Capital Area Pipeline Partnership
Supply Side Analysis

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Executive Summary

This project is performed as part of the charge of the Capital Area Pipeline Project (CAPP) data work group, and provides a contextualized analysis of the supply gap in mid-level manufacturing occupations[1] in North Central Connecticut, with a focus on programs and services that prepare young adults to meet employer needs. The goal of the analysis is to assist the CAPP Data Workgroup in its determination of the skills gap between supply and demand in manufacturing occupations and identification of the extent to which current education and training providers and employers are maximizing the talent pipeline of local young adults ages 18 to 29.

The approach undertaken for this project includes a quantitative analysis of existing data and a qualitative component that contextualizes the data. By using qualitative as well as quantitative data, we are able to provide context to the facts, in order to more fully understand the factors contributing to the current supply gap, and create the foundation for strategy development to address the issue.

Our approach of combing quantitative and qualitative approaches to analyzing the supply side gap has provided data about existing programs and candidate training, employer need for qualified candidates, and the story that empowers the reader to understand some of the key considerations and dynamics of the data, as well as suggestions for further research and policy implications.

Summary of Findings

Training programs provide value; job candidates need additional support and/or training in order to meet employer needs, including more hands-on training.

In many cases manufacturers view training completers as having some general skills and knowledge that can be used as needed for different occupations, following additional on the job training. Additionally, employers identified multiple other occupations for which workers are currently needed, and which require training.

In addition to existing training programs, employers identified a need for incumbent worker training on an ongoing basis. This is especially true for small to mid-sized companies which struggle to retain staff members once they have been trained, thereby becoming more attractive to larger, higher-paying companies. This creates an additional challenge because small to mid-sized companies don't have the critical mass or resources to unilaterally develop elaborate training programs.

[1] Mid-level occupation as defined by the CAPP data Workgroup in Attachment A: "Manufacturing Occupations Skills Required" CAPP Data Workgroup -Manufacturing Occupations Follow Up, 10/9/19

Employers express that candidates are often not ready for employment in their target occupations, and often need additional skill development and emotional maturity. This is particularly true for younger (those age 18-29) completers.

Employers and training providers utilize and value internships and formal apprenticeships; employers report that a coordinated internship program could be more valuable than the current, informal, approach.

Employers and training providers expressed the value in coordinated education and training initiatives that span high school, community college, and 4-year degree programs

Training programs currently help to address the supply-demand gap by only 18.8%. Some positions – tool and die makers and supervisors – are rarely hired out of training programs based on the additional experience necessary to hold such positions. Manufacturers continue to hire from their competition, as well as from temporary agencies.

Accurate and current data are hard to coordinate across data sources, which makes estimates of the supply of potential workers difficult and less accurate than ideal. Additionally, because training programs can prepare participants for multiple occupations, it is difficult to align specific numbers of completers for specific occupations.

The total number of completers from Hartford Area manufacturing training programs for the occupations targeted in this study is approximately 723. Statewide, the count of completers for the same targeted occupations is 1234.

Components of Supply-Side Analysis

Purpose of Study

This project is performed as part of the charge of the Capital Area Pipeline Project (CAPP) data work group, and provides a contextualized analysis of the supply gap in mid-level manufacturing occupations[2] in North Central Connecticut, with a focus on programs and services that prepare young adults to meet employer needs. The goal of the analysis is to assist the CAPP Data Workgroup in its determination of the skills gap between supply and demand in manufacturing occupations and identification of the extent to which current education and training providers and employers are maximizing the talent pipeline of local young adults ages 18 to 29.

The approach undertaken for this project includes a quantitative analysis of existing data and a qualitative component that contextualizes the data. By using qualitative as well as quantitative data, we are able to provide context to the facts, in order to more fully understand the factors contributing to the current supply gap, and create the foundation for strategy development to address the issue.

Specifically, the scope of COG's work included

- Development of an inventory of manufacturing training providers and programs in the North Central region
- Develop and administer an online survey to all program contacts
- Develop, administer and analyze an online survey of manufacturing employers in the North Central region
- Plan and conduct focus groups of Manufacturers and Training Providers
- Integrate and analyze data from existing sources to develop an estimate of the current and potential supply of manufacturing workers, by middle-skill occupational title for the North Central region and the state
- Integrate employer feedback into the demand-side data provided by the Data Workgroup
- Collaborative meetings with, and presentations to, the Data Workgroup, CWP staff, and the CAPP steering committee

Mix of Quantitative and Qualitative Methods

COG employed a mix of quantitative and qualitative methods for this work. The compilation and integration of completer data for manufacturing training and education programs drove

[2] Mid-level occupation as defined by the CAPP data Workgroup in Attachment A: "Manufacturing Occupations Skills Required" CAPP Data Workgroup -Manufacturing Occupations Follow Up, 10/9/19

the supply estimation process. Frequency distributions, measures of central tendency, various significance tests, and measures of effect size were employed in the analysis of on-line survey data as well. However, These quantitative approaches were informed by qualitative information gathered from conversations with employers and education and training providers.

Due to seasonal challenges and end of year deadlines for most manufacturers, we found that manufacturing employers were not readily available to participate in focus groups. However, multiple employers were willing to participate in teleconference or videoconference interviews. These interviews are described later in this report, and yielded rich and individualized information, and allowed employers to share information specific to their own experiences and needs. The richness of the interviews provided a full picture of the challenges to hiring the target population, as well as providing context for answers to the employer survey, also detailed later in this report.

Based on the success of individual interviews with employers, we also utilized the individual interview approach with training providers. Similar to the information shared by employers, the provider interviews allowed each provider the opportunity to share their challenges, strategies, and suggestions for dealing with the target population.

Contextualized analysis of the existing supply gap:
Our approach of combining quantitative and qualitative approaches to analyze the supply side gap has provided the data about existing programs and candidate training, employer need for qualified candidates, and the story that empowers the reader to understand some of the dynamics and factors that inform the data, as well as suggestions for further research and policy implications.

