Lennon Charitable Trust, commissioned a report to examine if additional manufacturing career-technical education (CTE) programming for the secondary students in the eastern neighborhoods in Cleveland and the adjacent inner-ring suburbs would bring a disconnected pool of potential workers into the manufacturing workforce. The project team expanded the study to identify opportunities to improve CTE programming throughout the region to address the challenges of the Northeast Ohio manufacturing employment marketplace. The analysis in this report focuses on both school-based and community-based manufacturing programs for public high school students. These programs are designed to prepare students for entry-level manufacturing opportunities which require some technical skills but not a college degree.

Based on the data gathered and numerous interviews with active participants and stakeholders, this report confirms that there is insufficient CTE programming in the targeted neighborhoods on the eastside of Cleveland and adjacent suburbs and adding capacity could meaningfully contribute to the manufacturing workforce. In addition, capacity constraints exist at facilities in far eastern and southeastern suburbs which could also justify further investment while the opportunities for the westside of Cleveland and southwest suburbs involve finding ways to fill the vacant seats at facilities which are currently under-utilized.

Highlights of this Report

Based on data and interviews, this study provides a regional analysis of:

1. The concentration of job opportunities
2. The availability and utilization of current CTE training capacity
3. Reasons for participation gaps in some existing programs
4. Factors generally limiting the availability of CTE training throughout the region
5. Challenges connecting students with training and job opportunities

This analysis shows:

1. While manufacturers throughout the region have unmet hiring needs, job availability for manufacturing workers is greatest in the eastern and southeast suburbs.
2. CTE training capacity for secondary school students is limited and the existing facilities are concentrated in the suburban school districts. The exception is Max S. Hayes High School, the Cleveland Municipal School District's career-tech school for manufacturing located on the near west-side of Cleveland. CTE programs in the eastern and southeastern suburbs where the job demand is greatest are at capacity in places and have opportunity for more enrollment in others, while the western suburban CTE capacity and the capacity at Max Hayes is under-utilized. There is little capacity in the eastern neighborhoods of Cleveland and adjacent suburbs.
3. The most often cited reason by educators and employers for low participation in some CTE programs is a lack of interest by parents and students. Most believe this disinterest is a result of an outdated mental model of manufacturing including a lack of awareness of career pathways available to students. Closer proximity to manufacturing jobs and deliberate efforts to increase manufacturing career awareness among parents and students are two factors seemingly related to higher levels of interest in CTE programs.
4. Overall, CTE capacity for the region is 811 total seats which cannot make a significant impact on the manufacturing employment gap. Each year approximately 300 students graduate. Recent studies suggest there are ~4,300 job openings annually for CTE-aligned employment. Adding capacity is difficult due to funding limitations, the need for small class size due to safety considerations given the equipment in use and finding qualified instructors and employment partners.
5. In addition to a lack of access to training facilities, students on the east-side of Cleveland and adjacent suburbs are disadvantaged by the lack of availability of transportation alternatives to access employer sites, especially in the regions of greatest job growth which are the eastern and southeastern suburbs.

Implications of this Analysis

1. It is important to note that CTE is only one part of the worker supply solution. However, CTE students represent an important component of the potential future workforce, particularly since the labor market is expected to remain tight with a current workforce that has a high proportion of participants approaching retirement age.

2. The economic development and manufacturing communities should explore the addition of new CTE training capacity in the eastern part of Cleveland and adjacent suburbs where there are concentrated pockets of young adults who do not have access to manufacturing-focused CTE opportunities. A recent commitment by Job Corps to add manufacturing equipment for training at their facility in East Cleveland is a positive step; however, there appears to be a much greater opportunity for investment in this region. High rates of utilization for the Mayfield Excel and Lake Shore Compact programs may indicate an opportunity for expanding CTE programming in the eastern and southeastern suburbs where job demand is higher.

3. To ensure the utilization of this proposed expanded capacity and to fill the under-utilized CTE capacity which already exists in certain institutions including Max Hayes, manufacturers and their supporters must do a better job of changing the perception of students, parents and their advisers to consider the attractiveness of choosing a career-path in manufacturing. Persistent education and awareness campaigns must be pursued to reach these students and their influencers, providing access to facilities and enabling current employees to tell their stories. Employers must institute explicit career-pathways including accredited pre-apprenticeship programs which lead to apprenticeship, learn & earn and college degree options.

4. Expanding CTE training opportunities will require additional qualified instructors. The Cleveland Foundation, through its Encore Initiative, is underwriting Manufacturing Works' Technical Corps Program which recruits, hires and trains manufacturing retirees to assist teachers in accredited programs. While this is an example of working to provide expanded instruction capacity, much more needs to be done going forward. In addition to more instructors, expanding CTE programming requires broadening the number of employment partners. Companies too small to independently support internships and pre-apprenticeships need assistance in creating and administering these programs for CTE students. For example, Manufacturing Works facilitates the development of programming leading to apprenticeships through an Apprenticeship Consortium model.

5. Students often lack access to transportation alternatives to be able to participate in work-based training experiences at companies' locations. This problem is especially acute for students in the targeted neighborhoods identified for this study. Companies and organizations, such as The Fund for Our Economic Future, are working on solutions to address this issue, but it is complex, needs to be creatively explored and will require resources.

Perhaps the most important piece of the puzzle – Employer Engagement

The challenges found through this analysis require creative and collective solutions. In order to address the changing workforce demands in manufacturing, employers must be engaged in a substantive way on an ongoing basis. A report commissioned by local partner Cuyahoga Community College found that when employers contribute essential knowledge and resources to improve education and training programs, and are consistently engaged, the programs produce better outcomes and are more sustainable. Employer-led organizations with strong leadership and clear goals are necessary for a successful partnership. The strength of employer-led interventions has been proven locally and nationwide.

Some of the innovative solutions suggested in this report could be implemented in the Greater Cleveland region to benefit both secondary students seeking career opportunities as well as the manufacturers needing the pool of skilled workers. These solutions include: companies providing dedicated space in their facilities for CTE instruction delivered by a certified teacher; students alternating weeks between school-based classroom instruction and work-based learning experiences delivered at the worksite in partnership with the school for which they are paid; pre-apprenticeship experiences leading to skill mastery and transitioning into an apprenticeship following graduation. Exploring ways to increase access to under-enrolled programs could benefit all regional stakeholders.

Building on proven strategies and local success, employers must be empowered to co-create unique solutions with education and community partners. Employers can provide oversight, give guidance on program content and design, assist in program delivery, provide facilities for program delivery, create internships, apprenticeships and other work-based learning opportunities available to students, and contribute financial or in-kind resources to a partnership dedicated to strengthening the region's career-technical education pipeline. Helping employers use a collective voice provides clarity, consistency, and weight to efforts and provides a way for smaller companies to engage in the process.

Manufacturing Works' proven ability to engage employers and channel their collective voice makes them well positioned to be a key partner and provide leadership in the work of organizing employers and connecting the educational systems to create collaborative strategies to improve the region's career-technical education talent pipeline. For next steps, the organization looks to do a deeper dive on program evaluation to better understand the relative performance of the region's various CTE initiatives. Factors such as region, program design and content, quality of instruction and local employer engagement will be considered. The objective will be to create a list of best practices to apply to initiatives to optimize and increase CTE program capacity in the region. Manufacturing Works will join with their partners to directly engage with Cleveland's east-side communities to apply these practices to improve the resources available to CTE students and other candidates for manufacturing employment in that area. As the region moves forward to create collaborative opportunities, this CTE study is just one example of the contributions Manufacturing Works stands ready to make.

Introduction

Manufacturing is thriving in Northeast Ohio, but the workforce is not fully caught up with the modern demands of the industry. Manufacturing is Northeast Ohio's largest sector in terms of sales, producing $40.5 billion dollars annually and providing approximately 75,919 jobs.[1] In 2017, the average annual earnings for an entry-level manufacturing worker who has the same skills as a career-technical education graduate in the region was $37,570.[2] Yet, despite the strength of the industry, manufacturers are having trouble filling positions with qualified workers. For example, research in Northeast Ohio found that about 14,000 manufacturing jobs are unfilled because of a skills gap, with businesses reporting that many applicants do not have the foundational employability or technical skills needed to be successful in the jobs.[3]

Northeast Ohio's manufacturing sector is evolving into a new industrial era, and there are serious growing pains as a result. The digitization of production is transforming the way goods are produced as the manufacturing industry enhances already-computerized production systems with smart, autonomous, and interconnected systems driven by big data and advanced technology. However, this transformation is not uniform, many regional manufacturers still use traditional forms of production which require hands-on skills. Companies are puzzling through how best to bring these new technologies into their environments in order to compete, and having the skilled workers prepared with both the new technical and traditional employability skills needed to succeed in this changing environment. Finding or training the workers that can thrive in these dynamic conditions has become a major pain point for regional businesses.

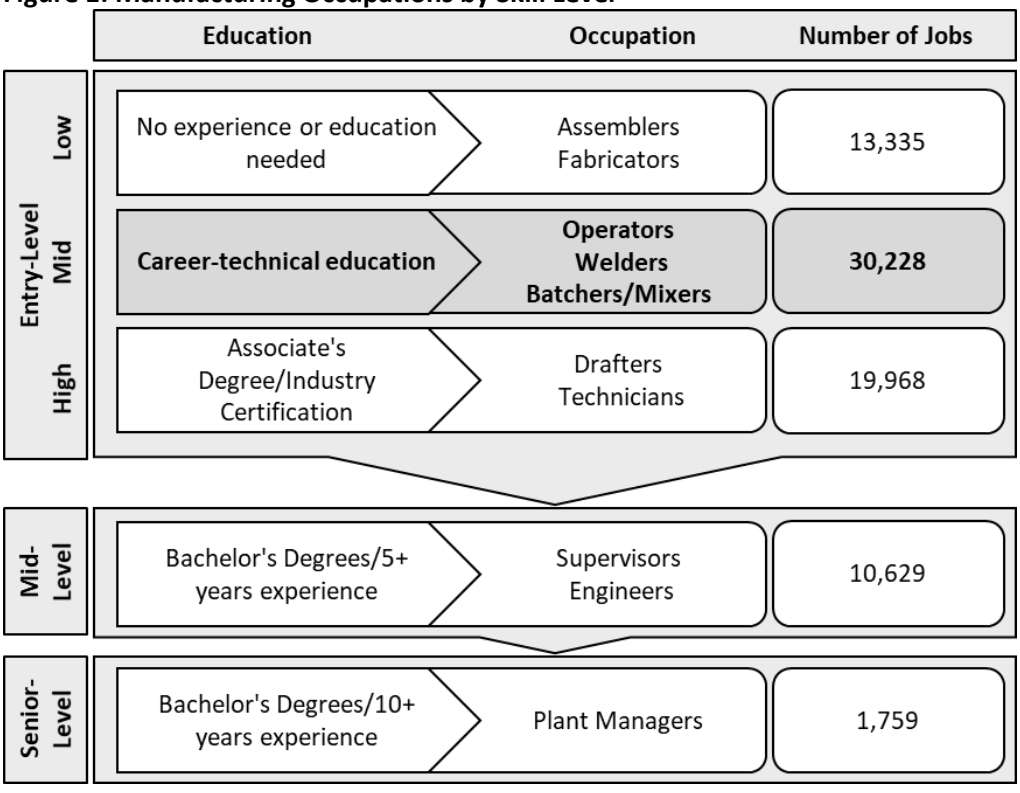
[1] "Northeast Ohio" refers to the target region of Cuyahoga, Geauga, and Lake Counties, unless otherwise specified.
[2] Source: Economic Modeling Specialists, Inc.
[3] Source: Aligning Opportunities in Northeast Ohio: A Resource Guide to Aid in Addressing the Demand and Supply Imbalance in the Region's Workforce. TeamNEO.

Looking for sources of talent throughout the region to meet the current and shifting needs of manufacturers, Manufacturing Works, with funding from The Fred A. Lennon Charitable Trust, commissioned this report to detail the existing career-technical education (CTE) manufacturing programs in Cuyahoga County, its eastern suburbs, and the adjoining suburbs in Geauga and Lake Counties and investigate if there is a need for additional or expanded programs. The analysis in this report focuses on public school-based CTE programs and considers community-based manufacturing-focused training programs for high school students. These programs are designed to prepare students for entry-level manufacturing opportunities which require some technical skills, but not a degree.

