The Changing Manufacturing Workforce in the Shenandoah Valley

2016 Update

SVWDB
Shenandoah Valley Workforce Development Board

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Executive Summary

Following the 2013 report "The Changing Manufacturing Workforce in the Shenandoah Valley" completed by Chmura Economics & Analytics, there is anecdotal evidence that employers in the Shenandoah Valley region remain concerned about various workforce issues. These issues include impending retirements in an aging workforce and the upskilling of workers due to technological advances, with associated changes in processes and practices. Chmura was retained to help the Shenandoah Valley Workforce Development Board (SVWDB) collect and analyze primary and secondary data on regional manufacturing employers' workforce concerns and needs, including those employers who partnered with the SVWDB in the H-1B Technical Skills Training Grant program (April 2012-March 2017).

The Shenandoah Valley region's population grew at a relatively slower pace than the rate in Virginia and the United States, and employment in the region has still not fully recovered to its pre-recession peak. The largest major occupation group in the Valley is office and administrative support with 31,554 workers, followed by sales and related employment (23,235), food preparation and serving related (21,500), and production workers (21,325).

The percentage of residents with only a high school education is higher in the Valley (35.6%) when compared with the state (23.9%) and the nation (26.5%). On average, occupations requiring a bachelor's degree or above have ten-year forecast growth rates that are 0.4 percentage points higher than those occupations typically requiring a high school education. In addition, occupations that typically require a bachelor's degree or higher have lower unemployment rates than those requiring a high school education.

As of the third quarter of 2016, there were 32,366 workers employed in the region's manufacturing sector, accounting for 13.8% of employment and making manufacturing the largest sector across the Valley and in all three sub-regions—Northern, Central, and Southern.

The myth that the manufacturing sector employs predominately low-wage workers is persistent, but data for the Shenandoah Valley indicate that wages in manufacturing are considerably higher than regional averages. Average wages for manufacturing workers in the Valley are $50,366, exceeding the regional average by more than $11,000. Manufacturing also has higher-than-average overall wages in all three sub-regions. Manufacturing sectors paying relatively higher annual wages are chemical ($71,005), petroleum and coal products ($61,727), and plastics and rubber products manufacturing ($60,142). Overall industry employment has increased 2.3% over the past year, faster than the 1.7% increase in total regional employment.

Job losses based on the Worker Adjustment and Retraining Notification Act (WARN) identify the industries and regions that have suffered the most between 2010 and 2016. WARN notices in manufacturing over this period were limited to four companies in three counties. In contrast, between January 2010 and December 2016, the Virginia Economic Development Partnership (VEDP) announced 97 economic development projects in the region that generated 3,657 jobs and resulted in $1.03 billion in new capital investment. Of the total number of announced projects, 70 (or 72%) have been in manufacturing (9 companies made more than one project announcement during this period). Of total new jobs created, 2,829 (or 77%) have been in the manufacturing industry.

Data on drivers of potential gaps are identified from analysis of secondary data compiled by Chmura and from JobsEQ®. Two focus groups were held to validate preliminary data and glean further context and specifics about conditions in the region. The focus groups were held in Verona, Virginia on November 29, 2016, and in Winchester, Virginia on December 1, 2016. Insights from the focus groups helped craft an online survey of manufacturers, sent via email by the SVWDB to about 264 recipients, including all H-1B OJT grant employer sponsors, between December 12 and December 28. The complete responses speak for 77 unique companies, representing 14% of the Valley region's 560 covered manufacturing establishments. As many of the surveyed firms are large employers, these survey results represent 64% of manufacturing employment in the region.

Several national and regional trends support potential current and future supply gaps for manufacturing occupations and related skills in the Shenandoah Valley. Retiring workers from the baby boomer generation are impacting many industries, but the manufacturing workforce in particular has been aging and may face significant shortages in the near future due to retirements.

Another hiring trend impacting the region is the increasing difficulty businesses face finding workers in an environment of lower unemployment and flat labor force growth. Additionally, job-to-job flow data are consistent with concerns expressed in the focus groups and in the survey. Finding new workers is difficult, and often employers trade the same workers between themselves. When discussing recruiting in a low-unemployment environment and how these factors influence labor force availability, one focus group participant said “it’s a perfect storm, the worst recruiting environment.”

The new machines and robotics that have supported productivity gains also require greater skill to program, maintain, and troubleshoot—creating a potential gap for these higher skilled occupations. As stated by a focus group participant, “technology helps the machine operator but hurts maintenance.” A few focus group respondents also suggested that because they have to offer higher wages to attract workers, they require more skills of their employees, and that the difficulty in finding people is driving automation.

To identify occupations relevant to the manufacturing sector in the Shenandoah Valley, Chmura uses a test of significance and dominance. Occupations that account for a substantial share of total employment (1% or greater) in the manufacturing sector are considered significant, while if 20% or greater of an occupation’s total employment is in the manufacturing sector, it is considered dominant. Among the 171 detailed occupations meeting these criteria, the largest are team assemblers, with current employment of 1,542; packaging and filling machine operators and tenders (1,191); and first-line supervisors of production and operating workers (1,168).

Job openings identify immediate skill needs (and potential gaps) for employers, as well as opportunities for job seekers. At the top of the list is heavy and tractor-trailer truck drivers with 272 openings, followed by laborers and freight, stock, and material movers, hand (222). Although many of the jobs typically require relatively less education, they also typically require some degree of on-the-job training. Five occupations require long-term OJT, including maintenance and repair workers, general; industrial machinery mechanics; and bakers.

Among manufacturing occupations at the detailed level in the Shenandoah Valley, the largest projected demand/potential shortfalls over the next five years are for packaging and filling machine operators and tenders, with total demand of 210 over this period. Notable for typically requiring long-term on-the-job training are industrial machinery mechanics (107 needed over five years), maintenance and repair workers, general (66), and machinists (62).

The responses from focus group participants and survey respondents indicate gaps exist, and employers are taking steps to close these gaps. In particular, the primary data collected confirmed both the difficulty of hiring workers from within the region, and the current practices to attract and hire from outside the Shenandoah Valley. Along with the availability of workers, the survey also confirmed some of employers’ most pressing concerns are around the pipeline of younger workers and impending retirements. The most prominent workforce concern was that people applying for jobs lack basic work skills. Over half of the respondents stated a lack of interest by younger workers and a lack of mechanical skills among new hires as prominent workforce issues. Some workforce concerns, including hiring from outside the Valley and rising employee costs, varied by industry and region.

The survey also captured concerns about hiring for specific occupations. Of all respondents, 62% classified maintenance technician and 46% classified electrician as two of the hardest-to-fill occupations. Respondents shared similar concerns about retirements over several occupations. The most common answer was maintenance technicians, with 40% of respondents concerned about retirements from this occupation. Apprehension over retirements at the supervisory and management levels are fairly high, at 20% of respondents. Respondents also shared concerns about electricians (19%), machine operators (14%), and machinists (12%) over the next five years.

In terms of in-demand certifications and skills, the most requested certification by far in online job ads for manufacturing occupations in the Shenandoah Valley is a commercial driver's license (CDL). Survey results also indicated credentials are needed for truck drivers, welders, and computer controlled machine tool programmers.

With context provided from focus group participants, survey results suggest that while certifications are required for many occupations, in the current hiring environment, certifications may be more of a differentiating factor than absolute requirement for hard-to-fill occupations. The only difficult-to-fill occupations with more than 50% of respondents indicating a requirement for a certification or credential are truck drivers (58%) and welders (55%). More than 40% of respondents who selected computer controlled machine tool programmers (47%), electricians (41%), and tool and die makers (41%) as difficult-to-fill occupations also indicated that they require a related credential or certification. In the survey results, there does not appear to be a correlation between hard-to-fill occupations and a certification requirement for those occupations.

In contrast to certifications and credentials, the lack of basic work skills and work readiness were emphasized as difficult to find. These soft skills are significant workforce issues for survey respondents. As was true for difficult-to-fill occupations, in-demand skills vary somewhat across industries and regions.

Despite the expressed current and potential gaps in occupations and skills for manufacturing respondents in the Shenandoah Valley, upskilling workers was among the least pressing concerns for survey respondents. When asked to name the most pressing workforce concerns of their businesses, 34% chose upskilling workers by skills transfer, and 28% selected upskilling workers through a formal training program.

To assure skills transfer within their organizations, on-the-job training is almost universally used by respondents' firms. Standard operating procedures (70%), cross training (69%), and internal training programs (66%) are used in at least two-thirds of respondents' companies. More than half (51%) of respondents rely on tribal knowledge as a method for skills transfer inside their organization. The reliance on tribal knowledge, and the associated risks, presents an opportunity for the SVWDB to share best practices in transferring skills.

Regarding possible improvements in workforce development, the principal themes heard from employers are better promotion of technical careers—especially to young people—and improving training and education. In a separate question, employment and training providers were grouped into three categories: K-12 schools, technical centers, and community colleges. Respondents were similarly satisfied across all providers, with about half indicating the provider is meeting their firms' needs. Additional technical and soft skill training was emphasized as lacking in K-12 schools, while additional resources for technical training and transferrable skills were suggested for secondary schools. Comments on improvements for technical schools and community colleges ranged from a need for technical and work-readiness skills in graduates to additional occupational-specific training. However, multiple focus group participants also emphasized productive relationships with community colleges in their region.

Evident throughout the focus group and survey results is support that manufacturers in the Shenandoah Valley region currently face national, state, and regional trends driving gaps in skills and occupations. There is also potential for significant gaps over the next five years. Results from this updated study should serve as another step in a continuing process of evaluating employer needs and ensuring preparation of a ready workforce in the region to support continued economic prosperity.

Study Background

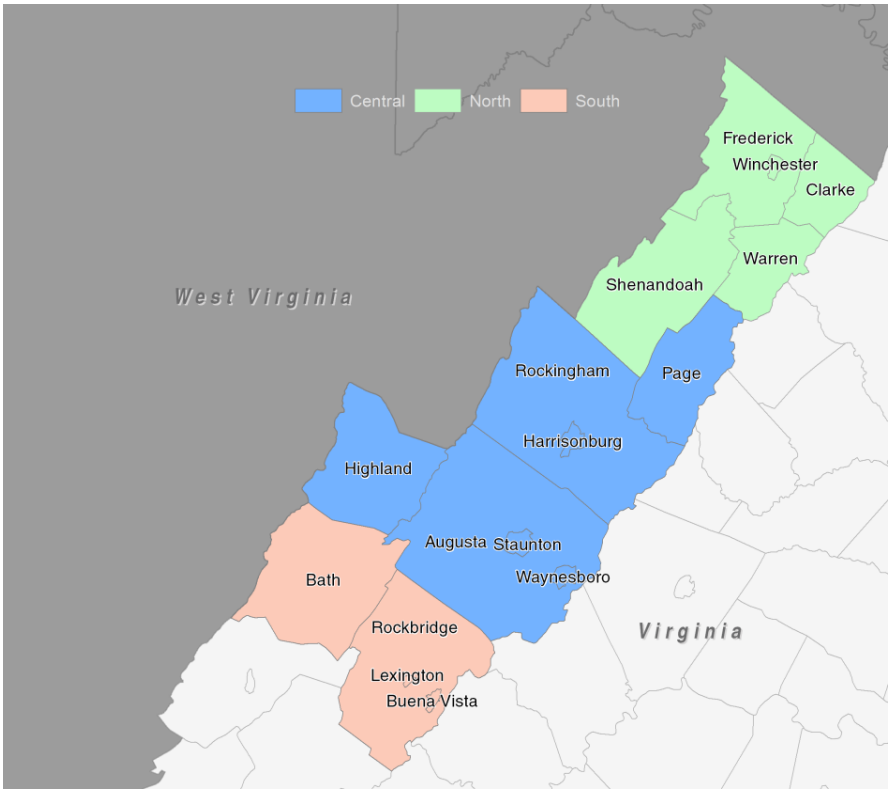
Chmura Economics & Analytics (Chmura) was retained to help the Shenandoah Valley Workforce Development Board (SVWDB) understand the current trends in their manufacturing labor market. This study updates the 2013 report "The Changing Manufacturing Workforce in the Shenandoah Valley" completed by Chmura. Anecdotally, employers remain concerned about an aging workforce and the need to advance incumbent worker skills as required by technological advances and changing processes and practices. The study is therefore primarily focused on these perceived or real concerns for manufacturing businesses in the Valley:

- Skill shortages in the current workforce
- The magnitude of businesses' hiring strategies and perceptions of the available labor market
- Employer practices for knowledge and job skill transfer, particularly as it relates to registered apprenticeship as a model for upskilling and transfer of knowledge
- Employer needs regarding workforce upskilling
- Hiring challenges in a low-unemployment economy compared with a higher-unemployment economy

The Valley is geographically broad and economically diverse. For that reason, the region may be divided in the report into three sub-regions: Northern, Central, and Southern—as shown in the map below.

Shenandoah Valley Region and Sub-Regions

The Shenandoah Valley Region *refers to the counties of Augusta, Bath, Clarke, Frederick, Highland, Page, Rockbridge, Rockingham, Shenandoah, and Warren and the cities of Buena Vista, Harrisonburg, Lexington, Staunton, Waynesboro, and Winchester.*

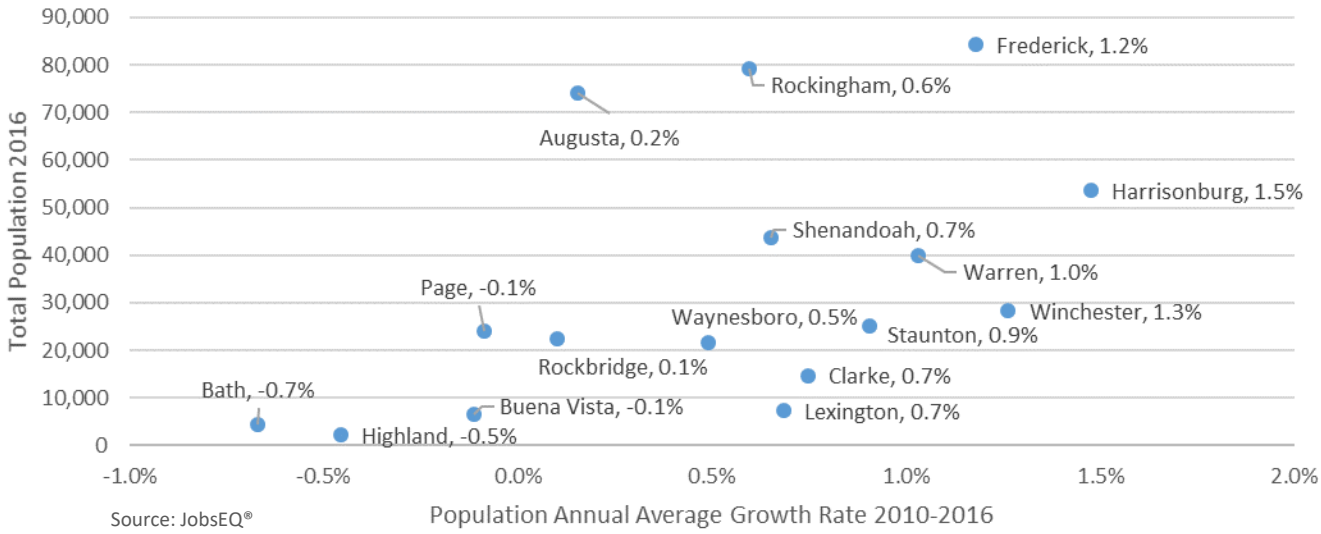


Demographic Profile

The demographic profile of the Shenandoah Valley provides an overview of the population, education, and labor market characteristics of the region.

The Shenandoah Valley region's population was 508,933 in 2016. Between 2010 and 2016 the population increased at an annual average rate of 0.7%, slightly slower than the United States (0.8%) and Virginia (0.9%). In general, larger counties and cities continued to grow while the population in already less populous counties declined as shown in the figure below. The fastest growth over this period was in the City of Harrisonburg (1.5%), followed by the City of Winchester (1.3%), and Frederick County (1.2%), each of which outpaced population growth in the U.S. and Virginia. Population declined in the counties of Bath (-0.7%), Highland (-0.5%), Page (-0.1%), and the City of Buena Vista (-0.1%). The largest counties are Frederick, Rockingham, and Augusta, which each have populations greater than 70,000.

Population and Population Growth Rates in the Valley, 2010 – 2016



Source: JobsEQ®

The median age in the Valley (39 years) is slightly higher than the national average (37 years). The Southern region and the Northern region have the highest median ages (41 and 40, respectively). Among younger-aged cohorts, the proportion of the population that is 18 to 24 years of age is considerably higher than the national average, especially in the Central and Southern regions. This is driven primarily by the large number of colleges in the Shenandoah Valley. Poverty rates for the Valley are below the national average, but slightly higher than the state average. At the sub-regional level, the Northern region is well below the nation at 10%. The Central and Southern regions both have poverty rates of 15%, slightly above the national average.

Shenandoah Valley Demographic Characteristics

	SV	Northern SV	Central SV	Southern SV	Virginia	USA
Population	513,000	201,000	271,000	41,000	8,097,00	312,000,00
Population Annual Average Growth (2001 to 2011)	1.2%	1.7%	1.0%	0.4%	1.1%	0.9%
Median Age	39.1	39.9	38.2	41.1	37.5	37.2
Percent of Population 18-24 Years of Age	12%	8%	14%	15%	10%	10%
Poverty Level	13%	10%	15%	15%	11%	14%

Source: JobsEQ®, Census

Educational Attainment

The percentage of residents with only a high school education is higher in the Valley (35.6%) when compared with the state (23.9%) and the nation (26.5%). Post-secondary education is lagging both the state and the nation in all four categories from some college but no degree through a post-graduate degree, as shown in the table below.

Shenandoah Valley Educational Attainment Levels
Age 25-64

	Number of Individuals	Percent		
	SV	SV	Virginia	USA
No High School Diploma	33,446	12.8%	9.9%	12.0%
High School Graduate	93,037	35.6%	23.9%	26.5%
Some College, No Degree	49,382	18.9%	20.6%	21.9%
Associate Degree	18,375	7.0%	7.7%	8.7%
Bachelor's Degree	42,453	16.2%	22.3%	19.7%
Post-Graduate Degree	24,973	9.5%	15.5%	11.2%

Source: Chmura Economics & Analytics and JobsEQ®, American Community Survey 2010-2014

Labor Market Characteristics

The largest major occupation group[1] in the Valley is office and administrative support with 31,554 workers, followed by sales and related employment (23,235), food preparation and serving related (21,500), and production workers (21,325). The table below identifies the major occupation groups, their annual average wages per worker, and the location quotient for the Valley as of the third quarter of 2016. The location quotient (LQ) is the proportion of employment by occupation in the Valley relative to that occupation's concentration in nation. An LQ of 1.00 indicates the region has the same concentration of that occupation as in the nation. Hence, an LQ of 1.01 indicates employment is 1% larger than the national average, and a LQ of 0.99 would indicate that employment is 1% lower than the national average. The occupation groups in the Valley with the largest LQ are production (1.47), transportation and material moving (1.24), and farming, fishing, and forestry education occupations (1.18). The region has low employment concentrations in computer and mathematical occupations (0.56), legal occupations (0.59), and architecture and engineering occupations (0.67).

Employment and Earnings by Major Occupation Groups, Shenandoah Valley, 2016 Q3

SOC	Title	Employment	Annual Average Wages per Worker[1]	Location Quotient
43-0000	Office and Administrative Support Occupations	31,554	$32,800	0.90
41-0000	Sales and Related Occupations	23,235	$33,200	0.95
35-0000	Food Preparation and Serving Related Occupations	21,500	$21,100	1.06
51-0000	Production Occupations	21,325	$34,200	1.47
53-0000	Transportation and Material Moving Occupations	19,637	$33,800	1.24
25-0000	Education, Training, and Library Occupations	14,917	$45,500	1.13
11-0000	Management Occupations	14,677	$101,700	1.04
29-0000	Healthcare Practitioners and Technical Occupations	12,336	$72,400	0.94
47-0000	Construction and Extraction Occupations	11,161	$37,700	1.07

[1] Occupations are defined according to the Standard Occupational Classification (SOC) with major groups corresponding to the first two digits of the SOC code.

SOC	Title	Employment	Annual Average Wages per Worker[1]	Location Quotient
37-0000	Building and Grounds Cleaning and Maintenance	9,671	$24,100	1.14
49-0000	Installation, Maintenance, and Repair Occupations	9,381	$41,400	1.05
39-0000	Personal Care and Service Occupations	8,752	$22,900	0.94
13-0000	Business and Financial Operations Occupations	8,094	$64,300	0.71
31-0000	Healthcare Support Occupations	6,593	$27,100	0.96
21-0000	Community and Social Service Occupations	3,622	$42,700	0.97
15-0000	Computer and Mathematical Occupations	3,589	$71,700	0.56
33-0000	Protective Service Occupations	3,355	$39,800	0.74
27-0000	Arts, Design, Entertainment, Sports, and Media	3,131	$43,600	0.77
17-0000	Architecture and Engineering Occupations	2,616	$71,700	0.67
45-0000	Farming, Fishing, and Forestry Occupations	1,804	$29,600	1.18
19-0000	Life, Physical, and Social Science Occupations	1,672	$66,600	0.89
23-0000	Legal Occupations	1,088	$78,100	0.59
00-0000	Total - All Occupations	233,711	$40,900	1.00

Source: JobsEQ®
[1]Occupation wages are as of 2015 and should be taken as the average for all Covered Employment

The following table provides the education, earnings, and ten-year growth rates for jobs by education level in the Valley. On average, occupations requiring a bachelor's degree or above have ten-year growth rates that are 0.4 percentage points higher than those occupations typically requiring a high school education. In addition, occupations that typically require a bachelor's degree or higher have lower unemployment rates than those requiring a high school education.

Employment by Entry-Level Education Required in the Shenandoah Valley

Typical Entry-Level Education	Employment 2016 Q3	Average Annual Wages	Unemployment Rate	2016 Q3-2026 Q3 Annual Average Growth Rates
Doctoral or professional degree	5,867	$105,523	1.7%	1.0%
Master's degree	3,841	$67,993	2.1%	1.0%
Bachelor's degree	40,494	$70,779	2.5%	0.6%
Associate degree	4,462	$48,295	2.4%	0.7%
Postsecondary non-degree award	14,830	$36,103	3.8%	0.9%
Some college, no degree	5,273	$31,931	4.1%	-0.1%
High school diploma or equivalent	85,138	$38,748	3.7%	0.2%
Less than high school	73,805	$23,587	5.9%	0.6%

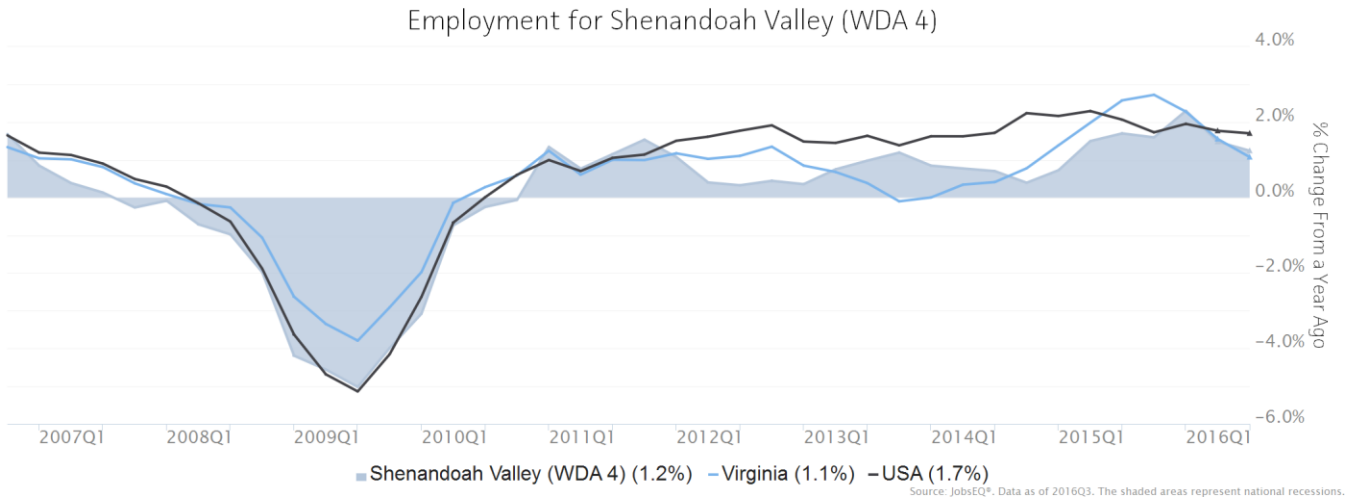
Source: JobsEQ®, Bureau of Labor Statistics

The State of Manufacturing

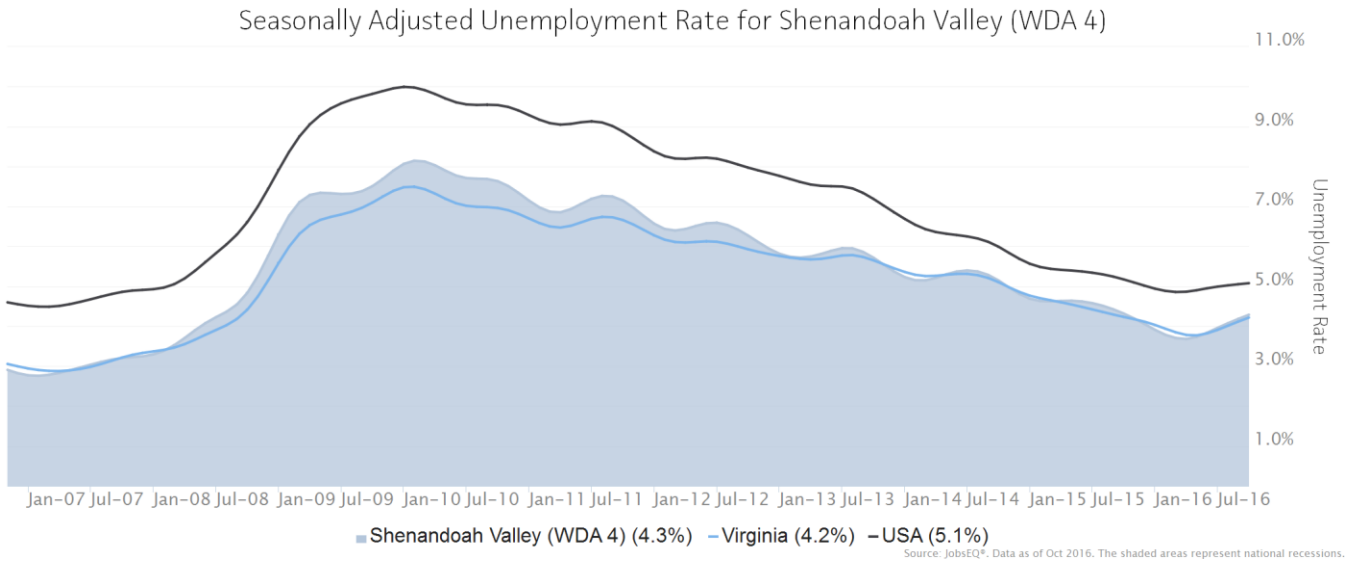
This section provides an overview of the regional economy and specifically the manufacturing industry in the Shenandoah Valley. Understanding the types of manufacturing industries that exist in the Valley provides the framework by which the regional workforce issues can be viewed.

