



Skills Gap Analysis & Sector Strategies

*Commissioned by Workforce Central on behalf of
the Pierce County Workforce Development Council*

September 2016



EXECUTIVE SUMMARY

Background and Purpose

WorkForce Central (WFC) and the Pierce County Workforce Development Council (WDC) work closely together to support a strong economy by leading and overseeing our region's comprehensive workforce development system that prepares job seekers and workers with 21st century knowledge and skills required by businesses. WFC and WDC partner with leaders from the business community, philanthropic organizations, organized labor, education, government, community based organizations and other key stakeholders to shape and support workforce solutions.

Commissioned by WFC on behalf of the WDC, this study compares projected demand for specific occupations against labor supply to identify potential workforce gaps. This skills gap and sector strategy analysis, combined with feedback from industry stakeholders, will be used to plan for the changing needs of the industry and inform workforce preparation strategies. In addition, this study may be used to influence policy and investment decisions throughout and beyond the workforce development system.

Since 2010, Community Attributes Inc. (CAI) has produced multiple talent pipeline studies that examine various sectors. The studies compare projected demand for specific occupations against labor supply to identify potential workforce gaps.

Methods

Talent pipeline analysis draws from data published by the Washington State Employment Security Department (ESD), the Bureau of Labor Statistics (BLS) and the National Center for Education Statistics (NCES).

In addition to the talent pipeline analysis, in-depth interviews conducted with stakeholders in the advanced manufacturing industry inform findings. Interviews covered topics of hiring, recruiting, education and training as well as skills needs. Stakeholders interviewed included representatives from a variety of advanced manufacturing employers who provided a range of perspectives on the advanced manufacturing industry and “on-the-ground” realities.

Key Findings

Pierce County is one county in a four-county region with a thriving manufacturing industry, in particular advanced manufacturing, which includes aerospace, computer equipment and ship and boat building. **As a whole the manufacturing industry in Pierce County is projected to**

experience moderate annual growth of 0.8 percent between 2013 and 2023.

The advanced manufacturing industry in Pierce County provides employment in occupations that provide career pathways that do not require a bachelor's degree or higher for entry, and also pay average wages higher than the regional average. Across the Seattle-Tacoma-Bellevue MSA the average wage is \$57,370, in comparison **the average wage among advanced manufacturing occupations is almost \$63,000 annually.**

The **Talent Pipeline Dashboard** (*page vii*) shows occupations in the advanced manufacturing industry grouped by education level required for entry ranked by average annual openings within the industry from 2018 to 2023. The minimum education required for entry is defined by the Bureau of Labor Statistics and is not meant to indicate the education requirement defined by individual employers. In some cases, the actual education required by regional employers may be higher than the minimum education level category, and existing workers may have less education than shown. Supply is composed of two elements: the entry of new graduates into the workforce and the existing talent pool of qualified unemployment insurance (UI) claimants actively seeking employment.

Some overall findings include the following:

- Total demand among advanced manufacturing occupations is projected to be 125 openings annually. Overall supply among these same occupations is projected to be 351 local candidates, of which almost 77 percent are unemployment insurance claimants whose previous occupation is a core advanced manufacturing occupation.
- The largest projected surplus is among production worker helpers due to a strong supply of UI claimants. The largest shortages are among ophthalmic laboratory technicians and industrial engineers, neither of which have supply of local candidates. Electrical and electronics equipment assemblers are projected to have the strongest growth rate between 2018 and 2023, at 2.7 percent annually.
- Across the advanced manufacturing industry there are challenges in finding qualified candidates. Although there are plenty of applicants for open positions, there is a high dropout rate among these applicants. Basic math and soft skills seem to be the biggest problem in finding qualified candidates.

- Competitive wage rates are also a challenge for employers within an industry that has union employers competing with non-union employers.
- The number of women working in advanced manufacturing is increasing. As employers look for qualified talent, women are becoming an increasingly important potential talent resource. Unfortunately, it can be challenging to recruit women.
- Stakeholders reported that JBLM provides employers with access to both qualified transitioning military and military families seeking work.
- Overall, stakeholders agreed that online labor exchange sites are difficult to work with and do not provide the services for which they are looking.
- Stakeholders noted that the best recruiting workforce programs help applicants understand the job, provide training in soft skills, GED courses or ESL training, and have a strong understanding of industry and employer needs.
- Regional vocational schools have strong programs and graduates; however, due to the skills crossover between manufacturing, construction and other skilled trades there is competition for some of these graduates. According to advanced manufacturing industry stakeholders the trades often pay higher wages than manufacturing and thus are more successful in recruiting regional graduates.
- Universities and colleges throughout the region produce graduates qualified to work in manufacturing. Some manufacturing employers could use help establishing and/or improving relationships with these colleges to improve recruiting results.
- Stakeholders indicated that they would be willing to train employees internally, and often do. However, this causes problems with finding qualified candidates for positions vacated by incumbent workers.

Some initial recommendations include the following:

- Develop systems and partnerships to identify UI claimants seeking re-employment in advanced manufacturing occupations and assess their basic and soft skills. If necessary, offer them additional basic and/or soft skills training.

- Expand opportunities for women to gain training and experience in manufacturing jobs through partnerships with AJAC and other relevant stakeholders.
- Regional job fairs can be good options for recruitment. High school job fairs are a good option to get in front of high school students, and it is not unheard of that family members of students will become interested in manufacturing opportunities through these events.
- Develop opportunities for advanced manufacturing employers and administrators from local colleges to build and/or improve relationships, identify common needs and work together.
- Identify employers that train employees internally and provide them enhanced business services to ensure a ready supply of entry-level workers.

Pierce County Advanced Manufacturing Talent Pipeline

On-the-Job Training

Annual Average Demand and Supply All Occupations by Education		Occupation	Employment		CAGR	Annual Demand and Supply, 2018-2023		
		Ranked by Annual Openings (2018-2023)	2013	2023	2013-2023	Scale: 0 - 39 annual openings in sector		
<p>79 Demand, 224 Supply (189 UI Claims, 35 Graduates)</p>	1	Machinists	649	677	0.4%	Demand 11	Supply 27	16
	2	Inspectors, Testers, Sorters, Samplers, and Weighers	783	849	0.8%	Demand 9	Supply 13	3
	3	Industrial Machinery Mechanics	798	983	2.1%	Demand 7	Supply 2	(5)
	4	Ophthalmic Laboratory Technicians	112	124	1.0%	Demand 6	Supply 0	(6)
	5	Petroleum Pump System Operators, Refinery Operators, and Gaugers	89	99	1.1%	Demand 5	Supply 0	(5)
	6	Structural Metal Fabricators and Fitters	170	209	2.1%	Demand 4	Supply 2	(2)
	7	Team Assemblers	705	805	1.3%	Demand 4	Supply 0	(4)
	8	Computer-Controlled Machine Tool Operators, Metal and Plastic	300	261	-1.4%	Demand 4	Supply 21	16
	9	Welders, Cutters, Solderers, and Brazers	391	456	1.5%	Demand 4	Supply 28	24
	10	Grinding and Polishing Workers, Hand	159	149	-0.6%	Demand 3	Supply 5	2
	11	Dental Laboratory Technicians	64	69	0.8%	Demand 3	Supply 4	2
	12	Production, Planning, and Expediting Clerks	491	596	2.0%	Demand 3	Supply 4	1
	13	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	443	395	-1.1%	Demand 2	Supply 6	4
	14	Helpers--Production Workers	510	572	1.2%	Demand 2	Supply 33	31
	15	Assemblers and Fabricators, All Other	317	396	2.3%	Demand 2	Supply 6	5
	16	Purchasing Agents, Except Wholesale, Retail, and Farm Products	485	544	1.2%	Demand 2	Supply 1	(1)
	17	Production Workers, All Other	313	350	1.1%	Demand 2	Supply 7	6

Associate Degree or Postsecondary Award

Annual Average Demand and Supply All Occupations by Education		Occupation	Employment		CAGR	Annual Demand and Supply, 2018-2023		
		Ranked by Annual Openings (2018-2023)	2013	2023	2013-2023	Scale: 0 - 17 annual openings in sector		
<p>9 Demand, 33 Supply (27 UI Claims, 5 Graduates)</p>	1	First-Line Supervisors of Production and Operating Workers	982	1,080	1.0%	Demand 5	Supply 14	9
	2	Electrical and Electronics Engineering Technicians	202	209	0.3%	Demand 2	Supply 8	6
	3	Mechanical Drafters	117	139	1.7%	Demand 1	Supply 0	(1)
	4	Electric Motor, Power Tool, and Related Repairers	84	82	-0.2%	Demand 0	Supply 2	2