CTE Aligned Occupations

The figure below shows the most commonly open manufacturing occupations in the region, by skill level. This pathway is locally defined, based on total number of jobs in the region and was validated through interviews with local employers. The skills required for the entry level positions align with the skills provided in the CTE programs.

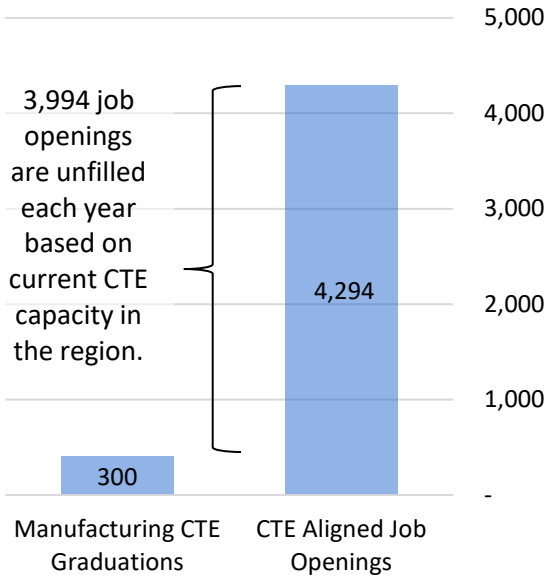
Figure 1: Manufacturing Occupations by Skill Level



*Source: Economic Modeling Specialists, Inc.; O*NET; Ohio Department of Education; Stakeholder Interviews*

Manufacturing Job Openings

While the total number of job openings for entry level jobs annually in the region is 8,374, the total number of job openings for CTE-aligned employment annually is 4,294.[4] Assuming full enrollment, the CTE system at current capacity will train 599, with approximately 300 students expected to graduate, in 2019.[5] This number clearly does not meet the demand for skilled workers. It should be noted that not all manufacturing-focused CTE students transition immediately into an aligned career, many choose to pursue additional education or enter into the military. As one educator put it "Career-technical education is a piece of the solution to solving the skills gap, but we are not designed to be and cannot be the only source of talent".



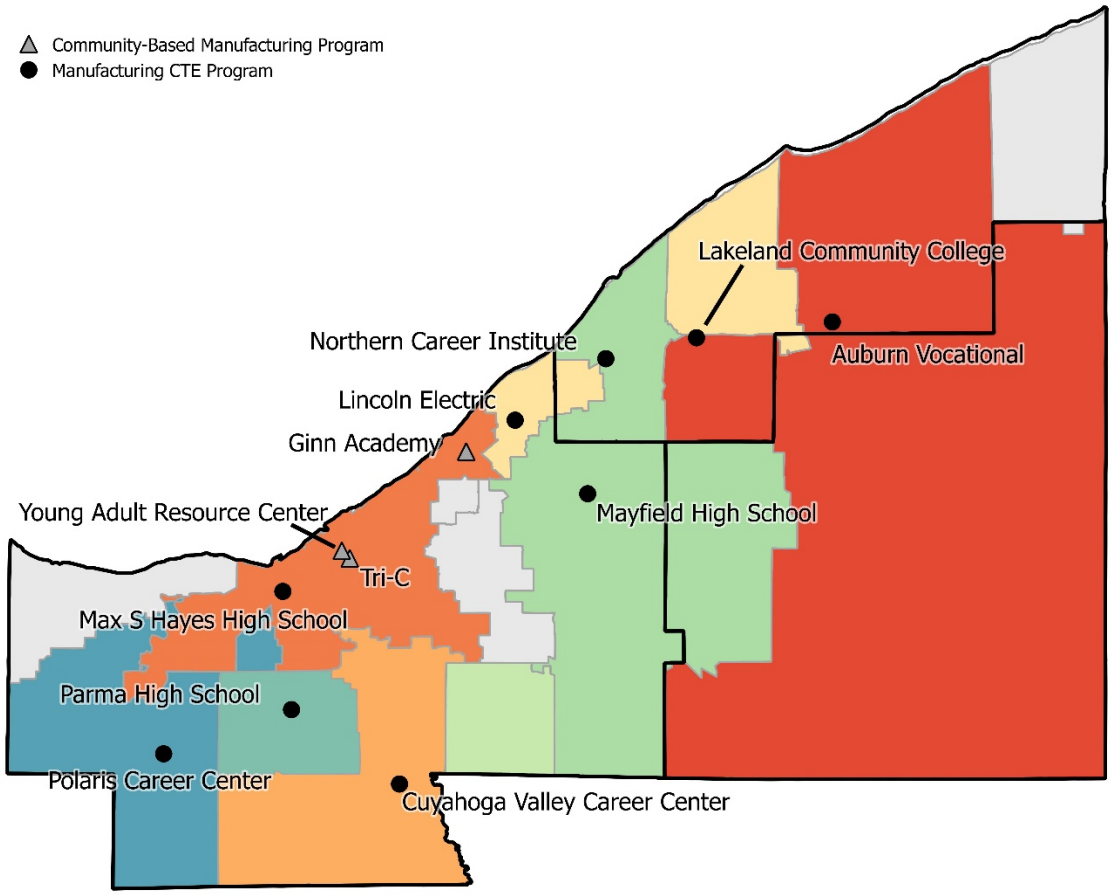
Methodology

A comprehensive approach, using both qualitative and quantitative methods was used to examine the need for additional manufacturing pathways programming in Cuyahoga County and particularly the eastern parts of Cleveland and its eastern suburbs. Working with Manufacturing Works and key partners, the research team assessed the current state of manufacturing-focused CTE in the region and identified factors contributing to the perpetuation of gaps in access, enrollment, and capacity. Please see the Appendix for the full list of interview subjects and learning agenda.

The following figures detail the region and the Career Technical Planning Districts (CTPD) and specific programs evaluated for this analysis.

[4] Source: Economic Modeling Specialists, Inc.
[5] Source: Stakeholder Interviews (Interviewee list is found in the Appendix)

Figure 2: Regional CTE with Manufacturing-Focused Programs



Career-Technical Planning District (CTPD)		Building	Manufacturing Focused Program(s)	Number of Students Enrolled in Manufacturing
	Auburn	Auburn Vocational	Advanced Manufacturing; Industrial Maintenance; Welding	95
	Cleveland	Max S Hayes High School	CAD; Machining; Welding	140
	Cuyahoga Valley	Cuyahoga Valley Career Center	Manufacturing	36
	Lake Shore Compact	Lakeland Community College	Advanced Manufacturing; CAD	46
		Lincoln Electric	Welding	32
	Mayfield Excel	Mayfield High School	CAD Engineering Technologies	50
		Northern Career Institute	Welding	70
	Parma	Parma High School	Welding	48
	Polaris	Polaris Career Center	Electronics; Machining; Welding	82
	Tri-Heights	Cleveland Heights High School	N/A	0
	East Cleveland	East Cleveland High School	N/A	0
	West Shore Compact	Lakewood High School	N/A	0

While the public K-12 CTE system was the primary focus of this investigation, the research does consider the contributions of community-based training programs as well. Community-based organizations and industry focused nonprofits are working to expand manufacturing opportunities to more students. A description of efforts taking place across the region can be found in the figure below.

Figure 3: Community-Based Manufacturing-Focused Training Program Descriptions

Program Name	Administrator	Description	Capacity
Early College Early Career (ECEC)	MAGNET	ECEC provides students from select Cleveland Metropolitan School District High Schools, Wickliffe and Warrensville Heights the opportunity to take manufacturing courses at Tri-C and participate in internship experiences at local manufacturers.	80 Students
Workroom Program Alliance	Dan T. Moore	Workroom Program Alliance facilitates delivery of an Intro to Manufacturing program by Tri-C at Ginn Academy. Successful students are connected with a paid internship following graduation. A summer Welding Boot Camp for rising seniors is offered by Lorain CCC.	20 Students (between the two programs, with some cross over)
Young Adult Resource Center (YRC)	OhioMeansJobs-Cleveland/Cuyahoga County (OMJ) • Youth Opportunities Unlimited (YOU) • Towards Employment • Tri-C	The YRC is housed at OMJ and is co-run by YOU and Towards Employment. Temporary Assistance for Needy Families and Workforce Innovation Opportunity Act eligible students can receive services aligned to career pathways, including manufacturing at the Advanced Technology Academy at Tri-C.	40 Students

Findings

The goal of this report is to answer whether the existing CTE system is meeting the talent needs of regional employers and if additional manufacturing-focused CTE programs are needed. There is special interest in whether there are opportunities to enhance programming in eastern parts of Cleveland and eastern suburbs to improve upon workforce gaps. The findings indicate that existing CTE programs are successfully preparing students with both the technical and professional skills needed to move directly into a variety of entry-level manufacturing occupations. However, CTE is not a silver bullet.

Overall, the analysis found:

- The manufacturing-focused CTE programs in the region are producing high-quality graduates, prepared with the skills needed to thrive in a variety of manufacturing environments. However, students on the east side of the county, particularly in the city of Cleveland and its eastern inner ring suburbs, have limited access to these programs.
- Parents and students generally have minimal awareness of manufacturing career opportunities and have an outdated view of the industry overall, creating gaps in enrollment in manufacturing-focused CTE across the region.
- Manufacturing focused CTE is purposefully designed to align to a specific set of middle-skill entry-level career occupations which are often hard to fill. However, the current capacity of the career-technical education system is not great enough to meet the needs of industry.
- Companies are willing to work with schools and community organizations to connect with these students/potential employees if the relationship produces a positive return on investment (ROI).
- Facilitating connections for companies to training providers, whether school or community based, helps maximize company staff resources. This facilitation is especially useful for small to mid-sized companies with limited resources to devote to building partnerships.
- Barriers to success for high school level students as well as other job seekers include transportation, basic knowledge and skill preparation for the jobs, and access to support services needed to reduce personal barriers that would impede success both in school and on the job.

Factors Affecting the CTE Manufacturing Pipeline

Manufacturers in Cuyahoga County and its eastern suburbs are experiencing a pinch in recruitment and retention – especially of entry-level talent - and much human resources time and energy is spent on this challenge. Existing school-based manufacturing-focused CTE programs and community-based manufacturing-training programs, give students the professional and technical skills needed to succeed in an ever-evolving manufacturing labor market, and provide businesses with a stream of well qualified, prepared and committed entry-level employees with a strong foundation for future career success. However, there is a need for skilled workers right now that is not being met, and the pipeline for careers in manufacturing is not preparing enough students to meet the future needs of local companies.

Several factors influence the CTE pipeline including:

- Limited opportunities exist for students to access manufacturing career-technical programs through their school districts or within their communities.
- Enrollment shortfalls in some existing programs are driven by lack of interest and knowledge of manufacturing career pathways.
- Throughout the region, manufacturing-focused CTE programs have limited capacity, often due to available instructional facilities, funding limitations, and implementation constraints.
- Systemic issues, such as transportation mismatches and communication breakdowns between education and employers, can prevent students and graduates from connecting to the local manufacturing labor market.

This section explores the data behind each of the factors, provides examples of innovative programs which address these factors, and presents points of consideration for solutions to address them.