Regional Economic Overview

As of 2016Q3, total employment for the Shenandoah Valley was 233,711 (based on a four-quarter moving average). Over the year ending 2016Q3, employment increased 1.2% in the region. Employment in the region peaked at 235,422 in 2007Q3 before the recession, and still has not fully recovered.

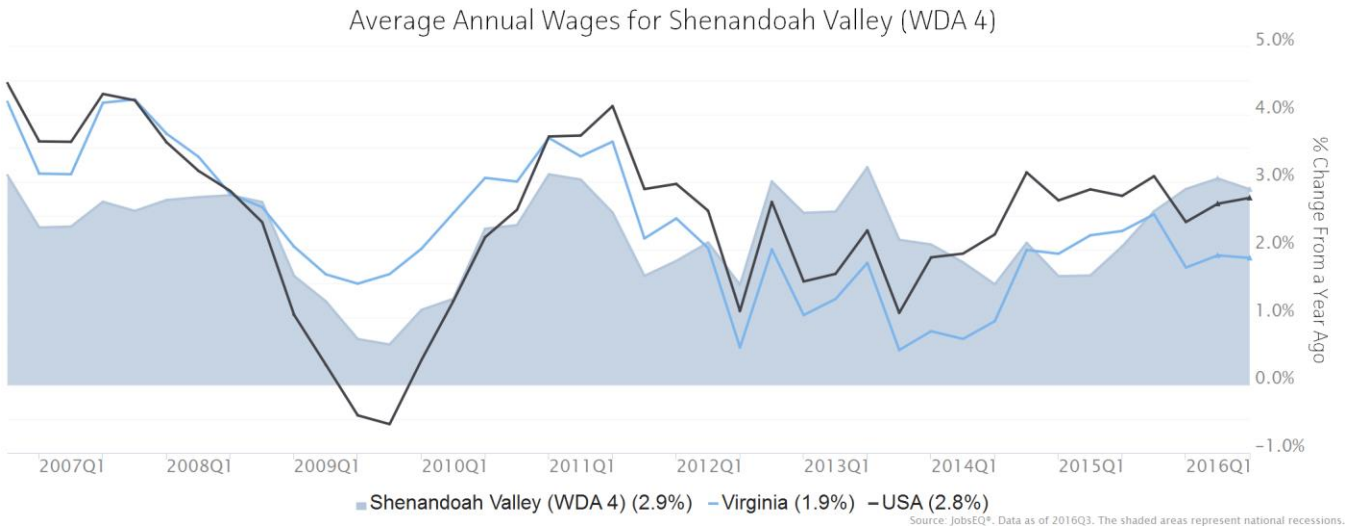


The seasonally adjusted unemployment rate for the Shenandoah Valley was 4.3% as of October 2016. The regional unemployment rate was slightly higher than the rate in Virginia of 4.2%, but lower than the national rate of 5.1%. One year earlier, in October 2015, the unemployment rate in the Shenandoah Valley was also 4.3%. At its peak in February 2010, the regional unemployment rate was 8.1%, but has been as low as 2.1% in November 2000.



Unemployment rate data are from the Local Area Unemployment Statistics, provided by the Bureau of Labor Statistics and updated through October 2016.

The average worker in the Shenandoah Valley earned annual wages of $38,960 as of 2016Q3. Average annual wages per worker increased 2.9% in the region during the preceding four quarters. For comparison purposes, annual average wages in Virginia increased 1.9% over this period to $53,485, while average wages were $52,724 in the nation as of 2016Q3, up 2.8%.



As of 2016Q3, there were 32,366 manufacturing workers employed in the Shenandoah Valley, accounting for 13.8% of total employment in the region. Manufacturing is the largest sector in the region, followed by health care and social assistance (13.5% of total employment) and retail trade (11.8%). However, manufacturing employment is not evenly distributed across the three sub-regions. In the Central region, manufacturing accounts for 14.6% of total employment, with over 18,000 workers. About 1,900 are employed in the sector in the Southern region, accounting for 11.1% of total employment. In the Northern region, manufacturing employment makes up 13.4% of total employment, employing 12,332 as of 2016Q3.

Manufacturing Employment and Share of Total Employment by Sub-Region, Four Quarters Ending 2016Q3

	Northern SV	Central SV	Southern SV	Shenandoah Valley
Employment	12,332	18,145	1,889	32,366
Share of Sub-Region Total Employment	13.4%	14.6%	11.1%	13.8%

Source: JobsEQ®

Manufacturing Employment and Earnings by Sector

Within the manufacturing cluster in the Shenandoah Valley region, food manufacturing is the largest industry, employing 10,421 workers or 32.2% of the total manufacturing workforce. Plastics and rubber products manufacturing account for 12.5% of manufacturing employment, followed by printing and related support activities (9.0%) and fabricated metal products manufacturing (7.8%). Manufacturing sectors paying relatively higher annual wages are chemical ($71,005), petroleum and coal products ($61,727), and plastics and rubber products manufacturing ($60,142). Overall industry employment has increased 2.3% over the past year, faster than the 1.7% increase in total regional employment; however, employment declined in seven industries, including apparel and primary metal manufacturing.

Employment and Earnings by Manufacturing Industry, Four Quarters Ending with 2016 Q3

NAICS	Manufacturing Industry	Employment 2016 Q3	Percent of Manufacturing Employment	Avg. Annual Wages	Location Quotient	2015 Q3-2016 Q3 Avg. Annual Growth	2015 Q3-2016 Q3 Avg. Annual Growth Rate
311	Food	10,421	32.2%	$43,134	4.32	151	1.5%
326	Plastics and Rubber Products	4,041	12.5%	$60,142	3.76	87	2.2%
323	Printing and Related Support Activities	2,915	9.0%	$36,247	4.03	-21	-0.7%
332	Fabricated Metal Product	2,538	7.8%	$51,196	1.14	106	4.4%
325	Chemical	1,920	5.9%	$71,005	1.53	36	1.9%
321	Wood Product	1,831	5.7%	$33,007	2.89	117	6.9%
333	Machinery	1,562	4.8%	$51,372	0.93	121	8.4%
327	Nonmetallic Mineral Product	1025	3.2%	$49,380	1.62	147	16.7%
322	Paper	963	3.0%	$45,794	1.69	-102	-9.6%
339	Miscellaneous	923	2.9%	$51,885	0.93	6	0.6%
337	Furniture and Related Product	835	2.6%	$36,918	1.35	-9	-1.0%
336	Transportation Equipment	713	2.2%	$39,542	0.28	98	15.9%
312	Beverage and Tobacco Product	700	2.2%	$41,449	1.9	62	9.7%
334	Computer and Electronic Product	483	1.5%	$53,263	0.3	-6	-1.1%
314	Textile Product Mills	465	1.4%	$29,915	2.55	12	2.7%
331	Primary Metal	446	1.4%	$43,067	0.76	-62	-12.3%
313	Textile Mills	315	1.0%	$46,019	1.76	21	7.1%
315	Apparel	95	0.3%	$25,676	0.41	-37	-27.9%
335	Electrical Equipment, Appliance, and	89	0.3%	$49,294	0.15	-4	-4.5%
324	Petroleum and Coal Products	75	0.2%	$61,727	0.44	1	1.7%
316	Leather and Allied Product	13	0.0%	$27,190	0.25	1	12.8%
31	**Manufacturing**	**32,366**	**100%**	**$50,366**	**1.67**	**726**	**2.3%**

Source: JobsEQ®

One of the myths about manufacturing is that the industry employs predominately low-wage workers. Data for the Shenandoah Valley indicate that wages in manufacturing are higher than regional averages by a considerable margin. The table below shows the most current wages for the manufacturing sector, average annual growth in wages over the past five years, and purchasing power—a number which adjusts salary based on the area's cost of living. Please note that average industry wages account for production workers in addition to a myriad of other workers, such as administrative and sales employees.

Average wages for manufacturing workers in the Shenandoah Valley are about $50,366, which exceeds the regional average by more than $11,000. Manufacturing wages are also higher than average overall wages for all three sub-regions. Between 2011 and 2016, wages in manufacturing for the Shenandoah Valley grew by 2.23%, on par with the 2.22% growth for all industries in the region as a whole; however, this was not true for all sub-regions. In the Northern region, manufacturing wage growth (+2.25%) outpaced wage growth in all industries (+2.21%). In the Central and Southern regions, manufacturing wages grew more slowly than the regional average wage for all industries.

Several focus group participants confirmed the myth of low wages persists today, particularly among high-school students. One popular strategy to combat this is to specifically discuss wage expectations vs. reality during plant tours.

The table below also shows the purchasing power of wages in manufacturing, which indicates how far those earnings go in the region when adjusted for national cost of living. These figures are helpful for comparing wages between each of the sub-regions, the state, and the nation. For example, although manufacturing in the Northern region pays more on average than in the Central region, since there is a

higher cost of living in the northern part of the Valley, manufacturing workers in the Central region are in a slightly more advantageous position. Manufacturing workers in the Southern region are also in a somewhat better situation than would be indicated by wages alone, but their purchasing power is still lower than the other two regions. All three regions fall below both Virginia and the United States in average wages, but this is true for all job types, not only manufacturing.

Wages in Manufacturing Compared to Average Wages

	Average Wages Four Quarters Ending 2016 Q3		Average Annual Wage Growth Rate 2011 Q3-2016 Q3		Purchasing Power (US = 100) 2016 Q3	
	Manufacturing	Regional Average	Manufacturing	Regional Average	Manufacturing	Regional Average
Shenandoah Valley	$50,366	$38,960	2.23%	2.22%	$51,725	$40,011
Northern Region	$51,212	$40,996	2.25%	2.21%	$49,889	$39,937
Central Region	$50,740	$38,077	2.17%	2.19%	$53,904	$40,451
Southern Region	$41,252	$34,406	1.97%	2.27%	$44,577	$37,179
Virginia	$57,625	$53,485	1.53%	1.49%	$51,062	$47,394
United States	$64,442	$52,724	1.73%	2.23%		

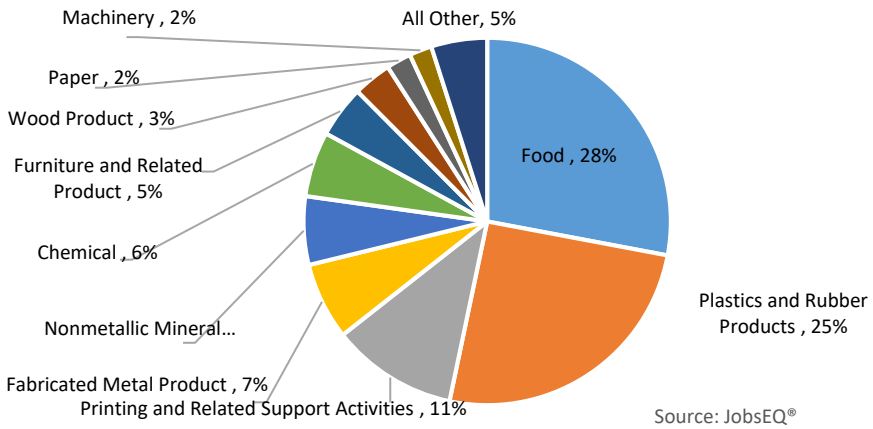
Source: JobsEQ®

Manufacturing Employment for the Three Sub-Regions

The three charts in this section show the largest manufacturing industry sectors (3-digit NAICS) in 2016 within each of the three sub-regions of the Shenandoah Valley. Each region has a slightly different mix of industries. Three of the top five industries for the Northern region and Central region are the same: food, printing and related support activities, and fabricated metal. The Southern region, on the other hand, has a different composition of industries; machinery, textile product mills, wood product, paper, and printing and related support activities are the top five industries.

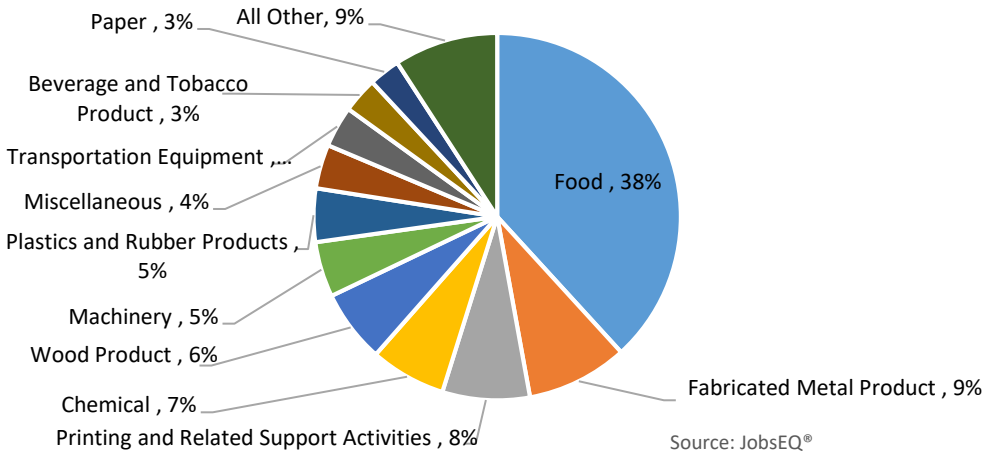
The food industry is highly developed in the Northern and Central regions. This is particularly due to the presence of numerous poultry processing companies as well as the location for large employers such as Hershey, Cargill,

Northern Region Employment in Manufacturing, Four Quarters Ending 2016 Q3



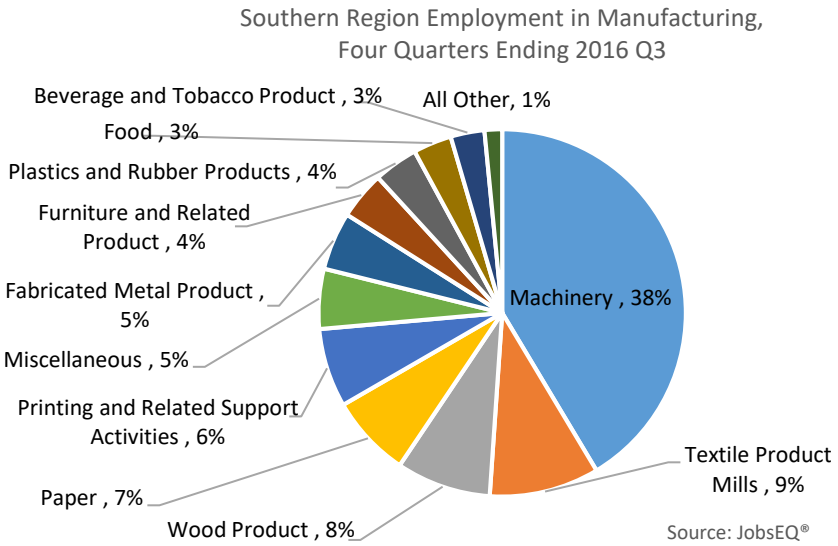
Source: JobsEQ®

Central Region Employment in Manufacturing, Four Quarters Ending 2016 Q3



Source: JobsEQ®

McKee, Kraft, and HP Hood. Plastic and rubber is the second-largest industry in the Northern region; Rubbermaid, International Automotive Components, O'Sullivan Films and Trex are some of the largest companies in the Valley in this industry. Fabricated metal products is the second-largest industry in the Central region, with Nibco and Cadence as large employers.



Printing and related support activities maintain a solid presence in the Northern and Southern regions with RR Donnelley & Sons, Berryville Graphics, and Quad/Graphics as large employers. Chemical manufacturing, one of the highest-paying of all production industries in the Valley, is the fourth-largest in the Southern region, fifth-largest in the Northern region, and sixth-largest in the Central region. The largest employers in the Southern region are Mohawk (textile products), Munters (machinery manufacturing), and Modine (machinery manufacturing).

Manufacturing WARN Notices in the Valley

Job losses based on the Worker Adjustment and Retraining Notification Act (WARN) identify the industries and regions that have suffered the most between 2010 and 2016.[2] Although WARN notices do not exhaustively record all types of layoffs, they provide an overview of the major plant closings and layoffs that affect full-time workers.[3] Only six companies reported through the WARN system in the Valley over this period, four of which were in manufacturing. Seventy-two percent of the total job losses reported through the WARN system in the Valley over this period were in manufacturing.

The table below details manufacturing job losses reported by WARN by county and sub-region for the Shenandoah Valley between 2010 and 2016. A ratio of manufacturing job losses to average manufacturing employment between 2010 and 2016 is provided, which indicates how deeply these job losses affected overall manufacturing employment for each county. Over this time period and according to the WARN system data, the Valley has shed 223 jobs.

WARN notices in manufacturing over this period were limited to four companies in three counties. The hardest-hit county was Buena Vista, with 120 jobs lost and a 19% ratio of manufacturing job losses, followed by Page (-92 jobs) and Rockingham (-11). Of the three sub-regions, the Southern region had the highest manufacturing job loss ratio at 6%.

[2] The data used for this section are from Virginia's Job Closings database, hosted by the Virginia Economic Development Partnership (VEDP). http://vedpweb.yesvirginia.org/announcements#/ReductionClosing

[3] Specific restrictions of WARN notices can be seen at http://www.doleta.gov/programs/factsht/warn.htm. WARN notices are designed to cover large-scale job losses and therefore do not provide a good indication of job losses at smaller companies.

Impact of Manufacturing Job Losses by County
Based on Worker Adjustment and Retraining Notification Act (WARN), 2010-2016

	WARN Manufacturing Job Losses	Average Employment in Manufacturing	Ratio of WARN Manufacturing Job Losses to Average Manufacturing Employment	Percent of Regional WARN Manufacturing Job Losses
Buena Vista	120	649	19%	54%
Page County	92	739	12%	41%
Rockingham County	11	7,358	0%	5%
Northern Region	0	11,792	0%	0%
Central Region	103	18,358	1%	46%
Southern Region	120	2,054	6%	54%
Shenandoah Valley	223	32,203	1%	100%

Source: Virginia Economic Development Partnership and Chmura Economics & Analytics

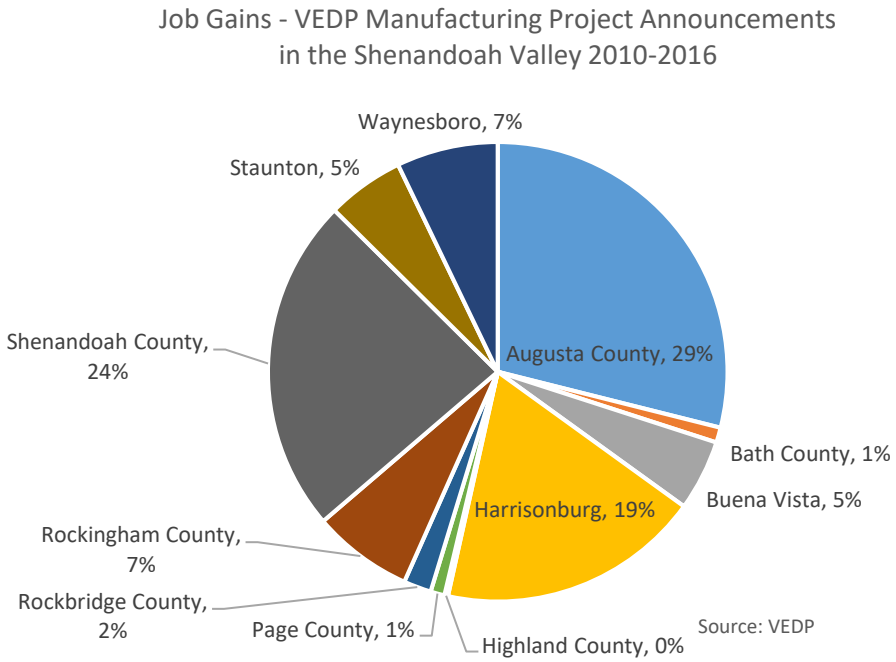
Manufacturing Economic Development Project Announcements in the Valley

Between January 2010 and December 2016, VEDP announced 97 economic development projects in the region that generated 3,657 jobs and resulted in $1.03 billion in new capital investment.[4] This investment was made by 83 separate companies—both new and existing businesses. This database is not comprehensive and is not intended to represent every economic development project in the state. It does, however, capture most large business expansion and significant new business locations that have a job creation and/or capital investment component.

Of the total number of announced projects, 70 (or 72%) have been in manufacturing (9 companies made more than one project announcement during this period). Of the total new jobs created, 2,829 (or 77%) have been in the manufacturing industry. Job gains were particularly concentrated in transportation equipment manufacturing and machinery manufacturing, and each manufacturing project resulted in an average gain of 40 jobs for the Valley.

According to the Virginia Economic Development Partnership's announcements database, the largest manufacturing job gains were reported in the Central region (1,933), representing 68% of the total. This was followed by the Northern region (670), representing 24% of the manufacturing job gains announced. The Southern region added 226 new jobs in manufacturing over the same period. This represented 8% of the announced job gains during the referenced period.

[4] The data used for this section are from Virginia's Announcements database, hosted by the Virginia Economic Development Partnership (VEDP). http://vedpweb.yesvirginia.org/announcements#/NewExpanding



The figure above shows the percent distribution of manufacturing job gains reported by VEDP at the county level. Augusta County and Shenandoah County were the biggest winners in the region, receiving 29% and 24%, respectively, of the announced manufacturing jobs. Augusta represents 17% of the region's total manufacturing employment, while Shenandoah County represents 11%.

Eighty-three percent of the projects and 86% of the new jobs resulting from these projects came from existing businesses. This is positive news for the future of manufacturing in the Valley, and demonstrates that existing businesses are competitive and growing. This underscores the need to continue engaging existing businesses in conversations about the developing workforce in the region, because those firms are significant customers that need to be served by the workforce system.

Occupation Gap Analysis

Approach

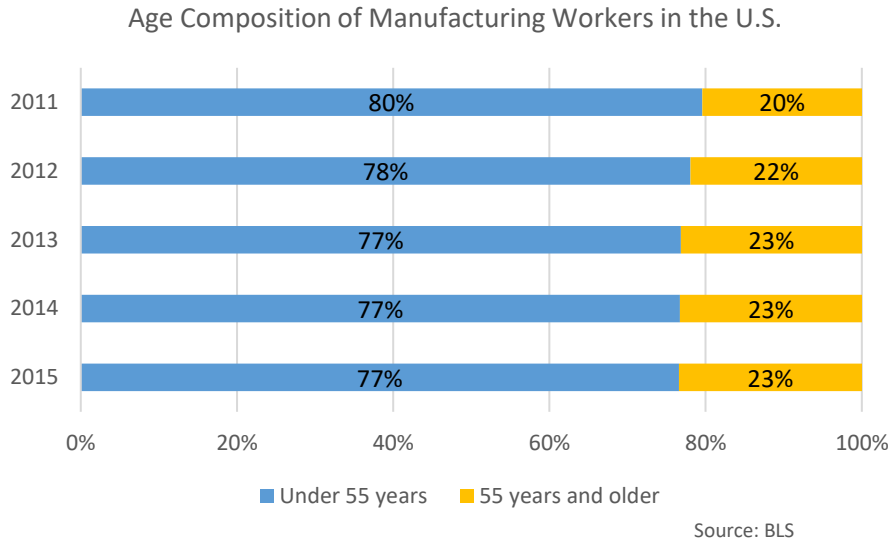
The approach taken in this section is to identify employment needs of employers as evidenced by current and potential gaps between supply and demand in manufacturing in the Shenandoah Valley. Drivers of potential gaps are first identified from analysis of secondary data compiled by Chmura and from JobsEQ®. Two focus groups were held to validate the data and glean further context and specifics about conditions in the region. The focus groups were held in Verona, Virginia on November 29, 2016 and Winchester, Virginia on December 1, 2016. Full summaries of the focus groups are included in Appendix 2 of this report. Insights from the focus groups helped craft an online survey of manufacturers, sent via email by the SVWDB to about 264 recipients, including all H-1B OJT grant employer sponsors, between December 12 and December 28. Of the 238 successfully delivered survey links, Chmura received 106 complete surveys and an additional ten partially completed surveys, resulting in a 44.5% completion rate. As many of the surveyed firms are large and have several locations and/or industry segments in the Valley region, some were surveyed multiple times. The complete responses speak for 77 unique companies, representing 14% of the Valley region's 560 covered manufacturing establishments.[5] As many of the surveyed firms are large employers, these survey results represent 64% of manufacturing employment in the region.

[5] Sixteen firms had two completed surveys (from different respondents/different firm locations) included in the analysis. Four firms had more than two complete responses included in the analysis.

A full survey report is included in Appendix 1 of this report. Findings from the survey and comments from the focus groups are included in this section along with the secondary data analysis.

Drivers of Gaps

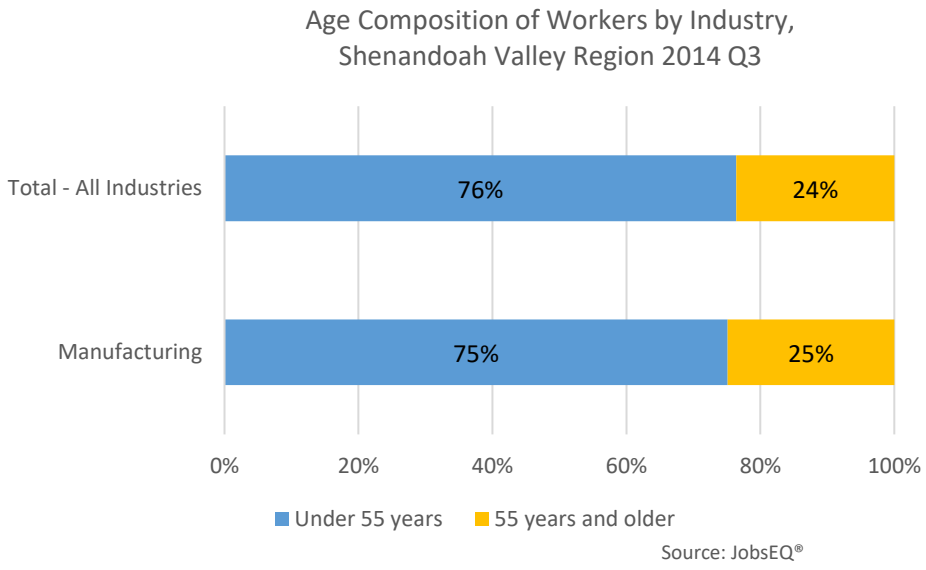
Several national and regional trends suggest potential current and future supply gaps for manufacturing occupations and related skills in the Shenandoah Valley. Trends include an aging manufacturing workforce, an increase in skills and education required to meet technological advances and the changing processes and practices in the industry, and difficulty finding and retaining skilled workers within the regional labor force in the context of a low-unemployment environment.



Retiring workers from the baby boomer generation are impacting many industries, but the manufacturing workforce in particular has been aging and may face significant shortages in the near future due to retirements. Based on Chmura's analysis of Current Population Survey data from the Bureau of Labor Statistics, the composition of the manufacturing workforce in the nation has changed from 20% age 55 or older in 2011 up to 23% age 55 or older in 2015. This represents an increase of 663,000 workers at or near retirement age in manufacturing. The median age in manufacturing in the U.S. was 44.4 years in 2015, compared with a median age of 42.3 across all industries. Further breaking down the age composition of the national manufacturing workforce, there was an uptick in employment of those 25-34 years old between 2014 and 2015, which may indicate younger workers entering the industry in the coming years. However, focus group participants indicated that in their experience this recent uptick has not been seen in the Shenandoah Valley region.