Inventory

Initial surveys of available training for the manufacturing industry indicate a wide range of programs and providers in Connecticut. The parameters for this project include:
Programs in the north central region; programs that offer training for CNC programming, inspectors, machine operators, machinists, supervisors, tool and die making, and welding; and programs that offer less than a two-year degree. When filtering results by these parameters, the number of programs was drastically reduced. Please note that this may not reflect programs implemented during the current academic year.

- North Central CT programs that offer manufacturing training for targeted occupations without requiring college degree: **9**
  - CNC Programming 5
  - Inspectors 3
  - Machine Operators 0
  - Machining 8
  - Supervisors 0
  - Tool and Die Making 3
  - Welding 5

Provider	Programs	Machinists	Computer Controlled Machine (CCM) Tool Operators	Computer Numerically Controlled (CNC) Tool Programmers	Tool and Die Makers	Welders	Inspectors	Supervisors of Production Workers
Asnuntuck Community College	Additive Manufacturing; CAD/CAM Programming; CNC Computer Numerically Controlled (CNC) Machinist Technology/CNC Machinist; Machining; Mechatronics; Precision Sheet Metal Fabrication; Quality Inspection - Metrology; Welding; Welding Engineering Technology/Technician	✓		✓		✓	✓	
Bristol Technical High School	Mechatronics; Precision Machining; Welding; Metal Fabrication	✓				✓		
Goodwin Universitiy	Manufacturing Engineering Technology/Technician (2 programs)	✓		✓	✓			
Howell Cheney Technical High School	Mechanical Design and Engineering Technology; Precision Machining Technology; Welding and metal fabrication	✓				✓		
Lincoln Tech		✓				✓		
Manchester Community College	CAD/CAM Programming; CNC; Lean Manufacturing; Machining; Manufacturing Engineering Technology/Technician; Quality Inspection – Metrology; Tool and Die	✓		✓	✓		✓	
Middlesex Community College	Computer Numerically Controlled (CNC) Machinist Technology/CNC Machinist			✓				
Prince Technical High School	Automated Manufacturing Technology; Mechanical Design and Engineering Technology; Mechatronics; Precision Machining Technology; Welding and Metal Fabrication	✓						
Tunxis Community College	CNC; Machining; Mechatronics; Quality Inspection - Metrology	✓		✓	✓	✓	✓	

Interviews with Manufacturers

Initially, individual interviews were not proposed as part of this project; however, the switch from the proposed focus groups to individual interviews allowed for more in-depth questioning and answers, and allowed employers the opportunity to share their unique perspectives, challenges, and in some cases, potential solutions to their hiring issues.

The interviews were held with ten manufacturing employers, representing aerospace, injection molding, precision springs and metal shaped solutions, catches latches and handles, and precision metal components and assemblies. Interviews ranged from 30-60-minutes, and were structured on a set of common questions, which were individualized based on employer experiences with 18-24-year-old job candidates and employees.

Eight Major themes emerged from the employer interviews:

1. Training programs provide substantial benefit; however, soft skills (also known as pre-employability skills) are a key benefit of the trainings. Employers reported that, in general, training programs are not long enough, and do not prepare students adequately for employment without additional on-the-job training provided by the employer. Additionally, and with a couple of notable exceptions, for the most part, manufacturing equipment used for training is not current, and in some cases, is not applicable for employer needs.
2. Program completers believe they are more prepared, more skilled, and more valuable as employees than employers believe them to be. They demonstrate a lack of maturity, and often demonstrate lack of understanding of basic manufacturing terms, equipment, and tools. Additionally, even after completing training programs, they lack numeracy skills to the extent that it makes many of them ineligible for manufacturing jobs. This lack of skills has prompted some employers to develop screening tools they administer to job candidates before granting interviews.
3. Most employers hire into entry-level jobs and train new employees once hired. This is due in part to the lack of qualified candidates, including program completers, and due in part to specialized training needs of some companies. Multiple employers stated they would value access to customized in-house training and/or training for trainers.
4. Multiple employers interviewed utilize temporary agencies to hire entry-level staff. Some reported they use “temp to hire” arrangements as trials without committing to permanent employment until they are confident the temporary employee has the necessary skills for ongoing employment, or the aptitude to learn those skills.
5. Most employers interviewed utilize and value apprenticeship programs and the option for internship opportunities. The internships give young people the opportunity to demonstrate their ability and aptitude before being formally hired, and can sometimes transition into formal apprenticeship opportunities once hired. A number of employers stated that internships would be more useful if better coordinated across training programs and companies.

6. Many young people have transportation challenges which impacts their ability to get to work consistently and on time. Some employers have been able to arrange rides to help young employees until they are able to solve their transportation issues permanently.
7. Employers stressed the importance of assigning mentors to new, young-adult, employees for both technical guidance, and understanding company culture. Some also stressed the importance of being flexible enough to try multiple mentor/mentee pairings to find the right match
8. All employers interviewed discussed the importance of improved, coordinated, marketing to high school students, parents, and high school teachers and guidance counselors so that manufacturing is seen as a modern, competitive, and desirable career with a path to a well-paying future.

Interviews with Providers

Based on the usefulness of individual interviews with employers, individual, in-depth interviews were held with six training and education providers from North Central Connecticut, representing community colleges, a private university and the region's technical high schools.

Interviews consisted of 30-60-minute structured conversations with common questions that could be individualized based on participants' perspectives on preparing young adults for manufacturing careers.