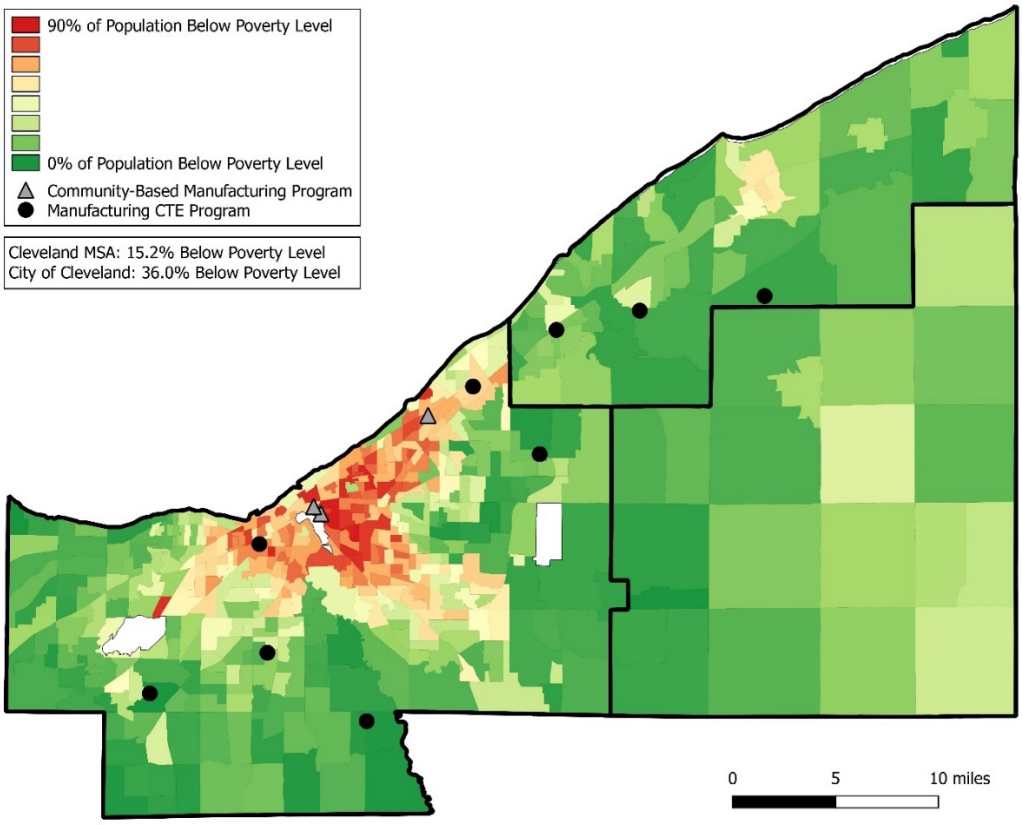
Factor 1: Limited opportunities for students to access manufacturing career-technical programs through their school district or within their community

Within the geographic scope studied, many students have limited access to manufacturing CTE programs through their school district. These opportunities are often not available to students in the highest poverty neighborhoods, which are a historically overlooked source of talent. Community-based efforts have been created to expand student access to opportunities, but these efforts often focus on out-of-school youth and are operated in silos with limited communication and alignment between them. Further complicating this effort, students are often geographically cut off from work-based learning opportunities such as internships or employer-based summer programs.

CTE Manufacturing Training Programs vs. Concentration of Poverty

The figure below shows the percent of population below the poverty level. Red represents 90% of the population below the poverty level, and green represents 0% of the population below the poverty level. The neighborhoods of Central, Buckeye-Woodhill, Kinsman, Hough, and St. Clair- Superior have the highest percentage of population below the poverty level. Notice that Manufacturing CTE programs are not located in areas where pockets of low-income students are concentrated thus limiting access to training that could lead to paid internships and earn and learn opportunities resulting in viable careers and postsecondary education.

Figure 4: Lack of Manufacturing CTE Training Facilities in High-Poverty Areas



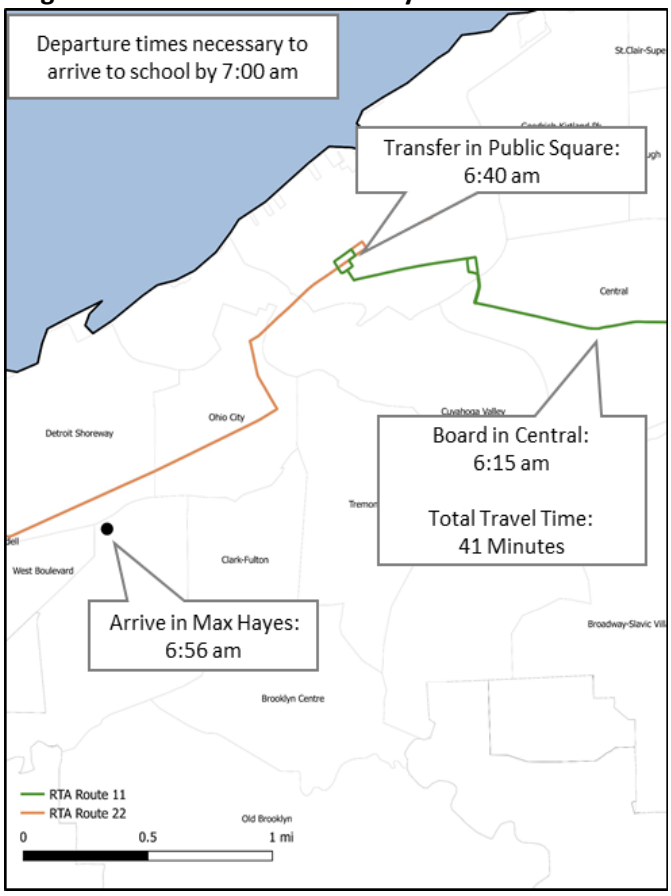
Source: US Census Bureau ACS 2012-2016 5-Year Estimates

Community-Based Programs

Community-based organizations and industry focused nonprofits are working to expand manufacturing opportunities to more students, especially those in underserved areas. While the efforts are growing, the programs are operating in pockets, with little to no coordination between program operators. In interviews, community leaders expressed they had little knowledge of what the other programs offered but note a willingness to partner to better serve students throughout the region.

Transportation Barriers

Figure 5: Travel time to Max Hayes from Central



When a student has access to training or internship opportunities, transportation to and from the work site can be a barrier, especially for low income students. In interviews, many of those working directly with students indicated that even within schools or CTPDs, it can take almost an hour and multiple buses to make it to school. Moreover, many of the manufacturing job hubs are located in the outermost suburbs, presenting challenges for those seeking internships or summer employment in manufacturing. For example, travel time by car typically takes up to 35 minutes, and by bus it can take over an hour. In addition to logistical concerns, safety concerns can prevent students from utilizing public transportation. An internship coordinator interviewed noted that many parents are not comfortable with their teens riding the bus unaccompanied or at certain times of the day. These concerns limit both the internship and training opportunities students are able to access.

Implications

- Concentrated pockets of young adults (16-24) without access to manufacturing-focused CTE opportunities exist in the typically underserved central and eastern neighborhoods of Cleveland and inner-ring eastern suburbs including East Cleveland, Cleveland Heights, and Bedford Heights.
- Access to community-based manufacturing training programs is scattered. Community-based organizations are working to expand opportunities to these underserved communities, but efforts are slowed by their siloed, and sometimes competitive, nature.
- The availability and safety of transportation options to training and internship opportunities can be a barrier for students, even if their CTPD offers manufacturing-focused programming.

Innovations

- The space and cost concerns of building and running manufacturing-focused CTE programs were identified as a top challenge to schools and CTPDs who didn't offer them to students. Throughout the region, schools have worked with community partners to help alleviate these concerns. For example, Lake Shore Compact has partnered with Lakeland Community College and Lincoln Electric to offer manufacturing-focused programs. In this partnership, the high school instructors teach the welding students at Lincoln Electric and the advanced manufacturing students at Lakeland. The Compact can leverage the space and equipment from partners to help reduce the cost of programming.
- Access to manufacturing-focused career-technical training opportunities is not a challenge unique to Cuyahoga County. Throughout the state and the nation, regions have worked collaboratively to expand opportunities to students through addressing common challenges. In Youngstown a group of educational and community partners led by Youngstown State University worked together to develop a teaching factory, the Mahoning Valley Innovation & Commercialization Center. Manufacturers and training providers (including CTE and community-based manufacturing-focused programs) can use this shared laboratory space to provide hands-on experiences with industry-standard advanced manufacturing equipment in real-world applications. This model maximizes shared resources and reduces the cost of operating a training program through providing space and equipment.
- In Louisville, KY community partners, manufacturers and educators came together to build a regional training center. This center is open to both training providers and manufacturers to help develop a skilled workforce. This expands access to opportunity through lowering the cost of running a program, making it easier for CTE centers to offer manufacturing-focused programs.

Points of consideration

- How might we expand opportunities and access to school-based manufacturing-focused CTE programming to students in traditionally underserved communities?
- Do we need additional facilities?
- How might we leverage existing resources (buildings, faculty, programs, funding)?
- How might we expand access to community-based training opportunities across the region?

Factor 2: Enrollment gaps in existing programs driven by lack of interest and knowledge of manufacturing career pathways

In many of the CTPD's where students have an opportunity to enroll in manufacturing-focused programs, they are not enrolling into them. In interviews with both education and employer stakeholders, the most often cited reason for this gap is a lack of awareness of what manufacturing career pathways are available to students, the opportunities manufacturing careers can offer, and a lack of interest in manufacturing from both students and parents. Digging deeper, the research team substantiated these claims through literature review and labor market analysis.

Enrollment Gaps

The figure below shows the total program enrollments of manufacturing training programs vs. total seats available (both juniors and seniors, and sophomores where offered), by CTPD. In total, 811 seats are available in manufacturing-focused programs to students, but only 599 are filled.

Figure 6: Enrollment Gaps of Manufacturing CTE Programs, by CTPDs

CTPD	Enrolled	Available	% Capacity
Auburn	95	120	79%
Cuyahoga Valley	36	50	72%
Lake Shore Compact	78	90	86%
Cleveland	140	225	62%
Mayfield Excel	120	120	100%
Parma	48	56	86%
Polaris	82	150	55%
Total	**599**	**811**	**74%**

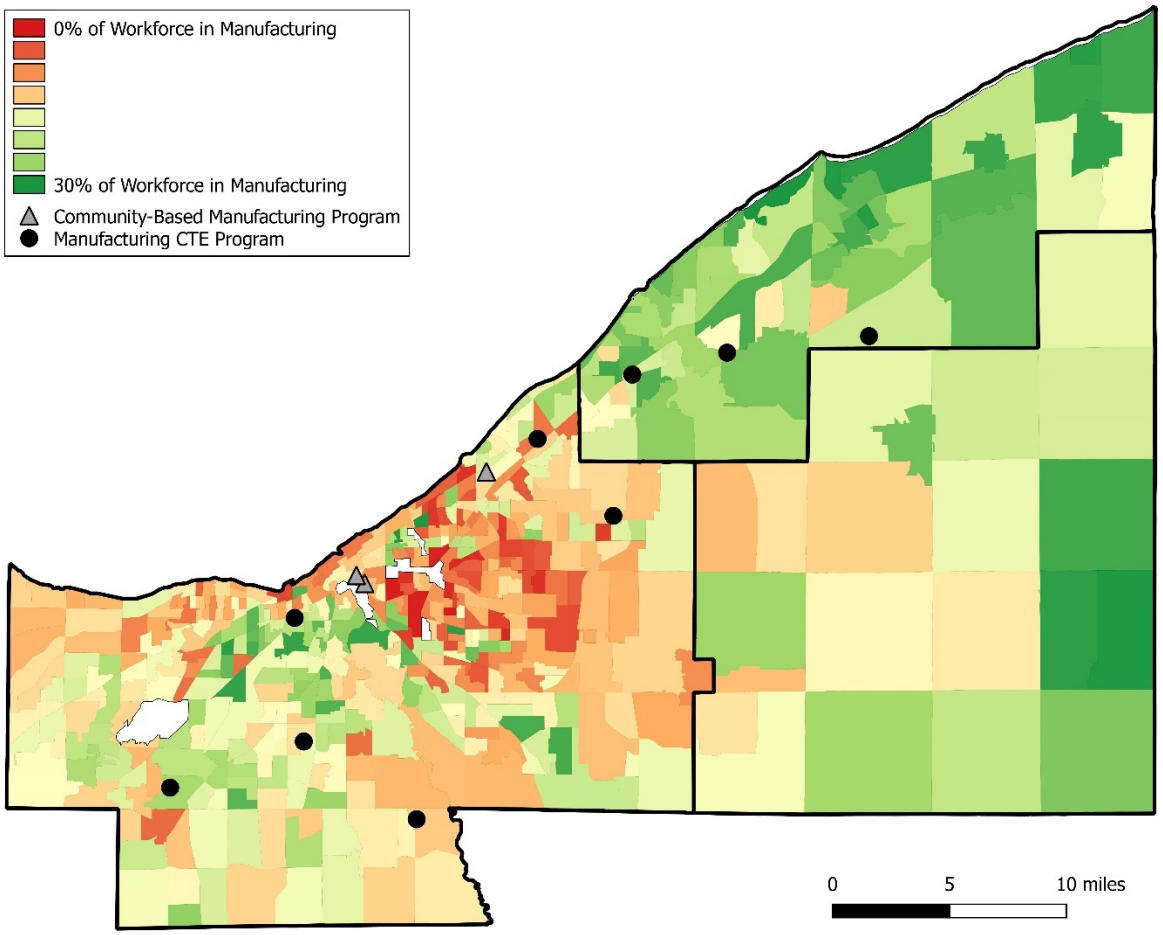
Awareness

The lack of exposure to modern manufacturing has left many students and parents with an outdated mental model of working conditions, earning potential, and strength of manufacturing as an industry. While there are still a few manufacturing facilities in the region which do not pay a living wage and use less advanced forms of production, manufacturing as an industry has been moving toward higher paying jobs in better conditions. A study conducted by Fortune Magazine and Great Places to Work found that many in the current manufacturing workforce take pride in their work with one respondent citing "modern factories are marvels of engineering".[6]

[6] http://fortune.com/2016/02/16/evolving-manufacturing-industry-workers/

The figure below shows where those who work in manufacturing live, with green representing a larger population, and red representing a smaller population. Lake and Geauga Counties are well represented, along with pockets of inner-ring suburbs in Cuyahoga County. The west-side suburbs, and some Cleveland neighborhoods, have very few workers, comparably, in manufacturing.