On average, survey respondents expect about 12% of their firm's workforce to retire over the next five years.

This trend appears in data for the Shenandoah Valley region as well. Within the region, the share of workers age 55 and older is higher across all industries than in the manufacturing sector nationally. As of the third quarter of 2014, 24% of workers across all industries were in this age cohort. In the manufacturing sector, 25% of workers were age 55 or older.

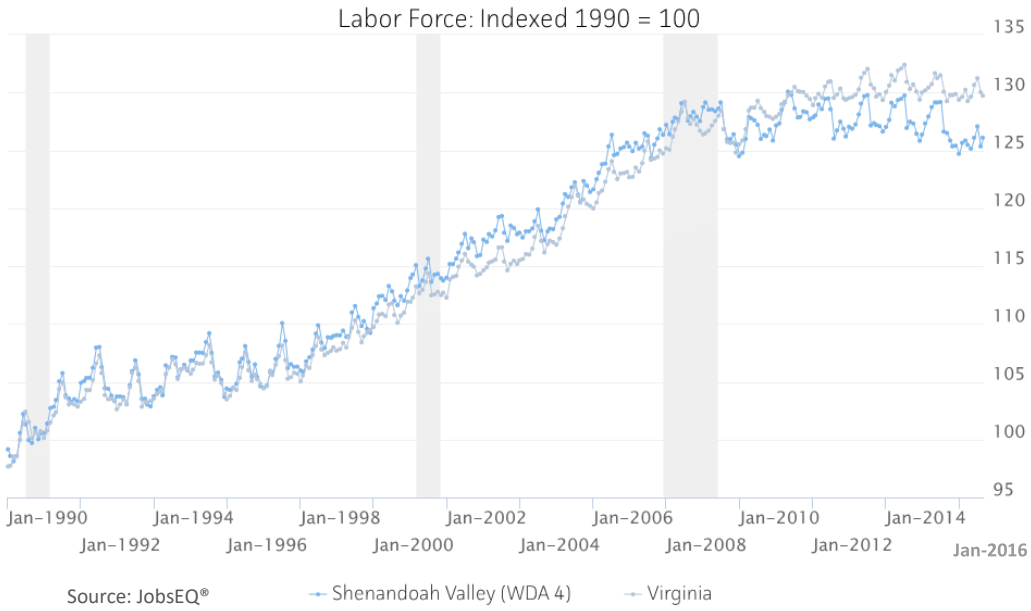


Concerns about an aging workforce trend and implications for retirement were confirmed anecdotally in the focus groups as well as in survey responses.

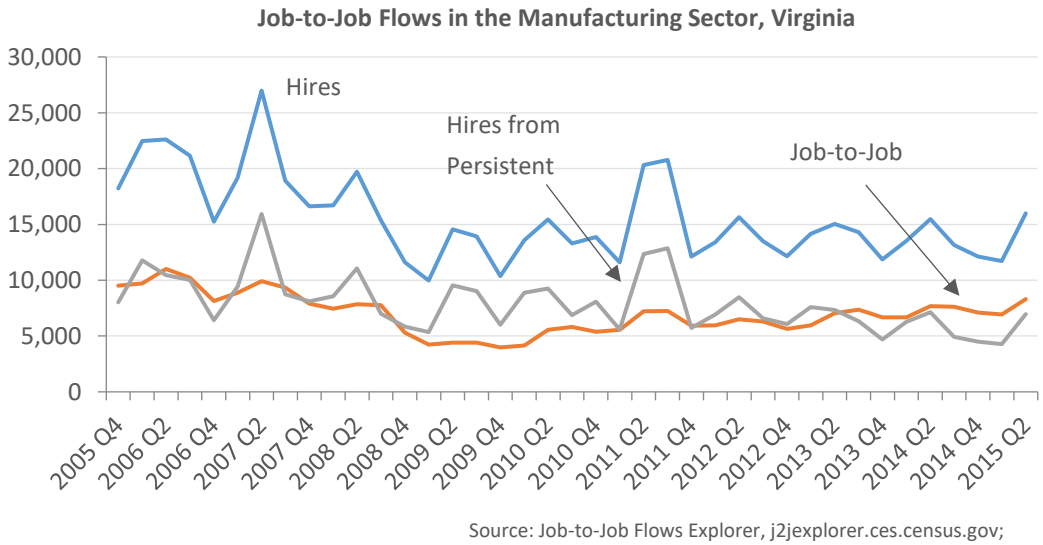
One focus group participant volunteered that their average workforce is 48 years old; two other participants countered that this was fairly young. One participant indicated their average worker is 55, while another said they have one young worker per eight older workers. Another participant mentioned they talk about their aging workforce a couple times a week. On average, survey respondents expect about 12% of their firm's workforce to retire over the next five years for an average annual retirement rate of 2.4%. This expected retirement rate is fairly uniform across industry group, locality, and employer size.

Another hiring trend impacting the region is the increasing difficulty businesses face finding workers in an environment of lower unemployment and flat labor force growth. As indicated in the regional economic overview above, unemployment in the region has dropped from a peak of 8.1% to 4.3% as of October 2016. In another measure of the unemployment environment, unemployment claimants from the manufacturing sector have declined from a peak of 1,964 in January 2009 to 215 in January 2016. Focus group respondents report staffing companies are short of employees and blame low unemployment.

Since the recession, labor force growth in the region has been relatively flat. The chart to the right shows overall labor force change for the Shenandoah Valley Region and Virginia indexed to 1990. While the available labor force in the state has expanded about 30% over this period, the Shenandoah Valley labor force has been relatively flat since the recession, leveling off at about 25% growth since 1990.



The declining available labor force for manufacturing appears in statewide data as well. Looking at the flow of jobs[6] within manufacturing in Virginia over time, for much of the recession, hires from persistent nonemployment[7] out-paced job-to-job hires in manufacturing.



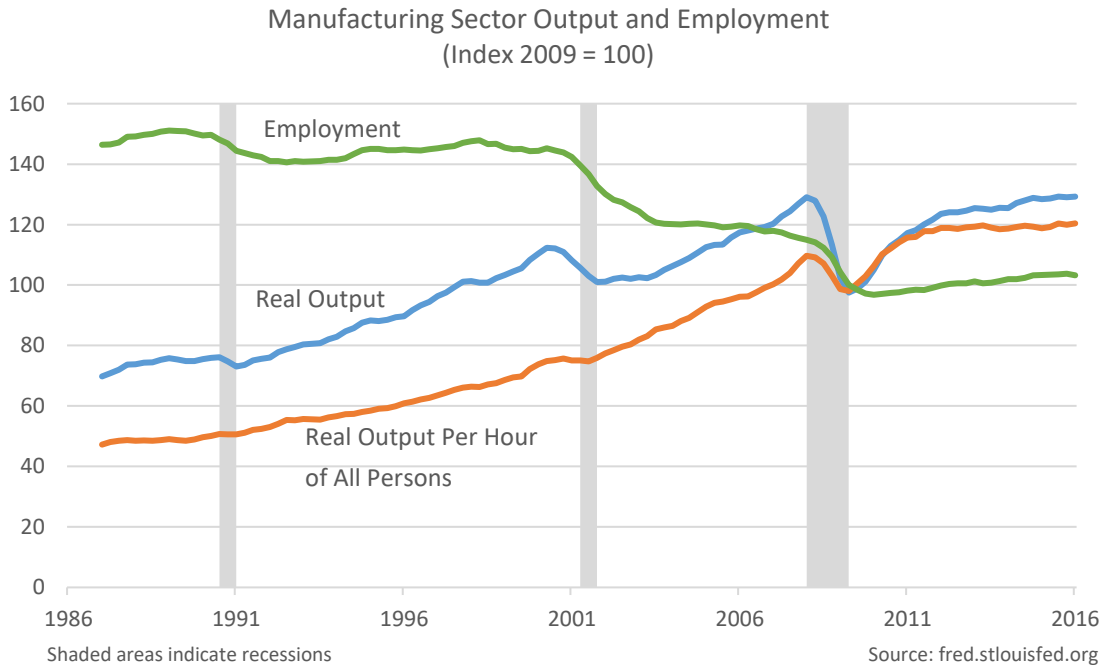
[6] The Job-to-Job Flows data from the Census Bureau is a beta release of new national statistics on worker reallocation.

[7] Hires from persistent nonemployment are workers hired for a main job who were not employed on the first day of the given quarter, or on the first day of the previous quarter.

"It's a perfect storm, the worst recruiting environment."

However, job-to-job hires began to overtake hires from persistent nonemployment beginning in 2013. While overall hires ticked up in 2015, most of that growth was attributable to job-to-job hires as workers switched jobs between employers, rather than to new hires from persistent unemployment. These data are consistent with the concerns expressed in the focus groups and in the survey about the difficulty of finding new workers and of employers consistently trading workers between themselves. As one focus group participant stated, the hardest part is keeping workers, since they know they can leave and go anywhere else. When discussing recruiting in a low-unemployment environment and these factors influencing labor force availability, one focus group participant said "it's a perfect storm, the worst recruiting environment."

Technology changes are a significant driver of potential gaps impacting the manufacturing sector—driving down demand for lower-skilled workers while increasingly requiring workers with higher skills and training across different functions. As shown in the graph below of output and employment in the manufacturing sector at the national level, manufacturing output (things produced) has trended up and continues to increase through 2016. However, employment has generally trended down, as manufacturing firms require fewer and fewer workers for production thanks to technology innovations and increasing productivity per worker. The new machines and robotics that have supported productivity gains require greater skill to program, maintain, and troubleshoot, creating a potential gap for these higher-skilled occupations. As stated by a focus group participant, "technology helps the machine operator but hurts maintenance" – for example, while the operator's job is made somewhat easier by using a screen to interact with a machine, if and when something goes wrong it may require people who understand mechanics and programmable logic controllers (PLCs) to diagnose and repair the machine. Another participant agreed that robotics are raising the bar on who can operate and maintain the machines.



A few focus group participants suggested an alternative view of increasing skill requirements and automation. One suggested their company has to offer higher wages to attract workers, but because of those higher wages the firm demands more skills of employees. Another focus group participant stated they used to automate to save costs, but now the fact that they cannot find people is driving automation.

Industry/Occupation Mix for the Manufacturing Sector

To identify occupations relevant to the manufacturing sector in the Shenandoah Valley, Chmura uses a test of significance and dominance. In this test, occupations that account for a significant share of total employment (1% or greater) in the manufacturing sector or occupations with a dominant share (20% or greater) of the occupation's total employment in the manufacturing sector are included in the industry/occupation mix. Out of the 821 detailed occupations classified by 6-digit Standard Occupational Classification (SOC) codes, 171 occupations meet these significance or dominance criteria. The largest occupations are team assemblers, with current employment of 1,542; packaging and filling machine operators and tenders (1,191); and first-line supervisors of production and operating workers (1,168). Overall, these occupations are expected to decline at an annual average rate of 0.6% over the next five years, for a total loss of 818 jobs; however, accounting for growth plus replacements due to retirements and workers changing occupations, these jobs are expected to have openings for 3,721 workers over the next five years. Among the 30 largest occupations, only three are expected to add jobs due to growth in the industry over the next 5 years—industrial machinery mechanics (+39); heavy and tractor-trailer truck drivers (+6); machinists (+11); and welders, cutters, solderers, and brazers (+3).

The 30 largest manufacturing occupations from the industry/occupation mix are shown in the table below with current employment, average wages, and 5-year forecasts. A full list of occupations is available in Appendix 3 of this report.

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley, 2016Q3

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
51-2092	Team Assemblers	1,542	$30,600	181	-42	181
51-9111	Packaging and Filling Machine Operators and Tenders	1,191	$29,600	217	-7	217
51-1011	First-Line Supervisors of Production and Operating Workers	1,168	$57,200	106	-30	106
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	1,117	$24,900	101	-5	101
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	1,001	$28,000	158	-17	158
51-9198	Helpers--Production Workers	919	$23,100	143	-46	143
51-3023	Slaughterers and Meat Packers	878	$28,600	105	-4	105
53-7064	Packers and Packagers, Hand	849	$29,300	114	-18	114
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	786	$36,800	104	-19	104
51-5112	Printing Press Operators	700	$36,200	68	-52	68
51-3092	Food Batchmakers	664	$26,600	96	-4	96
49-9071	Maintenance and Repair Workers, General	610	$35,900	80	-14	80
53-7051	Industrial Truck and Tractor Operators	601	$31,700	87	-13	87
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	593	$55,600	59	-18	59
49-9041	Industrial Machinery Mechanics	528	$45,900	68	39	107
11-1021	General and Operations Managers	520	$101,600	67	-14	67
53-3032	Heavy and Tractor-Trailer Truck Drivers	520	$40,600	48	6	54
43-5071	Shipping, Receiving, and Traffic Clerks	498	$31,200	51	-27	51
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	469	$32,800	75	-61	75

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley, 2016Q3

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
43-4051	Customer Service Representatives	417	$32,200	52	-19	52
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	387	$37,300	44	-45	44
43-9061	Office Clerks, General	384	$28,900	41	-21	41
51-4041	Machinists	358	$41,500	51	11	62
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	342	$36,100	45	-5	45
11-3051	Industrial Production Managers	333	$108,900	56	-8	56
51-4121	Welders, Cutters, Solderers, and Brazers	301	$42,400	50	3	53
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	286	$40,700	60	-37	60
53-7063	Machine Feeders and Offbearers	274	$33,800	29	-10	29
51-5113	Print Binding and Finishing Workers	273	$33,400	25	-21	25
51-9199	Production Workers, All Other	271	$27,600	27	-7	27

Source: JobsEQ®
1. Occupation wages are as of 2015 and represent the average for all Covered Employment

Occupation Gaps

This section identifies potential gaps in the short term and over the next five years. Current potential gaps are based on Real-Time Intelligence (RTI) gathered and analyzed by Chmura Economics & Analytics from online job postings. Long-term gaps are based on JobsEQ® analytics.

Short-Term Gaps

Job openings identify an immediate skills need, and potential gap, for employers as well as opportunities for job seekers. This is particularly relevant if there are large numbers of job postings for individual occupations indicating many businesses need the same skills. As shown in the table below, heavy and tractor-trailer truck drivers top the list with 272 openings,[8] followed by laborers and freight, stock, and material movers, hand (222). In the case of customer services representatives (178), while the job postings search was filtered by occupations relevant to manufacturing in the Valley, not all 178 online job postings are for manufacturing firms—the postings are collected from employers across different sectors. However, the demand for customer service representatives across industries remains indicative of potential gaps for manufacturers trying to hire for this occupation. Rounding out the top five, there were 94 postings for maintenance and repair workers, general, and 90 postings for production workers, all other. Five occupations in the top 20 list of job openings require a high school diploma and six require no formal educational credential. Two require postsecondary non-degree awards and seven typically require a bachelor's degree.

[8] Counts of unique job postings may not equate with actual job demand. For example, job postings may be placed in anticipation of possible openings that do not materialize. Moreover, slight variations of ads may be placed such that the number of ads exceeds the actual number of openings.

Online Job Postings for Top 20 Occupations, Manufacturing Occupations, Shenandoah Valley
December 2016 – January 2017

SOC	Occupation	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Number
53-3032	Heavy and Tractor-Trailer Truck Drivers	Postsecondary non-degree award	None	Short-term	272
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	Less than high school	None	Short-term	222
43-4051	Customer Service Representatives	High school diploma or equivalent	None	Short-term	178
49-9071	Maintenance and Repair Workers, General	High school diploma or equivalent	None	Long-term	94
51-9199	Production Workers, All Other	High school diploma or equivalent	None	Moderate-term	90
41-9011	Demonstrators and Product Promoters	High school diploma or equivalent	None	Short-term	70
43-9061	Office Clerks, General	High school diploma or equivalent	None	Short-term	54
51-1011	First-Line Supervisors of Production and Operating Workers	High school diploma or equivalent	Less than 5 yrs	None	54
11-1021	General and Operations Managers	Bachelor's degree	5 yrs or more	None	45
43-5071	Shipping, Receiving, and Traffic Clerks	High school diploma or equivalent	None	Short-term	44
17-2199	Manufacturing Engineers	Bachelor's degree	None	None	35
53-7051	Industrial Truck and Tractor Operators	Less than high school	None	Short-term	34
51-3011	Bakers	Less than high school	None	Long-term	27
11-2022	Sales Managers	Bachelor's degree	Less than 5 yrs	None	22
49-9041	Industrial Machinery Mechanics	High school diploma or equivalent	None	Long-term	22
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	Bachelor's degree	None	Long-term	21
53-7061	Cleaners of Vehicles and Equipment	Less than high school	None	Short-term	20
51-3021	Butchers and Meat Cutters	Less than high school	None	Long-term	18
53-7064	Packers and Packagers, Hand	Less than high school	None	Short-term	15
17-2141	Mechanical Engineers	Bachelor's degree	None	None	13

Source: Chmura, JobsEQ®

Note: Online jobs included were active at any point in the 30 days preceding January 20, 2017. As such, this report may include some ads that were closed as of that date and may include some ads that were first posted prior to the 30-day period.

The level of education required for these jobs is primarily less than a bachelor's degree. Fourteen occupations out of the top 20 (based on job openings) typically require a high school diploma or less for entry. Five generally require a bachelor's degree, and one opening typically requires a postsecondary non-degree award. None of these occupations usually require an associate degree or master's or higher degree.

Along with relatively lower education requirements, most jobs require no previous work experience but many require some level of on-the-job training. Out of this list, 17 occupations typically do not require any previous work experience. The three occupations that typically require some previous work experience are for supervisory or managerial positions. However, fifteen of the top 20 occupations require some measure of on-the-job training ("OJT"). Nine require short-term OJT, including heavy and tractor-trailer truck drivers and industrial truck and tractor operators. Five occupations require long-term OJT, including maintenance and repair workers, general; industrial machinery mechanics; and bakers.

Five-Year Gaps

Skills and occupations that are in demand today may not be in demand in the months or years ahead when a student finishes a training program or education. For that reason, long-term gaps need to be considered in conjunction with current gaps.

The approach taken here is to identify the apparent long-term skills gaps based on the total annual demand created from growth in manufacturing industries that need the occupation, as well as from positions that need to be filled because individuals are retiring or moving into a different occupation. In this case, a shortage of qualified workers could potentially occur if individuals are not being trained or educated to fill the openings. The potential supply shortfall or gap is an underlying force that the labor market will resolve in one way or another, such as by employers recruiting from further distances for these occupations, wages going up to attract more candidates, and demand and wages both enticing more local residents to get training for this occupation.

Among manufacturing occupations at a detailed level in the Shenandoah Valley, the largest projected demand/potential shortfalls are for packaging and filling machine operators and tenders, with total demand of 210 over the next five years. These occupations typically require a high school diploma or equivalent to enter, as well as moderate-term on-the-job training. The second through fifth occupations with the largest potential gaps each has a potential supply gap of more than 100 workers over the next five years: laborers and freight, stock, and material movers, hand; team assemblers; industrial machinery mechanics; and slaughterers and meat packers. Again, these occupations typically require either a high school diploma or no formal educational credential, but all require some term of on-the-job training. Industrial machinery mechanics require long-term on-the-job training, while team assemblers require moderate-term on-the-job training. Also notable for typically requiring long-term on-the-job training are maintenance and repair workers, general (66 needed over five years) and machinists (62).

Notable for typically requiring long-term on-the-job training are industrial machinery mechanics (107 needed over five years), maintenance and repair workers, general (66), and machinists (62).

Potential Manufacturing Occupation Gaps over 5 Years in Shenandoah Valley: Occupations with Total Demand > 30

SOC	Title	Typical Education Need For Entry	Current Employ-ment 2016Q3	5-Year Growth Demand	5-Year Repl Demand	Total Demand/ Potential Supply Gap
51-9111	Packaging and Filling Machine Operators and Tenders	High school diploma or equivalent	1,191	-7	217	210
53-7062	Laborers and Freight, Stock, and Material	Less than high school	1,001	-17	158	141

Potential Manufacturing Occupation Gaps over 5 Years in Shenandoah Valley: Occupations with Total Demand > 30

SOC	Title	Typical Education Need For Entry	Current Employ-ment 2016Q3	5-Year Growth Demand	5-Year Repl Demand	Total Demand/ Potential Supply Gap
	Movers, Hand					
51-2092	Team Assemblers	High school diploma or equivalent	1,542	-42	181	139
49-9041	Industrial Machinery Mechanics	High school diploma or equivalent	528	39	68	107
51-3023	Slaughterers and Meat Packers	Less than high school	878	-4	105	102
51-9198	Helpers--Production Workers	Less than high school	919	-46	143	97
53-7064	Packers and Packagers, Hand	Less than high school	849	-18	114	96
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	Less than high school	1,117	-5	101	96
51-3092	Food Batchmakers	High school diploma or equivalent	664	-4	96	92
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	High school diploma or equivalent	786	-19	104	85
51-1011	First-Line Supervisors of Production and Operating Workers	High school diploma or equivalent	1,168	-30	106	76
53-7051	Industrial Truck and Tractor Operators	Less than high school	601	-13	87	75
49-9071	Maintenance and Repair Workers, General	High school diploma or equivalent	610	-14	80	66
51-4041	Machinists	High school diploma or equivalent	358	11	51	62
53-3032	Heavy and Tractor-Trailer Truck Drivers	Postsecondary non-degree award	520	6	48	54
51-4121	Welders, Cutters, Solderers, and Brazers	High school diploma or equivalent	301	3	50	53
11-1021	General and Operations Managers	Bachelor's degree	520	-14	67	53
11-3051	Industrial Production Managers	Bachelor's degree	333	-8	56	48
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	High school diploma or equivalent	201	16	31	46
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	High school diploma or equivalent	593	-18	59	41
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	High school diploma or equivalent	342	-5	45	41
43-4051	Customer Service Representatives	High school diploma or equivalent	417	-19	52	34
17-2112	Industrial Engineers	Bachelor's degree	247	-5	38	33

Source: JobsEQ®

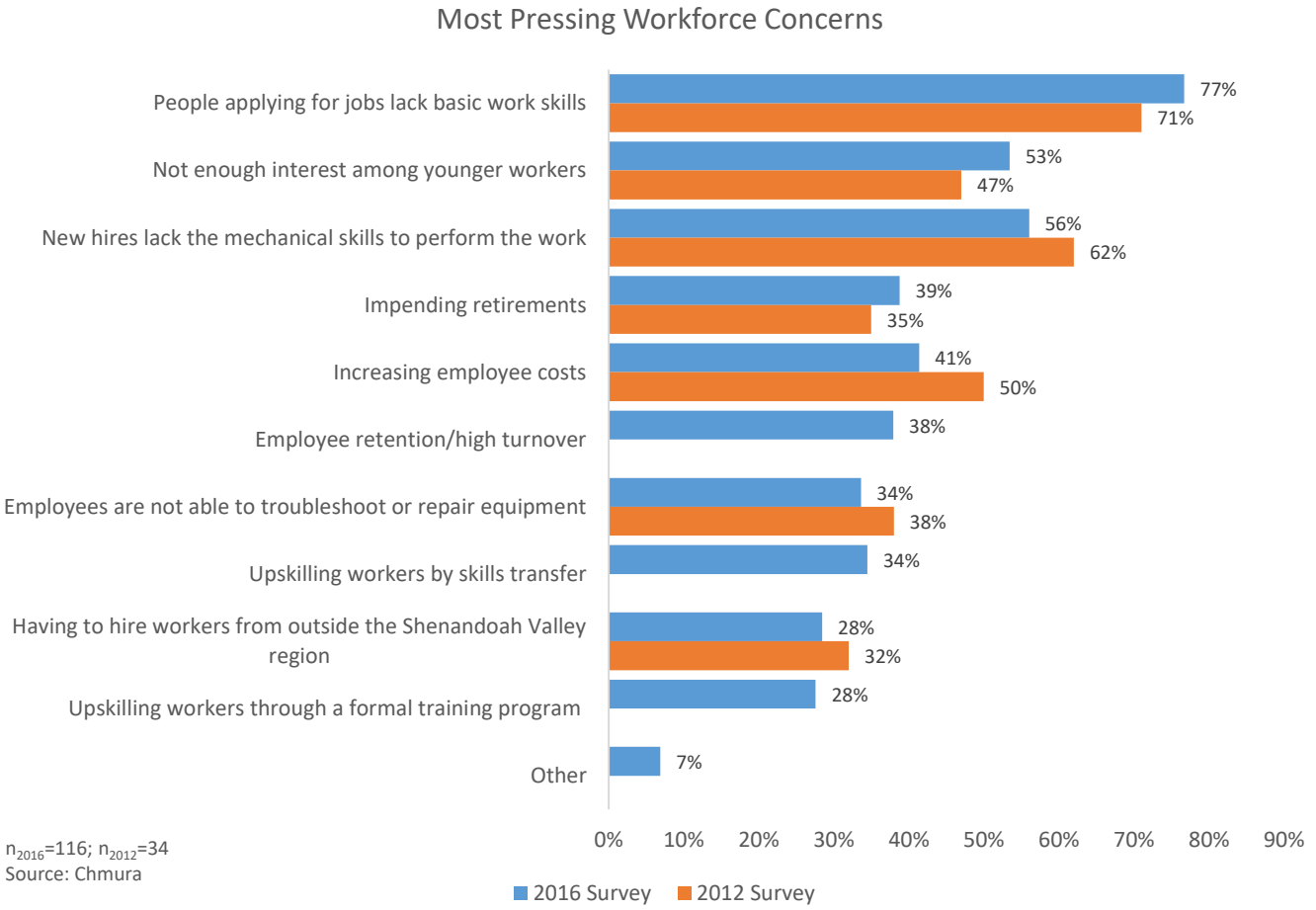
Gaps Identified in Primary Data Collection

In focus group sessions and in data collected in the survey, manufacturers identified gaps in their current workforce needs and shed light on their concerns about gaps in the near future. This section provides additional context from these primary data for the potential gaps identified in the secondary data analysis.[9]

[9] See Appendix 1 for the full survey report, and Appendix 2 for summaries of the focus group sessions.

The responses from focus group participants and survey respondents indicate gaps exist and employers are taking steps to close these gaps. In particular, the primary data collected confirmed the difficulty of hiring workers from within the region and current practices to attract and hire from outside the Shenandoah Valley. In the focus group, numerous reasons for preferring to hire from within the Shenandoah Valley region were provided. Hiring from within the region was associated with greater stability and higher employee retention, while hiring from outside the region, with associated relocation costs as well as the use of staffing companies, adds significantly to hiring costs. Despite the willingness to hire within the Valley, survey respondents indicated on average they hire 30% of their high-skilled employees and 23% of their low-skilled employees from outside the Shenandoah Valley region.[10] Respondents were also asked if they engage staffing companies to fill talent shortages. Of the 109 responses to this question, 61% use staffing agencies, 17% used to use staffing agencies but do not anymore, and another 20% of respondents' firms also do not use staffing agencies.