Eight major themes emerged from the provider interviews:

1. Improve marketing and perception of manufacturing programs and careers to Parents, high school teachers, and guidance counselors who don't understand current manufacturing technologies and environments. Misunderstanding current manufacturing opportunities takes multiple forms; in some instances, students may not be interested in a manufacturing career, but are coerced by parents to go through a manufacturing training program, and then drop out of the program when they realize they are training for a career that doesn't interest them or for which they are not suited; in other cases, students are dissuaded from pursuing a manufacturing career because it is perceived by parents or teachers as a less than optimal post-secondary school option. Providers stressed that marketing to parents and students related to manufacturing education should focus on modern manufacturing settings, the sophistication and professionalism of modern manufacturing, and the competitive pay scales for manufacturing careers.
2. Student candidates for programs often lack basic math skills. Some programs feel this weakens their overall effectiveness, and some programs have devised basic qualifying tests for program participation.
3. Programs spanning H.S. and P.S.E. programs are viewed by providers as opportunities for strong, coordinated learning experiences. Multiple providers offer programs that start in high school, and offer the opportunity for students to earn both high school and college credits at the same time. Community college programs can incorporate a high school to community college to 4-year degree continuum of learning.
4. Provider-Employer relationships are highly valued by training and education providers, and the providers reported that these relationships are Important for enhanced student opportunities, like individualized internships. They are also important for employers, because, due to the relationships and associated communication about employer needs, the training providers are sometimes able to develop specialized incumbent employee training for manufacturers.
5. Providers shared the importance of flexibility when working with the 19 to 29-year-old population. Specifically, flexibility with matching students and mentors, and flexibility in being able to assist with transportation where necessary and possible.

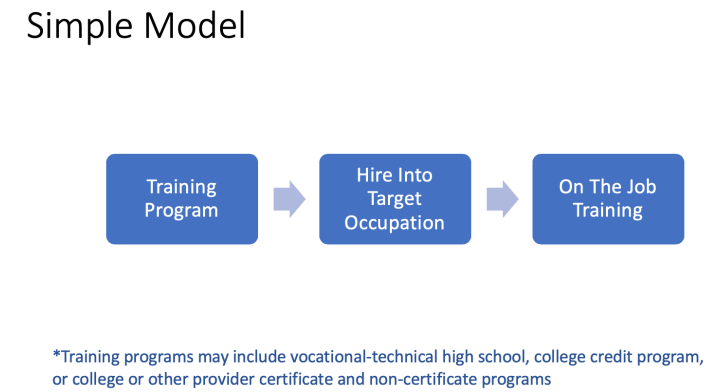
6. The length and depth of educational experience is important; providers who were interviewed stated that the organizations operating longer, or more intensive training are generally perceived as producing better qualified job candidates.
7. Providers described the importance of apprenticeship and internship programs, and the importance of ensuring that internships have worksite mentors. Mentors serve multiple roles that include reinforcing appropriate workplace behaviors, specific workplace culture, and a resource for tasks and skills learned in the workplace. Additionally, post-internship feedback between mentors and training providers allows providers to deliver additional supports to students who may need increased technical or business-related social skills.
8. Access to state-of-the-art equipment was a topic that all training providers discussed. Strong relationships with employers can positively impact access to state-of-the-art equipment through loaned or donated equipment. Some providers described how their relationships with manufacturers granted them this access, at least on a temporary basis; and a very small number of providers described regular access to state-of-the-art equipment due to partnerships with manufacturers and access to additional grant funding. However, for many providers, lack of readily accessible state-of-the-art equipment hampers their ability to adequately prepare students for manufacturing work. Many, but not all, of the providers expressed a desire for more up-to-date equipment so they could more fully prepare their students for modern manufacturing.

Training Models

Our discussions with manufacturers and training providers clearly demonstrated that there are a variety of different approaches taken to preparing and utilizing individuals who have recently completed area training programs.

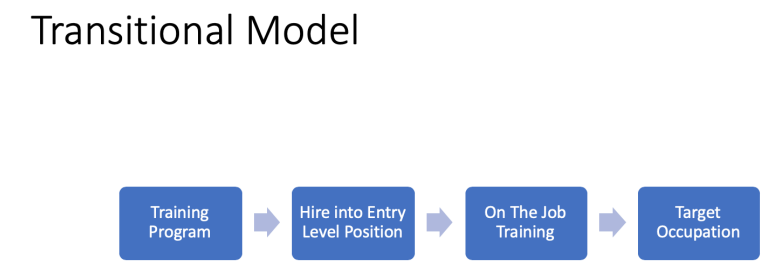
Figure 1 represents the "basic training model." For most manufacturing occupations, this model is not sufficient…most manufacturers use more elaborate approaches to prepare their workers.

Figure 1.



One model that we discovered several manufacturers used is shown in Figure 2 below. This transitional model emphasizes hiring training completers into an entry level position, such as machine operator, and providing on the job training. The new hire's skills and aptitudes are assessed, and they are moved to their target occupation when ready.

Figure 2.



A variation of the transitional model is shown in Figure 3. In this model, individuals are hired into an entry level position following an internship with the company. The internship usually comes as the individual is nearing completion of the training program. The internship allows the manufacturer to assess the potential employee's skills and aptitudes, and serves as a trial period for the potential employee, while providing the potential employee with workplace experience. However, the employee is still hired into an entry level position for further seasoning and on the job training before moving them to their target occupation.

Figure 3.

Transitional Model With Internship

Apprenticeships are a key component for many employers. In apprenticeship models, individuals are hired following completion of training programs into an apprenticeship, where they learn the knowledge and skills for advanced positions, such as machinists and tool and die makers. Figure 4 below shows one kind of apprenticeship model, where training completers are hired as apprentices following a successful internship.

Figure 4.

Apprenticeship Model 1

Figure 5 shows another approach to apprenticeship model, where a potential apprentice is identified after being hired into an entry level position. This is the key difference between the Apprentice Model 1 and 2—in Model 1 the apprentice is hired as an apprentice, while in Model 2 they are hired in an entry level position and subsequently moved into an apprenticeship.

Figure 5.

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On-Line Survey of Manufacturers

As part of this project, an on-line survey of manufacturers in the Hartford area was conducted. 21 responses were received.

The survey asked how many individuals were hired in the target occupations by the respondent in the last 12 months, and how many of these were hired from area training programs. Table 1 shows the aggregate responses. Overall, 18.8% of the hires in these occupations were filled by area training programs. Note that only 1 supervisor and no tool and die makers hired came from area training programs.

Table 1.