Figure 7: Where the Modern Manufacturing Workforce Lives



Source: US Census Bureau ACS 2012-2016 5-Year Estimates

Nationwide, parents are not knowledgeable about manufacturing and are not likely to encourage their children to pursue a career in the industry. The 2018 Kronos Manufacturing Day Survey conducted by Harris Poll found high percentages of parents associate manufacturing with manual work (59%), hourly wages (50%), with long hours and overtime (45%), and unfavorable working conditions (30%). Additionally, only 28% of parents perceive there to be a lot of available jobs in manufacturing. This finding was born out in local interviews with key stakeholders.

The figure below details themes in relation to parental and student attitudes toward manufacturing identified through interviews with educators, employers, and local leaders.

Figure 8: Attitudes Toward Manufacturing

Source	Themes
Educators	Many educators indicated that parents have a vital voice in a student's decision on whether to pursue career-technical education. Career-technical administrators and instructors noted that many parents have a college-bound mindset that precludes them from considering CTE as an option for their children, even though career-technical students have higher graduation rates, often graduate with more college credits and have better placement rates (often over 90%) than their peers who seek a non CTE pathway. Additionally, CTE produces more equitable outcomes for students, with reduced disparities among students of color and students from low income households.
Employers	Many employers stated that they were aware of student and parent hesitation to enter manufacturing careers. One respondent noted that even though they worked in manufacturing they would have reservations if their child indicated interest in pursuing a career in the industry. To combat this perception, manufacturers hold plant tours to highlight their clean facilities, hold informational sessions about career pathways including benefits like tuition reimbursement and internal training, and offer classroom presentations to share their stories of climbing up the career ladder with students and parents.
Community Leaders	Leaders from community-based organizations and public agencies noted that there have been many efforts to build momentum behind manufacturing careers, but to date these efforts have shown limited success. One respondent noted that although representatives from industry associations and employers provide informational sessions about opportunities in manufacturing, the messaging is often not relevant for students and the representative is often not from the same cultural or socio-economic background as the students. Another respondent noted that outreach efforts are often sporadic, with no consistent frequency or messaging.

Implications

- While there are enrollment gaps across the region, the gaps in enrollment are not as large as originally hypothesized. In fact, some programs have waitlists and most programs are over 75% of total capacity.
- Lack of awareness about manufacturing contributes to outdated mental models of manufacturing for both students and parents, leading to fewer students enrolling in manufacturing-focused CTE.

Innovations

- Through their work with Max S. Hayes High School, the comprehensive manufacturing-focused CTE provider in the Cleveland Metropolitan School District, Manufacturing Works has been working to connect students to apprenticeship and job opportunities at companies that pay a living wage and have growth opportunities. This work has helped change the perception of manufacturing opportunities among students, showing them that it is a viable career option.
- Regionally efforts are taking place to build interest and awareness in manufacturing career pathways. Both Auburn and Lake Shore have rebranded their machining programs to build more interest and attract a wider range of students. Alliance for Working Together, a manufacturing intermediary operating in Lake County, has taken on a number of awareness building efforts, including holding manufacturing expos which are a mix of job and awareness fairs, helping to build robotics clubs in a number of districts, participate in Battlebots competition, and working to build stronger partnerships between industry and education.
- Partners across Indiana have worked together to develop Hire Technology, a two-year turn-key Advanced Manufacturing and Logistics (AML) program delivered through Indiana high schools and career centers to help build interest in manufacturing. The program facilitates student achievement by including contextualized math and science concepts to reinforce key academic STEM concepts while promoting the development of the applied problem-solving skills demanded by AML industry members.

Points of consideration

- Do we need to validate perceived student and parent attitudes locally?
- What can we learn from other efforts aimed at changing the community's perspective on manufacturing (e.g., the national Dream It-Do It campaign organized by the National Association of Manufacturers)?
- How might we strengthen current engagement efforts? Consider:
  - Cultural relevance?
  - Frequency?
  - Messenger or messaging?
  - Capacity?

Factor 3: Limited program capacity, often due to safety requirements, funding limitations, and implementation constraints

CTE provides a pathway into middle-skill entry-level jobs through aligning curriculum to skill sets required for a sub-set of occupations. The capacity of the CTE system is limited by small class sizes due to safety requirements regarding use of industrial equipment, and funding restrictions. Additionally, districts face practical concerns such as the ability to find qualified instructors and employer partners.

Capacity Limitations

The capacity of existing career-technical programs is limited by both policy and practical concerns.

- Policy
  - Funding: The funding a training center receives is dependent upon whether it is a comprehensive (one school district with an on-campus career-technical center), a compact (two or more districts who partner to provide CTE with a training center on campus at one or more of the district partner schools), or a center (a consortium of two or more schools who send their students to a dedicated training center). Centers are able to ask for levies, in addition to the funding they receive from their partner districts, and therefore are usually better-resourced than comprehensives or compacts. This funding differential impacts the size and type of class a CTPD can support.
  - Safety: Policies limit the number of students who can be in a class at one time when using heavy machinery. The number is dependent upon the size and capacity of the facility.
- Practical
  - Instructors: Almost every educator interviewed stressed the importance of having a quality instructor and how difficult it is to find someone with the skill set needed to be successful. Given that the size of the classroom is limited by both space and instructor-to-student ratio, the ability to expand a program's capacity relies in no small part upon a school's ability to find additional instructors to support current instructors or take on additional classes.
  - Employer partners: Many educators wanted to build better relationships with employer partners to help get their students internships and other work-based learning opportunities. Expanding work-based learning opportunities can help build additional skills for students as well as augment current programs, building their capacity to train and retain students.

Implications

- In the current labor market, there are more job openings than total number of career technical completions possible (assuming max enrollment and 100% retention).
- CTE is designed to serve secondary students and is only one part of the talent shortage solution in the region.
- Policy changes at multiple-levels (local, state, federal) may be required to increase the capacity of existing programs or develop additional programs

Innovations

- While the size of CTE may not meet the total needs of the market, the strength of manufacturing-focused career-technical programs in preparing students has been lauded by employers and post-secondary administrators region-wide. Specifically, they said that CTE graduates have both the technical skills needed to fill many middle-skill entry-level jobs (regional welding programs have received accolades both regionally and nationwide) and are more professional and ready-to-work than their non-technical education peers.
- Manufacturing Works' Technical Corps Program, funded by The Cleveland Foundation as part of their Encore Initiative, is an innovation to augment the instructional staff by placing experienced technicians in the technical education classroom to support the lead faculty.

Points of consideration

- How do we expand the capacity of current programs, given policy and funding considerations?
- How do we extend manufacturing pathways to traditional/comprehensive high school students to meet the full spectrum of entry level positions?
- How might community partners and manufacturers contribute to efforts to expand pathways into manufacturing careers?

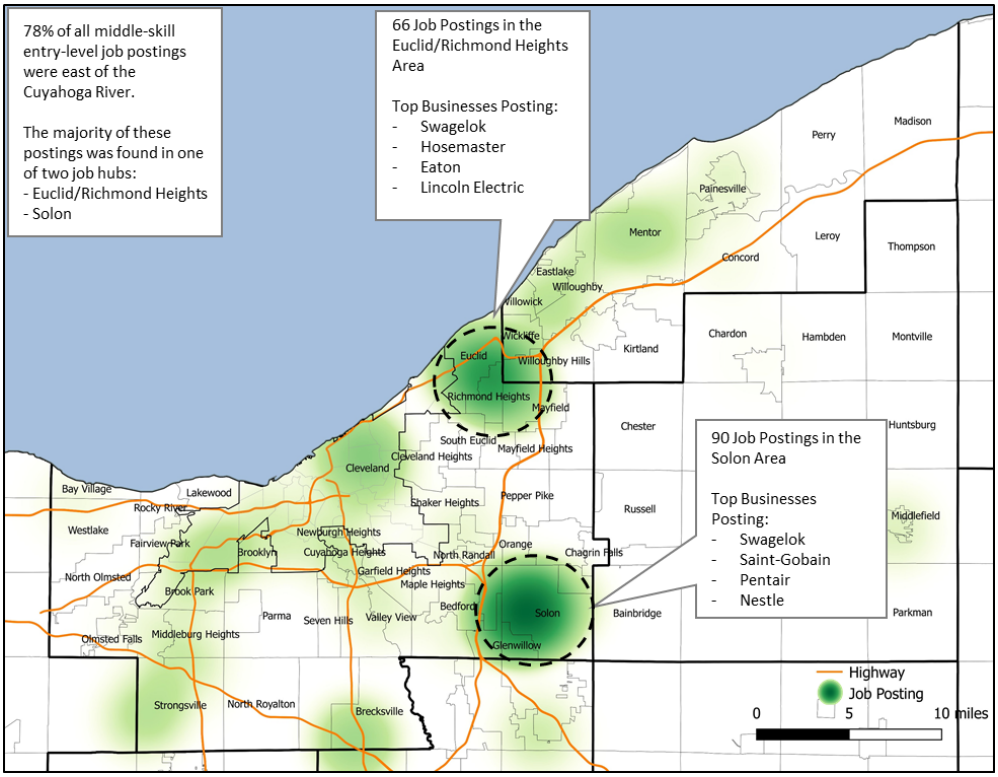
Factor 4: Breakdowns in the system prevent career-technical students and graduates from connecting to the local manufacturing labor market

Transportation and communication breakdowns between education and employers were the two most commonly identified barriers to entry into the labor market for students and graduates.

Transportation Barriers

As detailed in the figures below, three factors contribute to the transportation barriers: the geography of manufacturing job hubs; the share of households without access to a vehicle; and commute times for those using public transportation. Please note the geographic disconnect facing the concentrated pocket of potential manufacturing employees living in the near east side of the region (central and eastern neighborhoods of Cleveland, East Cleveland, and areas of Cleveland Heights).