Bachelor's Degree

Annual Average Demand and Supply All Occupations by Education		Occupation	Employment		CAGR	Annual Demand and Supply, 2018-2023		
		Ranked by Annual Openings (2018-2023)	2013	2023	2013-2023	Scale: 0 - 16 annual openings in sector		
<p>36 Demand, 59 Supply (34 Graduates, 25 UI Claims)</p>	1	Computer Hardware Engineers	161	153	-0.5%	Demand 6	Supply 4	(2)
	2	Industrial Engineers	232	241	0.4%	Demand 6	Supply 0	(6)
	3	Mechanical Engineers	227	251	1.0%	Demand 6	Supply 5	(0)
	4	Software Developers, Systems Software	204	219	0.7%	Demand 3	Supply 2	(1)
	5	Architectural and Engineering Managers	215	253	1.6%	Demand 3	Supply 1	(2)
	6	Computer and Information Systems Managers	294	356	1.9%	Demand 2	Supply 13	12
	7	Electronics Engineers, Except Computer	72	77	0.7%	Demand 2	Supply 0	(1)
	8	Logisticians	476	476	0.0%	Demand 2	Supply 3	1
	9	Industrial Production Managers	210	227	0.8%	Demand 2	Supply 11	10

Sources: Washington State Employment Security Department, 2014; Bureau of Labor Statistics, 2016; National Center for Education Statistics, 2016; Community Attributes Inc., 2016.

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INTRODUCTION

Background and Purpose

Pierce County as one of four counties in the Puget Sound Region is a part of a region with a strong advanced manufacturing industry. Boeing is the largest employer within the industry and a wide network of advanced manufacturers supporting the activities of the aerospace industry. Additionally, compared to the state, Pierce County has a particularly high concentration of petroleum and coal products manufacturing.

Advanced manufacturing is not only an important industry throughout the region, it also provides employment for occupations that offer positive career pathways that do not require a four-year degree or more. The average wage for the advanced manufacturing industry in the Seattle-Tacoma-Bellevue MSA is higher than the overall regional average wage. Among occupations that require an associate degree or less for entry, 13 have median wages greater than \$50,000 annually, and 24 occupations have wages in the 90th percentile greater than \$50,000 annually. Occupations that have wages greater than \$50,000 annually and are expected to experience shortages in local talent include: industrial machinery mechanics; petroleum pump system operators, refinery operators, and gaugers; purchasing agents, except wholesale, retail and farm products; and mechanical drafters.

As one of Pierce County's and the region's core industries, a strong understanding of the demand, supply and employer perceptions will allow WFC and industry leaders to help address the workforce challenges of the future. Workforce professional, educators and employers can use this information to help ensure Pierce County's workforce programs are providing the appropriate mix of training opportunities to meet the needs of the advanced manufacturing industry.

Methods

WorkForce Central serves employers and workers within Pierce County, representing ten percent of Washington's total employment. CAI's analysis relies on data published by the state of Washington and federal agencies. Specifically, the following data sources form the foundation of the modeling:

- **Occupational estimates and forecasts from the Washington State Employment Security Department (ESD) and the Bureau of Labor Statistics.** This data provides current estimates and forecasted demand for occupations in Pierce County and associated educational requirements, as well as occupational wages. Occupational forecasts include openings created by retirements and separations, in addition to openings generated by newly

created positions. For this reason, average annual openings are larger than the average of net jobs created over a period of time.

- **Washington unemployment insurance claims.** This data, also published by ESD, provides monthly unemployment claims and the previous occupations of the claimant by occupation code.
- **Educational attainment data from the National Center for Education Statistics' Integrated Postsecondary Education System (IPEDS).** IPEDS provides the number of graduates by educational program for Pierce County's higher education institutions, defined according to the Classification of Instructional Programs, as well as a table of equivalence used to match educational programs to occupations.

Subsequent sections explain the details and limits of this data. In general, this data provides measures of demand and supply by occupation across industries for a geographic region (i.e., Pierce County). The occupations are defined in accordance with the Bureau of Labor Statistics Standard Occupational Classification system and industries are delineated using definitions from the North American Industry Classification System.

To help provide context to the data, and capture rapidly evolving factors affecting employment patterns, in-depth interviews were also conducted as a part of this detailed advanced manufacturing talent pipeline analysis. Interviews were conducted with key stakeholders within the advanced manufacturing industry, ranging from food product manufacturers to concrete product manufacturers and more. These interviews were open-ended discussions and provided qualitative perspectives on workforce issues impacting the advanced manufacturing industry.

Organization of Report

- **Advanced Manufacturing Industry Overview.** Provides an overview of the advanced manufacturing industry and the occupations that define the industry.
- **Demand Analysis.** Describes the composition of advanced manufacturing occupational demand in Pierce County.
- **Supply Analysis.** Breaks out the two elements of talent supply: new graduates entering the workforce and the existing pool of unemployment insurance claimants.
- **Supply and Demand.** Examines how local supply is expected to meet occupational demand in Pierce County.
- **Summary of Key Findings and Recommendations.** Assesses in detail the results of the talent pipeline analysis and interview findings, focusing on key implications for Pierce County.

ADVANCED MANUFACTURING INDUSTRY OVERVIEW

Assessing occupational gaps in an industry relies on a strict operational definition of which occupations compose that industry. Some occupations are present in nearly every industry and do not characterize what makes that industry specifically. Many administrative roles, for example, fit into this category. The first step in determining the core occupations that represent the primary set of skills within Pierce County’s advanced manufacturing industry is developing an operable definition of the industry. The North American Industry Classification System (NAICS) groups industries in increasingly specific segments from the two-digit to the six-digit level. Advanced manufacturing is defined by a selection of four-digit NAICS that fall within the two-digit 31-33 manufacturing NAICS. The selection of NAICS that define the advanced manufacturing industry was based on a detailed literature review of advanced manufacturing industry definitions.

Exhibit 1. Pierce County Advanced Manufacturing Selected NAICS by Employment, 2013¹

Four Digit NAICS	Description	Employment, 2013
3364	Aerospace	2,910
3341	Computer and peripheral equipment mfg.	820
3241	Petroleum & Coal Prod.	570
3399	Other miscellaneous manufacturing	420
3366	Ship and boat building	370
3391	Medical equipment and supplies manufacturing	320
3335	Metalworking machinery manufacturing	290
3332	Industrial machinery manufacturing	170
3331	Ag., construction, and mining machinery mfg.	130
3363	Motor vehicle parts manufacturing	80
3345	Electronic instrument manufacturing	80
3279	Other nonmetallic mineral products	80
3251	Basic chemical manufacturing	70
3256	Soap, cleaning compound, and toiletry mfg.	50
Advanced Manufacturing Industry Total		6,360

Sources: U.S. Bureau of Labor Statistics, 2016; Washington State Employment Security Department, 2016; Community Attributes Inc., 2016.

Pierce County’s advanced manufacturing industry employs more than 6,360 people. Aerospace manufacturing is the largest segment within the

¹ The data in this analysis represents a base year of 2013. Although some employment datasets now have data available for 2014 and 2015, base year 2013 is used throughout this report for consistency. The occupational projections that are the source for the occupational employment and demand analysis are developed by the Washington State Employment Security Department and are updated annually. However, the projections lag available employment data by a year, and at the time of this analysis the projections had not yet been updated to reflect 2014 base year projections.

overall industry, employing 46 percent of advanced manufacturing workers. The next largest segment, computer and peripheral equipment manufacturers, represents more than ten percent of total industry employment. (**Exhibit 1**)

Another method for defining the advanced manufacturing industry is to identify the core occupations that represent the primary skills within the industry. **Exhibits 2** and **3** lay out the core occupations that define Pierce County's advanced manufacturing industry. The process of assembling this list began with examining the structure of the occupation codes with employment within the advanced manufacturing industry. The Bureau of Labor Statistics defines occupations using the Standard Occupation Code system (SOC). These occupations have a two-digit prefix, grouping occupations of similar types, followed by a more detailed four-digit code, identifying each individual occupation. Occupations matching advanced manufacturing are first grouped by their concentration within the advanced manufacturing industry.