Along with the availability of workers, the survey also confirmed some of employers' most pressing concerns are around the pipeline of younger workers and impending retirements. The most prominent workforce concern was that people applying for jobs lack basic work skills, while over half of respondents stated a lack of interest by younger workers and a lack of mechanical skills among new hires as prominent workforce issues. [11] The fourth-most popular response was impending retirements, selected by 39% of respondents to the survey—a slight increase compared to the 35% of respondents who selected this concern in the 2012 survey. Comparisons to the 2012 survey results are shown where available in the figure below.



n_{2016}=116; n_{2012}=34
Source: Chmura

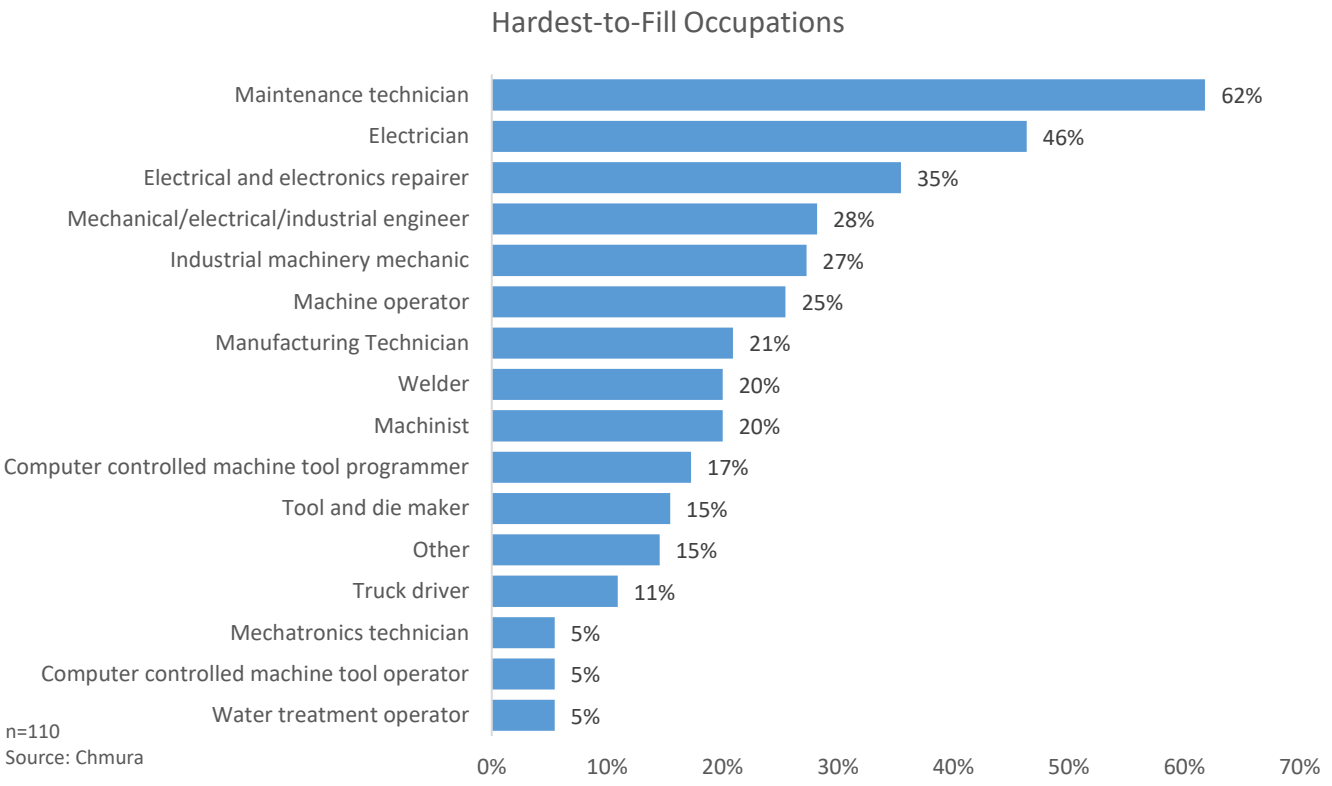
[10] Employers in the Northern region focus group clarified that due to their proximity to West Virginia, in some cases up to half of their workforce commute from West Virginia. This was especially true for operators.

[11] Multiple selections were allowed for this question.

Workforce concerns in the Valley varied by both industry type and location. When examined by industry group, a lack of interest among younger workers is a more pressing concern for plastics or rubber products manufacturers (10 of 13 respondents stated this as a pressing concern) when compared to the food or beverage manufacturing firms (8 of 22). Having to hire workers from outside the Valley region is a more prominent concern among machinery firms (7 of 10) than fabricated metal manufacturing firms (8 of 35). A couple of differences in workforce concerns also emerged at the regional level. A lack of basic work skills among job applicants was more often listed as a concern by respondents in the Northern region (83%) than respondents in the Central region (69%). Increasing employee costs was also a more prominent issue in the Northern region (48%) than the Central region (29%).

Some workforce concerns, including hiring from outside the Valley and rising employee costs, varied by industry and region.

The survey also captured concerns about hiring for specific occupations. The survey asked respondents to identify their hardest-to-fill occupations, and if there is an industry credential or certification required for employment. Of all respondents, 62% classified maintenance technician and 46% classified electrician as two of the hardest-to-fill occupations. Respondents also found electrical and electronics repairer (35%), mechanical/electrical/industrial engineer (28%), industrial machinery mechanic (27%), and machine operator (25%) fairly difficult to fill at their firm. Somewhat surprisingly, while a focus group participant indicated that there are not enough machinists in the Valley and they have been hiring for years, only 20% of survey respondents indicated that this was one of their hardest-to-fill occupations. There was no consensus on any "other" occupations not listed being difficult to hire—a testament to the input from the focus groups in the survey design. These "other" occupations included broad categories of workers such as entry-level positions, line workers, and manufacturing professionals as well as specific positions including environmental engineers, solderer, office manager, and 3D CAD SolidWorks modelers for structural steel. Compared to the 2012 survey, the difficulty in finding maintenance technicians has increased, while difficulty in finding engineers has somewhat decreased. Truck drivers (58%) and welders (55%) are the occupations that respondents most often state require a certification or credential. There does not appear to be a correlation between hard-to-fill occupations and a certification requirement for those occupations.



n=110
Source: Chmura

Survey respondents also indicated potential future occupation gaps due to impending retirements in their responses to several questions about estimated employment change over the next five years. According to 108 respondents, the 79 represented firms are expected to grow by about 24 employees on average, or 16%, over the next five years. Twenty-two firms expect to maintain their current employment level while 49 firms expect to grow; only one firm is expected to downsize. Along with demand due to growth, respondents expect about 12% of their firm's workforce, on average, to retire over the next five years. The average expected annual retirement rate of 2.4% is fairly uniform across industry group, locality, and employer size.

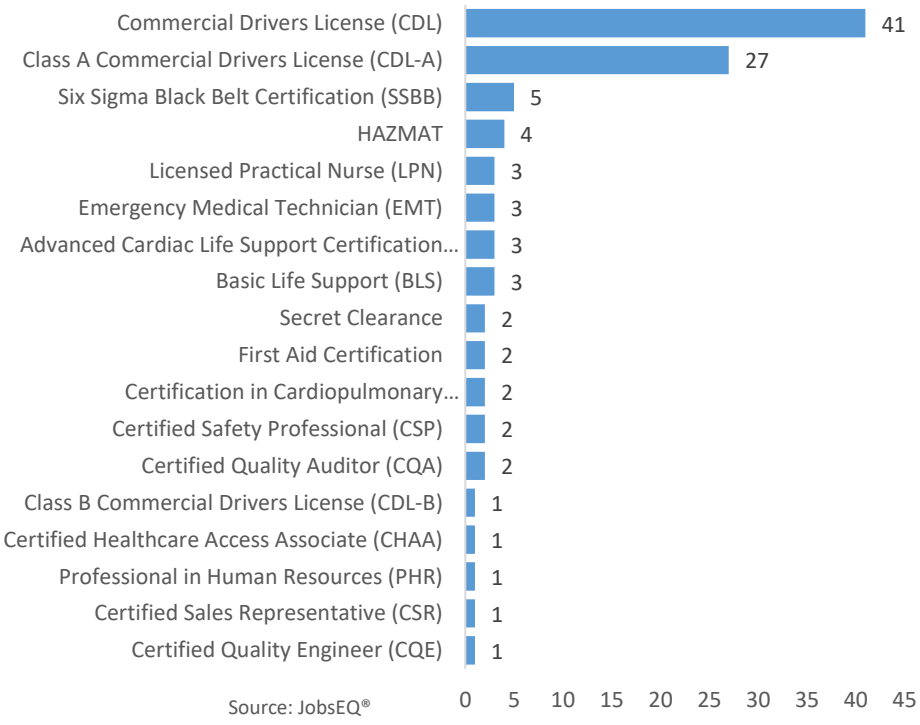
Respondents shared similar concerns about retirements over several occupations. The most common answer was maintenance technicians, with 40% of respondents concerned about retirements from this occupation. Apprehension over retirements at the supervisory and management levels is fairly high, at 20% of respondents. Respondents also shared concerns about electricians (19%), machine operators (14%), and machinists (12%) over the next five years.

In-Demand Skills and Credentials

This section details the in-demand skills and credentials as suggested by Real-Time Intelligence (RTI) gathered and analyzed by Chmura Economics & Analytics from online job postings and as revealed in the survey results.

By far the most requested certification in online job ads for manufacturing occupations in the Shenandoah Valley is commercial driver's license (CDL). CDL was mentioned in 41 job postings over a 30-day period in December 2016 to January 2017, while another 27 ads requested a Class A CDL and one ad requested a Class B CDL. Also related to truck drivers, HAZMAT certification appeared in four job postings over this period. Other certifications related primarily to manufacturing professionals or supervisory positions and medical training. These include Six Sigma Black Belt Certification (5 ads), Secret Clearance (2), and Certified Safety Professional (2) and Certified Quality Auditor (2), as well as Emergency Medical Technician (3), Basic Life Support (3), and First Aid Certification (2).

Certifications in Online Job Postings for Manufacturing Occupations in Shenandoah Valley
December 2016 - January 2017



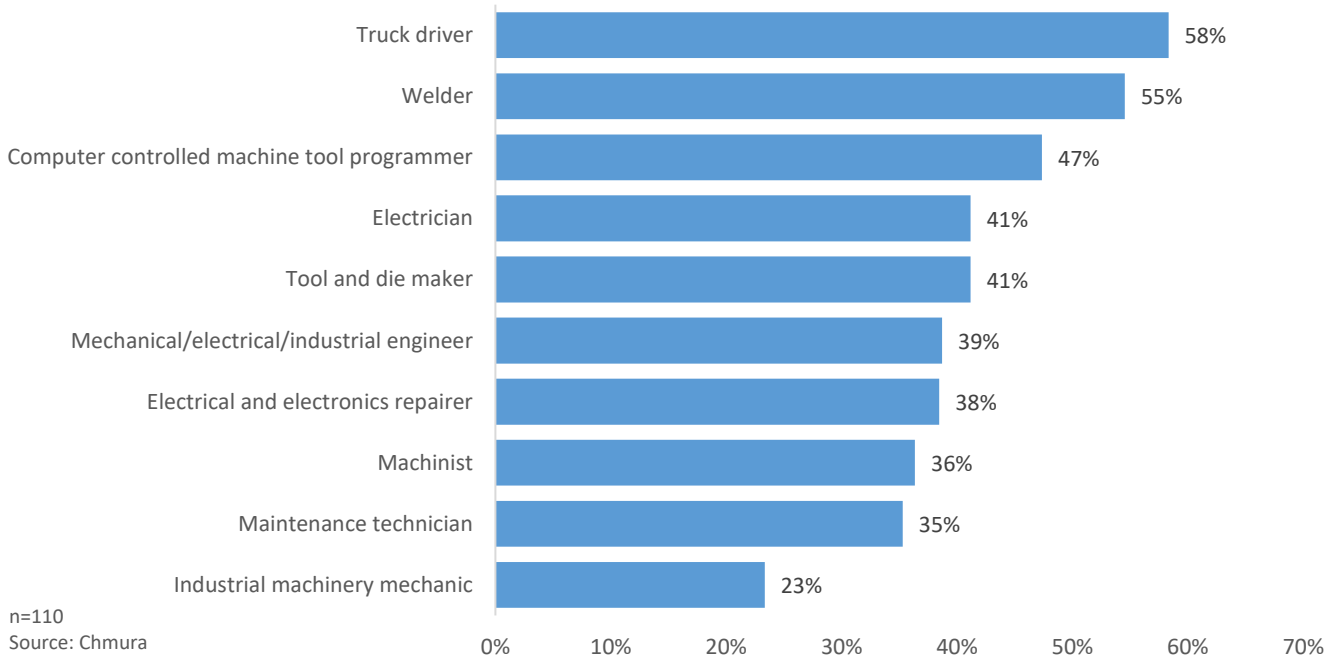
Source: JobsEQ®

Focus group participants mentioned some additional certifications that are important for their workforce, but are difficult to find. AWS (American Welding Society) certification was mentioned in both focus group sessions. Journeyman papers, soldering (J standard) and braising, and CDL Class A certifications were also named during the focus groups. However, due to the difficulty finding workers with these certifications in some cases, multiple companies in the focus groups stated they train employees for certifications after they are employed or hire employees with some minimum certification and then the company further certifies them. Some companies also test on site for certifications to make it easier for employees to be certified.

With the context provided from focus group participants, survey results suggest that while certifications are required for many occupations, in the current hiring environment certifications may be more of a differentiating factor than absolute requirement for hiring in hard-to-fill occupations. In the survey, respondents were asked which occupations are hardest to fill, as well as if there is an industry credential or certification required to be hired or maintain employment. The percent of respondents who stated a credential or certification is required is shown in the figure below for the 11 occupations with at least five responses. The only occupations with more than 50% indicating a requirement for a certification or credential are truck drivers (58%) and welders (55%). More than 40% of respondents who selected computer controlled machine tool programmers (47%), electricians (41%), and tool and die makers (41%) as difficult-to-fill occupations also indicated that they require a related credential or certification. Only about a third indicated a required credential or certification for machinists (36%) or maintenance technicians (35%). There does not appear to be a correlation between hard-to-fill occupations and a certification requirement for those occupations.

One focus group participant stated certifications are very much a differentiator. In the survey results, there does not appear to be a correlation between hard-to-fill occupations and a certification requirement for those occupations.

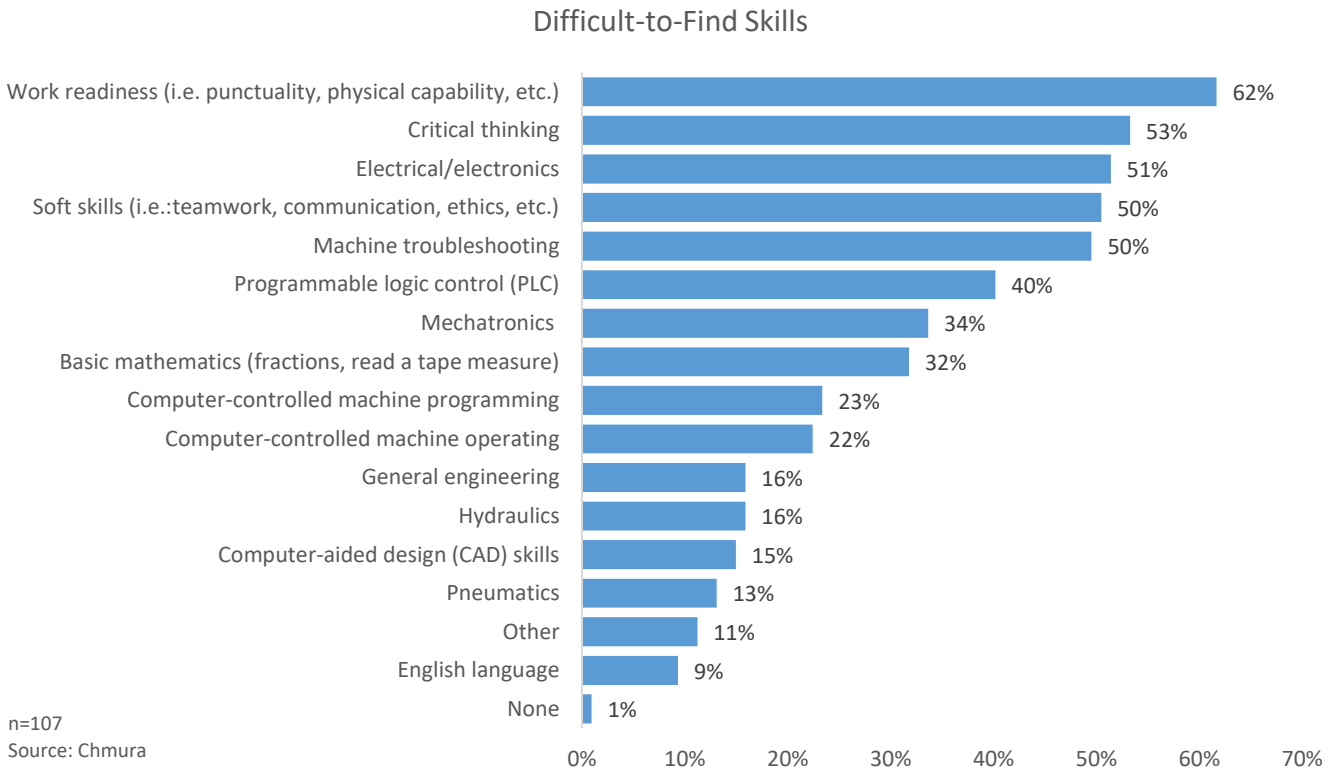
Percent of Respondents Indicating a Required Credential or Certification



n=110
Source: Chmura

In contrast to certifications and credentials, the lack of basic work skills and work readiness were emphatically supported as difficult to find and were significant workforce issues for survey respondents. The lack of basic work skills (such as work ethic, discipline, punctuality, etc.) among job applicants was the most prevalent workforce issue according to respondents, with 77% stating this as one of their firm's most pressing workforce concerns. This percentage is up from 71% in the 2012 study. In another question, work readiness (such as punctuality, physical capability, etc.) was most often recognized by respondents as difficult to find. Critical

thinking (53%), electrical/electronic skills (51%), soft skills such as teamwork or communication (50%), and machine troubleshooting (50%) were also characterized by at least half of respondents as difficult to find.

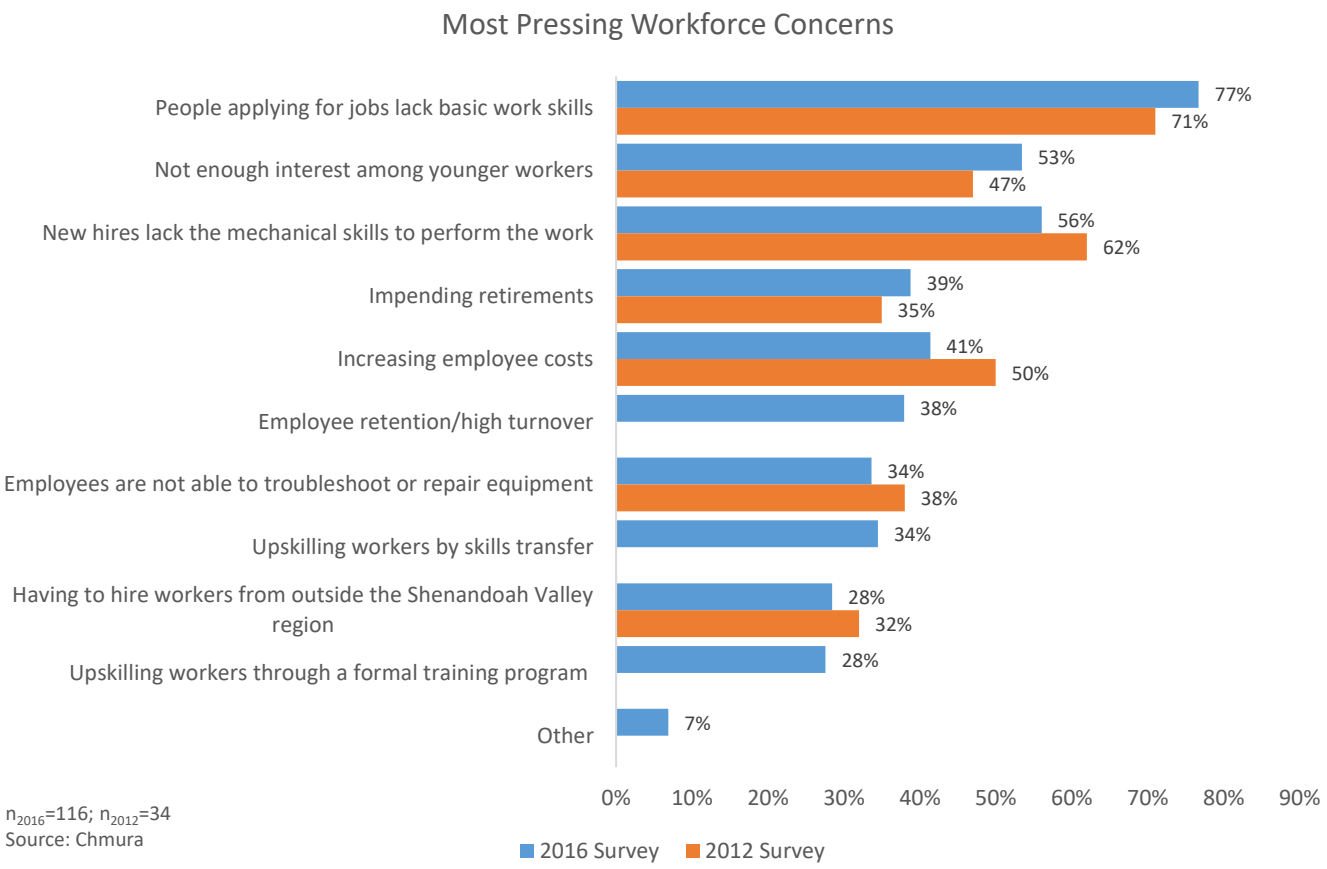


As was true for difficult-to-fill occupations, in-demand skills vary somewhat across industries and regions. Of respondents in the food or beverage manufacturing industry group, 79% identified mechatronics as a difficult skill to find, while only 24% of all other respondents identified it as hard to find. Almost all respondents (11 of 12) in the plastics or rubber products industry listed work readiness as difficult to find. Respondents in the Central region more often list electrical/electronic skills (61%) as difficult to find relative to the Northern region (42%). Alternatively, respondents in the Northern region more often list basic math skills (47%) and work readiness (71%) as difficult-to-find skills compared to the Central region (21% and 52%, respectively).

In-demand skills also vary by industry and region.

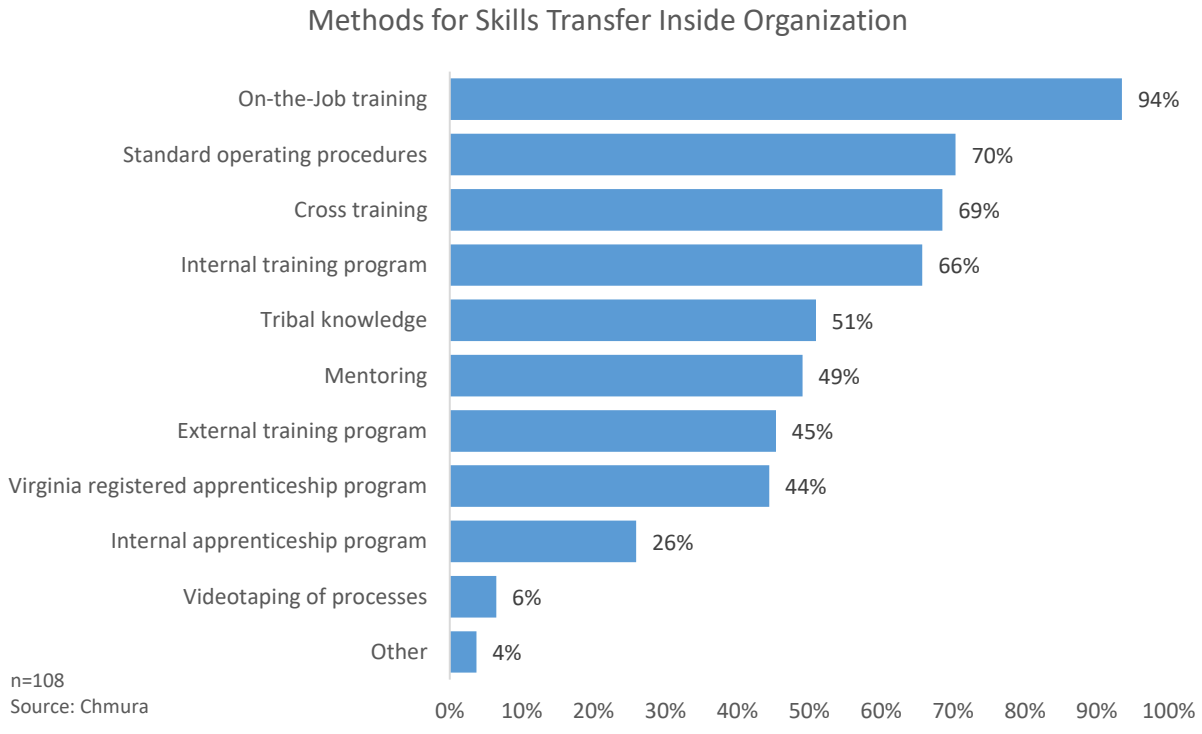
Employer Practices and Needs Regarding Workforce Upskilling

Despite the expressed current and potential gaps in occupations and skills for manufacturing respondents in the Shenandoah Valley, upskilling workers was among the least pressing concerns for survey respondents. When asked to name the most pressing workforce concerns of their businesses, 34% chose upskilling workers by skills transfer, and 28% selected upskilling workers through a formal training program (respondents were allowed to select multiple answers for this question). Employee retention/high turnover and impending retirements were slightly more widespread workforce concerns, selected by 38% and 39% of respondents, respectively. Again, the most pressing concerns expressed in the survey regarding skills were centered on basic work skills (77%) and mechanical skills among new hires (56%).



n_{2016}=116; n_{2012}=34
Source: Chmura

Respondents were asked what processes are currently used for assuring skills transfer within their organization. On-the-job training is almost universally used by respondents' firms, as shown in in the figure below. Utilization of standard operating procedures (70%), cross training (69%), and internal training programs (66%) are used in at least two-thirds of respondents' companies.