Figure 10: Job Hubs, Based on Unique Job Postings



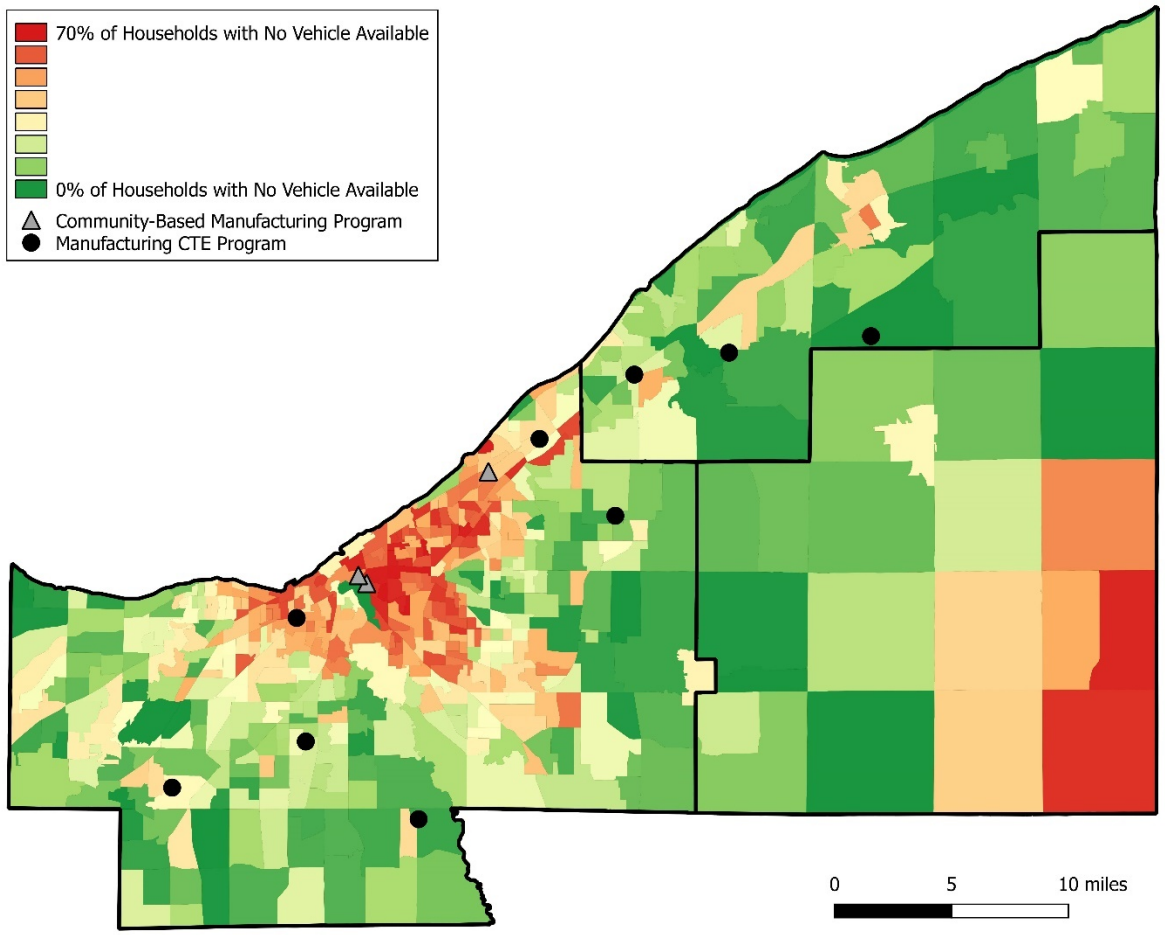
Job Hubs, defined by the number of unique job postings from October 2017 through September 2018 are represented in the figure.[7] 78% of middle-skill entry-level job postings are east of the Cuyahoga River. It should be noted that of the 1,217 unique middle-skill entry-level job postings, about half were posted by temp agencies, and are not represented on the map. However, many employers indicated that they use staffing agencies to fill immediate openings and then transition a percentage of these temporary workers to permanent following a successful probationary period.

Source: Economic Modeling Specialists, Inc., October 2017-September 2018 Unique Job Postings

[7] October 2017 through September 2018 was the most recent data available at the time of analysis. Job postings were looked at for middle-skill entry-level jobs, as specified in Figure 7.

Households without access to a vehicle are indicated by census tract in the map below. Red areas denote a higher share of households with no vehicle available, and green areas denote a lower share of households with no vehicle available. People living in east side neighborhoods, such as Central, Hough, Glenville, and East Cleveland, are less likely to have a personal car to drive to work.

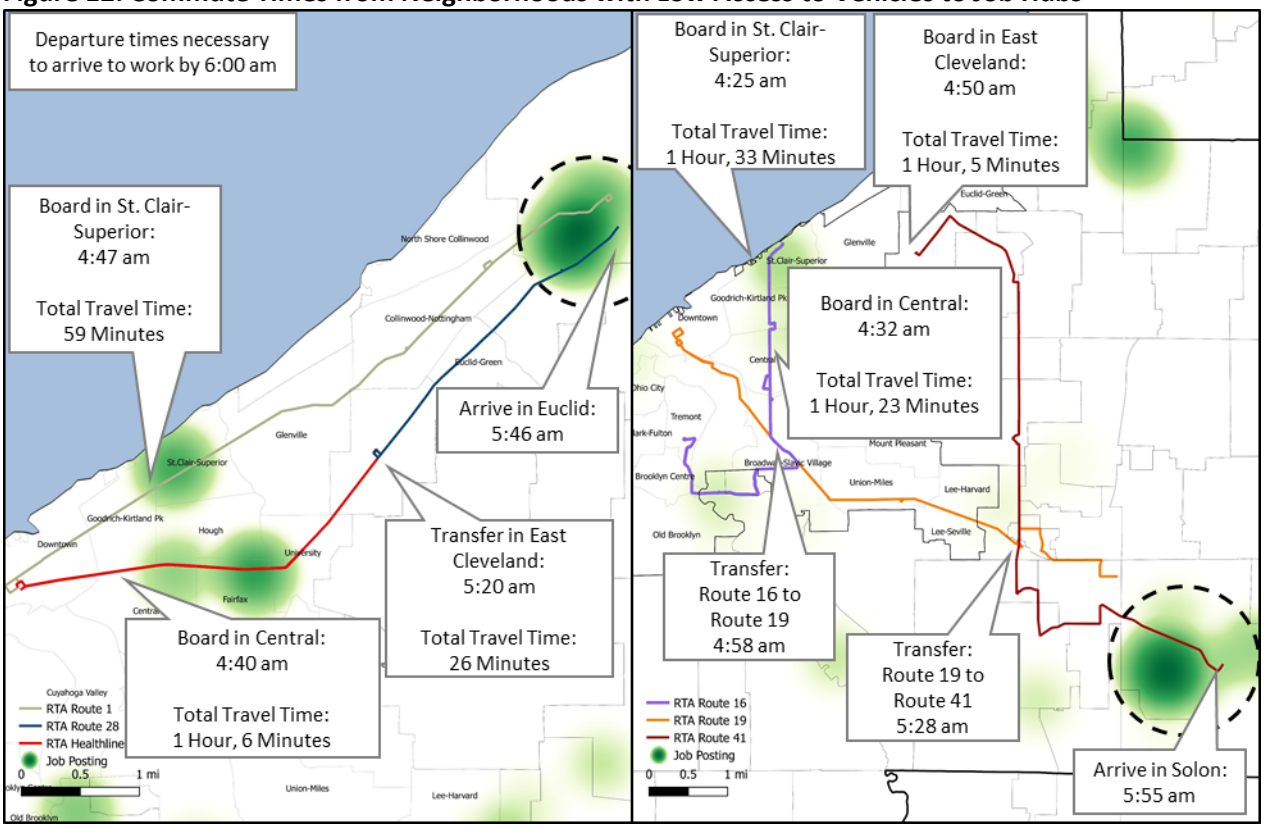
Figure 11: Households Without Access to Vehicles



Source: US Census Bureau ACS 2012-2016 5-Year Estimates

Commute times to job hubs from areas that would be likely to utilize public transportation are represented below. In many cases, one would expect at least a one-hour commute to job hubs.[8]

Figure 12: Commute Times from Neighborhoods with Low Access to Vehicles to Job Hubs



Source: Economic Modeling Specialists, Inc., October 2017-September 2018 Unique Job Postings; Greater Cleveland Regional Transit Authority

Communication Breakdown

A lack of coordinated, ongoing, facilitated and direct communication between educators, community-based organizations, and employers underlies the misalignment between the supply and demand forces in the manufacturing labor market. These create a number of barriers for career-technical students seeking work-based learning opportunities or employment after graduation. The barriers include skill mismatches, a break down in information flows, and limited engagement opportunities, particularly for small-to midsized employers with CTE programs.

[8] Commute times are based on an arrival time of 6:00 am, a common shift start time referenced in interviews. The map also assumes that both the worker and business are relatively close to the transit stops. Therefore, most commute times are likely to be longer than what is provided in the map.

Skills Mismatch

The figure below details common manufacturing skills employers look for in entry-level positions. The data was pulled from regional job postings and was vetted in interviews with employers.

Figure 13: Common Manufacturing Skills

Skill	Postings	% of Postings	CTE Training (Yes/No)
Machining	221	18%	Yes
Tooling	193	16%	No
Mechanical Aptitude	145	12%	Yes
Drilling	124	10%	Yes
Injection Molding	124	10%	Limited
Personal Protective Equipment (Following Safety Requirements)	100	8%	Yes
Computer Numerical Control (CNC)	89	7%	Yes
Welding	86	7%	Yes
Lathes	83	7%	Yes
Fabrication	78	6%	Yes
Grinding	72	6%	Yes
Continuous Improvement Process	69	6%	No
Warehousing	69	6%	No
Mills	63	5%	Yes
Blueprinting	62	5%	Yes

Source: Economic Modeling Specialists, Inc., October 2017-September 2018 Unique Job Postings

While these technical skills were validated in interviews with employers, many noted that existing manufacturing-focused career-technical programs did not fully prepare students with some of the skills required for the jobs. Specifically, employers stated that some machining/advanced manufacturing programs focused on operation of machines, but not necessarily on programming or set-up, which are vital skills for an entry-level machinist job. They also noted that if districts offered a robotics club or class, the focus was on building Battlebots and not on maintaining or operating robots and their use in manufacturing processes. Many employers indicated that most welding students are able to perform the welds needed to be successful in entry level positions, however some programs did not adequately prepare students for the application in a real-world environment. Additionally, some employers mentioned the need for generalists, and found that CTE graduates were not always the best fit for their company.

Inefficient and Ineffective Communication

Breakdown of information flow between educators and employers caused frustration when trying to work together. The lack of meaningful, ongoing communication leads to educators feeling ignored by employer partners, and employers feeling pushed aside when trying to engage.

- Educators: In interviews, educators indicated that they have found employers reticent to deeply engage in programming. One respondent noted that even companies on their advisory committee seemed to be disengaged and did little outside of attending meetings. Others pointed out that intermediary organizations such as AWT and Manufacturing Works were helpful in building relationships with employers, providing assistance through direct connection and co-constructing internship and pre-apprenticeship programs.
- Employers: When asked how they engaged with career-technical programs, some mentioned that they were not aware of what programs existed in the area, and if they were aware of programs, indicated that finding the right person to talk to about their needs was a challenge. Indeed, one employer noted an experience they had trying to find a career-technical student for a paid summer internship "We were directed to post our position on the job opening page, with little guidance and no connection to the program". Employers said that sometimes the schools did not listen to their needs or seemed unwilling to work with them. There is a lack of clarity regarding the employer skill needs and the skills taught in the programs. Employers also indicated they had limited success working with comprehensive high schools near them to talk about careers in their companies.

Limited engagement opportunities particularly for small to midsized businesses

Those employers who have found significant success engaging CTE programs are either:

- Large companies that have dedicated human resource or other staff who can devote time and energy to outreach and have the resources to support initiatives which might not have an immediate positive return on investment; or
- Small to midsize companies who are intentional about their talent solutions and/or have been targets of dedicated outreach and coaching from apprenticeship coordinators or instructors.

Small to midsize employers interviewed expressed interest in more deeply participating in career-technical programs, but they didn't have the time to research which programs existed in the community, how best to connect with them, nor could they devote the staff needed to develop and nurture entry-level trainees who couldn't fulfill their immediate needs.

Implications

- A geographic disconnect exists in the region: potential employees do not live where the jobs are located. Students face difficulties getting to internship experiences. Complicating this matter, there isn't a practical way to get to work if you don't have access to a family vehicle.
- Break downs in communication have led to skill mismatches, opportunities not being shared with students and educators, and engagement fatigue among both educators and employers.
- It is easier for large companies to partner with CTE programs due to their dedicated human resource staff and resources. Small to midsize companies often do not have the time, capacity or resources to devote to the task of fully engaging with programs and managing the logistics to provide work-based learning experiences to students.

Innovations

- Efforts are underway locally to develop pilots for helping people on the near east side of the region get to work in Solon and other job hubs. This work is being led by the Fund for Our Economic Future and is specifically aimed at developing sustainable strategies for solving the geographic disconnect in the region.
- Across the state of Ohio many CTE centers have built effective partnerships with industries. Miami Valley Career Technical Center and Upper Valley Career Technical Center have worked closely with employers of all sizes to develop an integrated model of instruction. In their senior year, students in these programs alternate between school and work for as long as two weeks at a time, working in an apprenticeship/internship at a local manufacturer. This model allows students to gain much needed on-the-job experience and apply their classroom learning while adding value to the companies. This value proposition has helped small to midsize employers engage more deeply with the programs and develop the needed skilled workforce.
- A few companies in Ohio are partnering with schools and career centers to provide instructional space in their facilities where teachers deliver career-tech instruction and support the transition into paid internship positions where students apply the skills while enrolled in the training.
- Partners for a Competitive Workforce in Cincinnati has successfully developed the connective tissue between industry and education partners to help build stronger talent pipelines into a number of fields, including manufacturing. They work by organizing and synthesizing the needs of both education and industry and bringing everyone to the table through a shared goal and language ensuring clarity regarding the skills needed and access to support services leading to success on the job.