Occupations with fewer than 15 employees in the advanced manufacturing industry, or less than ten percent of employment concentrated within the industry, are excluded from the analysis as they are not considered core jobs within the industry. The core occupations identified represent only a portion of total employment within the advanced manufacturing industry. However, these occupations are highlighted in **Exhibits 2** and **3** because their level of employment and concentration in the industry indicate that these occupations represent the primary occupations that define employment within this industry. Overall employment within the advanced manufacturing industry includes employment in other occupations that are not core to the industry. Additionally, core advanced manufacturing occupations are also present in other industries throughout Pierce County.

Exhibit 2. Production Occupations and Architecture and Engineering Occupations, Employment in Industry and Total Employment, Pierce County, 2013

SOC	Occupation	Employment in Industry ↓	Employment in Other Industries	Total Employment	Share in Industry
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	443	0	443	100%
51-4041	Machinists	393	256	649	61%
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	309	474	783	39%
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	248	52	300	83%
51-1011	First-Line Supervisors of Production and Operating Workers	230	752	982	23%
51-2092	Team Assemblers	174	531	705	25%
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	123	163	286	43%
51-9022	Grinding and Polishing Workers, Hand	119	40	159	75%
51-9083	Ophthalmic Laboratory Technicians	112	0	112	100%
51-4121	Welders, Cutters, Solderers, and Brazers	103	288	391	26%
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	84	5	89	95%
51-9198	Helpers--Production Workers	74	436	510	14%
51-4111	Tool and Die Makers	73	11	84	86%
51-2041	Structural Metal Fabricators and Fitters	69	101	170	41%
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	65	6	71	92%
51-9081	Dental Laboratory Technicians	55	9	64	86%
51-2099	Assemblers and Fabricators, All Other	46	271	317	14%
51-4192	Layout Workers, Metal and Plastic	41	7	48	85%
51-9122	Painters, Transportation Equipment	38	50	88	43%
51-9199	Production Workers, All Other	37	276	313	12%
51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	27	103	130	21%
51-2022	Electrical and Electronic Equipment Assemblers	26	72	98	27%
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	25	9	34	74%
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	18	28	46	40%
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	18	5	23	78%
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	16	0	16	100%
	Production Occupations Subtotal	2,966	3,945	6,911	43%
17-2112	Industrial Engineers	164	68	232	70%
17-2061	Computer Hardware Engineers	156	5	161	97%
17-2141	Mechanical Engineers	116	111	227	51%
17-3023	Electrical and Electronics Engineering Technicians	69	133	202	34%
17-3026	Industrial Engineering Technicians	46	6	52	89%
17-2072	Electronics Engineers, Except Computer	43	29	72	60%
17-2011	Aerospace Engineers	39	39	78	50%
17-3013	Mechanical Drafters	31	86	117	27%
17-2041	Chemical Engineers	25	22	47	53%
17-2199	Engineers, All Other	24	140	164	14%
17-2131	Materials Engineers	18	4	22	82%
	Architecture and Engineering Occupations Subtotal	732	642	1,374	53%

Sources: Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Production occupations represent more than 56 percent of total employment in core advanced manufacturing occupations. Overall, 36 percent of employment in core advanced manufacturing occupations is concentrated within the industry. This indicates that the occupations that

compose the advanced manufacturing industry have a high degree of crossover with other industries in Pierce County. However, several occupations are found only within the advanced manufacturing sector. These include aircraft structure, surfaces, rigging and systems assemblers; and ophthalmic laboratory technicians. (**Exhibits 2 and 3**)

Exhibit 3. All Other Advanced Manufacturing Occupations, Employment in Industry and Total Employment, Pierce County, 2013

SOC	Occupation	Employment in Industry ↓	Employment in Other Industries	Total Employment	Share in Industry
11-3051	Industrial Production Managers	66	144	210	31%
11-9041	Architectural and Engineering Managers	51	164	215	24%
11-3021	Computer and Information Systems Managers	42	252	294	14%
11-3121	Human Resources Managers	22	160	182	12%
	Management Occupations Subtotal	181	720	901	20%
49-9041	Industrial Machinery Mechanics	126	672	798	16%
49-2092	Electric Motor, Power Tool, and Related Repairers	32	52	84	39%
	Installation, Maintenance, and Repair Occupations Subtotal	159	723	882	18%
13-1081	Logisticians	95	381	476	20%
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	52	433	485	11%
	Business and Financial Operations Occupations Subtotal	148	813	961	15%
15-1133	Software Developers, Systems Software	106	98	204	52%
15-1143	Computer Network Architects	16	73	89	18%
	Computer and Mathematical Occupations Subtotal	122	171	293	42%
43-5061	Production, Planning, and Expediting Clerks	57	434	491	12%
41-9031	Sales Engineers	28	34	62	45%
53-7021	Crane and Tower Operators	26	219	245	11%
29-2091	Orthotists and Prosthetists	22	26	48	45%
47-2071	Paving, Surfacing, and Tamping Equipment Operators	16	66	82	20%
	All Occupations	4,456	7,794	12,250	36%

Sources: Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Beyond production occupations the advanced manufacturing industry requires talent from several other occupational categories, including: management; installation, maintenance and repair; business and financial operations; and computer and mathematical. In total 12,250 people work in core advanced manufacturing occupations. Of these, 4,456 work within the advanced manufacturing industry. (**Exhibit 3**)

Exhibit 4. Advanced Manufacturing Occupations Median Wage and 90th Percentile Wage, On-the-Job Training, Seattle-Tacoma-Bellevue MSA, 2014

SOC	Occupation	Employment in Industry	Median Wage ↓	90 th Percentile Wage
On-the-Job Training				
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	18	\$88,550	\$120,910
53-7021	Crane and Tower Operators	26	\$78,690	\$96,030
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	52	\$70,570	\$107,850
51-4192	Layout Workers, Metal and Plastic	41	\$59,860	\$93,520
49-9041	Industrial Machinery Mechanics	126	\$58,180	\$91,570
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	84	\$57,660	\$72,520
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	309	\$53,470	\$91,200
47-2071	Paving, Surfacing, and Tamping Equipment Operators	16	\$52,360	\$78,590
51-9122	Painters, Transportation Equipment	38	\$51,310	\$91,510
43-5061	Production, Planning, and Expediting Clerks	57	\$47,710	\$75,280
51-4041	Machinists	393	\$46,950	\$79,550
51-4121	Welders, Cutters, Solderers, and Brazers	103	\$45,820	\$66,020
51-9081	Dental Laboratory Technicians	55	\$44,240	\$58,730
51-2041	Structural Metal Fabricators and Fitters	69	\$38,030	\$58,900
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	123	\$36,510	\$71,130
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	18	\$35,780	\$59,630
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	65	\$34,250	\$57,520
51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	27	\$33,630	\$47,140
51-2022	Electrical and Electronic Equipment Assemblers	26	\$33,570	\$48,430
51-9083	Ophthalmic Laboratory Technicians	112	\$32,880	\$46,580
51-2092	Team Assemblers	174	\$31,270	\$49,090
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	16	\$30,720	\$51,960
51-9022	Grinding and Polishing Workers, Hand	119	\$30,050	\$52,940
51-2099	Assemblers and Fabricators, All Other	46	\$28,360	\$50,270
51-9198	Helpers--Production Workers	74	\$25,560	\$38,630
51-9199	Production Workers, All Other	37	\$23,510	\$46,390
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	443	*	*
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	248	*	*
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	25	*	*
51-4111	Tool and Die Makers	73	*	*

* indicates data is suppressed by the U.S. Bureau of Labor Statistics in order to comply with nondisclosure rules.

Due to data limitations median and 90th percentile wages are those for the matching occupation in the Seattle-Tacoma-Bellevue MSA, and are used as a proxy for Pierce County wages given data limitations for wages in Pierce County alone.