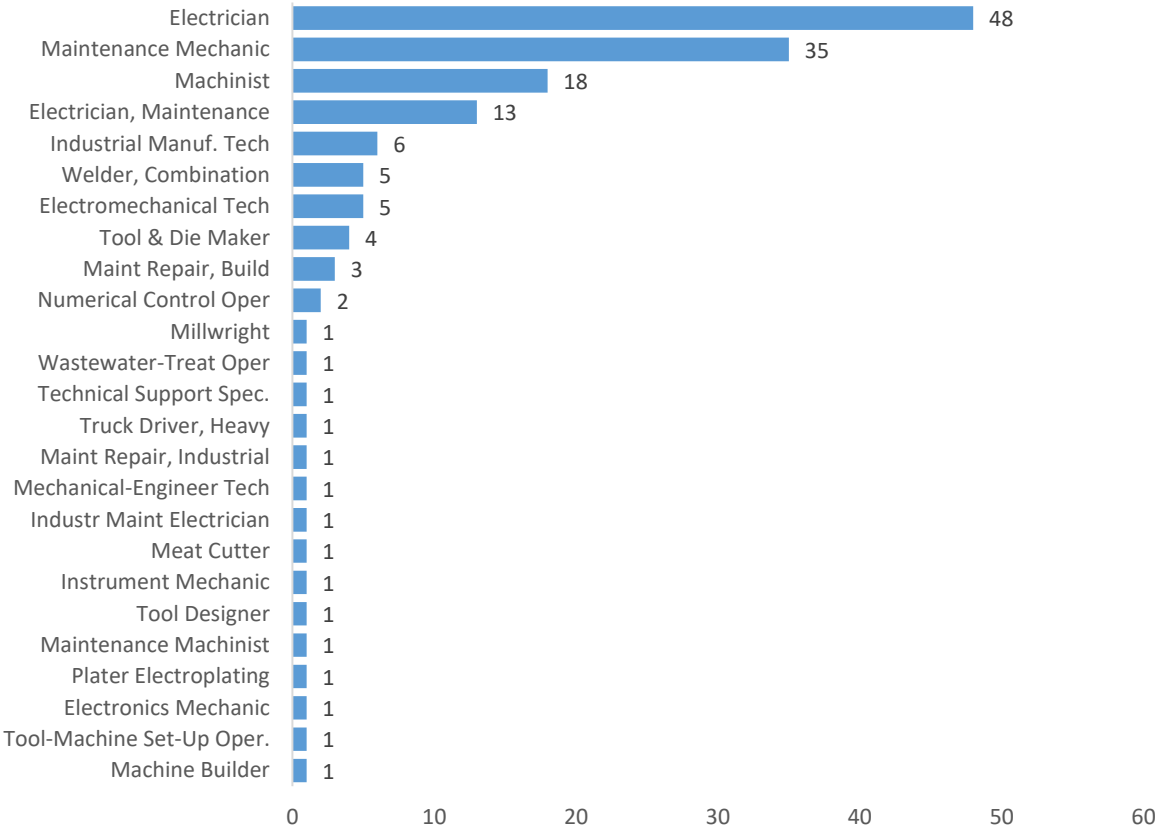
n=108
Source: Chmura

More than half (51%) of respondents rely on tribal knowledge as a method for skills transfer inside their organization. Coupled with reported concerns about employee retention and high turnover, this can result in the loss of vital knowledge for the company and significant loss in productivity. This area represents a good opportunity for the SVWDB to share best practices among manufacturing employers and assist in formalizing skills transfer. Mentoring was selected by 49% of respondents; one of the difficulties of mentoring, as mentioned in the focus group, is that some of the best workers are not necessarily the best at teaching or mentoring. Only 6% responded that they videotape processes, but this could be an indication of a process not yet widely adopted rather than an outdated one. When recording was mentioned in the focus groups as a practice some employers currently use to capture skills, many participants agreed it could be beneficial to replicate in their own firms.

The reliance on tribal knowledge reported in the survey, and the associated risks, presents an opportunity for the SVWDB to share best practices in transferring skills.

Forty-four percent of respondents indicated they use Virginia's Registered Apprenticeship program as a method to transfer skills within their organization. Working with sponsors (employers) to design of customized programs, Registered Apprenticeships produce skilled workers through a combination of on-the-job training and classroom instruction. Data from the Virginia Department of Labor and Industry indicate there are 110 sponsors within the Valley for apprenticeship programs related to 25 different manufacturing occupations.[12] Many align with in-demand manufacturing occupations and skills mentioned in the survey, such as training programs for electrical skills, maintenance, machinists, welders, CNC, heavy truck drivers, and tool & die workers. The number of sponsors in the region for each manufacturing-related program is shown in the figure below.

Virginia Registered Apprenticeship Sponsors in Shenandoah Valley
For Manufacturing-Related Programs



Source: Virginia Department of Labor and Industry

[12] Source: Virginia Department of Labor and Industry, www.doli.virginia.gov/apprenticeship. Data come with the following disclaimer: The following listing of registered program sponsors is intended to be a resource for information on sponsors. This is not a complete listing, and sponsors listed may or may not be actively seeking employees.

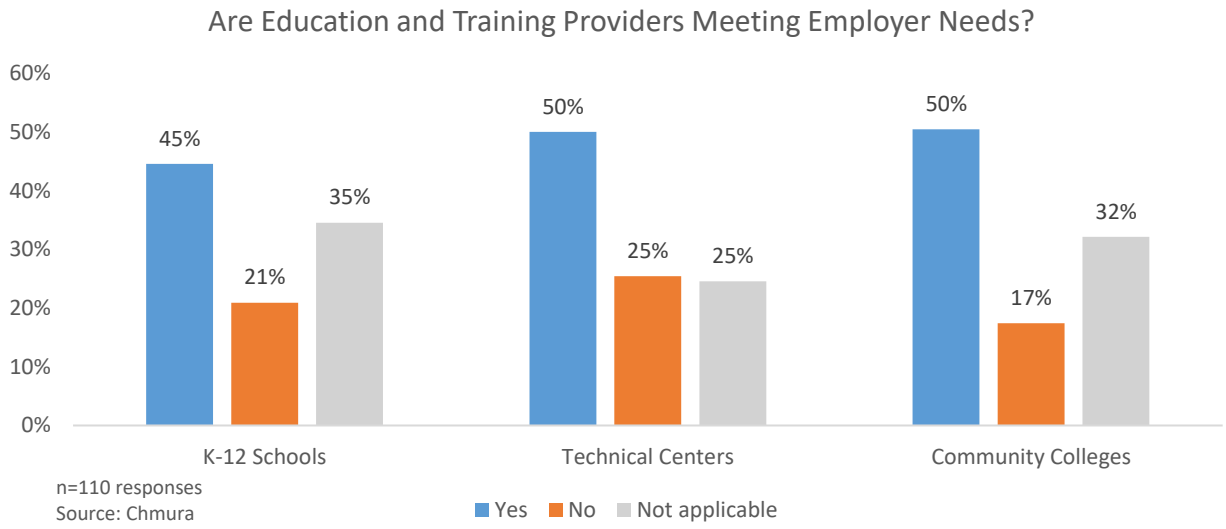
The SVWDB's American Apprenticeship grant is used to expand registered apprenticeships in advanced manufacturing industries—in a separate question, the survey asked respondents about their satisfaction with this grant, and the results are very positive. Of the 108 respondents that answered this question, a little over half (53%) have participated in this grant program. Of those grant program participants, 53% are very satisfied with the grant process, and an additional 23% are somewhat satisfied. No respondents were dissatisfied with the process, as 4% are neutral and 21% don't know or don't have an opinion. Respondents who participated in the grant program were asked for suggestions to improve the process. While many are still new to the process, communication was generally praised. The most common suggested area for improvement was in reducing the burden of paperwork. Full comments are available in Appendix 1 of this report.

Survey respondents were also asked about their satisfaction with the Valley OJT (On-the-Job Training) grant program, and the results are also very positive. Of the 73 respondents who participated in this program, 64% are very satisfied with it, and another 15% are somewhat satisfied. Suggestions for improvement also centered on paperwork, as well as a range in the work ethic of employees hired through the program. See Appendix 1 for a list of all comments from the survey.

Finally, to comprehensively inventory employer needs, the survey also asked respondents what they would like to see done in workforce development in the region that would most help their firm. Two common themes emerged from the 66 respondents who answered this question: better promotion of technical careers, particularly to young people, and improving training and education for manufacturing jobs. Nearly one-third of respondents left remarks about improving marketing and promotion of technical careers to high school students. Many of these remarks discuss trying to reverse the perceived negative stigma associated with factory jobs. The other common theme—improving training and education—was also mentioned by nearly one-third of respondents. Most of these comments focus on improving technical skills, often specific to each occupation, but several comments referenced a need for better training for broad skills such as basic math, critical thinking, and communication. Some respondents suggest a central hub of workforce information in the Valley, ranging from available jobs and grant information to training programs—a natural role for the SVWDB. Other responses mention further development of technical schools and more funding for grants and on-the-job training. All responses are listed verbatim in Appendix 1, as well as the respondent's locality and industry group.

Two common themes emerged for improvements in workforce development: better promotion of technical careers, especially to young people, and improving training and education.

Anticipating remarks about training and education, and based on the refrain heard in focus groups on this topic, the survey included a question asking if the training providers in the region are meeting respondents' needs. These providers were grouped into three categories: K-12 schools, technical centers, and community colleges. As shown in the figure below, respondent satisfaction rates are similar across all providers with about half of respondents indicating the provider is meeting their firm's needs.



Respondents who stated that K-12 schools were not meeting their firm's needs primarily stressed a lack of technical and soft skill training. The respondents stated that secondary schools do not allocate resources for technical training or transferrable skills necessary for the manufacturing industry's environment. Comments on improvements for technical schools and community colleges varied from a lack of high-quality graduates (technical and work-readiness skills) to a lack of occupation-specific training. However, multiple focus group participants also emphasized productive relationships with community colleges in their region. In particular, one company praised the "strong relationship" with Lord Fairfax Community College, including a registered apprenticeship program for mechanics, testing for maintenance technicians, and leadership development. Similarly, another company stated that Blue Ridge Community College has "a fantastic program," but regretted there are not enough people entering it. The participant suggested the college needs to be more flexible, mirroring other participants' calls for flexible hours and program offerings that can accommodate shift schedules. There are also a few variations regionally among survey respondents. Those in the Central region were more likely to say that K-12 schools and technical centers are meeting their needs. Of respondents in the Northern region, 58% state that community colleges are meeting their needs compared to 44% in the Central region.

Conclusion

Consistently across focus groups and survey results, manufacturers in the Shenandoah Valley region valued the chance to express their concerns about workforce issues affecting their companies and to offer recommendations. These issues include skill shortages, knowledge and job skill transfer and upskilling of workers—especially around the expectation of impending retirements—and other hiring challenges in a lower unemployment environment.

Several national and regional trends support concerns about supply gaps for manufacturing occupations and related skills in the Shenandoah Valley. The average age of workers in manufacturing is significantly higher than in all industries, positioning the industry for significant shortages in the near future due to retirements. Lower unemployment growth and flat labor force growth are impacting availability of workers within the region, leading employers to search for talent outside the region, with associated concerns about relocation and staffing agency costs, employee retention, and high turnover. Job-to-job flow data are also consistent with the concerns expressed in the focus groups and survey about the difficulty of finding workers, the tendency of workers to leave companies over a short period of time for higher wages at competitor firms, and employers trading the same workers between themselves. Technological advances are also driving demand for higher skills among workers.

Secondary data analysis, focus group responses, and results from the survey of manufacturing firms in the region reveal current and potential future gaps as a focus for the SVWDB.

From analysis of job postings data collected by Chmura, heavy and tractor-trailer truck drivers top the list of openings between December 2016 and January 2017 with 272, followed by laborers and freight, stock, and material movers, hand (222). Although some of the jobs typically require relatively less education, many require some quantity of on-the-job training. Five occupations require long-term OJT, including maintenance and repair workers, general; industrial machinery mechanics; and bakers.

The largest projected demand/projected shortfall over the next five years is for packaging and filling machine operators and tenders, with total demand of 210 over this period. Industrial machinery mechanics (107 needed over five years), maintenance and repair workers, general (66), and machinists (62) are also notable for potential gaps because these occupations typically require long-term on-the-job training.

The survey also captured concerns about hiring for specific occupations. Of all respondents, maintenance technicians and electricians were two of the hardest-to-fill occupations. Respondents shared similar concerns about retirements over several occupations; the most common answer was maintenance technicians. Apprehension over retirements at the supervisory and management levels is fairly high. Respondents also shared concerns about electricians, machine operators, and machinists over the next five years.

There is also support for some in-demand credentials and skills from the secondary and primary data collected. By far the most requested certification in online job postings for manufacturing occupations in the valley is for CDLs. The survey results reiterated credentials are needed for truck drivers, as well as for welders and computer controlled machine tool programmers. However, within the context provided from focus group participants, the survey results suggest that among the difficulties faced in hiring, certifications are more of a differentiating factor for hard-to-fill occupations. In the survey results, there does not appear to be a correlation between hard-to-fill occupations and a certification requirement for those occupations. Employers in the focus groups also confirmed that in some cases they work with hires to ensure they gain the necessary training and certification.

The lack of basic work skills and work readiness were emphatically supported in the survey results as difficult to find, and were revealed to be significant workforce issues. These issues were closely tied in the focus groups to education and training providers in the region. Survey respondents who stated that K-12 schools were not meeting their needs primarily stressed a lack of technical and soft skill training. Respondents stated secondary schools do not allocate sufficient resources for technical training or skills necessary

to support the needs of manufacturers in the region, while comments on improvements for technical schools and community colleges varied from a lack of graduates with technical and work-readiness skills to a lack of occupation-specific training. However, multiple focus group participants also emphasized productive relationships with community colleges in their region.

Despite the expressed current and potential gaps in occupations and skills for manufacturing respondents in the Shenandoah Valley, upskilling workers was among the least pressing concerns for survey respondents. When asked to name the most pressing workforce concerns of their businesses, 34% chose upskilling workers by skills transfer, and 28% selected upskilling workers through a formal training program.

Among practices for assuring skills transfer within their organization, on-the-job training is almost universally used by respondents' firms. Utilization of standard operating procedures, cross training, and internal training programs are used in at least two-thirds of respondents' companies. However, more than half (51%) of respondents report relying on tribal knowledge as a method for skills transfer inside their organization. The reliance on tribal knowledge, and the associated risks, presents an opportunity for the SVWDB to share best practices among employers around transferring skills.

Finally, recommendations for improvements in workforce development were primarily around two common themes—promoting technical careers, especially to young people, and improving training and education. Regarding the SVWDB's Apprenticeship grant and OJT grant, results were overall very positive, with almost all participant firms satisfied or somewhat satisfied. The communication between the SVWDB and sponsors was especially praised. The majority of improvements for those grant processes were related to minimizing the paperwork and increasing awareness among firms of these programs.

Firms participating in this study were appreciative of the effort taken to reach out to them and inventory their concerns and workforce needs. Continued excellence in this area—connecting workforce development efforts with employer's current and expected needs—will be required to stay on top of the trends driving potential gaps in manufacturing in the Shenandoah Valley region and ensure a prepared workforce to support future economic growth.

This workforce report was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The report was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

Appendix 1: Survey Report

A1.1. Background and Methodology

Chmura worked with the Shenandoah Valley Workforce Development Board to obtain 106 complete survey responses from manufacturing businesses in the Valley region.[13] Online links to the survey were distributed via email by the SVWDB to about 264 recipients between December 12 and December 28. Of the emails sent with survey links, 26 messages bounced back due to delivery errors. Of the 238 successfully delivered survey links, Chmura received 106 complete surveys and an additional ten partially completed surveys, resulting in a 44.5% completion rate. As many of the surveyed firms are large and have several locations and/or industry segments in the Valley region, some were surveyed multiple times. The complete responses speak for 77 unique companies, representing 14% of the Valley region's 560 covered manufacturing establishments.[14] As many of the surveyed firms are large employers, these survey results represent 64% of manufacturing employment in the region. Chmura and the SVWDB designed the survey instrument to include questions regarding the following key areas, and the results are presented in this format:

- Business characteristics, including size, industry, and location
- Workforce concerns including primary concerns, occupation shortages, satisfaction with education and trading providers, and skill deficiencies
- Hiring and training practices, including hiring methods, employee origins, and satisfaction with grant programs
- Outlook over the next five years, including estimated employment change and retirement concerns

Overall, survey results are very similar to the survey conducted in December 2012, although this survey received three times as many responses.

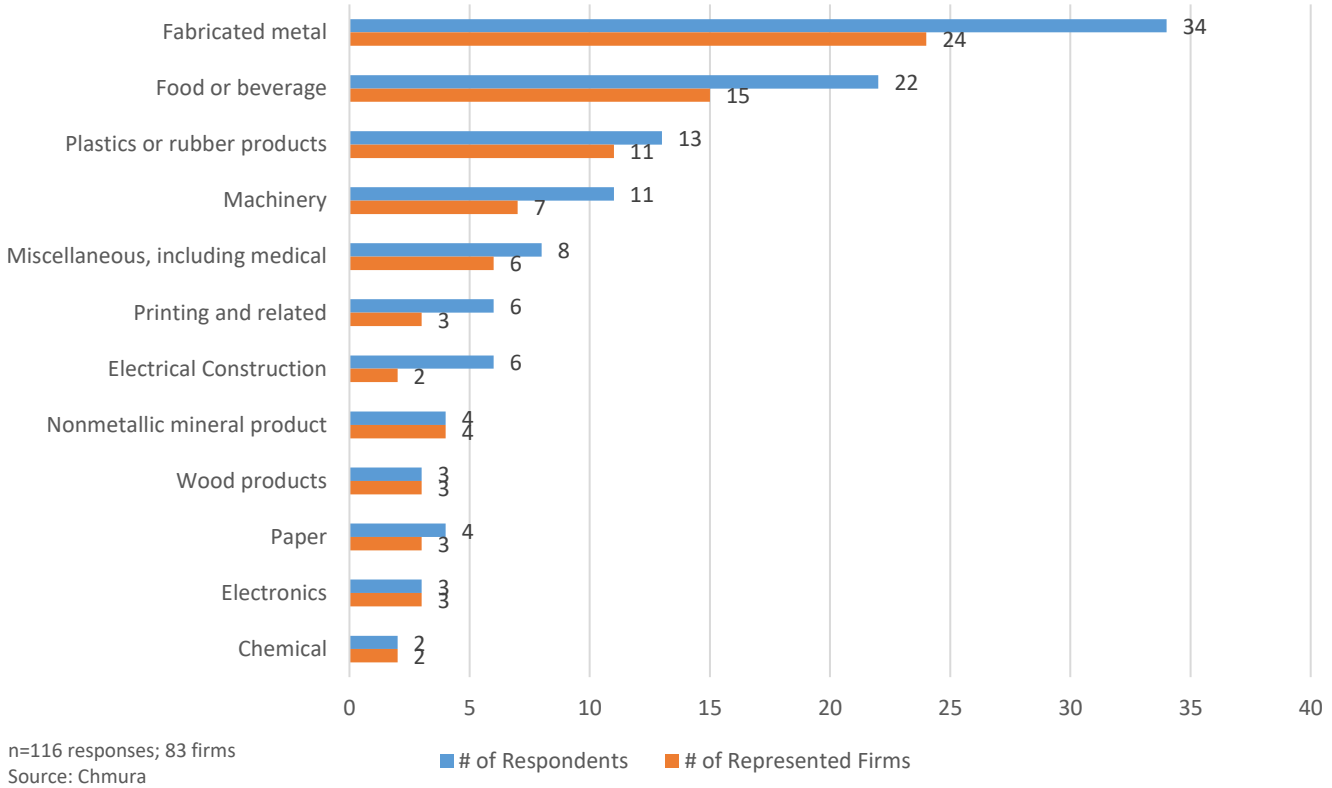
A1.2. Business Characteristics

Respondents were asked what manufacturing industry grouping best describes their firm. Chmura conducted additional research to supplement these industry self-identification responses to categorize all responding firms into a manufacturing industry grouping. As shown in Figure A1.1, over one-quarter of firms are in the fabricated metal industry, followed by the food or beverage industry (18%), and the plastics or rubber products industry (13%).

[13] Three responses (two complete and one partial) representing two firms are from localities outside the Valley: Roanoke and Covington.

[14] Sixteen firms had two completed surveys (from different respondents/different firm locations) included in the analysis. Four firms had more than two complete responses included in the analysis.

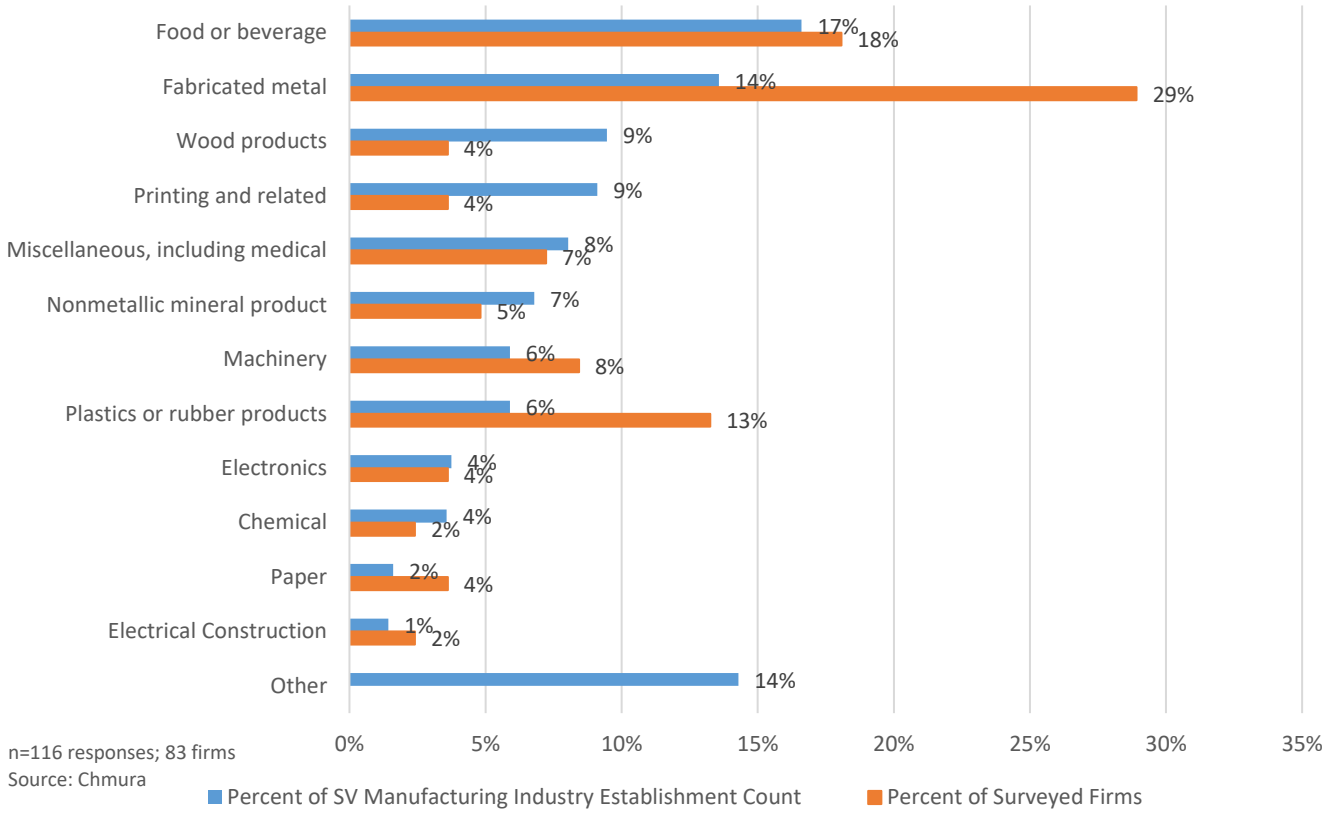
Figure A1.1: Manufacturing Industry Group



n=116 responses; 83 firms
Source: Chmura

When compared to the industry mix in the Valley region, the survey sample represents the regional manufacturing landscape fairly well. As Figure A1.2 shows, the proportion of surveyed industries roughly reflects the establishment count in the region. The fabricated metal firms (29% of surveyed firms) and plastics or rubber products firms (13% of surveyed firms) are somewhat over-represented in the survey responses relative to the regional mix (14% and 6%, respectively, of the regional manufacturing establishment count).

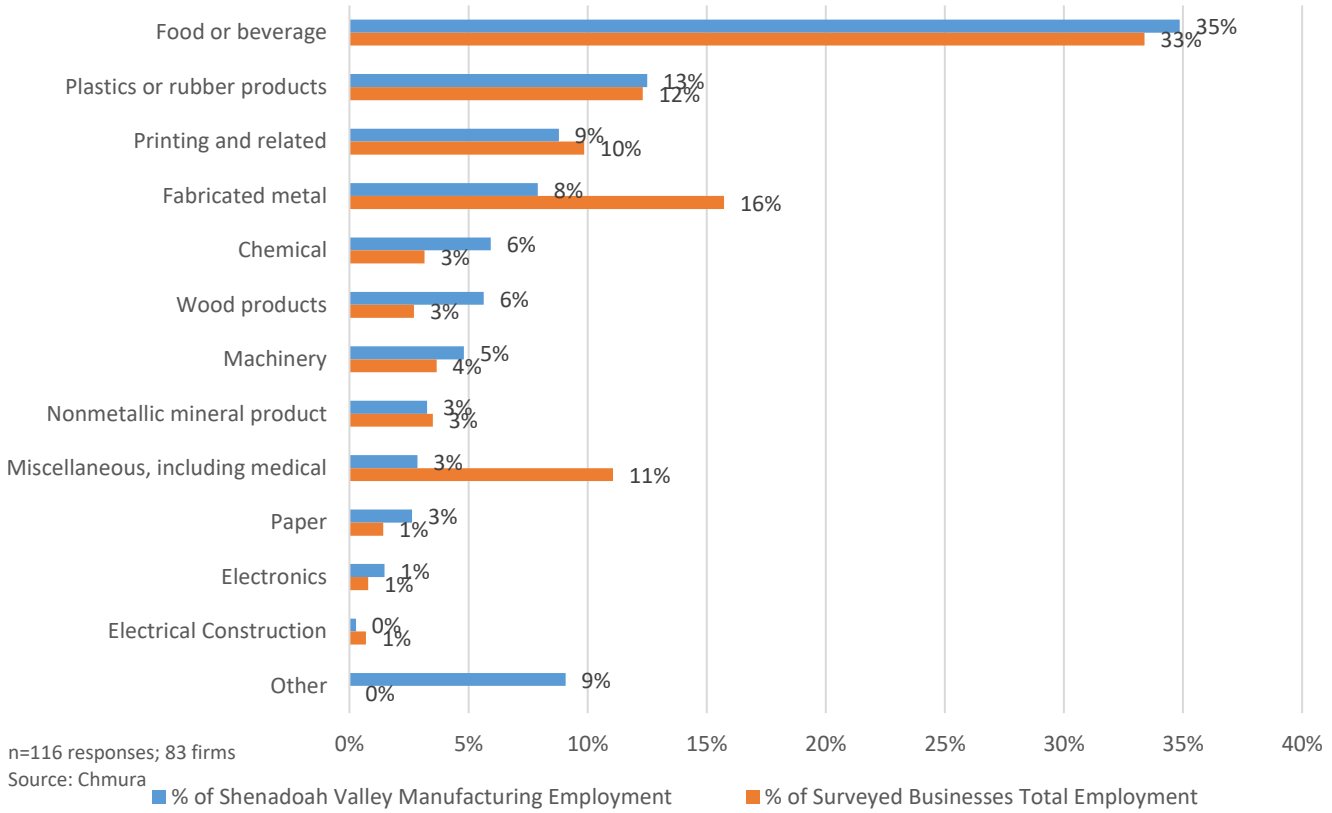
Figure A1.2: Shenandoah Valley Manufacturing Industry Mix Compared to Surveyed Firms



n=116 responses; 83 firms
Source: Chmura

The surveyed industry mix more accurately depicts the regional manufacturing mix when viewed by employment instead of by establishment count. As shown in Figure A1.3, the regional employment of each industry is very similar to the industry proportion of surveyed firms' total employment except for fabricated metal manufacturing and miscellaneous manufacturing.