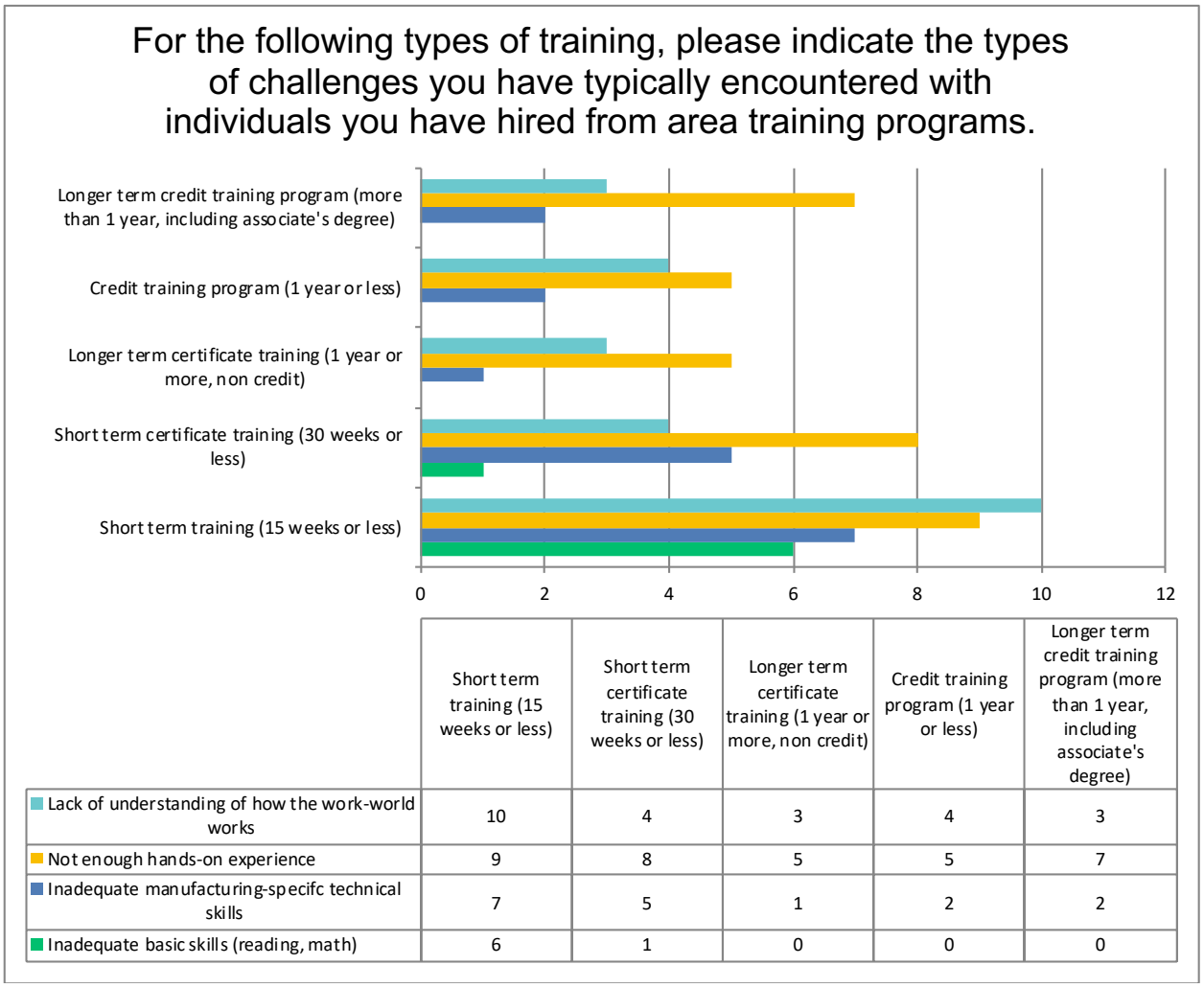
	Number Hired in Last 12 Months	Number Hired From Area Training Programs	Percent Hired From Area Training Programs
Computer controlled machine tool operator	100	17	17.0%
Computer numerically controlled machine tool programmer	48	7	14.6%
Inspector	55	11	20.0%
Machinist	64	14	21.9%
Tool and die maker	13	0	0.0%
Supervisor	14	1	7.1%
Welding technology/welder	31	11	35.5%
Total	325	61	18.8%

The survey also asked what types of area training programs individuals hired came from. Short term training of 5 weeks or less, and long-term credit-bearing training of 1 year or more were the most frequent responses. See Table 2 below.

Table 2.

	Short term training (15 weeks or less)	Short term certificate (30 weeks or less)	Long term certificate (1 year or more, non credit)	Credit training program (1 year or less)	Longer credit training program (more than 1 year, including associate's degree)	Total
Computer controlled machine tool operator	3	2	4	1	2	12
Computer numerically controlled machine tool programmer	3	2	0	0	3	8
Inspector	3	1	1	1	1	7
Machinist	1	1	3	1	2	8
Tool and die maker	1	0	1	0	0	2
Supervisor	1	0	0	0	1	2
Welding technology/welder	1	0	0	0	2	3
Total	13	6	9	3	11	42
Percent of Total	31.0%	14.3%	21.4%	7.1%	26.2%	100.0%

Chart 1.

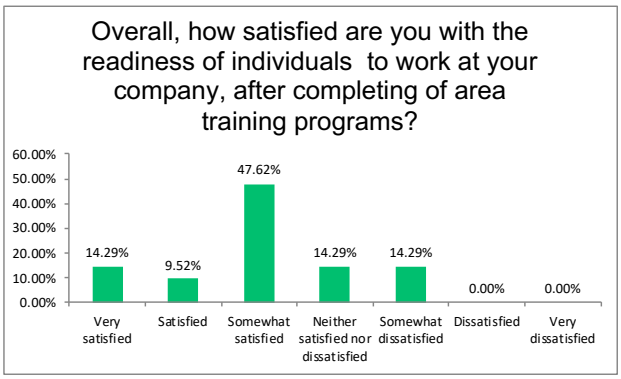


	Short term training (15 weeks or less)	Short term certificate training (30 weeks or less)	Longer term certificate training (1 year or more, non credit)	Credit training program (1 year or less)	Longer term credit training program (more than 1 year, including associate's degree)
Lack of understanding of how the work-world works	10	4	3	4	3
Not enough hands-on experience	9	8	5	5	7
Inadequate manufacturing-specifc technical skills	7	5	1	2	2
Inadequate basic skills (reading, math)	6	1	0	0	0

Respondents were also asked what kinds of challenges they encountered with individuals hired from area training programs, by type of program. See chart 1 above. Generally, there were more challenges with individuals coming from short term training. However, at least some manufacturers experienced all of these challenges across all types of training, and "not enough hands on experience" was reported as a pervasive challenge across types of training.