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

On-the-job training, associate degree or postsecondary award and bachelor's degree are categories used to break core occupations into key groupings. These categories are based on Bureau of Labor Statistics minimum education required for entry. These education levels are set at a

national level and may not be fully reflective of the hiring practices in Pierce County, or within individual companies. Additionally, actual openings for these occupations may have different requirements and the talent pool for these occupations may have different levels of education than indicated by the minimum educational level. These minimum education levels are used to group occupations by the relative level of training and education required for entry.

Of the 52 core advanced manufacturing occupations, 30 require a minimum of on-the-job training for entry. Among these occupations where data is not suppressed, median wages range between \$23,510 and \$88,550 annually. Within these same occupations, nine earn median wages greater than \$50,000 annually. Additionally, 12 occupations in the on-the-job training category have wages greater than \$70,000 annually at the 90th percentile, or the wage among the top ten percent of earners within each occupation. (Exhibit 4)

Exhibit 5. Advanced Manufacturing Occupations Median Wage and 90th Percentile Wage, Associate Degree or Postsecondary Award or Higher, Seattle-Tacoma-Bellevue MSA, 2014

SOC	Occupation	Employment in Industry	Median Wage ↓	90th Percentile Wage
Associate degree or Postsecondary Award				
17-3013	Mechanical Drafters	31	\$76,170	\$106,480
51-1011	First-Line Supervisors of Production and Operating Workers	230	\$68,680	\$109,690
17-3023	Electrical and Electronics Engineering Technicians	69	\$63,630	\$89,830
49-2092	Electric Motor, Power Tool, and Related Repairers	32	\$61,660	\$92,240
17-3026	Industrial Engineering Technicians	46 *	*	*
Bachelor's degree				
11-9041	Architectural and Engineering Managers	51	\$143,070	*
11-3021	Computer and Information Systems Managers	42	\$142,920	*
15-1133	Software Developers, Systems Software	106	\$115,330	\$155,970
11-3121	Human Resources Managers	22	\$114,170	\$177,710
15-1143	Computer Network Architects	16	\$113,780	\$153,570
17-2072	Electronics Engineers, Except Computer	43	\$108,100	\$152,250
11-3051	Industrial Production Managers	66	\$107,100	\$164,580
17-2061	Computer Hardware Engineers	156	\$104,630	\$166,730
17-2141	Mechanical Engineers	116	\$91,350	\$140,870
17-2041	Chemical Engineers	25	\$90,510	\$135,140
17-2199	Engineers, All Other	24	\$83,540	\$140,380
17-2011	Aerospace Engineers	39 *	*	*
17-2112	Industrial Engineers	164 *	*	*
13-1081	Logisticians	95 *	*	*
17-2131	Materials Engineers	18 *	*	*
41-9031	Sales Engineers	28 *	*	*
Master's degree or higher				
29-2091	Orthotists and Prosthetists	22	\$59,800	\$97,860

* indicates data is suppressed by the U.S. Bureau of Labor Statistics in order to comply with nondisclosure rules.

Due to data limitations median and 90th percentile wages are those for the matching occupation in the Seattle-Tacoma-Bellevue MSA, and are used as a proxy for Pierce County wages given data limitations for wages in Pierce County alone.

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Median wages among occupations that require an associate degree or postsecondary award and higher range between \$61,660 and \$143,070 annually, for those occupations with data that is not suppressed. Among occupations requiring an associate degree or postsecondary award 230 workers are employed as first-line supervisors of production and operating workers, which have a median wage of more than \$68,000 annually, and at the top ten percent of wages workers earn almost \$110,000 annually. (Exhibit 5)

Exhibit 6. Comparative Average Wages, Pierce County and Seattle-Tacoma-Bellevue MSA, 2014

	Employment	Average Wage
Pierce County Advanced Manufacturing Industry		
On-the-Job Training Occupations	3,014	\$47,207
Associate Degree or Postsecondary Award Occupations	410	\$69,313
Bachelor's Degree Occupations	1,011	\$111,455
Master's Degree or Higher Occupations	22	\$65,560
Advanced Manufacturing Industry Total	4,456	\$62,853
Seattle-Tacoma-Bellevue MSA	1,761,920	\$57,370

Due to data limitations average wages are those for the matching occupation in the Seattle-Tacoma-Bellevue MSA, and are used as a proxy for Pierce County wages given data limitations for wages in Pierce County alone.

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

The overall average wage among advanced manufacturing occupations in the Seattle-Tacoma-Bellevue MSA is more than \$62,800, compared to an average wage across the Seattle-Tacoma-Bellevue metropolitan statistical area of \$57,370 annually. Occupations requiring a bachelor’s degree have the highest wage levels in the industry at more than \$111,000 annually. However, occupations that require an associate degree or postsecondary award earn average wages greater than the regional average wage. (Exhibit 6)

Exhibit 7. Advanced Manufacturing Occupational Employment in Other Industries by Industry, 2013

Industry	Advanced Manufacturing Occupation Employment in Industry
Federal government	716
Plastics product manufacturing	499
Employment Services	431
Support activities for water transportation	402
Local government other	353
Architectural and structural metals mfg	315
Cement and concrete product manufacturing	313
Machine shops and threaded product mfg	262
Architectural and engineering services	222
Warehousing and storage	200
Commercial machinery repair and maintenance	145
Sawmills and wood preservation	137
Sugar and confectionery product manufacturing	135
Office furniture and fixtures manufacturing	133
Misc durable goods merchant wholesalers	129
Lumber and const supply merchant wholesalers	127
State government other	103
Building equipment contractors	100
All Other Industries	3,076
Total	7,798

Sources: Washington State Employment Security Department, 2015; Community Attributes Inc., 2016.

Almost 8,000 workers employed in core advanced manufacturing occupations are employed in industries other than advanced manufacturing. Many of these are manufacturing industries that are not classified as “advanced” manufacturing. A total of 18 industries employ 100 or more workers in advanced manufacturing occupations. These industries illustrate which industries have a high degree of crossover in the skills demanded by advanced manufacturing occupations. Chief among these other industries is the federal government, followed by plastics product manufacturing. (**Exhibit 7**)

Exhibit 8. Advanced Manufacturing Occupation Employment in Other Industries by Occupation, 2013

Occupation	Employment in Other Industries	Top Other Industry
First-Line Supervisors of Production and Operating Workers	752	Grocery stores
Industrial Machinery Mechanics	672	Support activities for water transportation
Team Assemblers	531	Specialized freight trucking
Inspectors, Testers, Sorters, Samplers, and Weighers	474	Federal Government
Helpers--Production Workers	436	Employment Services
Production, Planning, and Expediting Clerks	434	General medical and surgical hospitals
Purchasing Agents, Except Wholesale, Retail, and Farm Products	433	Federal Government
Logisticians	381	Federal Government
Welders, Cutters, Solderers, and Brazers	288	Other specialty trade contractors
Production Workers, All Other	276	Warehousing and storage
Assemblers and Fabricators, All Other	271	Building finishing contractors
Machinists	256	Machine shops and threaded product mfg.
Computer and Information Systems Managers	252	Computer systems design and related services
Crane and Tower Operators	219	Support activities for water transportation
Architectural and Engineering Managers	164	State Government Other
Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	163	Plastics product manufacturing
Human Resources Managers	160	Local Government Other
Industrial Production Managers	144	Architectural and structural metals mfg.
Engineers, All Other	140	Federal Government
Electrical and Electronics Engineering Technicians	133	Federal Government
Mechanical Engineers	111	Computer and peripheral equipment mfg.
Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	103	Household and institutional furniture mfg.
Structural Metal Fabricators and Fitters	101	Machine shops and threaded product mfg.
All Other Occupations	901	
Total	7,794	

Sources: Washington State Employment Security Department, 2015; Community Attributes Inc., 2016.

Among the 52 advanced manufacturing occupations, 23 have more than 100 workers employed in industries other than advanced manufacturing. First-line supervisors of production and operating workers have the largest number of workers employed outside of the advanced manufacturing industries, and represent ten percent of total employment of advanced manufacturing occupations outside of the advanced manufacturing industry. The grocery store industry is the top industry employing first-line supervisors of production and operating workers other than the advanced manufacturing industry. **(Exhibit 8)**

Advanced manufacturing occupations have relatively low concentration within the industry, at 34 percent across all occupations. This indicates that many of these advanced manufacturing occupations have a high degree of crossover with other industries. This is both an indicator that there will be competition with other industries for skilled workers and an indicator of which industries are possible options for qualified workers.