Figure A1.3: Shenandoah Valley Manufacturing Industry Mix Compared to Surveyed Firms



n=116 responses; 83 firms
Source: Chmura

The survey asked respondents to give their firm's primary location within the Shenandoah Valley region. Chmura used these responses and data supplied by the SVWDB to refine the geographic distribution of the respondents. Respondents represent businesses in 15 localities in the Valley region. As Table A1.1 shows, over one-quarter of the responses come from Augusta County.[15] Other heavily represented localities include Frederick County (15 responses), Winchester City (15), Harrisonburg City (14), and Rockingham County (12).

[15] The high number of responses in Augusta County can be partially attributed to three companies who combined to produce 13 complete survey responses.

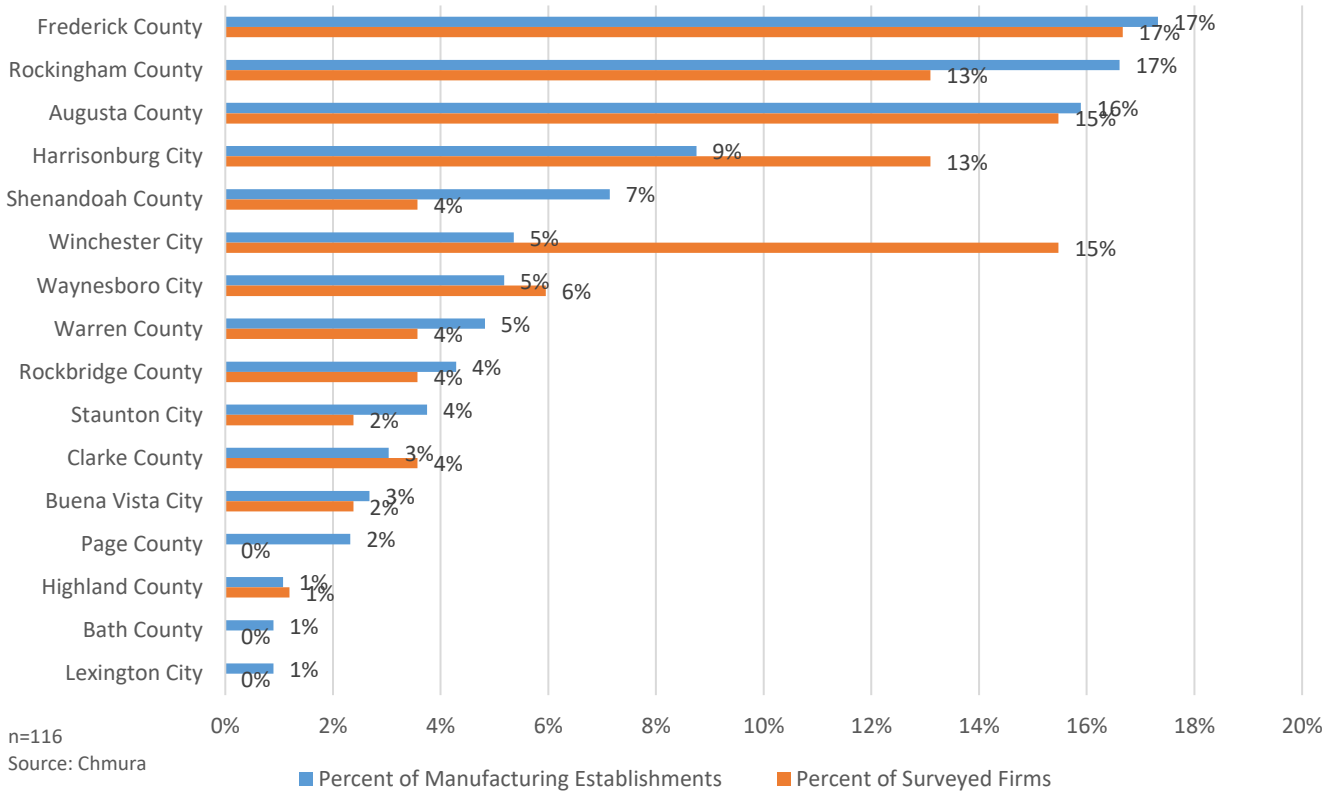
Table A1.1: Respondent Geographic Distribution

Locality	Complete Responses	Total Responses
Augusta County	28	30
Frederick County	14	15
Winchester City	13	15
Harrisonburg City	13	14
Rockingham County	11	13
Shenandoah County	5	5
Waynesboro City	5	5
Warren County	4	4
Buena Vista City	3	3
Clarke County	3	3
Rockbridge County	3	3
Covington City	1	2
Staunton City	1	2
Highland County	1	1
Roanoke County	1	1
Total	**106**	**116**

Source: Chmura

The surveyed firms are a fairly strong, representative sample of the manufacturing establishment counts by locality. Other than the over-representation of Winchester in the survey (likely due to the focus group held in that region), Figure A1.4 shows the strong fit of the surveyed firms in each locality to the manufacturing establishment counts in each locality.

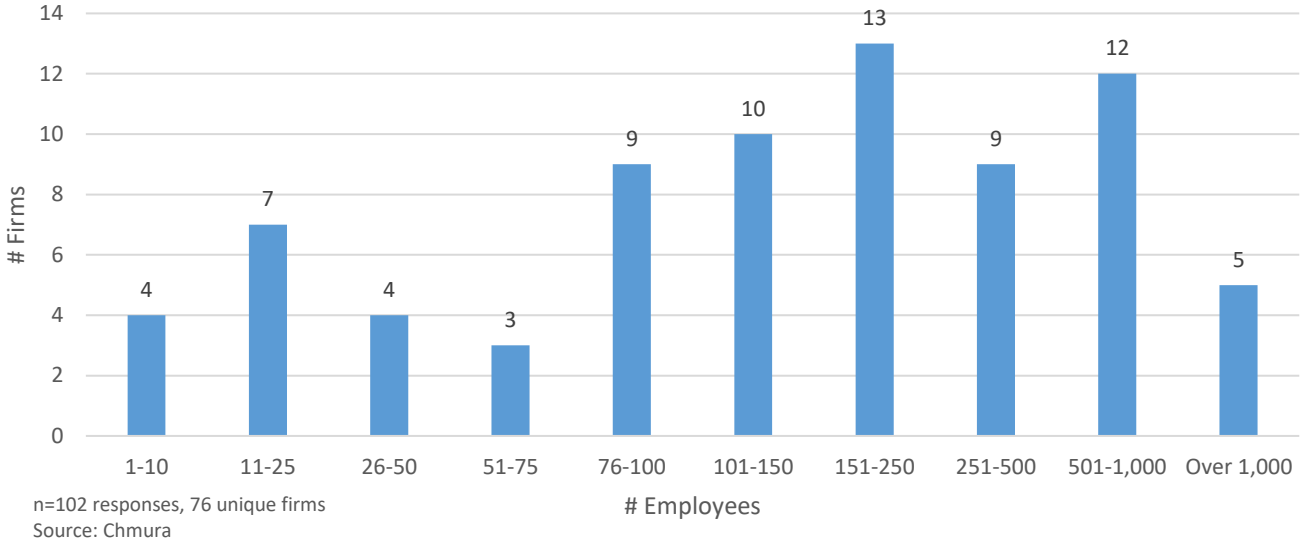
Figure A1.4: Shenandoah Valley Manufacturing Establishments and Surveyed Firms by Locality



Based on these locations, Chmura grouped respondents into the three Shenandoah Valley sub-regions: Northern, Central, and Southern. Over 50% of respondents work for firms in the Central region, and 36% of respondents work in the Northern region. Only 5% of respondents work in the Southern region, and three respondents work for firms in localities just outside the Valley region.[16] The surveyed firms are strongly representative of the manufacturing establishment counts in each region. Of the manufacturing establishments in the Valley region, 54% are in the Central region, 38% are in the Northern region, and 9% are in the Southern region. Similarly, 52% of surveyed firms are in the Central region, 40% are in the Northern region, and 6% are in the Southern region. Respondents were asked to estimate the number of employees in their firm within the Shenandoah Valley region. There are 76 firms represented from the 102 respondents who answered this question. On average, each firm is estimated to employ 267 permanent employees and 42 temporary employees. As seen in Figure A1.5, about one-third of surveyed firms employ less than 101 workers, and 42% employ between 101 and 500 workers. One-quarter of the firms have less than 76 permanent employees, and 14% have 25 or fewer permanent employees. Nearly half of surveyed firms do not employ any temporary workers, and another 22% of firms employ ten or fewer temporary workers. Only three firms employ more than 100 temporary workers.

[16] These three respondents are included in the results as they have close ties to the Shenandoah Valley region's manufacturing economy, but they are excluded from analysis by sub-region.

Figure A1.5: Firm Size

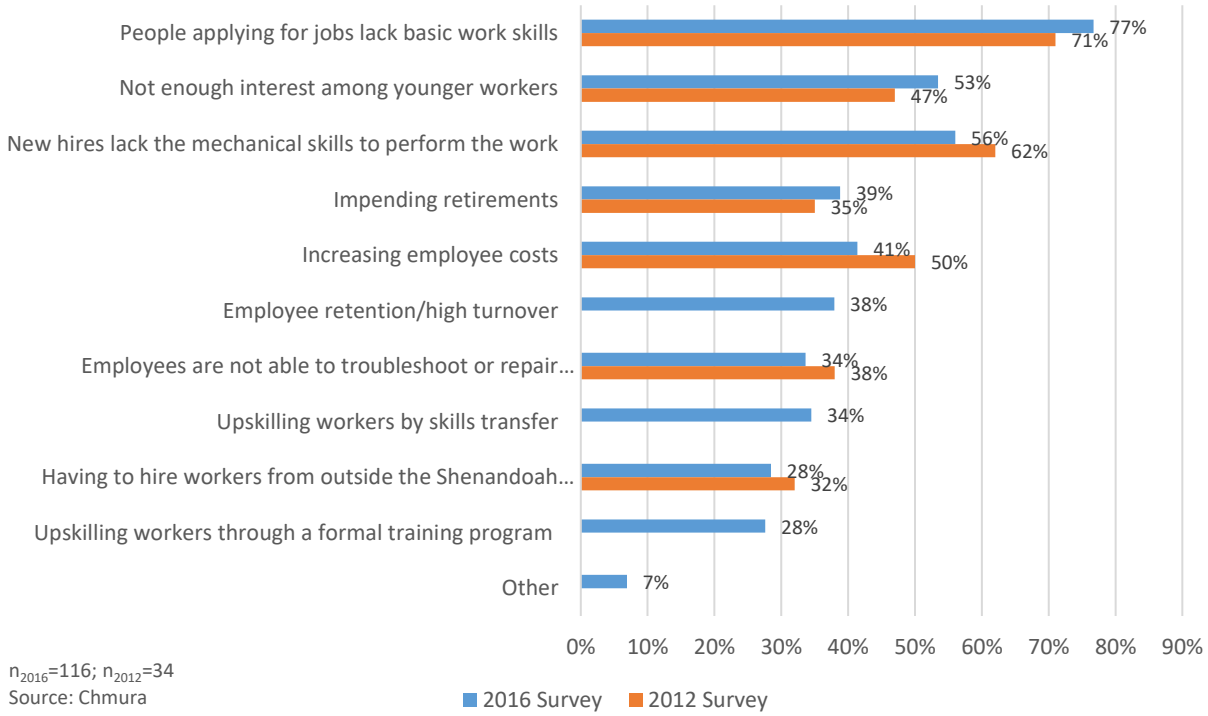


n=102 responses, 76 unique firms
Source: Chmura

A1.3. Workforce Concerns

Respondents were asked to identify the most pressing workforce concerns of their business. Multiple selections were allowed. The most prevalent workforce issue according to respondents is a lack of basic work skills (such as work ethic, discipline, punctuality, etc.) among job applicants, with 77% of respondents stating this as one of their firm's most pressing workforce concerns. This percentage is up from 71% in the 2012 study. Over half of respondents stated a lack of interest by younger workers and a lack of mechanical skills among new hires as prominent workforce issues. Comparisons to the 2012 survey results are shown where available in Figure A1.6, most notably seen in the decline in prominence of increasing employee costs as a pressing concern from 50% to 41% of respondents.

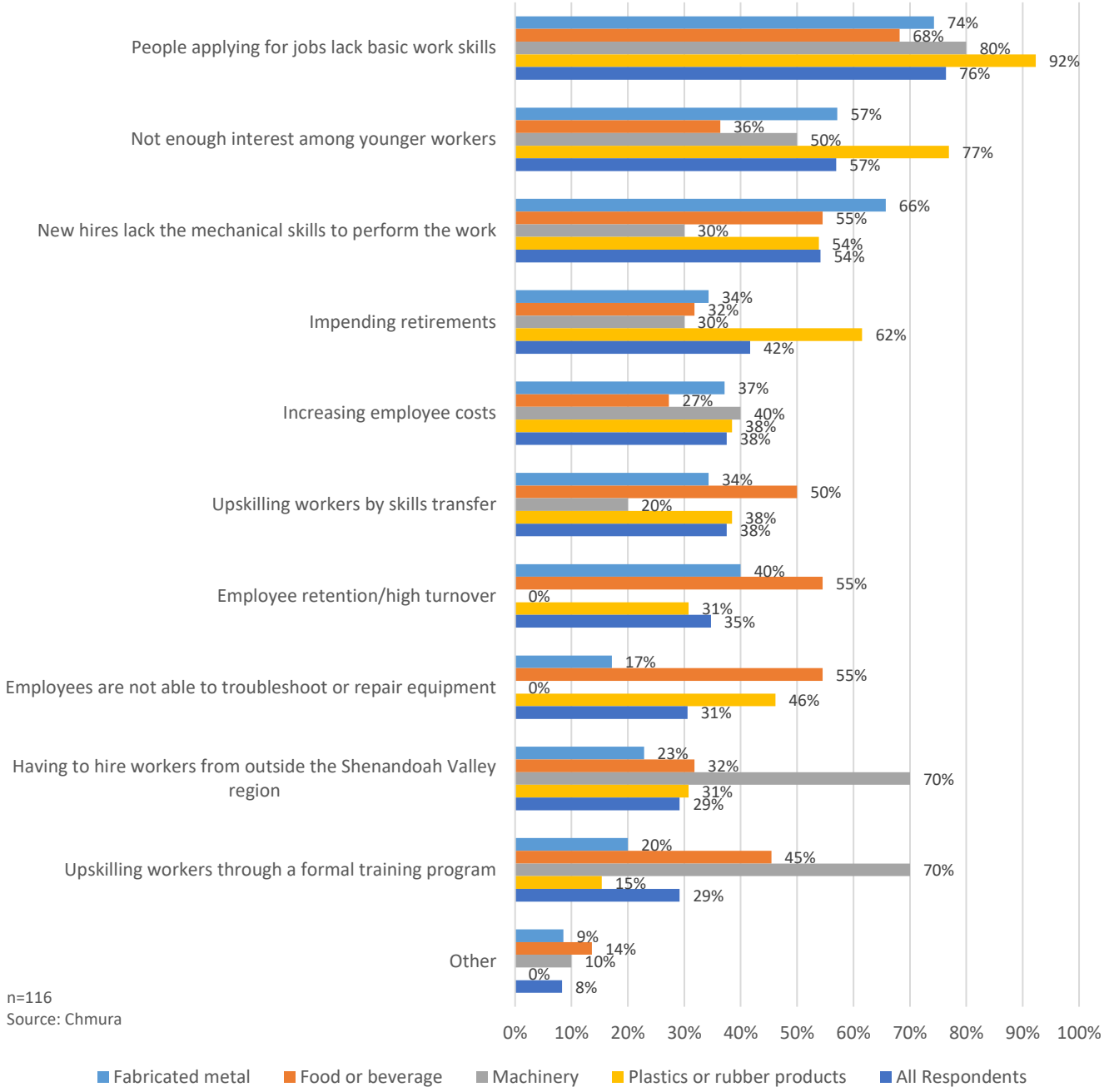
Figure A1.6: Most Pressing Workforce Concerns



n_{2016}=116; n_{2012}=34
Source: Chmura

When examined by industry group, a lack of interest among younger workers is a more pressing concern for plastics or rubber products manufacturers (10 of 13 respondents stated this as a pressing concern) when compared to the food or beverage manufacturing firms (8 of 22). Having to hire workers from outside the Valley region is a more prominent concern among machinery firms (7 of 10) than fabricated metal manufacturing firms (8 of 35). Figure A1.7 shows these concerns by industry group, for industry groups with at least ten respondents.

Figure A1.7: Most Pressing Workforce Concerns by Industry

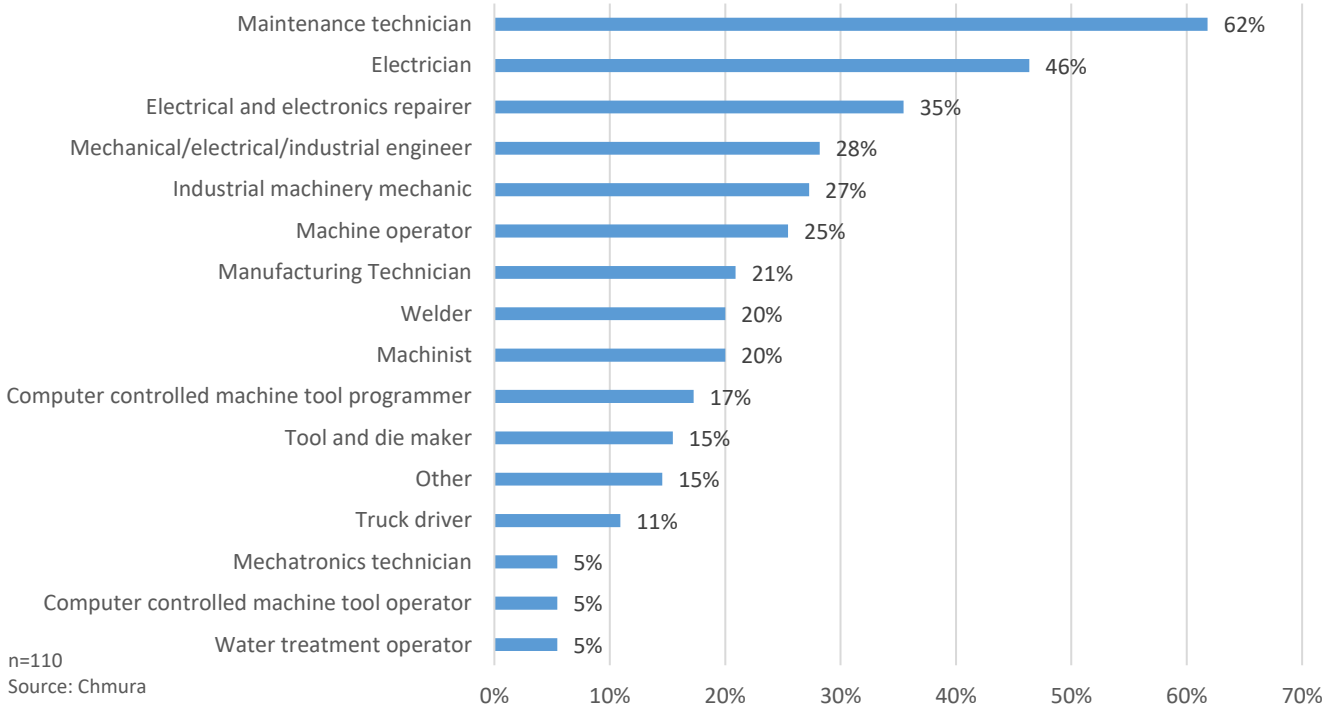


n=116
Source: Chmura

A couple of differences in workforce concerns emerged at the regional level. A lack of basic work skills among job applicants was more often listed as a concern by respondents in the Northern region (83%) than respondents in the Central region (69%). Increasing employee costs was also a more prominent issue in the Northern region (48%) than the Central region (29%). Also, respondents working for firms in Rockingham County generally listed fewer pressing workforce concerns than firms located elsewhere in the Valley region.

The survey asked respondents to identify the hardest-to-fill occupations, and if there is an industry credential or certification required for employment. Of all respondents, 62% classified maintenance technician and 46% classified electrician as two of the hardest-to-fill occupations. Respondents also found electrical and electronics repairer (35%), mechanical/electrical/industrial engineer (28%), industrial machinery mechanic (27%), and machine operator (25%) fairly difficult to fill at their firm, shown in Figure A1.8. Compared to the 2012 survey, the difficulty in finding maintenance technicians has increased, while difficulty in finding engineers has somewhat decreased.

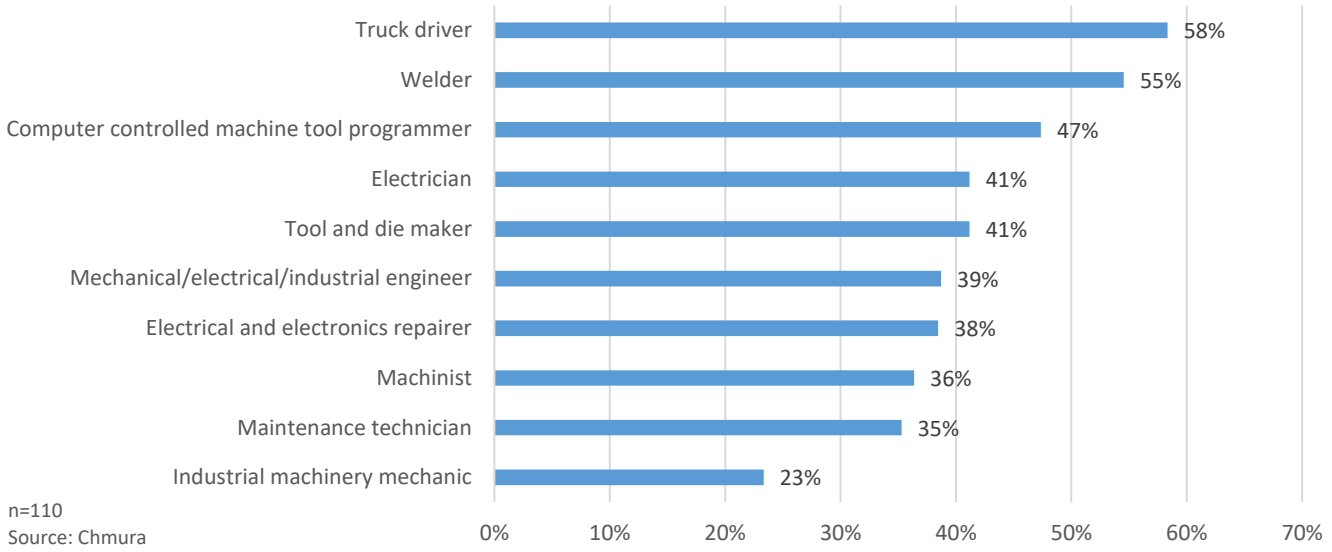
Figure A1.8: Hardest-to-Fill Occupations



n=110
Source: Chmura

Respondents who said an occupation is hard to fill were also asked if there is an industry credential or certification required to be hired or to maintain employment. The percent of respondents who stated a credential or certification is required is shown in Figure A1.9 for the 11 occupations with at least five responses. Truck drivers (58%) and welders (55%) are the occupations that respondents most often state require a certification or credential. There does not appear to be a correlation between hard-to-fill occupations and a certification requirement for those occupations.

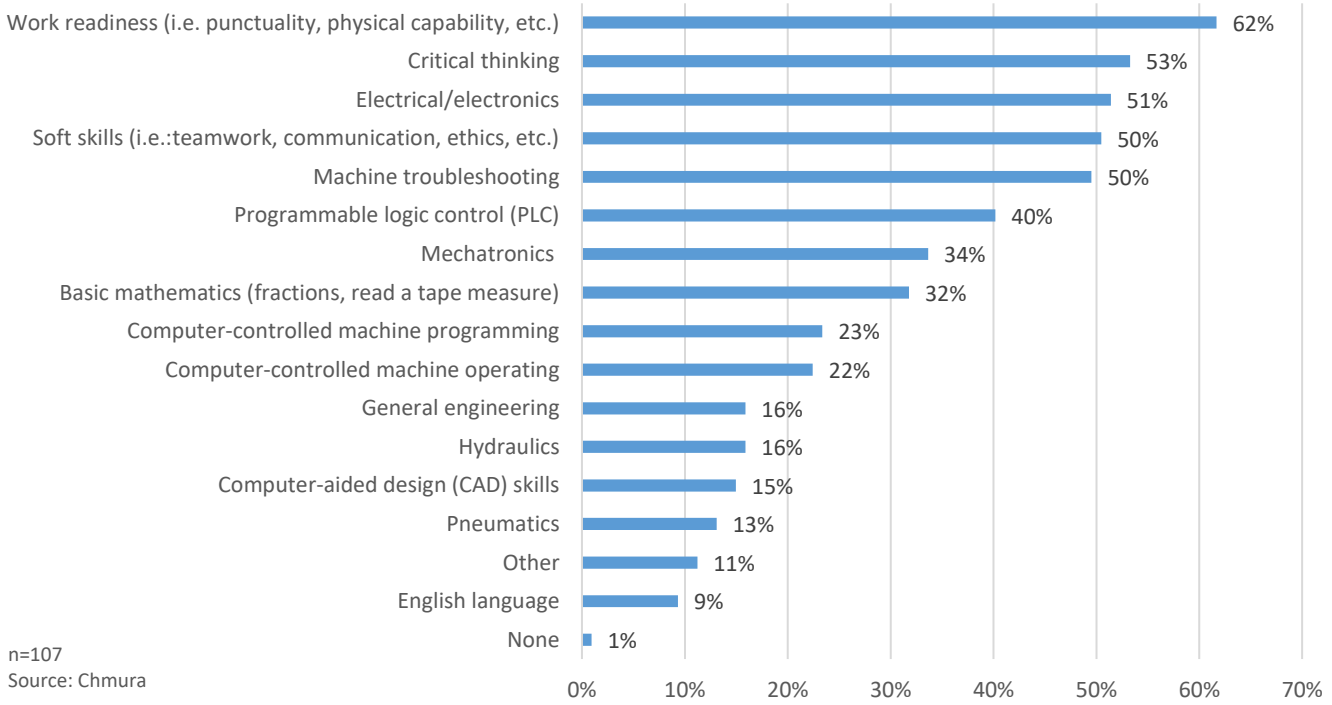
Figure A1.9: Percent of Respondents Indicating a Required Credential or Certification



n=110
Source: Chmura

In addition to hard-to-fill occupations, respondents were also asked to identify difficult-to-find skills. Work readiness (such as punctuality, physical capability, etc.) was most often recognized by respondents as difficult to find, as shown in Figure A1.10. Critical thinking (53%), electrical/electronic skills (51%), soft skills such as teamwork or communication (50%), and machine troubleshooting (50%) were also characterized by at least half of respondents as difficult to find.