Respondents were asked “Overall, how satisfied are you with the readiness of individuals to work at your company, after completing an area training program”. See chart 2 below. 47.6% of the respondents reported they were “somewhat satisfied.”

Chart 2.



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Respondents were asked what other occupations would individuals hired from area training programs qualify for, given the occupation they were trained for. See Table 3. It is clear that in many cases manufacturers view training completers as having some general skills and knowledge that can be used as needed for different occupations, following additional on the job training.

Table 3.

	Computer controlled machine operator	Computer numerically controlled machine tool programmer	Machinist	Inspector	Tool and die maker	Supervisor	Welding technology / welder
Computer controlled machine tool operator		5	7	7	3	2	0
Computer numerically controlled machine tool programmer	9		5	6	4	4	0
Machinist	8	5		6	7	3	0
Inspector	3	0	3		0	2	0
Tool and die maker	3	5	7	6		3	1
Supervisor	4	4	4	5	3		1
Welding technology/welder	1	0	2	1	1	0	

Survey respondents were asked “Other than the occupations listed above, are there other occupations for which you would like to see area training?” Respondents cited the following occupations:

- Deburring
- Assembly
- Electricians
- Automation Specialist (Mechatronics) Advanced quality training for established quality employees.
- "Automation & Robotics
- CMM Programming
- MRP, Production Coordinator
- Mechatronics
- Mold making
- Sheet metal fabrication, NDT, resistance welding
- Electromechanical Technician
- Procurement and Supply Chain
- Coordinate Measuring Machine, CMM, Operation and Programing. Zeiss-Calypso software
- Maintenance Technology (including electrical and some electronics)
- Environment, health and safety
- Printing Press Operators and Bindery Operators

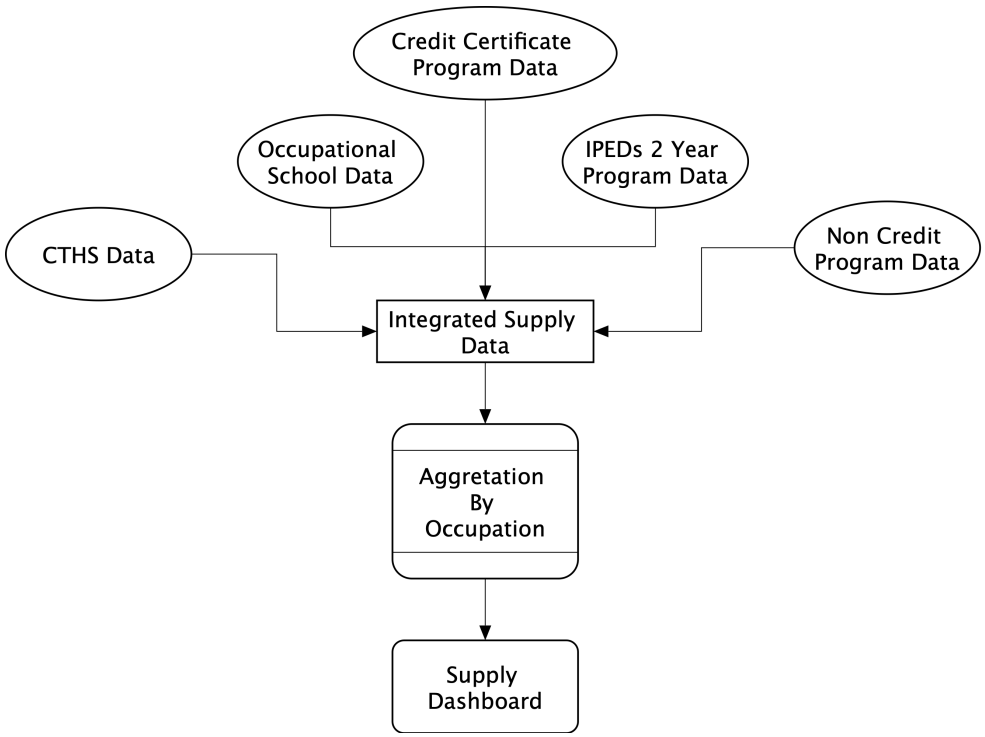
Respondents were also asked, “Do you have any other guidance regarding how manufacturing training programs can be improved to better meet your needs?” Their responses are below

- Involve experimental learning that involves OTJ experiences/work while training
- Programs need to focus on the fundamentals and include practical application of the course material to the real world. Critical thinking must be a part of this as well.
- The candidate has to complete aptitude test. Quality in means quality out.
- Smaller to mid-size companies like the one I work at are frustrated that we might hire more newly trained people, or invest in their training, and they leave for the higher pay at PWA.
- Training programs need to be made available to incumbent workers at various times of the day and on an ongoing basis. A target would be 3 hours per week per employee for all 50 weeks out of the year.
- Continued manufacturing company review and oversight with ACM organization
- More funding to support training
- Soft skill training is needed with basic work functions explained like punctuality.

- Need to market mfg. to Middle School students to get students thinking about careers in mfg. at an earlier age. That would help to get more young adults to enter training programs for manufacturing careers.

Integrating Supply Data

In order to obtain realistic estimates of the supply of potential workers for the different target occupations in this study, completer data had to be integrated from multiple sources. See Figure 6 below. These include community college credit certificate program data, occupational school data, IPEDS 2-year program data, and Connecticut Technical High School completer data. No good source of non-credit program data was identified.



These data were integrated, and aggregate estimates for each target occupation were developed. Unfortunately, because completers from manufacturing training programs could potential be hired for different occupations, it was difficult to allocate the program completers to the specific target occupations. We used a common-sense approach informed by our interviews with manufacturers, training providers, and survey data to inform this allocation process. Table 4 shows the supply estimates from category of training program, and the occupations to which they were allocated.