- Manufacturing Works has developed a state registered Apprenticeship Consortium to help small and mid-sized companies develop and retain their workforces. The partnerships developed through this consortium could facilitate placement of CTE students into apprenticeship pathways leading to journeyman level credentials. Awareness of these career opportunities could strengthen interest in CTE and increase enrollment of students interested in securing employment that also offers access to higher education.

Points of consideration

- How might we work together as a community (stakeholders) to help people get to work? Focus on certain neighborhoods?
- How might we build engagement and training solutions that work for small and midsize companies as well as larger corporations?
- How might we ensure that students who are in community training programs, career-tech programs and/or manufacturing bound traditional high school graduates are prepared with the professional and technical skills needed for success in manufacturing career positions today, as well as for tomorrow?

Building Toward Action

The challenges identified through this analysis require creative and collective solutions. In order to address the changing workforce demands in manufacturing, employers must be engaged in a substantive way in an ongoing basis. A report commissioned by local partner Cuyahoga Community College found that when employers contribute essential knowledge and resources to improve education and training programs, and are consistently engaged, the programs produce better outcomes and are more sustainable. Employer-led organizations with strong leadership and clear goals are necessary for a successful partnership. The strength of employer-led interventions has been proven locally and nationwide.

To ensure key stakeholder involvement, Manufacturing Works convened an advisory task force of member companies, educators and community stakeholders to validate the findings. Once the research was completed, the task force reviewed and validated the findings and worked to recommend areas of action Manufacturing Works could undertake which would begin to address the CTE pipeline. While strategies to address each of the factors impacting the pipeline were considered, the task force recommended Manufacturing Works begin by working in two areas which they hypothesize will set the table for further action and will have ripple effects into challenges impacting the entire regional manufacturing talent pipeline.

The first recommendation is aimed at educating and connecting the manufacturing community to the benefits of the public CTE system. This strategy would be most effective with a focus on supporting and assisting small and mid-size manufacturers in connecting with CTE to ensure their ability to benefit from their programs. This recommendation addresses the data from this report and also from a survey conducted by Manufacturing Works and MAGNET which found a 13-point gap between regional employers who engage high schools and career tech centers to find talent and their counterparts throughout the state. Working toward collaborative solutions to close this gap is aligned with Manufacturing Works' 2020 Vision and builds on their strength as a regional hub for manufacturing employer engagement.

The second recommendation addresses the awareness issue that emerged throughout this study Manufacturing Works should develop strategies which increase student, parent and educator awareness and interest in manufacturing career pathways throughout the region - with a focus initially on filling the unused capacity in the current public CTE system. This recommendation builds on the work Manufacturing Works is currently doing in this area. Manufacturing Works is building awareness throughout the county, through information sessions and plant tours for Max S. Hayes students, parents and school faculty; and working to connect manufacturers with school personnel to expand student experiences through internships.

This report confirms the need for CTE programming for the students in the eastern neighborhoods in Cleveland, and Cleveland's eastern inner-ring suburbs, and identifies contributing factors. Engaging employers and building interest and awareness among students and parents can help to achieve two objectives: fill unused existing capacity in the CTE system; and expand access and opportunity to those students who do not currently have manufacturing-focused programs in their schools or in close proximity to their schools. Ensuring that all students in the region can easily access high quality manufacturing-focused CTE programs is the ultimate goal of this work. Achieving this goal will require expanding existing or building new programs in Cleveland and its eastern inner-ring suburbs.

It was recommended that Manufacturing Works work with partners to develop creative solutions which maximize existing community resources, employ new delivery methods, look to unique approaches to facilities for training, and address transportation challenges. The Task Force advised that Manufacturing Works continue to partner with and support existing and future collaborative efforts throughout the region to avoid duplication and maximize existing resources, building the connective tissue which will enable the region's manufacturing economy to grow and thrive.

These recommendations were made within the specific purview of the boundaries of this report. To address challenges throughout the entire manufacturing talent pipeline, a deeper level of inquiry is required. The taskforce members indicated that finding out what happens to CTE students after graduation and the pathways taken by high school graduates who are not in CTE programs but are not college-bound would be helpful in addressing these challenges.

A more thorough study into effective CTE models and approaches from around the state and throughout the nation would benefit Manufacturing Works and the community as they begin to think through strategies to address the CTE pipeline locally.

Nationally, employer-led organizations such as Conexus Indiana and Partners for a Competitive Workforce in Cincinnati have demonstrated significant results when employers take an active role in developing the solutions. They have created new programs which prepare students with the knowledge and skills and hands-on experience needed to secure entry-level positions with dedicated career pathways. Regionally, employer-led organizations such as AWT and Manufacturing Works, are successfully building the connective tissue between industry and education and developing innovative strategies to increase awareness of manufacturing career pathways to grow the future workforce.

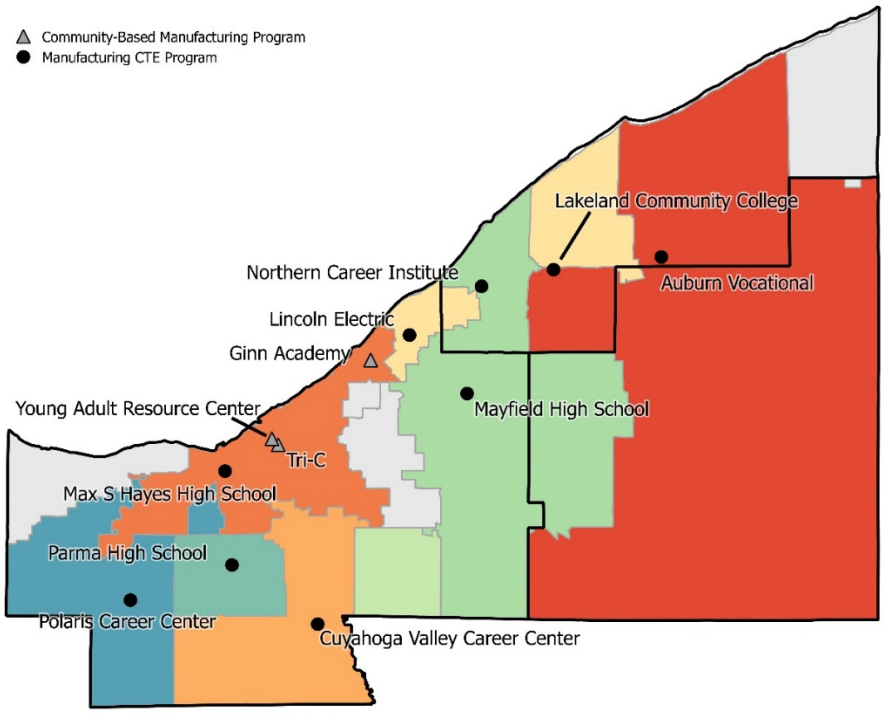
Building on proven strategies and local success, employers must be empowered to co-create strategies with education and community partners. Employers can provide oversight, give guidance on program design, provide assistance and facilities for program delivery, make internship, apprenticeship and other work-based learning opportunities available to students, and contribute financial or in-kind resources to a partnership dedicated to strengthening the region's career-technical education pipeline. Helping employers use a collective voice provides clarity, consistency, and weight to efforts and provides a way for smaller companies to actively engage in the process.

Manufacturing Works' ability to engage employers and amplify their needs, makes them well positioned to champion the work of organizing employers to facilitate and participate in collaborative strategies to improve the region's career-technical education talent pipeline. With a strong membership base of 337 companies employing more than 20,000 people in greater Cleveland and regular outreach to over 1,200 manufacturers as an administrator of the Cleveland Industrial Retention Initiative, Manufacturing Works has worked with community and industry partners to help to develop manufacturing-focused talent solutions for over 30 years. It is this orientation to the needs of employers which led to the creation of this report.

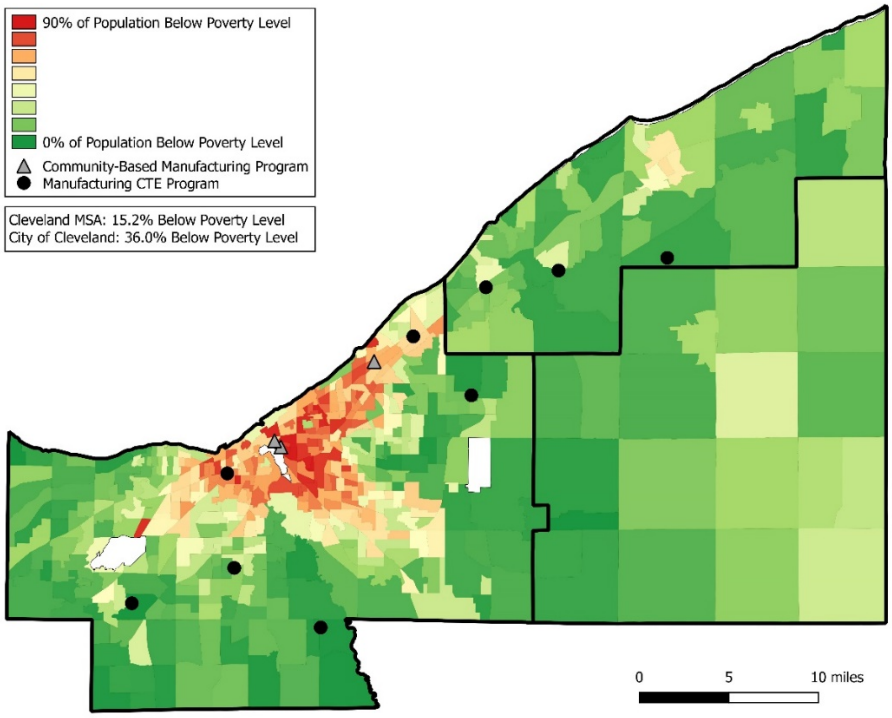
Armed with the information from this report and with the guidance of the advisory task force, Manufacturing Works will re-examine their priorities and decide how to build toward creating solutions to address the current and future workforce challenges of members and the manufacturing community of Greater Cleveland and the Northeast Ohio region.

Appendix 1: Maps

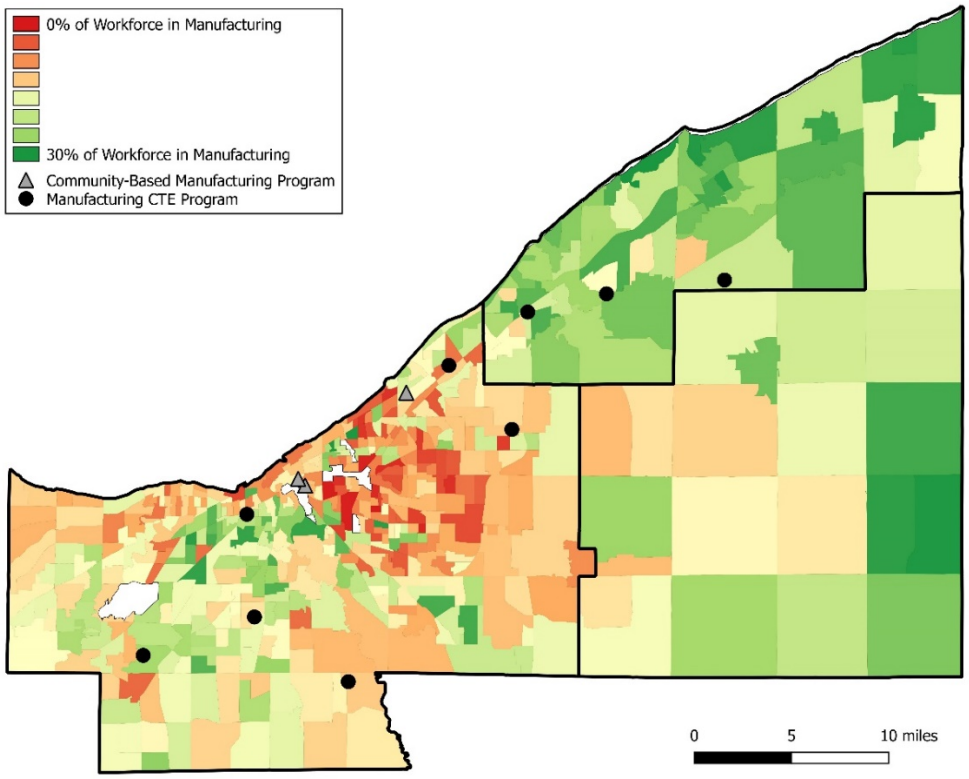
Map 1: Regional CTE with Manufacturing-Focused Programs