Figure A1.10: Difficult-to-Find Skills

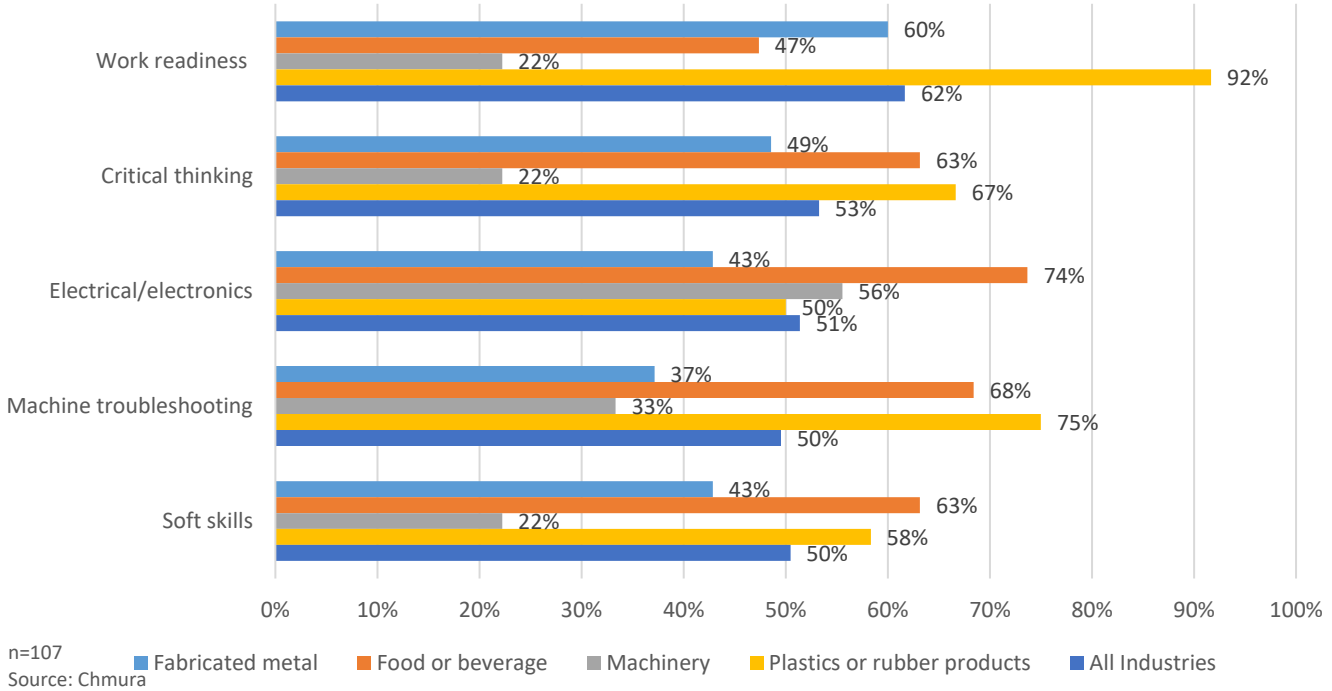


n=107
Source: Chmura

Figure A1.11 shows the breakdown by industry of difficult-to-find skills where at least 50% of respondents listed certain skills as hard to find (for industries with at least ten respondents). Almost all respondents (11 of 12) in the plastics or rubber products industry listed work readiness as difficult to find. Of respondents in the food or beverage manufacturing industry group, 79% identified mechatronics (approach systems and troubleshooting with a blend of mechanical systems, instrumentation, electronics, robotics,

automation, computers, and control system knowledge) as a difficult skill to find, while only 24% of all other respondents identified it as hard to find.

Figure A1.11: Difficult-to-Find Skills by Industry



n=107
Source: Chmura

A few differences appear when difficult skills to find are analyzed by region. Respondents in the Central region more often list electrical/electronic skills (61%) as difficult to find relative to the Northern region (42%). In contrast, respondents in the Northern region more often list basic math skills (47%) and work readiness (71%) as difficult to find skills compared to the Central region (21% and 52%, respectively).

When compared to the 2012 survey, fewer respondents said the following skills were difficult to find: electrical/electronics (down to 51% of respondents from 65% of respondents in 2012), machine troubleshooting (50% from 62%), programmable logic control (40% from 53%), computer-controlled machine programming (23% from 53%), and general engineering skills (16% from 38%).

The survey also asked respondents what they would like to see done in workforce development in the region that would most help their firm. Two common themes emerged from the 66 respondents who answered this question: better promotion of technical careers, particularly to young people, and improving training and education for manufacturing jobs. Nearly one-third of respondents left remarks about improving marketing and promotion of technical careers to high school students. Many of these remarks discuss trying to upend the perceived negative stigma associated with factory jobs. The other common theme—improving training and education—was also mentioned by nearly one-third of respondents. Most of these comments focus on improving technical skills, often specific to each occupation, but several comments referenced a need for better training for broad skills such as basic math, critical thinking, and communication. Some respondents suggest a central hub of workforce information in the Valley, ranging from available jobs and grant information to training programs—a natural role for the SVWDB. Other responses mention further development of technical schools and more funding for grants and on-the-job training. As the SVWDB may be able to glean more information from these comments, all responses are listed verbatim in Table A1.2, as well as the respondent's locality and industry group.

Table A1.2: Workforce Development Recommendations in the Valley Region

Industry Group	Locality	What would you like to see done in workforce development in the Shenandoah Valley region that would most help your firm?
Chemical	Frederick County	Provide skills to our high school students that don't choose to go to a 4 year college.
Electrical Construction	Augusta County	Help train good commercial electricians.
Electrical Construction	Augusta County	Be available with grants and funding of our apprenticeship program. Keep sending us skilled electricians or qualified "up-and-comers".
Electrical Construction	Augusta County	Stay helpful. Send good people to us. Help fund and support the electrical apprenticeship. Don't be bureaucratic.
Electrical Construction	Augusta County	Steer more young people to the trades and also steer more of the general public to the trades.
Electronics	Augusta County	Maybe find some young folks that want to try out different jobs almost like a short term internship but have them pre-qualified to generally fit the position requirements
Electronics	Harrisonburg	Electronics programs
Fabricated metal	Augusta County	Doing many good things and I feel it is improving all the time. Nothing comes to my mind that is not already being addressed. Many times, employers get what they put into it. We put much time and effort into supporting as many development programs, boards, plant tours, etc. as we possibly can. I guess communication skills would be one that may need to be addressed more formally but not sure what would be done.....cell phones are a mess.
Fabricated metal	Augusta County	Funding directed toward VCTC to help strengthen their Machinist and Electrical programs for the local schools, Apprenticeship programs and Adult evening classes.
Fabricated metal	Augusta County	I really think the Valley is doing a good job of adjusting our vocational and specialized educational training/teaching to fill the voids in our manufacturing companies. It is the responsibility of the local facilities to utilize the available training/teaching resources so that they can minimize the impact of retirements and changing technologies.
Fabricated metal	Augusta County	Target the high schools with an objective to increase the number of applicants at the Community College level. Blue Ridge needs more students.
Fabricated metal	Augusta County	Continue to develop programs to aid in the training of new associates based on the companies individual needs.
Fabricated metal	Augusta County	the local talent is a mess or none existent
Fabricated metal	Buena Vista	Closer partnership to let us know what you have going on and that we are hiring now!
Fabricated metal	Clarke County	Certify welders Per AWS
Fabricated metal	Frederick County	Get the many different agencies together that offer trainings, grants, processing of workforce, etc. and give all area employees the different options and/or what's available when it comes to workforce development (i.e. on-the-job training, apprenticeships, college/trades school classes available, VEC help, etc.).
Fabricated metal	Frederick County	Have a Machinist course at the High School level
Fabricated metal	Harrisonburg	More focus should be put on skilled trades in middle schools and high schools. The push for an English degree seems to start in middle school. I've interviewed hundreds of young folks in the last five years that are far less prepared to add value in the workforce than they should be, but they've taken a few college courses...
Fabricated metal	Harrisonburg	More emphasis on trade schools for young people entering the workforce.
Fabricated metal	Roanoke	Would like more OJT Grants available in the Roanoke Valley. Current grants have a tremendous amount of paperwork and hoops to jump through. Too complicated and time consuming. Both for candidates and employers
Fabricated metal	Rockingham County	Be a clearinghouse for workforce development information and candidate referral. There is no regional effective place to post openings where I have confidence that qualified candidates are accessing potential opportunities. When using the internet and social media resources you tend to

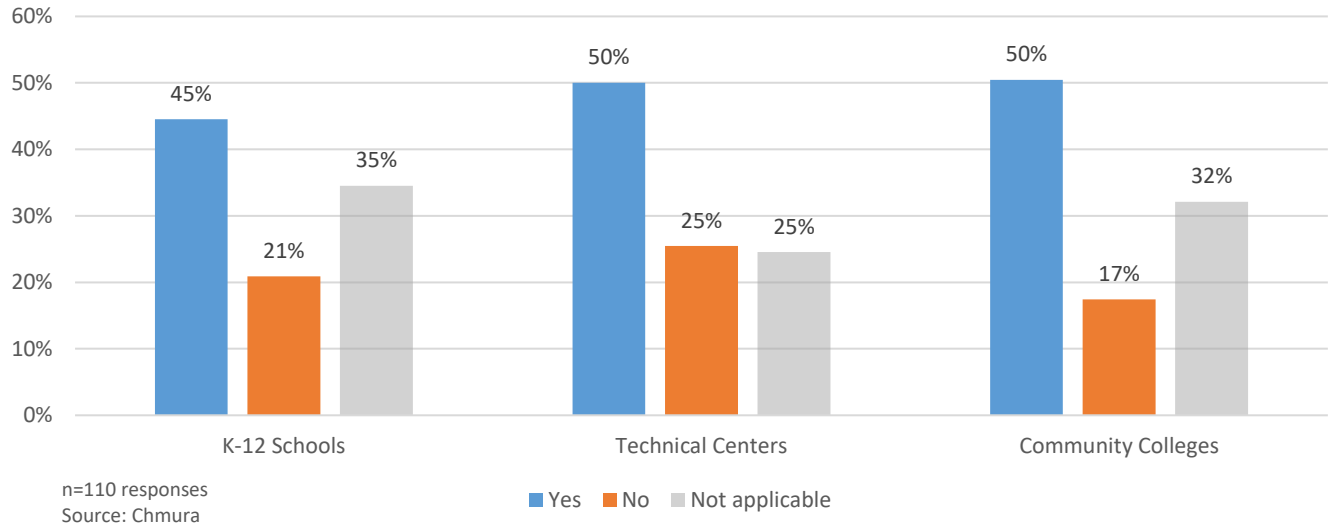
		get many candidates that are not local or regional that are not truly interested in relocation that waste time and resources. VEC is not has not been effective in that role for years. Void not filled regionally.
Fabricated metal	Rockingham County	Not sure.
Fabricated metal	Shenandoah County	Work with the K-12 to indemnify non college bound students and access their like and aptitudes and begin more specific training as early as practical. This would improve both hard and soft skills upon completion of High School
Fabricated metal	Waynesboro	For my department, is get better students trained in the field of machining.
Fabricated metal	Waynesboro	MORE focus on High School curriculum that emphasizes TECHNICAL skills and abilities.
Fabricated metal	Winchester	Get a technical skills center developed. In this area there seems to be lots of medical training (radiologist, etc) but no mechanical or electrical.
Fabricated metal	Winchester	More plant tours.
Food or beverage	Augusta County	Continue maintenance technician programs
Food or beverage	Augusta County	Parents are the key to creating a pipeline for new technically trained workers. Trades and apprenticeship are not bad words. We need parents to understand that quality jobs with excellent pay are available for technically trained personnel. A 4 year degree is not necessary to obtain a quality job, if you have technical skills. We need people who can troubleshoot and repair high tech machines.
Food or beverage	Augusta County	Provide more accurate industry specific wage ranges throughout for the area. Current wage scales combine too many manufacturing niches into one when there are drastic wage rate differences between each niche.
Food or beverage	Augusta County	robust high school level programs for production machine operators as well as maintenance/electrical apprentices
Food or beverage	Rockingham County	Continuous face-to-face meetings to ensure deadlines are being met and ensuring companies are taking advantage of all the programs available.
Food or beverage	Rockingham County	Higher technology skills training
Food or beverage	Rockingham County	Quit telling school children if they don't want to go to do well in school they'll work in a plant. Reset expectations for children looking to enter manufacturing - we are looking for talent.
Food or beverage	Rockingham County	see previous response
Food or beverage	Rockingham County	Graduating high school students that will not attend a 2 year or 4 year college should be encouraged to seek MTC as a place to learn a trade or even skills on working and taking direction without becoming mad. I think sometimes the younger folks find it hard to have structure at their employment.
Food or beverage	Shenandoah County	I know there was an in-demand job series on TV3, but I think regular programming commercials would help get the word out. Also, targeted social media ads might help get the word out. Those things would help my firm because more people would be trained, or come to me and ask for training.
Food or beverage	Warren County	Provide current communication when new programs/funding is available to employers. Sometimes we find out about it when the grant is nearing completion.
Food or beverage	Winchester	Focus on building Technical abilities of the workforce.
Food or beverage	Winchester	Industrial electricians is my major concern. Safety has to be number one. They need a solid background in electrical theory. They need to be able to think logically They need PLC experience, troubleshooting with a PLC mostly. They need practical troubleshooting experience.
Food or beverage	Winchester	More career day's at local high schools that teach students the different opportunities available in manufacturing.
Food or beverage	Winchester	We need to start to work on getting the upcoming HS graduates that are not planning to go to college better prepared to work in an industrial type environment. These are our workers of the future and I am unsure if they will be prepared to jump into manufacturing positions.
Machinery	Augusta County	Assist in the coordination of efforts between Technical Centers and Community Colleges. Market career opportunities for skilled trades in concert with Technical/Community Institutions in order to

		attract more students.
Machinery	Augusta County	* More classes to address the skills gap.
Machinery	Augusta County	Encourage young workers to seek the skills that will allow them to succeed in a factory setting. Teamwork, positive attitude, and strong work ethic are often difficult to find. Continued development of the Valley Technical School would be great, we struggle to find real Machinist who see themselves as professional tradesmen rather than just a machine "operator."
Machinery	Rockbridge County	It would be helpful if the schools students were attending for the apprenticeship grants were more helpful in aiding in the application and enrollment process. Those who are the contacts of these schools do not have answers with regard to these grants. It proves difficult to make sure all documentation is correctly submitted for individuals trying to enroll.
Machinery	Rockingham County	Listen to the local needs, which you are doing by this survey.
Machinery	Rockingham County	Encourage or promote the Trade Programs not only in High School but also in Middle School. Kid are being told at younger ages that they have to decide what they are going to do for a career and I would like
Machinery	Waynesboro	Increase amount of machinist available to the region. Promote the trade schools training more.
Miscellaneous, including medical	Harrisonburg	Trainning Dollars OJT Help HR in employee job search
Miscellaneous, including medical	Harrisonburg	Increase in communication about the types of grants and programs available.
Miscellaneous, including medical	Rockingham County	Be in touch with local business HR Partners, to be sure BRCC program graduates, high potential HS Vo Tech, and other highly skilled people meet the job opportunity criteria, and make it into the interview pools.
Nonmetallic mineral product	Frederick County	Increased vocational programs at the high school level
Nonmetallic mineral product	Harrisonburg	Train people on the soft skills like communication, being on time & being proactive.
Paper	Frederick County	Create a marketing campaign to help reverse the image that is portrayed by the media that manufacturing kills the environment and is led by unscrupulous people. Create a real world development opportunity for high school kids that simulates entering the workforce, begin working, and shows progression by those that work hard.
Paper	Shenandoah County	Forklift Operator Training Workforce readiness that includes typical basic company expectations More PLC and troubleshooting courses
Plastics or rubber products	Frederick County	I'd honestly like to find more workforce from the Central/South American communities. The kind of people that continually express interest in and fill out application now tend to bring a lot of baggage to the table that hinders them from working a full 40. We are forced to change hours, become extremely flexible and cannot enforce standards or we would lose our workforce. The hispanic/latino candidates have proven hard workers and tend to also come with some form of useful skill. Language is not an issue for us.
Plastics or rubber products	Frederick County	Thank you for supporting workforce development in the Shenandoah Valley. With the addition of Proctor and Gamble in Martinsburg, we may be in short supply of qualified candidates.
Plastics or rubber products	Harrisonburg	Have English taught to what would be qualified workers with the exception of a language barrier.
Plastics or rubber products	Winchester	coordinated effort to include k-12 schools with a training path to LFCC for continued certifications. Show the possible career paths with required training. Create an awareness of high quality good paying manufacturing jobs in the Valley. Help k-12 educators understand the path for jobs and careers in the community; not only a "college for all" approach. bring industries and educators together to take a concerted approach to address the employee shortage.. perhaps create a consortium approach where member industries and schools act together in the best interest of the community and local employers.
Plastics or rubber products	Winchester	More encouragement for younger workers to consider manufacturing as a career, whether at the high school or post secondary level. Also, more flexibility in classes offered at community colleges and technical schools that can fit a 12 hour shift schedule.
Plastics or rubber products	Winchester	Stay the course in matching education with industry needs. Support funding vocational training at high school level. Provide education re-entry programs for those that may have dropped out of

		traditional school curriculum.
Printing and related	Clarke County	Create programs that prepare young people for trades jobs with a focus on processes of manufacturing and all that entails.
Printing and related	Harrisonburg	High school students have a negative opinion of factories. They would rather work retail than at a high paying factory job. Some high schools are graduating students and 40% of them are staying in the Valley. We want those students, but they have never been taught that factories are an option.
Printing and related	Harrisonburg	Take a couple electricians to the high schools and have them address an assembly of 9th and 10th graders and then seniors in separate assemblies to share with them information and life experience in their trade as well as the money these kids can make in the vocational trades. Electricians here make $70,000 to $80,000. They need to see and hear it from those in the trade.
Wood products	Frederick County	Not real sure, but would like to see better overall math and problem-solving skills.

Respondents were asked if the training providers in the region are meeting their needs. These providers were grouped into three categories: K-12 schools, technical centers, and community colleges. As shown in Figure A1.12, respondent satisfaction rates are similar across all providers with about half of respondents indicating the provider is meeting their firm's needs.

Figure A1.12: Education and Training Providers Meeting Employer Needs



n=110 responses
Source: Chmura

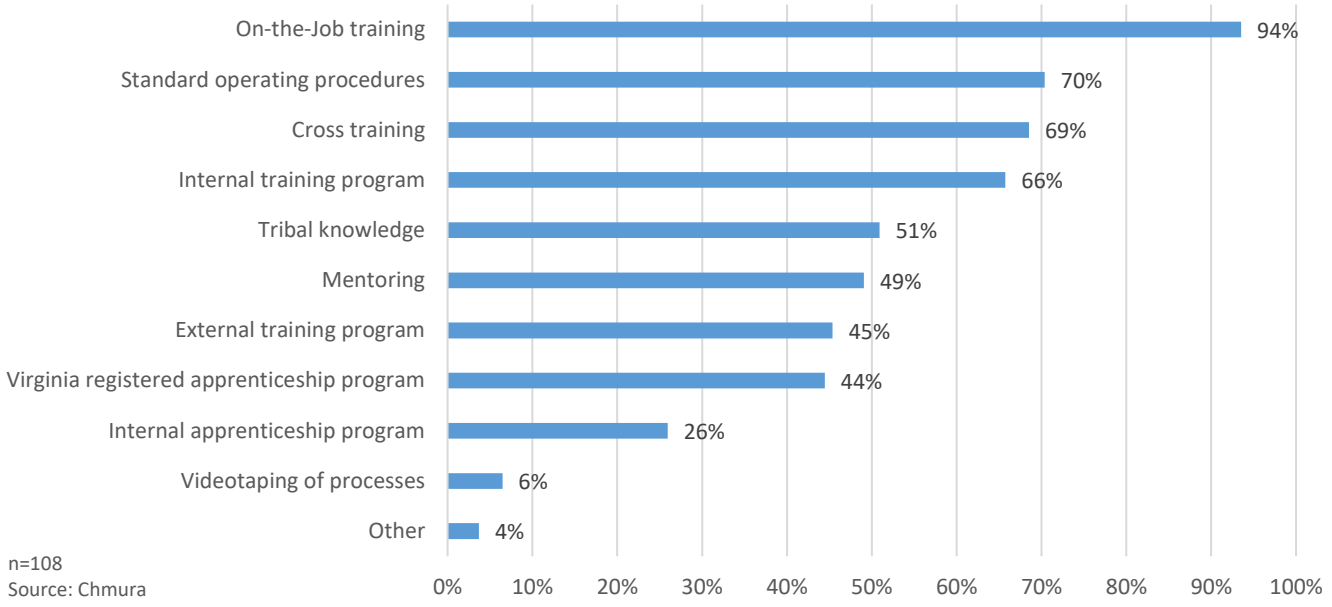
Respondents who said at least one of the three providers is not meeting their firm's needs were asked to explain why. Respondents who stated that K-12 schools are not meeting their firm's needs primarily stressed a lack of technical and soft skill training. The respondents stated that secondary schools do not allocate resources for technical training or transferrable skills necessary for the manufacturing industry's environment. Comments on technical schools and community colleges varied from a lack of high-quality graduates (technical and work-readiness skills) to a lack of occupation-specific training. Respondents in the Central region were more likely than those in the Northern region to say that K-12 schools (50% "Yes" compared to 35%) and technical centers (56% "Yes" compared to 40%) are meeting their needs. The opposite is true for community colleges when comparing respondents in the Central region to those in the north. Of respondents in the Northern region, 58% state that community colleges are meeting their needs compared to 44% in the Central region.

A1.4. Hiring & Training Practices

The survey asked respondents about their hiring practices. On average, respondents say they hire 30% of their high-skilled employees and 23% of their low-skilled employees from outside the Shenandoah Valley region. Respondents were also asked if they engage staffing companies to fill talent shortages. Of the 109 responses to this question, 61% use staffing agencies, 17% used to use staffing agencies but don't anymore, and another 20% of respondents' firms also do not use staffing agencies.

Respondents were asked what processes are currently used for assuring skills transfer within their organization. On-the-job training is almost universally used by respondents' firms, as shown in Figure A1.13. Utilization of standard operating procedures (70%), cross training (69%), and internal training programs (66%) are used in at least two-thirds of respondents' companies.

Figure A1.13: Methods for Skills Transfer Within Organization



n=108
Source: Chmura

The survey asked respondents about their satisfaction with the SVWDB's Registered Apprenticeship grant, and the results are very positive. Of the 108 respondents that answered this question, a little over half (53%) have participated in this grant program. Of the grant program participants, 53% are very satisfied with the grant process, and an additional 23% are somewhat satisfied. No respondents were dissatisfied with the process as 4% are neutral and 21% don't know or don't have an opinion. Respondents who participated in the grant program were asked for suggestions to improve the process, and the 13 relevant comments are shown in Table A1.3.

Table A1.3: Suggestions for Improving the SVWDB Registered Apprenticeship Grant Process

I do believe the program is starting to head in a positive direction.
I thought it was very easy.
It was a great deal of extra paperwork and follow up that became a burden on our organization due to the high turnover rate.
Open communication has been great so far, and hope it continues!
Paperwork has become more cumbersome than in the past.
Still in registering process
Still in the process of putting together program.
Still new to the program so trying to figure it all out.
The programs are a blessing to VPGC.
This process worked well however ways to communicate more efficiently with all manufacturing and small business that hire only one or two apprentices I see as critical to the over all success.
We are set up for utilizing but have not called upon it as of today
We are working on this now.
we just started process in past year

Source: Chmura

Survey respondents were also very positive when asked about their satisfaction with the Valley OJT grant program. Of the 73 respondents who participated in this program, 64% are very satisfied with it, and another 15% are somewhat satisfied. Only one respondent is somewhat dissatisfied, while 3% of respondents are neutral and 17% don't know or don't have an opinion. Respondents were also asked to give suggestions to improve the grant process, and the ten relevant comments are shown in Table A1.4.

Table A1.4: Suggestions for Improving the Valley OJT Grant Process

Again, fairly new to the program so am working on learning how it works.
Just need a quicker response time for applications to come in. If there's a pipeline of workers in the program, then a notice from an employer should result in resumes or applications within 24 hours.
paperwork + some people are unemployed for a reason, they are not employable
The concept of the program was great but all the candidates that were hired through OJT have been terminated. Most had very poor work ethic.
The one person I got has been here about 2 years and does an excellent job in our electrical panel shop.
We are prepared to use it but have not had the appropriate candidate for the process.
We have recently applied to participate
We hired an ex-employee from the now closed Transprint plant. We only wish we knew about him sooner.
We were very lucky to be able to retain (2) employees. However we've probably been through about 15-18 different OJT candidates to get these two. What set these two apart was work ethic. I find that there is a good bit of issues with some of these candidates that are underemployed or unemployed. Sometimes the reason(s) that an individual is un/underemployed becomes very apparent. Overall, it was absolutely worth it to find the few we are able to manage and keep.
Would like for it to include temporary employees...

Source: Chmura

A1.5. Outlook

Respondents were asked several questions about their estimated employment change over the next five years. The 108 responses to the question regarding projected total employment change over the next five years represent 79 unique firms. According to the respondents, the 79 represented firms are expected to grow by about 24 employees on average, or 16%, over the next five years. Only one firm is expected to downsize, and 22 firms expect to maintain their current employment level while 49 firms expect to grow. The large (over 200 employees) and midsize (51-200 employees) firms are expected to grow employment the most in the Valley region over the next five years (1,303 employees and 319 employees, respectively). The 33% growth rate of the smaller firms (50 employees or fewer) is much higher than that of mid-size (13%) and large (11%) companies. No noticeable differences exist between regions within the Valley.

On average, respondents expect about 12% of their firm's workforce to retire over the next five years for an average annual retirement rate of 2.4%. This expected retirement rate is fairly uniform across industry group, locality, and employer size. After estimating their firm's retirement, respondents were asked to list the top occupations about which they are the most concerned over the next five years. Respondents shared similar concerns over several occupations, the most common of which is maintenance technicians, with 40% of respondents concerned about retirements from this occupation. Apprehension over retirements at the supervisory and management levels is fairly high at 20% of respondents. There are also shared concerns about electricians (19%), machine operators (14%), and machinists (12%).