Table 4. Supply Estimates

	NORTH CENTRAL	OTHER	STATEWIDE	Allocated to
Certificates				
Welding	19		19	welding
CNC	173	81	254	CNC operation
Manufacturing Engineer Technology	22	3	25	CNC operation
Quality Control	0	12	12	quality control
Technical High Schools				
Automated Manufacturing	16	0	16	cnc programming
Precision machine technology	56	125	181	machine oepration
Welding	22	0	22	welding
Goodwin College				
Welding	66	0	66	welding
AS CNC Maching	16	0	16	CNC operation
AS Quality Management Systems	4	0	4	insection
Cert. Basic CNC Production	42	0	42	mahnine operator
Cert. CNC Machin. Metrlgy. Mfg.	70	0	70	cnc operation
Cert. CNC Machining	39	0	39	cnc operaton
Cert. Manufacturing and Logistic	1	0	1	machine operator
Cert. QJty Manufacturing Inspect	1	0	1	inspection
Occupational Schools				
Lincoln Tech	176	0	176	machine operation
EB Program				
Intro Manufacturing		145	145	machine operator
Machining		58	58	machinist
Welding		87	87	welding
Total	723	511	1234	

Sources: 2017-2018 CTHSS Completer data; 2017-2018 CT Community College Certificate Program Data; 2017-2018 IPEDS 2 Year program data; 2017-2018 Occupational School Data; targeted inquiries to Goodwin University and the EB program.

Table 5 below shows the supply estimates, by occupation, for both the North Central region and statewide. Since our focus was on the North Central region, our statewide estimates may be slight underestimates. However, most of our key data sources were comprehensive statewide data sources, so we believe the statewide estimates are fairly accurate. As can be seen, there are no completers for tool and die maker, or supervisor.

Table 5. Completers Cross-walked to Occupations

Occupations	NORTH CENTRAL	OTHER	STATEWIDE
Machine Operator	275	270	545
Machinist	22	61	83
CNC Machine Tool Operator	298	81	379
CNC Machine Tool Programmer	16	0	16
Welder	107	87	194
Inspector	5	12	17
Tool and Die Maker	0	0	0
Supervisor	0	0	0
Total	723	511	1234

Supply-Demand Dashboard

The following is a table comparing annual openings and postings with the annual pipeline (supply) for the target manufacturing occupations. The gap or surplus is also noted, both when the supply is compared with annual openings and when the supply is compared with annual postings. Appendix 4 shows a more elaborate dashboard embedding this information developed by Julie Geyer of Capital Workforce Partners.

Hartford County

Description	Annual Openings	Annual Postings	Annual Pipeline	(Gap)/Surplus - Pipeline less Openings	(Gap)/Surplus - Pipeline less Postings)
Inspectors	417	910	5	(412)	(905)
Machinists	390	815	22	(368)	(793)
Supervisors	289	1,509	0	(289)	(1,509)
Tool and Die Makers	73	59	0	(73)	(59)
CNC Machine Tool Programmers	30	168	16	(14)	(152)
Welders	76	173	107	31	(66)
Machine Tool Operators	381	210	573	192	363
Total Select Occupations	1,656	3,844	723	(933)	(3,121)

A primary goal of this study was to create a dashboard showing the above comparisons. These are the best comparisons that can be made using the data currently available. Replicating these comparisons on a regular basis is possible, but there are several important considerations:

- Completion data for most programs is available on annual, or at best semi-annual basis, except for shorter term training programs;
- The creation of these comparisons requires the mechanical integration of data from multiple sources; it is not as easy as downloading data from a single source and uploading it to a website, and requires considerable xxxxxxx;
- These comparisons are for select manufacturing occupations; a more comprehensive dashboard would require integrating data for many more occupations.
- The technical analytic difficulties experienced during this study persist; particularly the fact that completers from one kind of program can be seen as supply for multiple occupations. This is further complicated by our finding that most completers do not immediately enter their target occupation.
- These issues suggest that it would be difficult to comprehensive generate reports more often than perhaps twice a year, and this would require continued resources to fund an analyst to pay sustained attention to the data integration aspect of this work.

- It may be possible to create interim reports for certain occupations, where short term training programs might be generating additional supply on a more frequent basis.

Suggestions For Additional Research

An analysis of feedback from employers and training providers, combined with regional and statewide data, provides some answers to the questions about supply and demand for targeted manufacturing occupations in North-Central Connecticut. In addition to providing some answers, it also leads to additional questions. We have identified several suggestions for additional research to move from question to answer, and from research to policy development:

- Develop more robust model for allocating "completer plasma" to different occupational supply estimates
- Develop supply estimates for other important manufacturing occupations
- Gather data on new manufacturing hires—what positions they enter, what kinds of training they get once they are hired, and what positions they move to…
- Examine success of specific training models, alone and in combination with each other
- Examine the feasibility of a formal, coordinated internship program between the training/education system and regional employers

The approach taken in this study could also be readily applied to other industry sectors. While the characteristics of each sector obviously differ, the approach provides a robust way of gathering data about the sources of the supply for a particular sector as well as how the sector hires from those sources and how the initially use those hired. Specifically, utilizing the combination of quantitative and qualitative approaches, leads to a rich product with contextualized data that allows the consumer to better understand some of the nuanced types of information it includes. As this report demonstrates, the approach provides a practical, in-depth look at the pipeline for those selected occupations in a sector.

Policy Implications

We believe there are opportunities for policy and practice development to systemically address the gap between supply and demand. While the following concepts are not new, the data collected in the course of this study suggest a re-examination and re-emphasis on them as the manufacturing environment continues to rapidly evolve.