DEMAND ANALYSIS: PIERCE COUNTY ADVANCED MANUFACTURING OCCUPATIONAL FORECASTS

Within the advanced manufacturing industry itself, demand for most occupations is relatively muted. Machinists are projected to see the greatest number of average annual openings (11 openings annually). Twenty of 27 occupations have annual industry demand of five positions or less. However, when considering employment outside the industry, demand for core occupations is greater, with 23 of 27 occupations having demand of six positions or more. Industrial machinery mechanics are projected to see the greatest number of annual overall openings overall (43 openings or 11 percent of the total). Between 2018 and 2023 there will be an average of 391 openings annually² for advanced manufacturing occupations by all employers in Pierce County; 125 of these openings will be within the industry. Growth among advanced manufacturing occupations is projected to be 0.8 percent annually. Computer hardware engineers; computer information systems managers; industrial machinery mechanics; architectural and engineering managers; and assemblers and fabricators, all others are each projected to experience growth of more than 1.5 percent annually between 2018 and 2023. **(Exhibit 9)**

Occupations used throughout the analysis are defined by the Bureau of Labor Statistics using a standardized code system. The code system allows for the analysis of data, however, the occupations defined may not capture some of the specializations that fall within each occupation. Additionally, the occupation title may not match exactly with the titles used by Pierce County employers.

²Total demand, or annual openings, for occupations covers demand across all industries in Pierce County and includes but is not limited to the advanced manufacturing industry. Total demand may be underestimated as it is represented by average annual openings. Average annual openings are calculated by the Employment Security Department based on projections of employment by occupation. The employment projections only represent the point of equilibrium between demand and supply and therefore do not account for unmet demand or unfilled jobs. As a result, total demand may be underestimated.

Exhibit 9. Pierce County Advanced Manufacturing Occupational Demand per Year, 2018 and 2023

SOC	Occupation	Estimated Employment 2018	Estimated Employment 2023	Average Annual Openings ↓ (2018-2023)	Average Annual Openings in Industry (2018-2023)	Estimated Employment CAGR (2018-2023)
49-9041	Industrial Machinery Mechanics	910	983	43	7	1.6%
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	821	849	24	9	0.7%
43-5061	Production, Planning, and Expediting Clerks	561	596	22	3	1.2%
51-1011	First-Line Supervisors of Production and Operating Workers	1,052	1,080	21	5	0.5%
51-4041	Machinists	667	677	18	11	0.3%
51-2092	Team Assemblers	780	805	17	4	0.6%
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	517	544	15	2	1.0%
51-4121	Welders, Cutters, Solderers, and Brazers	436	456	15	4	0.9%
53-7021	Crane and Tower Operators	285	304	14	1	1.3%
51-9198	Helpers--Production Workers	551	572	13	2	0.8%
51-9199	Production Workers, All Other	330	350	13	2	1.2%
11-3021	Computer and Information Systems Managers	322	356	13	2	2.0%
51-2099	Assemblers and Fabricators, All Other	367	396	12	2	1.5%
11-9041	Architectural and Engineering Managers	234	253	11	3	1.6%
17-2141	Mechanical Engineers	237	251	11	6	1.2%
51-2041	Structural Metal Fabricators and Fitters	199	209	11	4	1.0%
13-1081	Logisticians	471	476	8	2	0.2%
11-3121	Human Resources Managers	197	211	8	1	1.4%
17-2112	Industrial Engineers	238	241	8	6	0.3%
17-3023	Electrical and Electronics Engineering Technicians	197	209	7	2	1.2%
15-1133	Software Developers, Systems Software	204	219	6	3	1.4%
17-2061	Computer Hardware Engineers	138	153	6	6	2.1%
51-9083	Ophthalmic Laboratory Technicians	117	124	6	6	1.2%
11-3051	Industrial Production Managers	222	227	5	2	0.4%
17-2199	Engineers, All Other	165	172	5	1	0.8%
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	284	261	5	4	-1.7%
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	95	99	5	5	0.8%
	All Other Occupations (25)	2,394	2,430	49	23	0.3%
	Total	12,991	13,503	391	125	0.8%

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

SUPPLY ANALYSIS: AVAILABILITY OF REGIONAL TALENT AND EMPLOYABLE WORKFORCE

The local workforce supply is primarily composed of two elements: the entry of new graduates into the available talent pool and the existing talent pool of qualified unemployed workers actively seeking employment. Qualified graduates are drawn from the National Center for Education Statistics' Integrated Postsecondary Education System (IPEDS) data via a match of Classification Instructional Program (CIP) codes to the appropriate SOC codes. These are totaled by occupation code, including duplicates, and are then adjusted down controlled to total occupational employment. Unemployment insurance claimants are organized by their most recently reported occupation (i.e. SOC codes) and represent the second element of supply. It is important to note that workers from outside Pierce County can fill talent gaps, but are not assessed in this analysis.

Local Graduates

IPEDS standardizes educational curriculum with CIP codes. Each CIP code can match to several SOC codes because graduates from the same program can be qualified to be employed in a variety of occupations and industries. Similarly, each occupation may draw on graduates from several relevant CIP codes. For example, graduates in industrial engineering programs may be qualified to work as industrial production managers as well as architectural and engineering managers. The latter occupation can also draw on graduates from engineering/industrial management programs (**Exhibit 10**).

Exhibit 10. Other Occupational Matches for Graduates Qualified to Work as Industrial Production Managers

CIP	Description	SOC	Description
14.3501	Industrial Engineering	11-3051	Industrial Production Managers
15.1501	Engineering/Industrial Management	11-9041	Architectural and Engineering Managers
52.0101	Business/Commerce, General	17-2112	Industrial Engineers
52.0201	Business Administration and Management, General	25-1032	Engineering Teachers, Postsecondary
52.0203	Logistics, Materials, and Supply Chain Management	17-3026	Industrial Engineering Technicians
52.0205	Operations Management and Supervision	25-1011	Business Teachers, Postsecondary

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Accredited programs matching to one or more advanced manufacturing occupation(s) are summarized across educational institutions and programs located in the county in order to determine the number of graduates that will be able to fill forecasted annual openings within the advanced manufacturing industry in Pierce County.

Graduation data is tied to the primary location of the educational institution providing the accredited program. Therefore, institutions located outside of Pierce County are not included as part of the local talent supply.

IPEDS data is only available through the 2013-2014 academic year. Because the majority of completions occur at the end of the spring semester, students who complete programs during the 2013-2014 academic year are most likely to seek employment in 2014. Completions data provides a snapshot of what educational programs are expected to look like in future years if current conditions do not change.

IPEDS data only captures information on people who complete programs in postsecondary schools. This means that high school graduates, many of whom may be appropriately qualified for certain positions, are not counted in this analysis. One example of a high school program not captured in IPEDS is the Pierce County Skills Center. Stakeholders interviewed mentioned that the Pierce County Skills Center does a good job of preparing high school students for certain positions in the advanced manufacturing industry.

Additionally, apprenticeships are not included among the graduate supply estimates. The primary feature of an apprenticeship program is on-the-job training. Therefore, these individuals are already counted among the individuals employed in the industry. If they were to be added to the talent pool calculations, they would be double-counted within the analysis.