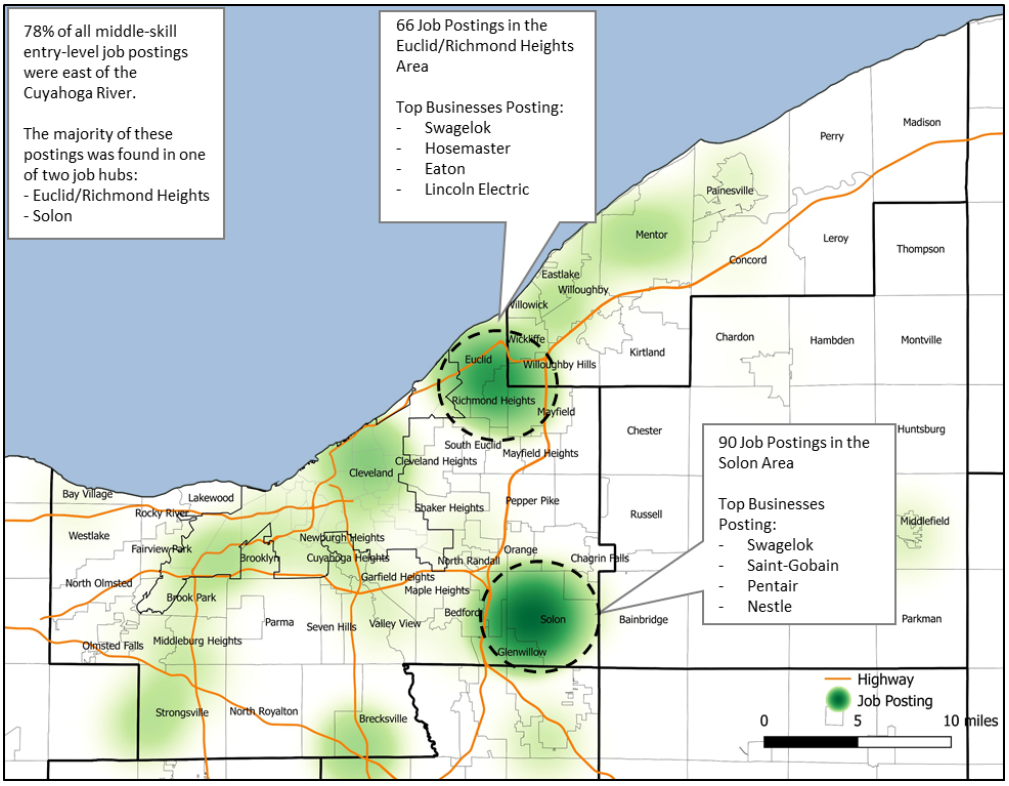
Map 2: Lack of Manufacturing CTE Training Facilities in High-Poverty Areas



Map 3: Where the Modern Manufacturing Workforce Lives



Map 4: Job Hubs, Based on Unique Job Postings



Appendix 2: Interview Themes

Interview Overview							
	Comprehensive: EC CMSD Parma	**Compact:** West Shore Excel TECC Lake Shore	**Centers:** Polaris CVCC Auburn	**System:** ODE OMJ	**Small/Mid-Size Business:** Voss Arrowhead Talan	**Large Business:** Dan T. Moore Lincoln Electric Swagelok Oatey Tremco	**Community-Based Training Providers:** Tri-C AWT YOU MAGNET WPA
Need: Is there a need for additional CTE programs?	**Mixed:** Those districts not offering manufacturing focused CTE programs had mild interest in the possibility of a new program, but noted the cost to build a facility/purchase equipment and limited community interest in manufacturing as barriers. Those districts that do offer manufacturing focused CTE programs did not express interest in expanding them, but did note they were either working with	**Mixed:** One district which was not offering manufacturing focused CTE programs were in talks with Tri-C to offer a machining program. The partnership would help to offset the cost of equipment for both parties. Those districts that do offer manufacturing focused CTE programs were very proud of their programs. One went so far as to call their CAD program their "Shining Star". Another program noted their waitlist, and wanted to	**Limited:** Each of the centers offer manufacturing focused CTE programs. In two of the centers, many seats go unfilled. However, the third has waitlists for both of its manufacturing programs. One administrator noted that there are several training centers located throughout the region and that there wasn't a need for additional programming, just better alignment.	**Mixed:** It was noted that when compared to other regions throughout the state, that the Greater Cleveland area does not have as high of a concentration of manufacturing-focused programs even though it has the highest concentration of manufacturing jobs. It was also noted that although the programs offered in the region are high-quality, many have unfilled seats, which could be a challenge to building more programs.	**Yes:** The small businesses interviewed all had skilled positions which align to manufacturing-focused CTE programs. One of the companies interviewed is already recruiting from a local CTE program and noted that they would like to hire more graduates if they could.	**Mixed:** The businesses interviewed had a mixed need for CTE graduates. Two of the companies interviewed noted that they had not hired CTE graduates and had positions open which required more of a generalist skill set rather than a specific occupation (Machinist, Welder, etc.) The remaining three companies interviewed looked to CTE as a talent source and were actively working to build a stronger	**Yes:** Each of the training providers interviewed generally agreed that there was a need for additional manufacturing-focused CTE or community-based training programs in the community. Some of those interviewed noted that existing programs should be filled before building new ones. However, given the strength of the industry and the jobs available it was important to work to build stronger pathways for students and community members into the field.

	community-based programs to expand access to students who were not enrolled in CTE or offered their facilities for use to community-based manufacturing training programs.	offer more opportunities to students who were not selected to participate in the program. That said, not all programs were at capacity, and the focus for the districts was more on increasing enrollment than expanding programs.				pipeline of CTE hires.	
Experience: What experience do you have with CTE programs?	**Varying Levels of Experience:** While all administrators interviewed had experience with CTE. Many had background in education, but some interviewed had backgrounds in industry.	**Varying Levels of Experience:** All of the CTE administrators and instructors were experienced in industry or delivering CTE. However, many noted that those making funding decisions and guidance counselors did not have CTE experience, presenting a barrier to enrollment	**Experienced:** All of the administrators and instructors at the career centers were experienced in CTE. Many are noted as experts in their field, including having developed curriculum and programming for the helping students develop soft and professional skills.	**Varying Levels of Experience:** Everyone interviewed has mixed levels of experience with manufacturing and CTE. Some were experts in CTE and apprenticeships, while others had experience with training programs and manufacturing, but not CTE specifically.	**Varying Levels of Experience:** Some of the companies interviewed were actively working with CTE programs to provide internships and hired from CTE. Others provided plant tours and would speak at engagement fairs, but were not providing internship or hiring from CTE programs. One company was unfamiliar with CTE and was not aware of any CTE programs in the area.	**Varying Levels of Experience:** Two companies were not currently with CTE and had limited knowledge of regional programs. The remaining companies who took part of in in this analysis were very knowledgeable. These companies were also working closely with community- based training programs or had created their own. Additionally, one of the companies interviewed provides their welding lab as a	**Varying Levels of Experience:** While everyone interviewed had experience with training, not everyone had a deep knowledge of CTE or which programs were available regionally.

						training facility for a regional CTE program.	
Challenges: What challenges do you face when working with CTE or community-based programs?	**Funding:** Every administrator interviewed noted that the funding formula for CTE puts comprehensive districts at a disadvantage because they are unable to levy for additional funding from the community and rely on a single district's allocation for CTE funding. **Perceptions of Manufacturing:** Every administrator noted the perception of manufacturing among parents, students and the broader community was a challenge to building a program or maintaining enrollment. **College-going Culture:** Every administrator interviewed noted that CTE	**Funding**: Much like their Comprehensive counterparts, the administrators from the Compacts all agreed that funding was a challenge. Each district interviewed noted that they worked with advocacy organizations to help move policy at the state level **Instructors**: Each administrator noted the importance of a quality instructor to program enrollment and retention and how difficult it was to find one. **Engaging Employers:** While employers serve on advisory councils for the programs, the administrators noted that deeper engagement was a challenge. One	**Recruitment:** Although one Center has been able to bolster interest in their programs, the other two centers have noted that they have had challenges working with the guidance counselors and teachers from their feeder districts to boost enrollments. **Perceptions of Manufacturing:** Every administrator noted the perception of manufacturing among parents, students and the broader community was a challenge to maintaining and building enrollment. **College-going Culture:** Every administrator interviewed noted that CTE	**Transportation:** Students often do not have a personal car which can limit both their training and internship options. **Cost of Equipment:** Manufacturing equipment is expensive and can be hard to justify with tight budgets and low enrollments. **Perceptions of Manufacturing:** The leaders noted the perception of manufacturing among parents, students and the broader community was a challenge to adding more manufacturing-focused programs. **Instructors:** Leaders noted the importance of a quality instructor to program enrollment and retention and how	**Finding candidates with professional skills:** All of the small to midsize employers interviewed noted challenges in finding candidates who had professional skills such as time management, attendance, big picture thinking, etc. **Attendance:** Attendance is a problem for each company interviewed, even among recent CTE grads. Many hypothesized that this was due to a lack of reliable transportation, either public or personal. **Working with Schools:** One respondent noted that they have had difficulty engaging CTE	**Attendance:** Attendance is a problem for each company interviewed, even among summer interns in manufacturing focused programs. Many hypothesized that this was due to a lack of reliable transportation, either public or personal. **Technical Skills:** Finding candidates with the technical skills for the job was a challenge for almost all of the companies interviewed, even among CTE grads. For those who had hired CTE grads, they noted that the programs had prepared them with the basic skills needed, but not for some of the higher-level skills, such as set-up and programming of	**Perceptions of Manufacturing:** The community-based providers noted the perception of manufacturing among parents, students and the broader community as a challenge to expanding access. **Misaligned Messaging:** One provider noted that often times awareness building efforts on behalf of manufacturing fell flat because the messenger was not a person that the participants said they work with could relate to. Another noted that efforts to build interest in CTE were sporadic and didn't have a consistent message with tangible next steps for how a student could enroll in

	enrollments suffered because of the focus on college from both parents and guidance counselors. **Transportation:** Some students may have to take public transportation to get to the career center, which is both a time and safety barrier.	administrator noted there seemed to be engagement fatigue among employers. **Perceptions of Manufacturing:** Every administrator and teacher interviewed noted the perception of manufacturing among parents, students and the broader community was a challenge to building a program or maintaining enrollment. **College-going Culture:** Every administrator interviewed noted that CTE enrollments suffered because of the focus on college from both parents and guidance counselors.	enrollments suffered because of the focus on college from both parents and guidance counselors.	difficult it was to find one.	programs, noting that when they want to work with programs, they are often directed to post internship positions on job boards. **Risk of Investing in Candidates:** Some employers noted that it can be risky to invest in internships and apprenticeships. The intern/apprentice may leave shortly after the training which is a harder cost for smaller companies to absorb. **Perceptions of Manufacturing:** Every company noted the perception of manufacturing among parents, students and the broader community was a challenge to recruiting a quality workforce.	CNC machines or repetitive technical welding. **Perceptions of Manufacturing:** Every company noted the perception of manufacturing among parents, students and the broader community was a challenge to recruiting a quality workforce.	training. **Working with Schools:** Respondents noted that working with CTE programs could be difficult. One stated that if you could get to the instructor partnerships became easy, but finding the way to instructor was a challenge. **Transportation:** Some participants do not have access to personal transportation and rely on public transportation to get to the school and/or training facility, as well as any employment or internship opportunities.