- Enhance bridging (technical) high school to (community) college transition strategies
- Explore enhancing customized job training for specific employers (both new hires and incumbent workers)
- Rethink outreach and marketing strategies for middle school and high school students, staff, and parents
- Increase development and investment in apprenticeship and internship programs; explore the relationship between internships and apprenticeships; consider shorter term, focused apprenticeships and pre-apprenticeships
- Increase depth of preparation in college, technical high school, and other training programs (longer duration, intensity, with focus on skills employers need)

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Appendix 1: Inventory

Inventory of North Central Providers: Training Programs for Targeted Occupations; Requiring Less Than Two Years of College

Provider	Programs	Machinists	Computer Controlled Machine (CCM) Tool Operators	Computer Numerically Controlled (CNC) Tool Programmers	Tool and Die Makers	Welders	Inspectors	Supervisors of Production Workers
Asnuntuck Community College	Additive Manufacturing; CAD/CAM Programming; CNC Computer Numerically Controlled (CNC) Machinist Technology/CNC Machinist; Machining; Mechatronics; Precision Sheet Metal Fabrication; Quality Inspection - Metrology; Welding; Welding Engineering Technology/Technician	✓		✓		✓	✓	
Bristol Technical High School	Mechatronics; Precision Machining; Welding; Metal Fabrication	✓				✓		
Goodwin Universitiy	Manufacturing Engineering Technology/Technician (2 programs)	✓		✓	✓			
Howell Cheney Technical High School	Mechanical Design and Engineering Technology; Precision Machining Technology; Welding and metal fabrication	✓				✓		
Lincoln Tech		✓				✓		
Manchester Community College	CAD/CAM Programming; CNC; Lean Manufacturing; Machining; Manufacturing Engineering Technology/Technician; Quality Inspection – Metrology; Tool and Die	✓		✓	✓		✓	
Middlesex Community College	Computer Numerically Controlled (CNC) Machinist Technology/CNC Machinist			✓				
Prince Technical High School	Automated Manufacturing Technology; Mechanical Design and Engineering Technology; Mechatronics; Precision Machining Technology; Welding and Metal Fabrication	✓						
Tunxis Community College	CNC; Machining; Mechatronics; Quality Inspection - Metrology	✓		✓	✓	✓	✓	

Appendix 2: Matrix of Employer Interviews

Summary of Employer Interviews

Technical Preparedness	Training programs provide mostly soft skills	Training programs provide mostly soft skills	Wide range of skills and preparedness coming out of the same training programs	Give feedback to the training providers on what they need and where the providers need to improve	Hire from all types/lengths of programs – programs useful for soft skills; sometimes more	Training programs provide mostly soft skills; we need people trained specifically on our equipment	Training programs provide mostly soft skills; individuals coming out of these programs think they are much more qualified than they are	Training programs provide mostly soft skills	Training programs provide mostly soft skills	Training programs provide mostly soft skills; individuals coming out of these programs think they are much more qualified than they are
Maturity of Younger Job Candidates	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed	Younger job candidates don't have enough experience working and working as part of teams	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed	Younger job candidates need to develop maturity to remain employed
Career Path to Targeted Occupations	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Hire everyone into entry level jobs, and train internally; if they bring more skills from outside training, they will move up faster	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Mostly hire for entry level jobs, and train employees who show they have the aptitude for more skilled jobs	Hire for entry level jobs – everyone starts in an entry level position - and train employees who show they have the aptitude for more skilled jobs	Usually hire from postings, and don't have trouble attracting qualified candidates. Will sometimes hire younger workers
Opportunities for Strengthening Training Programs		Specialized skills require focused on-the-job training	The training programs don't have the advanced machinery used by manufacturers, so they are limited in what they can train	The training programs don't have the advanced machinery used by manufacturers	Currently analyzing the training they provide to employees as OJT and online – things that are specific to, and required for, their company	Would like to do some specialized training, and would like to expand current relationships; doesn't want to share due to competitiveness in field; Train the trainer	Would like some specialized training for company; training trainers onsite would be helpful	Would like some specialized training for company; training trainers onsite would be helpful. Taking highly skilled people off the line to train takes away from productivity		
Importance of Supporting New Hires	Mentoring is really key	Mentoring is really key	Lack of transportation is an issue for some young employees	Really like hiring and developing new talent; really like to promote employees – long term employees benefit the company Try to be flexible and give new employees lots of chances to succeed	Require everyone bring three things to the job: on time ready to play; treat coworkers respectfully; seek opportunity to learn more, and when they know enough, teach others.	Mentoring is important; younger employees need to understand they have a lot to learn	Mentoring important	Mentoring is important; Younger employees coming out of training programs think they know everything, when they barely know the basics	Mentoring important	Everyone gets a mentor; rules and company culture are handled through the supervisory process
Value of Apprenticeship			Apprenticeship program is really useful	Heavily utilize apprenticeship program	Use apprenticeship program – especially for tool and die makers	Apprenticeship program useful	Apprenticeship program helpful	Apprenticeship program useful	Apprenticeship program useful	Limited use due to lack of company-sponsored training