A total of 29 programs captured by IPEDS supply graduates qualified for core advanced manufacturing occupations. The top two programs business administration and management and business/commerce supply 38 percent of total completions. Just four programs have annual completions greater than 100, including business administration and management; business/commerce; computer and information sciences; and computer and information systems security/information assurance. Together these four programs supply 63 percent of Pierce County completions. **(Exhibit 11)**

Exhibit 11. Total Graduates by CIP Codes that Match to One or More Advanced Manufacturing Occupation(s), Pierce County, 2014

CIP	Description	Graduates
52.0201	Business Administration and Management, General	285
52.0101	Business/Commerce, General	225
11.0101	Computer and Information Sciences, General	187
11.1003	Computer and Information Systems Security/Information Assurance	150
11.0901	Computer Systems Networking and Telecommunications	79
48.0501	Machine Tool Technology/Machinist	60
11.0103	Information Technology	46
48.0508	Welding Technology/Welder	46
49.0202	Construction/Heavy Equipment/Earthmoving Equipment Operation	38
47.0603	Autobody/Collision and Repair Technology/Technician	31
52.1001	Human Resources Management/Personnel Administration, General	31
11.0201	Computer Programming/Programmer, General	25
11.1001	Network and System Administration/Administrator	24
11.0701	Computer Science	21
14.1901	Mechanical Engineering	18
15.1202	Computer Technology/Computer Systems Technology	14
51.0603	Dental Laboratory Technology/Technician	12
14.1001	Electrical and Electronics Engineering	9
15.1301	Drafting and Design Technology/Technician, General	8
48.0510	Computer Numerically Controlled (CNC) Machinist Technology/CNC Machinist	8
52.0203	Logistics, Materials, and Supply Chain Management	6
48.0506	Sheet Metal Technology/Sheetworking	6
47.0101	Electrical/Electronics Equipment Installation and Repair, General	4
14.0901	Computer Engineering, General	3
15.0399	Electrical and Electronic Engineering Technologies/Technicians,	2
15.0303	Electrical, Electronic and Communications Engineering Technology/Technician	2
14.0701	Chemical Engineering	1
52.1201	Management Information Systems, General	1
52.0409	Parts, Warehousing, and Inventory Management Operations	1
Total		1,343

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Examining the same completions by the institution from which they graduated shows the geographic source of qualified advanced manufacturing occupation candidates, and the institutions from which Pierce County residents graduate and move on to fill advanced manufacturing occupation openings. A total of eight local institutions have completions that match to one or more advanced manufacturing occupation(s). Six local institutions have more than 100 annual completions, the largest being the University of Washington-Tacoma Campus, followed by Tacoma Community College. (**Exhibit 12**)

Exhibit 12. Pierce County's Educational Institutions by Graduates Qualified for Advanced Manufacturing Occupations, 2014

Institution	Graduates Qualified for Advanced Manufacturing Occupations
University of Washington-Tacoma Campus	294
Tacoma Community College	257
Bates Technical College	196
Clover Park Technical College	181
Pacific Lutheran University	135
Pierce College-Fort Steilacoom	121
University of Puget Sound	87
Pierce College-Puyallup	72
Total	1,343

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

In order to determine the number of potential graduates that are likely to fill occupations within Pierce County's advanced manufacturing industry, qualified graduates are totaled by every possible combination of CIP and SOC codes. Each combination is adjusted to match the ratio of occupational employment to total occupational employment for all possible occupations matching to relevant CIPs. This method results in an estimate of how many graduates could potentially be employed in each available occupation. Each estimate is adjusted to account for the approximate share of local graduates who obtain work locally after graduation by multiplying the estimates by a 70 percent local retention rate. Lastly, the number of graduates expected to seek work locally is adjusted again to account for the number of local graduates who can reasonably be expected to fill positions within the advanced manufacturing industry.

This approach yields a total of 363 graduates in 2014 who are qualified for the needs of the advanced manufacturing industry. Among these graduates 254 are expected to stay in Pierce County. Of these graduates expected to stay in the county, 74 are expected to seek work within the advanced manufacturing industry. Computer network architect is the occupation with the greatest number of graduates expected to fill openings in Pierce County's advanced manufacturing industry. Additionally, computer and information systems managers and industrial production managers are each projected to supply 11 and ten percent respectively of total local graduates. (**Exhibit 13**)

Exhibit 13. Advanced Manufacturing Occupations by Total Graduates, Pierce County, 2014

SOC	Description	All Graduates	Graduates After 70% Retention	Graduates in Industry ↓
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	23	16	6
51-4121	Welders, Cutters, Solderers, and Brazers	23	16	4
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	5	4	4
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	5	4	3
51-4192	Layout Workers, Metal and Plastic	5	4	3
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	5	4	3
51-9122	Painters, Transportation Equipment	8	6	2
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	8	6	2
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	4	3	2
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	4	3	2
51-4041	Machinists	5	4	2
47-2071	Paving, Surfacing, and Tamping Equipment Operators	2	1	0
53-7021	Crane and Tower Operators	2	1	0
43-5061	Production, Planning, and Expediting Clerks	1	1	0
	On-the-Job Training Subtotal	100	70	35
17-3023	Electrical and Electronics Engineering Technicians	18	13	4
49-2092	Electric Motor, Power Tool, and Related Repairers	2	1	1
17-3013	Mechanical Drafters	2	1	0
	Associate degree or Postsecondary Award Subtotal	22	15	5
15-1143	Computer Network Architects	112	78	14
11-3021	Computer and Information Systems Managers	79	55	8
11-3051	Industrial Production Managers	35	25	8
15-1133	Software Developers, Systems Software	5	4	2
17-2011	Aerospace Engineers	3	2	1
11-9041	Architectural and Engineering Managers	4	3	1
17-2072	Electronics Engineers, Except Computer	1	1	0
17-2141	Mechanical Engineers	1	1	0
11-3121	Human Resources Managers	1	1	0
	Bachelor's degree Subtotal	241	169	34
	Grand Total	363	254	74

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Unemployment Insurance

The second key element of the local talent supply is the pool of unemployment insurance (UI) claimants whose previous occupations match those in Pierce County's advanced manufacturing industry. Due to nondisclosure rules, not all UI data is available for every SOC.

Overall, there are a total of 887 UI claimants whose previous occupation was a core advanced manufacturing occupation. Of these UI claimants, 241 are projected to seek work within the Pierce County advanced manufacturing industry. (**Exhibit 14**)

A total of 34 out of 52 core advanced manufacturing occupations have UI claimants whose previous occupation matches to a core advanced

manufacturing occupation. A total of 78 percent of UI supply is concentrated among occupations within the on-the-job training category. The largest contributors to supply are production worker helpers with 13 percent of total UI claimant supply, followed by machinists and welders, cutters, solderers and brazers each with ten percent of UI claimant supply. (Exhibit 14)

Exhibit 14. Unemployment Insurance Claimants by Previous SOC, Pierce County, 2014

SOC	Description	Total Qualified Unemployment Insurance Claimants	Unemployment Insurance Claimants in Sector ↓
51-9198	Helpers--Production Workers	225	33
51-4041	Machinists	41	25
51-4121	Welders, Cutters, Solderers, and Brazers	92	24
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	22	18
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	32	13
51-9199	Production Workers, All Other	63	7
51-2099	Assemblers and Fabricators, All Other	45	6
51-9122	Painters, Transportation Equipment	15	6
47-2071	Paving, Surfacing, and Tamping Equipment Operators	32	6
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	14	6
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	6	6
51-9022	Grinding and Polishing Workers, Hand	7	5
51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	22	5
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	5	5
51-9081	Dental Laboratory Technicians	5	4
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	4	4
43-5061	Production, Planning, and Expediting Clerks	32	4
51-4111	Tool and Die Makers	4	3
51-2041	Structural Metal Fabricators and Fitters	6	2
49-9041	Industrial Machinery Mechanics	11	2
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	4	2
53-7021	Crane and Tower Operators	14	1
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	10	1
	On-the-Job Training Subtotal	711	189
51-1011	First-Line Supervisors of Production and Operating Workers	60	14
17-3026	Industrial Engineering Technicians	9	8
17-3023	Electrical and Electronics Engineering Technicians	11	4
49-2092	Electric Motor, Power Tool, and Related Repairers	4	2
	Associate degree or Postsecondary Award Subtotal	84	27
11-3021	Computer and Information Systems Managers	38	5
17-2141	Mechanical Engineers	10	5
17-2061	Computer Hardware Engineers	4	4
11-3051	Industrial Production Managers	11	3
13-1081	Logisticians	15	3
17-2011	Aerospace Engineers	5	3
17-2199	Engineers, All Other	9	1
	Bachelor's degree Subtotal	92	25
	Grand Total	887	241

Sources: Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Total supply is defined as the sum of local qualified graduates and qualified unemployment insurance claimants. Pierce County has a projected supply of 74 local graduates and 241 unemployment insurance claimants who can reasonably be expected to fill the needs of the advanced manufacturing industry in Pierce County. The sum of the two sources of supply leads to total projected supply of 315 candidates.
(Exhibit 15)

Exhibit 15. Total Talent Supply, Pierce County, 2014

Source of Supply	Qualified Workers
On-the-Job Training	35
Associate Degree or Postsecondary Award	5
Bachelor's Degree	34
Master's Degree or Higher	-
Graduate Subtotal	74
Unemployment Insurance Claimants	241
Grand Total	315

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

SUPPLY AND DEMAND

The combined elements of expected supply and projected occupational demand yields a summary of annual occupational gaps within the advanced manufacturing industry. **Exhibits 16** and **17** summarize graduate supply, total demand, UI claimant supply and the expected gaps for each advanced manufacturing occupation.