Solutions: How have you worked to address the challenges?	**Off-hours partnerships:** An administrator noted that they were interested in working with community colleges and other community-based training programs to use their lab after school or during the summer to help expand training opportunities throughout the community. In this way, the partners could share the cost for equipment purchases, lessening the financial burden for the district.	**Community Partnerships:** One compact interviewed noted that they partnered with a local business and community college for space and equipment. As noted previously, a district which is not currently offering manufacturing focused programming is considering a community partnership to share the cost of equipment. **Re-Branding:** Working with an industry intermediary focused on Lake and Geauga Counties, a district is working to re-brand their machining program as "Advanced Manufacturing" to build enrollment and align with existing outreach efforts.	**Awareness-building:** One center has boosted enrollment through working with a local industry intermediary to change the perception of manufacturing in their feeder pattern through manufacturing related after school programs and re-branding their existing programs. Another program has worked to build awareness through offering plant tours for students and parents. **Dedicated soft-skills curriculum:** Administrators from one center noted that they have developed and implemented a soft-skills course which every student regardless of program must take to graduate.	**Transportation:** If a student doesn't have a license, the Department of Public Safety will help schools access driver's ed for students Some companies are helping students finance a car. In this model the company facilitates a loan to employees sets up payroll deductions to dealership the student pays back the loan through payroll deductions. **Community Partnerships:** To help offset the cost of building a new facility and the challenge of finding quality instructors, many districts have partnered with community colleges or other career centers which already have facilities to offer programming. Community	**Awareness-building:** In an effort to build awareness and interest in manufacturing some companies are working with CTPD's to host plant tours and speaking engagements to help students and parents better understand the industry.	**Awareness-building:** In an effort to build awareness and interest in manufacturing some manufacturers are working with CTPD's to host plant tours and speaking engagements to help students and parents better understand the industry. **Internal Training:** Two of the companies interviewed noted they have internal training programs, which can help CTE grads quickly learn the technical skills needed to be successful on the job. This training has allowed one employer to hire CTE grads into the higher skilled machinist positions rather than operators. **After School and Summer Programs:** One of the employers	**Community-Based Programs:** One of the providers interviewed is in the second year of a program which brings together employers, schools, and community colleges to provide technical training and internship opportunities in manufacturing. As the program grows, they have adapted recruitment policies to ensure students who enroll are interested in entering manufacturing careers. The program provides transportation from the school to the community college and internships. **School-based awareness building:** One of the programs interviewed is working with the CTPD's to change the perception of manufacturing CTE programs through

				partners can also provide wrap around services such as mentoring and financial support for equipment.		interviewed has started their own training programs to build interest in manufacturing, develop soft/professional skills, and teach basic technical skills.	re-branding efforts. These efforts include changing the name of programs and holding events which serve as both expos and job fairs. This program is also working with individual schools throughout the region to build interest in manufacturing through robotics clubs and competitions.
Best Practices: What are the programs from the region, state, or nation that you look to as best examples of how to effectively deliver CTE?	**Augmenting CTE with internship experience**: Both of the CTE districts offering manufacturing focused programs used internship opportunities to help students get working experience in the field.	**Employer-led partnerships:** Administrators pointed to a Manufacturing-focused CTE program in Northeast southwest Ohio which has an integrated internship model where student go to class for two-weeks and work onsite for two weeks. The program was initiated by the employer who needed a stronger	**State-wide awareness building**: One administrator noted that the Ohio Department of Education has taken on the challenge of building awareness of manufacturing careers. This is helping some programs build a recruitment pipeline that reaches into middle school and builds awareness of manufacturing careers earlier.	**Employer-led partnerships:** Manufacturing-focused CTE programs from across the state have worked with employers across the state to offer onsite training and integrated internship models where student go to class for two-weeks and work onsite for two weeks.	**Facilitated Relationships:** The company who is working closely with CTE programs to provide internships noted that working with a designated coordinator who facilitated the relationship to the school was essential.	**Employer-led partnerships:** Manufacturing-focused CTE programs in Columbus and Kentucky are led by employers and offer onsite training and integrated internship models where student alternates between classroom and work-based learning. **Regional Programs:** The employers who are working with	**Regional Programs:** The providers who are working with regional CTE programs all noted the quality of students graduating from the manufacturing-focused programs. A provider noted that not only did CTE programs provide the technical skills needed to secure entry level employment, CTE grads were more professional and

		pipeline of welders.				regional CTE programs all noted the quality of students graduating from the manufacturing-focused programs. Employers also noted that the community-based training programs in the region were improving and proving to be valuable sources of talent.	were much better post-secondary students than their non-CTE peers.
Policies: What institutional, local, or state policies impact your work with CTE or community-based training programs?	**Funding Formulas:** The state's funding formula for CTPD's is a major policy concern. **Graduation Requirements**: Administrators noted that CTE graduates often have trouble meeting high school graduation requirements. Some are able to utilize the alternative pathway to graduation, in which a student receives an industry credential	**Funding Formulas:** The state's funding formula for CTPD's is a major policy concern. **Graduation Requirements:** Administrators noted that CTE graduates often have trouble meeting high school graduation requirements. Some are able to utilize the alternative pathway to graduation, in which a student receives an industry credential	**Graduation Requirements:** Administrators noted that CTE student often have trouble meeting high school graduation requirements. Some are able to utilize an alternative pathway to graduation, in which a student receives an industry credential and takes the WorkKeys assessment as a substitute for the OGT.	**Local Policies:** Locally funding is going to a number of different initiatives, which are tangentially related. If a need is identified, it is important to work with local leaders to align any efforts to maximize funding.	**Child Labor Laws:** Some employers expressed concerns about child labor laws in regard to hiring non-CTE high school students as interns or for summer employment.	**Unions:** One employer noted that they were unionized and taking on interns or apprentices would have to be approved through the union.	**Graduation Requirements:** Providers who were working with schools noted that some of their students/ participants are having trouble meeting high school graduation requirements. To remedy this, they are looking into providing the WorkKeys assessment as part of the alternative pathway to graduation, in which a student receives an industry credential

	and takes the WorkKeys assessment as a substitute for the OGT.	and takes the WorkKeys assessment as a substitute for the OGT. **Transcribing College Credit:** The administrators noted that transcribing credit for those students in articulated courses programs can be a lengthy and difficult process.	Instructors also noted that the requirements limit the amount of time they can devote to subjects because they must take other classes or teach to the certificate, which may not be aligned to the needs of employers. **Transcribing College Credit:** The administrators noted that transcribing credit for those students in articulated courses can be a lengthy and difficult process.				and takes the WorkKeys assessment as a substitute for the OGT. **Transcribing College Credit:** Those representing or working with community colleges to provide training noted that transcribing credit for those students in college credit plus or tech prep programs can be a lengthy and difficult process.

Appendix 3: Methodology

A comprehensive approach, using both qualitative and quantitative methods was used to examine the need for additional manufacturing pathways programming in Cuyahoga County and its eastern suburbs. Working with Manufacturing Works and key partners, the research team developed a six-question learning agenda to determine if there was a need and if so, what factors contributed to the perpetuation of the gap.

a) Is there a need

To identify if additional pathways were needed the research team examined which programs currently existed to prepare high school students for manufacturing careers, if the programs were aligned to the needs of local manufacturers, and if the number of students graduating from current programs met the number of entry-level job openings in the region. To answer this question, the research team interviewed local career-tech instructors and administrators to learn more about their programs, in addition to local manufacturing employers to get their perspective on whether or not existing programs were meeting their hiring needs, focusing on both capacity and skills attained.

The information gleaned from the interviews was paired with quantitative research which assessed the need on both the supply and demand side. Regional job postings data from EMSI was aggregated to determine the most common manufacturing occupations and skills requested by employers. This data, paired with job openings data from the Bureau of Labor Statistics Employment Projections program helped give a full picture of specific job and skill demand. CTE data was collected from the Ohio Department of Education to determine manufacturing program enrollments and completions. Lastly, demographic data, such as poverty and unemployment rate, were collected to determine if certain neighborhoods had a higher need for employment/training.

b) Regional experience

Identifying regional experience with building and implementing manufacturing career pathways was also an important line of inquiry for the research team. This information was used to develop an understanding of the benefits of existing programs as well as identify regional experts whose expertise could be used to help strengthen current programs and develop new models if needed. Here, the research team relied on interviews with key career-tech administrators and community-based service leadership to identify their experience and familiarity with different pathway models, including pre-apprenticeships and work-based learning programs.

c) Existing program best practices

Examining local, state and national models for manufacturing career pathway programming helped the research team build a repository of best practices which can be used to both examine the strengths and weaknesses of existing programs, and provide thoughtful discussion for strategies to develop additional capacity within the current system. To accomplish this, the research team conducted a literature review and interviews with key stakeholders including educators, employers and system administrators.

d) Challenges

Determining what challenges students, employers and educators face within the current career-technical education system helped the research team understand what contextual factors might be contributing to any existing gaps in opportunity or alignment. To identify these contributing factors, the research team asked both educators, administrators and employers what challenges they face and what solutions they have created to address these issues.

A quantitative analysis was also conducted which focused on the spatial mismatch between manufacturing training programs and job hubs. Unique job postings of key middle-entry-level occupations was mapped out, highlighting cities with high demand of entry-level manufacturing talent. This information was combined with public transportation data from the Greater Cleveland Regional Transit Authority (GCRTA) to determine which job hubs may be hard-to-reach via public transit.

e) Policies

In addition to contextual factors which may contribute to gaps in manufacturing career pathway programming, the research team also considered which systemic factors may be foundational to the gaps. In this line of inquiry, the team considered how funding, career-tech educational service district type, and structure of agreements between districts impacted career-tech education. This information was validated through interviews with both local and state education administrators.

f) Regional support

Recognizing the analysis may identify capacity and/or alignment gaps in manufacturing career pathway programming throughout the region, it was important to determine the willingness of educators, community training providers, system administrators and employers to partner to build collaborative solutions, if needed. To sus?? this out, the research team established a line of inquiry

Full list of interviews

SUPPLY-SIDE INTERVIEWEES				
Prefix	**First Name**	**Last Name**	**Title**	**School**
Dr.	John	Buckner	CTE Director	East Cleveland
Mr.	Anthony	Battaglia	Direct of College & Career Readiness	CMSD
Mr.	Nate	Bishko	CTE Director	Excel TECC

Dr. Ms. Mr.	Brian Michelle Jeff	Bontempo Rodewald Slavkovsky	Superintendent Business Partnership Coordinator Asst. Superintendent	Auburn Career Center
Mr. Mr.	Dave Rich	Mangus Parrott	Superintendent Machining Instructor	Cuyahoga Valley Career Center
Mr.	Joseph	Glavin	Director	Lakeshore Compact Tech Ed Office
Mr. Ms.	Ryan Karen	Eubank Brown	Welding Instructor Strategic Initiatives Director	Euclid City Schools
Mr.	David	Neylon	Machining Instructor	Max S. Hayes High School
Ms.	Jessica	Westropp	MW Senior Manager, Workforce @ MS Hayes	Max S. Hayes High School
Mr.	William	DiMascio	Educational Coordinator	Westshore Compact-Lakewood
Mr. Ms.	Gerald Pam	Lanning Vizer	Principal Coordinator of Corporate Partnership	Polaris Career Center
Ms. Dr.	Jamie Andrew	Bollinger Cox	Program Manager, Tech Prep Chief Administrator, Northeast Reg. Ctr. , Tech Prep	Cuyahoga Community College
Ms. Mr.	Becky Michael	Slack Waugh	Dean, The Senney Honors Academy Director of Academics School Counselor Principal	Lutheran West High School
Ms.	Kristen	Plagemen	Director, Career Technical Education	Parma City Schools

SYSTEM/POLICY INTERVIEWEES				
Prefix	**First**	**Last**	**Title**	**Organization**
Ms.	Linda	O'Connor	Assistant Director Apprenticeships/Work-Based Learning and Pre- apprenticeship Industry Credential	Ohio Department of Education
Ms. Mr.	Grace Steve	Kilbane Greenwell	Executive Director Youth and Young Adult Program Manager	OMJ- Cleveland/ Cuyahoga County
Ms	Alice	Cable	Exec Director	AWT
Mr	Eric	Matheny	VP Employment Services	YOU
Ms.	Autumn	Russell	Executive Director, ECEC	MAGNET
DEMAND-SIDE INTERVIEWEES				
Prefix	**First**	**Last**	**Title**	**Company**
Ms.	Maureen	Pansky	Human Resources Manager	Oatey
Mr.	Geoff	Lipnevicius	Operations Manager, Automation Division	The Lincoln Electric Company
Mr. Mr. Mr. Ms.	Tobias Brian David Laurie	Midcalf Martin Malusky Pogel	Supervisor Trainer Trainer Manager, Hourly Workforce Development	Swagelok
Dr	Jason	Drake	Director, Education and Workforce Development.	Dan T. Moore
Mr.	Brian	Pyclik	Plant Manager	Tremco
Mr.	Miguel	Lugo	Plant Manager	Talan
MS.	Emilia	Ejsmont	HR	Voss
Mr	Alec	Scovil	President	Arrowhead