Appendix 3: Matrix of Education-Training Provider Interviews

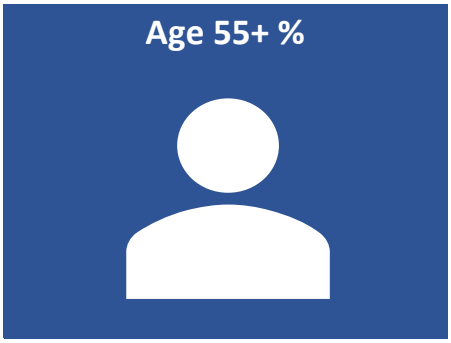
Training Provider Interviews

	College/University	College/University	Colllege/University	College/University	Technical H.S.	Technical H.S.
reparation:	Students entering in 11th grade complete high school and year at MTC with HS diploma, MTC certify., AS degree, and a job 1200-hour program	Based on Asnuntuck program; share faculty and equipment; building new Tunxis program	State of the art equipment; high percentage of completers and employment	CC programs do the basics – provide the ground floor of what everyone needs, and which forms the basis for other jobs. 3 8-week fulltime sessions condensed to get the same amount of credit as a 15-week program Completion rate over 90% b/c they use cohort model and test candidates before program. At least 50% need math remediation	Machinist program: Solid basic knowledge that allows for growth and development	Two programs: pr manufacturing; v 4-year program; s spend ⅓ time on a and ⅓ time in sho
ger Job		Some students can't handle math; some think they can do program and work full-time. students can have challenges with ability to follow-through on commitments	Adolescents act like adolescents	Maturity is an issue and kids need to be taught. Additionally, companies need some training about culture and understanding about the environments kids have just come out of	Maturity issues related to job readiness – biggest challenge is cellphone use	Employers interes students with soft
rgeted	90% of students have job before they graduate		Strong relationship with employers helps to ensure strong hiring rates	Biggest challenge is understanding what manufacturing really is. 95% of students have job before graduation	90+% of completers are hired after completion	Estimated 95% of complete prograr
Strengthening s	Will adjust program to meet employer's needs	Students receive training in programming, and have access to key programs, but not enough training to be considered programmers; working on streamlining electro-maintenance program from 3 to 2 semesters		Biggest challenge is finding teachers to expand the program. Many instructors are past retirement age – and it is hard to recruit young students with all older teacher Usually non-completers leave for a job b/c they need the job more than they need the education s. There is a perception of being smart versus going into manufacturing, which needs to be corrected	More modern equipment investment into program (feedback, equipment, dollars) from employers	Challenge in hirin instructors
pporting New	A good mentor is very important to ensure technical success and navigate company culture				Mentors assigned by employer during paid internship is key	Employers really i in students with s and they will train themselves – don students to have "unlearn" skills th differently
ips and n employers	Paid internships leading to jobs; Paid scholarships; ability to modify program based on employer needs		strong relationships with employers lead to strong internships that lead to jobs			

Appendix 4. Select Manufacturing Occupations Supply/Demand Dashboard

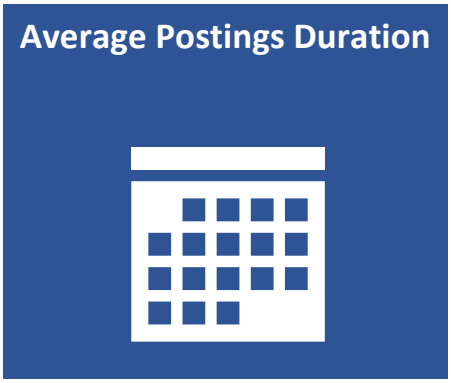
Connecticut Manufacturing

161,700



35.2%

$82,569



36 days

Sources: Emsi; CTDOL

Connecticut Supply/Demand

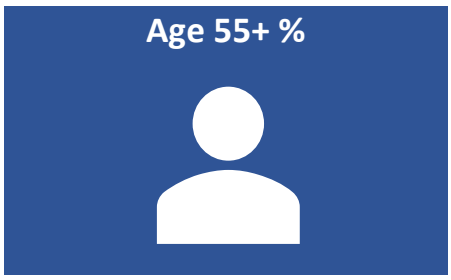
The table below shows the Demand for select Manufacturing occupations in Connecticut, the Pipeline to Supply that Demand, and the effective Gap.

Description	Annual Openings	Annual Postings	Annual Pipeline	(Gap)/Surplus - Pipeline less Openings	(Gap)/Surplus - Pipeline less Postings
Inspectors	1,195	2,399	17	(1,178)	(2,382)
Supervisors	883	4,342	0	(883)	(4,342)
Machinists	908	1,978	83	(825)	(1,895)
Tool and Die Makers	175	178	0	(175)	(178)
Welders	343	470	194	(149)	(276)
CNC Machine Tool Programmers	67	284	16	(51)	(268)
Machine Tool Operators	891	599	924	33	325
Total Select Occupations	4,462	10,250	1,234	(3,228)	(9,016)

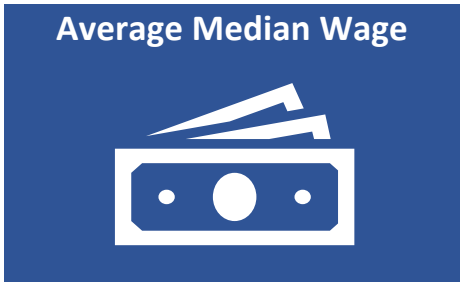
Sources: Emsi; Charter Oak Group Estimates

Hartford County Manufacturing

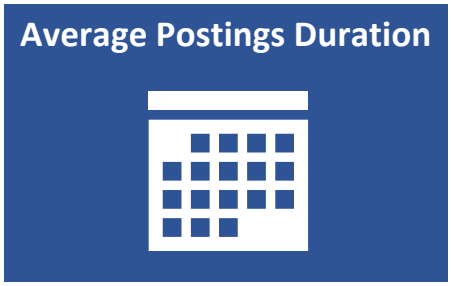
54,593



34.7%



$86,250



40 days

Sources: Emsi; CTDOL

Hartford County Supply/Demand

The table below shows the Demand for select Manufacturing occupations in Hartford County, the Pipeline to Supply that Demand, and the effective Gap.

- Manufacturers are actively seeking manufacturing employees to fill demand by major employers, e.g., Pratt and Whitney's F35 contract for $5.7 billion, Collins Aerospace $320 million NASA contract, as well as original equipment manufacturers (OEMs) who make up the supply chain.
- Individuals hired from regional training programs have baseline knowledge and are hired as entry level; it takes three to four years to be fully trained, e.g., Tool and Die Maker, Machinist.
- Manufacturing equipment is expensive and changing rapidly; regional training providers do not have capital to maintain most current equipment.

Hartford County Demand/Supply

Description	Annual Openings	Annual Postings	Annual Pipeline	(Gap)/Surplus - Pipeline less Openings	(Gap)/Surplus - Pipeline less Postings)
Inspectors	417	910	5	(412)	(905)
Machinists	390	815	22	(368)	(793)
Supervisors	289	1,509	0	(289)	(1,509)
Tool and Die Makers	73	59	0	(73)	(59)
CNC Machine Tool Programmers	30	168	16	(14)	(152)
Welders	76	173	107	31	(66)
Machine Tool Operators	381	210	573	192	363
Total Select Occupations	1,656	3,844	723	(933)	(3,121)

Sources: Emsi; Charter Oak Group Estimates

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