For the 30 out of 52 occupations requiring a minimum of on-the-job training, the vast majority are balanced between supply and demand; 17 of 29 are projected to have an annual surplus or deficit of five or less positions. Within these occupations there is an expected supply of 224 local candidates. Demand among these occupations is projected to be 79 openings annually. The combination of supply and demand leads to an expected surplus of 145 qualified workers. The surplus is primarily driven by a large number of UI claimants centered in a few occupations: machinists (16); computer-controlled machine tool operators, metal and plastic (18); welders, cutters, solderers and brazers (24); and helpers-production workers (23).

Industry stakeholders shared that regional vocational schools have strong programs and graduates, however, due to the skills crossover between manufacturing, construction and other skilled trades there is competition for these graduates. According to advanced manufacturing industry stakeholders the trades often pay higher wages than manufacturing and thus are more successful in recruiting regional graduates. Additionally, programs that provide training in specialized skills such as composites provide students with skills that are in high demand among the region's largest advanced manufacturers, including Boeing.

Stakeholders also shared that across the advanced manufacturing industry there are challenges in finding qualified candidates. Although there are plenty of applicants for open positions, there is a high drop-out rate among these applicants. Certain basic skills seem to be the biggest problem in finding qualified candidates. Stakeholders indicated that they face challenges in finding workers with basic math skills required for the industry, as well as soft skills required at any job. Stakeholders repeatedly called out continual challenges around attitude and willingness to work.

Competitive wage rates are also a challenge for employers within an industry that has union employers competing with non-union employers. Union employers noted that higher entry-level wages from competitors was a challenge, especially given that pay grades and caps are negotiated during contract updates. Employers also expressed concern about the rising minimum wage rate. In addition to raising minimum wages, they anticipate employees above entry-level will demand increased wages that acknowledge their higher skill levels. Finally, they anticipate increased

pressure on their talent supply for entry-level workers due to more competitive entry-level wages across industries and the region.

Four occupations have zero projected local supply, though expected annual demand for these positions does not warrant opening local programs: ophthalmic laboratory technicians (six openings per year); petroleum pump system operators, refinery operators, and gaugers (five per year); team assemblers (four per year); and electrical and electronic equipment assemblers (one per year). (Exhibit 16)

Exhibit 16. Annual Supply and Demand, On-the-Job Training, Pierce County, 2018-2023

Occupation	Total Graduate Supply	Total Demand	Interim Gap	Total UI Claims Supply	Final Gap ↓
Ophthalmic Laboratory Technicians	0	6	(6)	0	(6)
Industrial Machinery Mechanics	0	7	(7)	2	(5)
Petroleum Pump System Operators, Refinery Operators, and Gaugers	0	5	(5)	0	(5)
Team Assemblers	0	4	(4)	0	(4)
Structural Metal Fabricators and Fitters	0	4	(4)	2	(2)
Electrical and Electronic Equipment Assemblers	0	1	(1)	0	(1)
Purchasing Agents, Except Wholesale, Retail, and Farm Products	0	2	(2)	1	(1)
Crane and Tower Operators	0	1	(1)	1	0
Production, Planning, and Expediting Clerks	0	3	(2)	4	1
Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	2	1	1	0	1
Dental Laboratory Technicians	0	3	(3)	4	2
Grinding and Polishing Workers, Hand	0	3	(3)	5	2
Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	3	0	3	0	3
Layout Workers, Metal and Plastic	3	0	3	0	3
Inspectors, Testers, Sorters, Samplers, and Weighers	0	9	(9)	13	3
Tool and Die Makers	0	0	0	3	3
Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	0	1	(1)	5	4
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	0	2	(2)	6	4
Assemblers and Fabricators, All Other	0	2	(2)	6	5
Production Workers, All Other	0	2	(2)	7	6
Paving, Surfacing, and Tamping Equipment Operators	0	0	(0)	6	6
Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	2	1	1	6	7
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	6	1	6	2	7
Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	4	0	4	4	8
Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	3	0	3	5	8
Painters, Transportation Equipment	2	1	2	6	8
Machinists	2	11	(9)	25	16
Computer-Controlled Machine Tool Operators, Metal and Plastic	2	4	(2)	18	16
Welders, Cutters, Solderers, and Brazers	4	4	0	24	25
Helpers--Production Workers	0	2	(2)	33	31
On-the-Job Training Subtotal	35	79	(44)	189	145

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Five out of the total 52 advanced manufacturing occupations fall within the associate degree or postsecondary award minimum education level required for entry. Two of these occupations are relatively balanced between supply and demand: mechanical drafters and electric motor, power tool, and related repairers. In one occupation, first line supervisors of production and operating workers, annual demand of five slots is wiped out by the expected 14 annual UI claimants. Total supply among these occupations is projected to be 32 local candidates, while demand is projected to be nine annual openings. The difference between supply and demand leads to an anticipated surplus of 24 local candidates. Among these five occupations mechanical drafters are projected to have zero annual supply, this occupation is also projected to have a small annual shortage in workers. **(Exhibit 17)**

An examination of supply among occupations requiring a bachelor's degree demonstrates a total of 34 local graduates, which when combined with a supply of 25 UI claimants leads to total expected supply of 59 local workers. The total projected demand among these occupations is projected to be 36 openings annually. As such, the expected talent surplus among bachelor's degree occupations is anticipated to be 22 workers annually. However, the majority of occupations in this category are in balance (12 out of 16). Of those not in balance, one, industrial engineers, will have a projected annual gap of six positions. Three occupations show a slight surplus: industrial production managers (ten); computer and information systems managers (12); and computer network architects (13). Six of the 16 occupations within the category are projected to have zero local supply (though not enough demand to warrant starting programs). **(Exhibit 17)**

Exhibit 17. Annual Supply and Demand, Associate Degree or Postsecondary Award and Higher, Pierce County, 2018-2023

Occupation	Total Graduate Supply	Total Demand	Interim Gap	Total UI Claims Supply	Final Gap ↓
Mechanical Drafters	0	1	(1)	0	(1)
Electric Motor, Power Tool, and Related Repairers	1	0	0	2	2
Electrical and Electronics Engineering Technicians	4	2	2	4	6
Industrial Engineering Technicians	0	0	0	8	8
First-Line Supervisors of Production and Operating Workers	0	5	(5)	14	9
Associate degree or Postsecondary Award Subtotal	5	9	(4)	27	24
Industrial Engineers	0	6	(6)	0	(6)
Architectural and Engineering Managers	1	3	(2)	0	(2)
Computer Hardware Engineers	0	6	(6)	4	(2)
Electronics Engineers, Except Computer	0	2	(1)	0	(1)
Sales Engineers	0	1	(1)	0	(1)
Software Developers, Systems Software	2	3	(1)	0	(1)
Chemical Engineers	0	1	(1)	0	(1)
Human Resources Managers	0	1	(1)	0	(1)
Materials Engineers	0	1	(1)	0	(1)
Mechanical Engineers	0	6	(5)	5	(0)
Engineers, All Other	0	1	(1)	1	1
Logisticians	0	2	(2)	3	1
Aerospace Engineers	1	1	0	3	3
Industrial Production Managers	8	2	6	3	10
Computer and Information Systems Managers	8	2	6	5	12
Computer Network Architects	14	1	13	0	13
Bachelor's degree Subtotal	34	36	(2)	25	22
Orthotists and Prosthetists	0	1	(1)	0	(1)
Master's degree or higher Subtotal	0	1	(1)	0	(1)
Grand Total	74	125	(51)	241	190

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

It is important to bear in mind not all occupations within an educational grouping are easily substitutable. A surplus in one occupation may not necessarily be countered by a shortage in another occupation. The skills required may not be the same between occupations. As such, a detailed account of the prospective supply and demand for each primary occupation can help organizations anticipate and plan for possible labor shortages and surpluses in the future.

Addressing surpluses among certain occupations includes examining other occupations in which workers could be qualified to work. The occupation with the largest surplus is production worker helpers. Individuals qualified for this occupation may also seek work as janitors and cleaners, except maids and housekeeping cleaners; dishwashers; molders, shapers, and casters, except metal and plastic; and packaging and filling machine operators and tenders; all of which are expected to see shortages in talent supply across the region. (**Exhibit 18**)

Exhibit 18. Job Transferability for Production Worker Helpers

SOC	Occupation	Annual Advanced Manufacturing Gap (2018-2023)	Annual Pierce County Gap (2018-2023)
51-9198	Helpers--production workers	31	212
37-2011	Janitors and cleaners, except maids and housekeeping cleaners	(1)	(156)
35-9021	Dishwashers	0	(54)
51-9195	Molders, shapers, and casters, except metal and plastic	(2)	(30)
51-9111	Packaging and filling machine operators and tenders	(0)	(18)
37-3011	Landscaping and groundskeeping workers	0	(4)
51-2021	Coil winders, tapers, and finishers	0	0
51-3023	Slaughterers and meat packers	0	0
51-6031	Sewing machine operators	0	2
51-7041	Sawing machine setters, operators, and tenders, wood	0	15
51-4121	Welders, cutters, solderers, and brazers	24	93

Sources: O*NET Resource Center, 2016; Community Attributes Inc., 2016.

The talent pipeline analysis also indicates that welders, cutters, solderers, and brazers are also projected to have a large surplus in regional talent. Workers qualified for this occupation may also seek employment as molders, shapers, and casters, except metal and plastic; packaging and filling machine operators and tenders; and plating and coating machine setters, operators and tenders, metal and plastic. These alternative occupations are each projected to see shortages in talent across Pierce County's industries. (**Exhibit 19**)

Exhibit 19. Job Transferability for Welders, Cutters, Solderers and Brazers

SOC	Occupation	Annual Advanced Manufacturing Gap (2018-2023)	Annual Pierce County Gap (2018-2023)
51-4121	Welders, cutters, solderers, and brazers	24	93
51-9195	Molders, shapers, and casters, except metal and plastic	(2)	(30)
51-9111	Packaging and filling machine operators and tenders	(0)	(18)
51-4193	Plating and coating machine setters, operators, and tenders, metal and plastic	0	(1)
51-4034	Lathe and turning machine tool setters, operators, and tenders, metal and plastic	2	4
51-7041	Sawing machine setters, operators, and tenders, wood	0	15
51-4031	Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	7	17
51-9121	Coating, painting, and spraying machine setters, operators, and tenders	4	18
51-4122	Welding, soldering, and brazing machine setters, operators, and tenders	7	18

Sources: O*NET Resource Center, 2016; Community Attributes Inc., 2016.

It is important to keep in mind that although the data may indicate a shortage of local talent, these positions may be filled by talent from other nearby counties. Conversely, the local talent indicated in occupational surpluses may be seeking work outside of Pierce County. Stakeholders interviewed noted a high degree of competition for local talent from other skilled trades industries both in and outside of Pierce County.

SUMMARY OF KEY FINDINGS AND PRELIMINARY RECOMMENDATIONS

Pierce County's advanced manufacturing industry is projected to have an annual supply of 315 local candidates between 2018 and 2023.

Unemployment Insurance claimants represent the largest share of local supply, 75 percent. (**Exhibit 20**)

Exhibit 20. Summary of Annual Pierce County Advanced Manufacturing Talent Supply, 2018-2023

Projected Talent Supply (Annual)	
Unemployed	241
Newly-Trained Candidates	74

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Combining the annual supply with projected annual demand of 125 openings yields a surplus of 190 local workers annually, which amounts to 4.3 percent of total core occupation employment in the industry.

Although the talent pipeline data indicates a surplus of workers, stakeholders discussed important challenges in finding candidates that they consider to be qualified for their open positions. (**Exhibit 21**)

Exhibit 21. Summary of Annual Pierce County Advanced Manufacturing Talent Supply and Demand, 2018-2023

Annual Surplus or (Shortage)	
Total Openings (Demand)	125
Total Supply	315
Surplus or (Shortage)	190

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

There are several occupations in advanced manufacturing that generate high numbers of UI claimants each year. These include Production Worker Helpers and Machinists.

Across the advanced manufacturing industry there are challenges in finding qualified candidates. Although there are plenty of applicants for open positions, there is a high dropout rate among these applicants. Certain basic skills seem to be the biggest problem in finding qualified candidates. Stakeholders indicated that they face challenges finding workers with basic math skills required for the industry, as well as soft skills required at any job. Stakeholders repeatedly called out continual challenges finding candidates with appropriate attitude and willingness to work.

Not only are applicants for open positions lacking in soft skills, but **those applicants that do get hired still have to be trained in soft skills on top of the specific hard skills required within their particular organization.** Communication is a particular challenge. Stakeholders mentioned that employees often do not communicate about job satisfaction leading to higher turnover rates.

- *Recommendation* – Partner with the Employment Security Department to develop systems to identify UI claimants seeking re-employment in advanced manufacturing occupations and assess their basic and soft skills. If necessary, offer them additional basic and/or soft skills training. With soft skills training include opportunities to role-play and receive practical feedback.

Competitive wage rates are also a challenge for employers within an industry that has union employers competing with non-union employers. Union employers noted that higher entry-level wages from competitors was a challenge; especially given that pay grades and caps are negotiated during contract updates. Employers also expressed concern about the rising minimum wage rate. In addition to raising minimum wages, they anticipate employees above entry-level will demand increased wages that acknowledge their higher skill levels. Finally, they anticipate increased pressure on their talent supply for entry-level workers due to more competitive entry-level wages across industries and the region.

The number of women working in advanced manufacturing is increasing. As employers look for qualified talent, women are becoming an increasingly important potential talent resource. Unfortunately, it can be challenging to recruit women. **Traditionally women have been steered away from heavy industry, however, employers would like to see more efforts made to share opportunities in manufacturing with women.**

Stakeholders reported that JBLM provides employers with access to both qualified transitioning military and military families seeking work.

- *Recommendation* – Expand opportunities for women to gain training and experience in manufacturing jobs through partnerships with AJAC and other relevant stakeholders.
- *Recommendation* – Regional job fairs can be good options for recruitment. High school job fairs are a good option to get in front of high school students, and it is not unheard of that family members of students will become interested in manufacturing opportunities through these events.

Industry employers are willing to use a very diverse set of resources for recruitment. However, many of these prove to have little success. Online sources like Monster and CareerBuilder are not as strong for recruiting.

Newspaper ads are expensive and provide little return on investment. Overall, stakeholders agreed that online labor exchange sites are difficult to work with and do not provide the services for which they are looking.

Stakeholders noted that the best recruiting workforce programs help applicants understand the job, provide training in soft skills, GED courses or ESL training, and have a strong understanding of industry and employer needs. These resources most effectively screen prospective applicants to identify the best match between employer and applicant. Examples of these programs mentioned by employers include Tacoma Community House, Orion Industries, GoodWill and WorkForce Central.

Regional vocational schools have strong programs and graduates; however, due to the skills crossover between manufacturing, construction and other skilled trades there is competition for some of these graduates. According to advanced manufacturing industry stakeholders the trades often pay higher wages than manufacturing and thus are more successful in recruiting regional graduates. Programs that provide training in specialized skills, such as composites, provide students with skills that are in high demand among the region's largest advanced manufacturers, including Boeing.

Universities and colleges throughout the region produce graduates qualified to work in manufacturing. Some manufacturing employers could use help establishing and/or improving relationships with these colleges to improve recruiting results. Stakeholders indicated that they are interested in working with regional colleges. Additionally, they indicated that college job fairs can be a good recruitment option, but are typically too expensive to be a good investment for manufacturing employers.

- *Recommendation* – Develop opportunities for advanced manufacturing employers and administrators from local colleges to build and/or improve relationships, identify common needs and work together.

Stakeholders indicated that they would be willing to train employees internally, and often do. However, this causes problems with finding qualified candidates for positions vacated by incumbent workers. **The challenges in finding qualified entry-level workers reduce the incentive to provide career advancement opportunities for incumbent workers.**

- *Recommendation* – Identify employers that train employees internally and provide them enhanced business services to ensure a ready supply of entry-level workers.