Appendix 2: Focus Group Summaries

A2.1 Focus Group Attendees

Table A2.1: Focus Group Attendees

Name	Title	Organization
-------Businesses: Central and Southern-------		
Rachel Brown	Human Resources Manager	Cerro Fabricated Metals
Larry Kroggel	Director of Human Resources	Daikin Applied Technologies
Bruce Horkley	Director of Human Resources (Labor Relations)	Daikin Applied Technologies
Eric Fontaine	Plant Manager	Rexnord
Julia Bowling	Human Resources Manager	Rexnord
Jeff Stapel	Human Resources Manager	Shickel Corporation
Cynthia Ashby	Human Resources Manager	AccuTEC Blades, Inc.
Pam Snyder	Human Resources Manager	Comsonics
Carla Fisher	Human Resources Manager	Graham Packaging
Ben Entsminger	Human Resources Generalist	LSC Communications
Tina Hoover	Human Resources Manager	Virginia Poultry Growers Cooperative
Robert Bamburg	Plant Manager	FR Drake
Vickie Martin	Human Resources Manager	FR Drake
Darlene Correa	Human Resources Manager	Shamrock Foods
George Homan	President and CEO	Friendship Industries
-------Businesses: Northern-------		
Penny Mathias	Human Resources Manager	Ashworth Bros
Dom Rybak	Production Manager	Evolve Manufacturing
Craig Demko	Division Manager	Green Bay Packaging
Jason Diebel	Sr. HR Business Partner	Kraft Heinz Company
Betsy Hyson	Human Resources Manager	New World Pasta
Jeff Shryver	Plant Manager	New World Pasta
Rick Till	VP Human Resources	O'Sullivan Films, Inc.
Tony Milionta	Human Resources Manager	Rubbermaid
Jeanie Alexander	VP Human Resources	Shockey Companies
Holly Combs	Injection Molding Operations Manager	Southeastern Container
Josh Phelps	President	Winchester Metals
-------Economic Development, Workforce Development, and Community College-------		
Patrick Barker	Executive Director	Frederick County Economic Development Authority
Sally Michaels	Existing Business Coordinator	Frederick County Economic Development Authority
Shirley Dodson	Economic Redevelopment Assistant	Winchester City Economic Development Authority
Amanda Glover	Director of Economic Development	Augusta County
Sherry Pinto	OJT Grant Participant Employment Specialist	Lord Fairfax Community College
Debby Hopkins	Project Director Valley OJT	SVWDB
Joan Hollen	Data and Communications Specialist	SVWDB

Source: Chmura Economics & Analytics

A2.2 Central and Southern Focus Group

1. **What are the most pressing workforce concerns for your business? (short-term, long-term, or both).**

- Upcoming retirements and years needed to get replacement employees up to speed (especially in technical occupations, such as maintenance technicians).
- Unemployment is currently low, making it difficult over the just the last 2 years to find maintenance technicians and technically skilled employees.
- Companies hire and train employees and they leave to work for another local employer for a slight wage increase.
- Electro mechanical technicians are difficult to find.
- It is difficult to find qualified applicants with basic skills in math and reading, they can't read an LOP, a ruler, precision measuring.
- There are not enough machinists in the Valley, "we've been hiring for years."
- There is a need for temporary labor for short-term and long-term employment needs.
- Temporary labor shows no loyalty to employers and they have a mindset that the work is temporary and they can move on.
- Companies hire employees and they don't show up for orientation.
- Staffing companies are short of employees and blame low unemployment.
- Underemployed workers that are currently employed can't leave their jobs for education and training to upskill to a better position. Education and training is often not offered at night. "They're in a trap and can't break free."
- A lot of people left the labor force. Where did they go?
- During the recession, employees vacated the construction industry. These employees could be potential manufacturing workers.
- It is difficult to fill positions that require overnight travel.
- The dynamics are changing in the labor market creating lots of challenges.

2. **Which occupations are most critical to the functioning of your organization? Which, if any, have supply issues and what are these issues? (Issues can be in terms of quantity or quality).**
   a. **Maintenance Technicians**
   b. **Manufacturing technicians**
   c. **Mechatronics technicians**
   d. **Machinists**
   e. **Industrial machinery mechanics**
   f. **Welders**
   g. **Machine operators**
   h. **Computer controlled machine tool programmers/operators (CNC Machinists/Operators)**
   i. **Mechanical/electrical/industrial engineers**
   j. **Electrical and electronics repairers**

- CNC Machine. They are not operators, they have to do a lot more, including doing their own programming, troubleshooting, and moderate maintenance. Demands are higher now than 5, 10, or 15 years ago.
- Sophisticated equipment and robotics require higher skills.
- Production welders can be found, but metal fabricators are difficult to find. BRCC is teaching some metal fabrication.
- Certifications are needed for pressure vessel production. Certifications differentiate employees—"Certifications are very much a differentiator."
- Robotics welding requires a higher skill set. Higher skilled machine operators are needed.
- Electricians often get "stolen" by other local companies.
- Electrical and mechanical cross training is needed.
- Companies are cross training and partnering electronics and mechanical employees.
- "Work used to be very siloed, now to troubleshoot equipment you have to know everything"
- Electricians need to know electronics.

- Tool and Die makers are aging and retiring creating a void in this occupation. A company reports all 5 workers they have in this occupation will retire. Another is restarting an apprentice program, but it will take 6 years to complete.
- Water treatment plant operators are in demand.
- Companies are cross training tool and die makers and machinist.
- Cross discipline training is a common theme.

3. **For your organization's hiring needs, is there a sufficient supply of labor in the region?**
    a. **What are the top positions that are the hardest to fill?**
    b. **What percentage of your hires comes from within the region?**
    c. **Is the pattern different for high-skilled positions than it is for low-skilled positions?**
    d. **(if needed) Are you engaging staffing companies to fill talent shortages?**

- Companies are hiring higher skilled employees from outside the region but the retention rate is lower than hires from within the region.
- One company is hiring exempt employees from outside the region and non-exempt employees from within the region.
- Companies are not really successful with out of region hiring.
- Companies go out of the region to hire military personnel which sometimes works and sometimes does not work.
- Companies are engaging staffing companies at the entry level only.
- Staffing agencies are experiencing an employee shortage.
- Staffing agency costs have increased and are not cost effective for employers. Staffing agencies won't negotiate rates.
- Companies are moving temporary employees to permanent employees.

4. **Have your recruiting practices changed recently? How are hiring challenges in a low unemployment economy different from the hiring challenges in a higher unemployment economy?**

- The best recruitment practice is hiring local people that fit the culture of the company.
- Use of existing employee networks (family and friends) to recruit employees is very effective.
- Companies use their own networks to recruit.
- Companies use social media to mine for people with needed skill sets. An online resource is WorkRocket.
- Companies are moving away from newspaper advertising for recruiting.
- Companies are re-evaluating nepotism policies and moving to family and friend networks.
- The hiring process is more compressed. If a company finds a good potential employee candidate, they hire immediately or lose the opportunity.

5. **Are local education and training resources meeting your needs? What, if anything, is lacking?**

- Entry level employees will leave to get education and training.
- Not all classes are offered at night and employers can't spare the employee during the day for training.
- More online and flexible training options are needed.
- Skilled trades requires hands on training in open labs with flexible times.
- Flexible education and training is needed because companies can't send skilled labor to technical schools and community colleges during the day because they can't spare them from work.
- BRCC is not getting enough people in their programs to positively impact the employee pipeline.
- College track people have the basic skill sets needed in manufacturing but do not see manufacturing as a viable career option (non-manufacturing mindset).
- It is not cost effective for technical schools and BRCC to train on site at the manufacturing facility.
- Companies are upskilling existing employees by training employees on their own equipment.
- The labor pool is not that big in the Valley.
- Manufacturing is not a career choice for millennials, we need to rebrand manufacturing.
- The young cohort is not interested in manufacturing. The 25-34 age cohort that have tried other career options that did not work out may reconsider a career in manufacturing.

- Employers can't find workers skilled in electronics. They are upskilling existing employees.
- Employers have had little luck hiring veterans. It is too expensive to relocate them to the Valley. The Valley does not have the amenities to keep relocated Veterans in the Valley.
- Valley Technical Center and Massanutten Technical Center are not getting people into electrician and maintenance mechanic programs.
- MTC is getting students excited about skilled trades but they can't take them far enough to make them employment ready. Community colleges can offer more advanced technical programs than the technical schools.
- For every young employee there are eight old employees. To attract young workers, companies have increased pay and made work flexible but the candidates are just not there.
- We need to educate students on the value of manufacturing.
- Increasing soft skills education might improve recruitment into skilled trades.

6. **Are skills transfers a critical issue for your organization?**
    a. **Is the issue more acute among certain occupations? Which ones?**
    b. **What is your process for assuring skills transfers? How would you rate its success?**
    c. **(if needed) Are skills transfers from older to younger workers a concern?**

- Companies are using mentoring and peering to train workers. They are upskilling workers by pairing them with workers who can help them grow and diversify their skills. They are teaming young workers with older workers to pass on work skills.
- Employees are not always great mentors and great employees are not always great trainers.
- Identify subject matter experts and use them to train others.
- Toolbook software offers one central point of command for electronic learning processes.
- A company is videotaping the work process for training purposes. This has proven to be a fast and effective way to train on company equipment.
- The attention to standard operating procedures is slipping. Operating on tribal knowledge does not allow for control of what knowledge is being passed on.
- Temporary employees are started on easy machines and get hired after they demonstrate their ability. This has been a successful model.
- Companies are hiring temporary workers for unskilled positions. After 90 days of satisfactory temporary employment, they are hired for a permanent position. This has been a successful model.
- Mentors may or may not be compensated for training other employees.
- The highest skilled employees are the trainers but they get no extra compensation.
- There is a huge gap in the skills required for non-skilled labor and the skills required for a Maintenance Technician.

7. **How do emerging technologies affect your current and future workforce demands (especially in terms of the types of occupations and skill sets required for your business)?**

- People with an AAS in Computer Science understand the concepts required to be an equipment operator, but they don't have a manufacturing mindset.

8. **What knowledge, skills and abilities are the most difficult for your firm to find? (Below are some common examples but feel free to be more specific or less specific):**
    a. **Computer-Controlled Machine Programming**
    b. **Mathematics**
    c. **Machine Troubleshooting**
    d. **Maintenance & Repair**
    e. **Soft skills (e.g. teamwork, ethics, etc.)**
    f. **CAD skills**
    g. **Work readiness (i.e. punctuality, focus, etc.)**

- Troubleshooting, maintenance skills, independent problem solving, critical thinking.
- Human Resources assesses on critical thinking, mechanical aptitude and behavior.
- One company uses WorkKeys® to assess potential employees.
- Agriculture based employees (who grew up on a farm) and car enthusiasts (gear heads) are the best employees because they have mechanical aptitude and are not afraid to get their hands dirty.

9. What certifications are important for your workforce, and which are the most difficult for your firm to find?

- AWS Welding Certification (employees must pass 5 certifications).
- Companies train employees for certifications after they are employed. Employees must maintain certifications.
- Journeyman papers.
- Soldering (J standard) and Braising.
- Some companies test on site for certifications to make it easier for employees to be certified.

10. Is your business a registered apprentice sponsor?

a. If yes:

1. How long has your business been a sponsor?

2. How many apprentices have you trained?

3. For what occupations do you train apprentices?

b. If no or not sure:

1. Is there a reason why you do not participate in registered apprenticeship?

- Seven companies sponsor Registered Apprenticeships.
- One company has been sponsoring Registered Apprenticeships for 30 plus years and it has been very successful.
- One company has been sponsoring Registered Apprenticeships for 25 years and currently has 13 employees in Registered Apprenticeship programs.
- One company just started a Registered Apprenticeship program and currently has two apprentices in the program.
- Other companies will consider Registered Apprenticeship sponsorship.

11. Has your company utilized the SVWDB's Registered Apprenticeship grant that helps fund technical instruction associated with registered apprenticeship training?

a. How has this grant assisted in your workforce upskilling efforts? If it has not assisted, do you have recommendations for how it would be more helpful?

b. Are there occupations or instructional training that should be a priority of this grant funding?

- One company has used the SVWDB Registered Apprenticeship grant.
- Employees have benefited from the SVWDB Registered Apprenticeship grant.
- The SVWDB Registered Apprenticeship grant has helped companies enroll in Registered Apprenticeship program.
- One company just started a Manufacturing Technician Registered Apprenticeship program through Blue Ridge Community College. It has been good for upskilling unskilled employees. They have four employees in the program and are working to sponsor additional employees.
- Companies need a resource to break down language barriers in the workforce. The immigrant population is under employed due to language barriers. They have great technology skills, but they can't speak English.
- Converting credentials from other countries is difficult.
- Is Registered Apprenticeship prioritized by occupational or instructional training?
- Registered Apprenticeship is being used by regional manufacturing companies.

12. **Has your company benefited from the Valley OJT program that offers wage reimbursements for hiring the unemployed or underemployed? How was the program helpful?**
    a. **Is it a model to replicate?**
    b. **Are there ways to improve the program?**
    c. **Have you used other programs or services from Valley OJT/SVWDB? If so, are there ways to improve those services/programs?**

- Several companies have used the OJT program and found it beneficial.
- The OJT program reduced the company's risk in hiring.
- The OJT program has been extremely helpful to several companies.
- One company has used OJT and recommends it.
- Some employers are aware of the OJT program.
- With the OJT program, companies know the employee has soft skills and can hold a job.

13. **Are you aware of industry best practices around upskilling that can help inform improvements to workforce development programs?**

- Concern was expressed about how the education systems are connected. For example, how is Massanutten Technical School connected to Blue Ridge Community College? Is there a defined career pathway for manufacturing occupations?
- There is a lack of coordination among education and training programs.
- Who do you call? A single point of contact is needed for workforce development.
- Schools don't work together to create career pathways.
- Education and training providers need to collaborate.
- The Blue Ridge Community College Career Pathways Consortium meets monthly to coordinate programming. The Career Pathways Consortium builds partnerships between high schools, technical schools, Blue Ridge Community College and area employers.
- Employers are not aware of the Blue Ridge Community College Career Pathways Consortium.
- The Career Pathways Consortium is having discussions at the middle school level.
- The Career Pathways Consortium needs to be marketed to employers.
- There needs to be a link (articulation agreement) between education (high schools and technical schools) and employers.
- The Shenandoah Valley Partnership provides an opportunity for private sector companies to network with education leaders.
- The Shenandoah Valley Partnership and SVWDB can help link education to business.

14. **What questions do you think we should ask that we have not asked?**

- Is there wage inflation for hourly skilled employees? Wages appear to be explosive in high demand occupations.
- Are there untapped sources for workforce? What is the immigration population? What skills and knowledge does the immigrant population have and how can employers access immigrant talent.
- Companies need a benchmark for wage inflation.
- How can employers be more competitive and feel comfortable about a sufficient labor market?
- Companies need to address environmental working conditions that require employees to work in extreme cold or heat. This is a new concern for employers.
- How can employers make employment of Veterans more successful? Ex-military people are structured and have needed critical thinking skills.
- How can we make our area more attractive to veterans? Veterans seek major attractions and urban amenities when relocating.
- We must sell veterans and their families on benefits of living in the Valley. It is a great place to raise children.

A2.3 Northern Focus Group

1. **What are the most pressing workforce concerns for your business?(short-term, long-term, both)**

   - Aging workforce is discussed weekly. It is difficult to know when to pull the trigger to replace them.
   - Finding employees that stay.
   - Entry level production technician operators require a higher skill and have a high turnover rate.
   - It is difficult to recruit employees from out of the area due to the rural, small-town nature of the area.
   - Wage pressures from new companies locating in the area that may pay more and take employees away from existing employers.
   - Companies steal employees from each other.
   - There are rumors that a new company that has announced it will be locating in the area will be hiring a large number of employees. The new company is already hiring and some existing employers have already lost employees to the new company.

2. **Which occupations are most critical to the functioning of your organization? Which, if any, have supply issues and what are these issues? (Issues can be in terms of quantity or quality). Some examples:**
   a. **Maintenance Technicians**
   b. **Manufacturing technicians**
   c. **Mechatronics technicians**
   d. **Machinists**
   e. **Industrial machinery mechanics**
   f. **Welders**
   g. **Machine operators**
   h. **Computer controlled machine tool programmers/operators (CNC Machinists/Operators)**
   i. **Mechanical/electrical/industrial engineers**
   j. **Electrical and electronics repairers**

   - Machinist and engineers are recruited from outside the region or recruited from existing companies.
   - Electronics, electrical repair.
   - PLC Technician occupations are highly technical and must be recruited from outside the region.
   - Maintenance Technicians.
   - Multi-craft skill sets (mechatronics).

3. **For your organization's hiring needs, is there a sufficient supply of labor in the region?**
   a. **What are the top positions that are the hardest to fill?**
   b. **What percentage of your hires comes from within the region?**
   c. **Is the pattern different for high-skilled positions than it is for low-skilled positions?**
   d. **(if needed) Are you engaging staffing companies to fill talent shortages?**

   - One half of the workforce comes from outside the SVWDB region (WV and MD).
   - Technical skill sets are recruited from outside the region or recruited from other companies in the region.
   - A company assesses potential employee interest in their low skill manufacturing process (will they get their hands dirty?) and trains employees on site due to the unique nature of the manufacturing process.
   - A company uses staffing agencies for temporary labor but not for recruiting permanent employees.
   - A company uses staffing agencies to recruit employees, but the turnover is high.
   - A company stopped using staffing agencies to recruit and now hires internally.
   - A company uses recruiters to fill management positions.
   - A company thinks they can do just as good a job at hiring as the staffing agencies.
   - Low unemployment has had an impact on employee availability for staffing agencies.

4. **Have your recruiting practices changed recently? How are hiring challenges in a low unemployment economy different from the hiring challenges in a higher unemployment economy?**

   - Wages are more competitive when there is low unemployment.

- Higher skilled employees are being recruited to offset increased labor costs.
- It is difficult to hire high school graduates because they are not ready for the workforce.
- The 30-45 age cohort are the best workers.
- A company has had moderate success using staffing agencies.
- The younger generation does not want to work in dirty jobs.
- A company is recruiting in diverse communities. They have had good luck hiring in the Hispanic community.
- It is the perfect storm…the worse recruiting ever.
- Companies are resisting temptation to lower employee standards when recruiting.
- A company has moved from using temporary employees to permanent hires of higher caliber.

5. **Are local education and training resources meeting your needs? What, if anything, is lacking?**

- A company expressed surprise at the lack of knowledge of people exiting high school, particularly knowledge in reading, writing and general math.
- A company has a strong relationship with Lord Fairfax Community College (LFCC). They have used the Registered Apprenticeship program and find it a very successful model.
- A company successfully uses LFCC to test Maintenance Technicians.
- A company uses the Leadership Development program at LFCC.
- Employees enrolled in the Registered Apprenticeship program stay with the company.
- Several companies use the Registered Apprenticeship program.
- The LFCC technical program is good.
- K-12 is hit and miss. Manufacturing companies are getting the bottom of the barrel when recruiting from K-12. Good students are not interested in manufacturing.
- Manufacturing is looked down upon. It has a bad reputation with young people. Young people do not recognize a career pathway in manufacturing.
- The Frederick County EDA does a great job introducing high school students to manufacturing.

6. **Are skills transfers a critical issue for your organization?**
   a. **Is the issue more acute among certain occupations? Which ones?**
   b. **What is your process for assuring skills transfers? How would you rate its success?**
   c. **(if needed) Are skills transfers from older to younger workers a concern?**

- Skills transfer among employees is vital. A company will hire new employees but will cross train all employees.
- A company tells young people that the development of core skills is transferrable to higher paying positions.
- Companies look for transferrable skill sets.
- The region's non-union environment allows for more skills transfer.
- A company says that skills transfer is not always successful. They can teach employees new skill sets but they do not always stick.
- Skills transfer is essential.
- 39% of employees have 0 to 5 years' experience. The company has a career pathway policy to transfer skills.

7. **How do emerging technologies affect your current and future workforce demands (especially in terms of the types of occupations and skill sets required for your business)?**

- Machine operator technology advancement is helping the machine operator. Technology is more challenging for PLC operators, maintenance technicians and electricians.
- Different machine vendors have different programming signatures creating a challenge in training employees.
- Young people are very computer savvy. Old people are afraid of emerging technology.
- Automation saves time and requires less employees, but employees require a higher skill set to operate highly automated machinery.
- The lack of a labor force is now forcing automation on companies.

8. **What knowledge, skills and abilities are the most difficult for your firm to find? (Below are some common examples but feel free to be more specific or less specific):**

a. **Computer-Controlled Machine Programming**
b. **Mathematics**
c. **Machine Troubleshooting**
d. **Maintenance & Repair**
e. **Soft skills (e.g. teamwork, ethics, etc.)**
f. **CAD skills**
g. **Work readiness (i.e. punctuality, focus, etc.)**

- CAD skills.
- Technical skills.
- Maintenance Technician. This occupation is not attractive to young people.
- PLC skills and computer controlled machines.
- Basic math skills (fractions and decimals).
- Hydraulics and pneumatics.
- Employees seem to have work readiness but they don't want to work overtime or third shift.
- Critical thinking skills.
- To get critical thinkers, you need to grow them.

9. **What certifications are important for your workforce, and which are the most difficult for your firm to find?**

- AWS Welding Certificates. A company hires employees with minimum certification and the company further certifies them.
- CDL Class A drivers.

10. **Is your business a registered apprentice sponsor?**
    a. **If yes:**
        1) **How long has your business been a sponsor?**
        2) **How many apprentices have you trained?**
        3) **For what occupations do you train apprentices?**
    b. **If no or not sure:**
        1) **Is there a reason why you do not participate in registered apprenticeship?**

- Three companies indicated that they sponsor Registered Apprenticeships.
- A company uses Registered Apprenticeships to train maintenance employees.
- Some companies are considering Registered Apprenticeships.

11. **Has your company utilized the SVWDB's Registered Apprenticeship grant that helps fund technical instruction associated with registered apprenticeship training?**
    a. **How has this grant assisted in your workforce upskilling efforts? If it has not assisted, do you have recommendations for how it would be more helpful?**
    b. **Are there occupations or instructional training that should be a priority of this grant funding?**

- Some companies are considering using the Registered Apprenticeship program.
- A company is a big supporter of Registered Apprenticeship.

12. **Has your company benefited from the Valley OJT program that offers wage reimbursements for hiring the unemployed or underemployed?**

    How was the program helpful?
    a. **Is it a model to replicate?**
    b. **Are there ways to improve the program?**

c. Have you used other programs or services from Valley OJT/SVWDB? If so, are there ways to improve those services/programs?

- Several companies have used the SVWDB OJT program.
- A company stated the OJT program is a good model.
- Employees in the OJT program stay with the company.
- OJT is very beneficial to a new small business.
- OJT is a good model to replicate.
- OJT is easy to administer.
- OJT employees were already vetted and stay with the company.
- Another program that has been beneficial is the retraining grant.

13. Are you aware of industry best practices around upskilling that can help inform improvements to workforce development programs?

- One company video tapes senior employees to document what they do for use in training.

14. What questions do you think we should ask that we have not asked?

- A company has used Facebook to recruit with good results.
- It would be interesting to evaluate K-12 linkages and find a way to communicate career opportunities in manufacturing to K-12 students.
- Some companies use back ground checks to weed out violent felons.
- One company says employee screening has relaxed somewhat.
- Nepotism policy is still being used. One company eliminated their nepotism policy.
- Incentivize employees for successful recruitments.
- A company has had good success hiring family members.
- Family member employees have a sense of loyalty.
- How do we raise awareness of manufacturing career opportunities and wages to get good candidates?
- How do we market manufacturing?
- A company has hired technical school students, but they did not have the needed skills.
- Technical schools need to focus on Manufacturing 101.
- In manufacturing there could be an insurance issue with work based learning, job shadowing and internships.

Appendix 3: Industry/Occupation Mix Table

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
51-2092	Team Assemblers	1,542	$30,600	181	-42	181
51-9111	Packaging and Filling Machine Operators and Tenders	1,191	$29,600	217	-7	217
51-1011	First-Line Supervisors of Production and Operating Workers	1,168	$57,200	106	-30	106
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	1,117	$24,900	101	-5	101
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	1,001	$28,000	158	-17	158
51-9198	Helpers--Production Workers	919	$23,100	143	-46	143
51-3023	Slaughterers and Meat Packers	878	$28,600	105	-4	105
53-7064	Packers and Packagers, Hand	849	$29,300	114	-18	114
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	786	$36,800	104	-19	104
51-5112	Printing Press Operators	700	$36,200	68	-52	68
51-3092	Food Batchmakers	664	$26,600	96	-4	96
49-9071	Maintenance and Repair Workers, General	610	$35,900	80	-14	80
53-7051	Industrial Truck and Tractor Operators	601	$31,700	87	-13	87
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	593	$55,600	59	-18	59
49-9041	Industrial Machinery Mechanics	528	$45,900	68	39	107
11-1021	General and Operations Managers	520	$101,600	67	-14	67
53-3032	Heavy and Tractor-Trailer Truck Drivers	520	$40,600	48	6	54
43-5071	Shipping, Receiving, and Traffic Clerks	498	$31,200	51	-27	51
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	469	$32,800	75	-61	75
43-4051	Customer Service Representatives	417	$32,200	52	-19	52
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	387	$37,300	44	-45	44
43-9061	Office Clerks, General	384	$28,900	41	-21	41
51-4041	Machinists	358	$41,500	51	11	62
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	342	$36,100	45	-5	45
11-3051	Industrial Production Managers	333	$108,900	56	-8	56
51-4121	Welders, Cutters, Solderers, and Brazers	301	$42,400	50	3	53
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	286	$40,700	60	-37	60
53-7063	Machine Feeders and Offbearers	274	$33,800	29	-10	29
51-5113	Print Binding and Finishing Workers	273	$33,400	25	-21	25
51-9199	Production Workers, All Other	271	$27,600	27	-7	27
51-7042	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	267	$27,300	26	-6	26
51-9196	Paper Goods Machine Setters, Operators, and Tenders	258	$41,500	29	-16	29
17-2112	Industrial Engineers	247	$78,300	38	-5	38
51-7011	Cabinetmakers and Bench Carpenters	244	$32,600	12	2	14

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
43-5061	Production, Planning, and Expediting Clerks	232	$40,900	33	-7	33
51-3099	Food Processing Workers, All Other	224	$24,100	26	0	26
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders	216	$40,700	35	-9	35
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	201	$37,500	31	16	46
51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	198	$38,400	38	-9	38
51-6031	Sewing Machine Operators	194	$22,700	39	-33	39
51-2099	Assemblers and Fabricators, All Other	192	$29,800	17	-6	17
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	190	$34,600	34	-5	34
51-3093	Food Cooking Machine Operators and Tenders	183	$27,300	22	0	22
51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	181	$26,700	31	-5	31
49-9043	Maintenance Workers, Machinery	176	$39,900	14	4	18
51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	158	$33,500	18	-4	18
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	156	$58,500	22	-4	22
51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	154	$40,600	29	1	29
17-2141	Mechanical Engineers	148	$79,700	25	-3	25
53-7061	Cleaners of Vehicles and Equipment	147	$23,700	27	0	28
51-5111	Prepress Technician and Workers	145	$39,300	20	-24	20
27-1024	Graphic Designers	143	$43,300	22	-11	22
51-9011	Chemical Equipment Operators and Tenders	136	$50,100	32	-5	32
51-4111	Tool and Die Makers	120	$48,800	4	-9	4
51-3021	Butchers and Meat Cutters	112	$31,900	11	-1	11
51-2022	Electrical and Electronic Equipment Assemblers	111	$32,200	11	-5	11
11-2022	Sales Managers	103	$128,700	13	-3	13
51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	99	$27,700	26	-16	26
51-2041	Structural Metal Fabricators and Fitters	96	$35,800	8	2	10
45-2041	Graders and Sorters, Agricultural Products	95	$30,400	9	-4	9
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	95	$35,600	27	-11	27
51-3011	Bakers	94	$26,300	12	1	13
19-2031	Chemists	90	$78,500	10	-3	10
17-3026	Industrial Engineering Technicians	87	$50,300	12	-3	12
51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	84	$33,500	19	1	19
51-6064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	78	$27,700	15	-12	15
51-6091	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers	76	$43,500	10	-6	10
47-2211	Sheet Metal Workers	75	$38,000	8	3	11

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
51-3091	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders	74	$26,700	7	0	7
51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	72	$29,000	11	0	11
11-9041	Architectural and Engineering Managers	71	$121,900	10	-2	10
43-4151	Order Clerks	71	$29,600	10	-6	10
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	64	$41,200	12	-8	12
43-5111	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	61	$31,200	9	-3	9
19-4031	Chemical Technicians	61	$44,600	9	-2	9
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	60	$40,400	10	-7	10
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	60	$39,100	9	-6	9
51-8091	Chemical Plant and System Operators	60	$57,500	15	-3	15
53-7011	Conveyor Operators and Tenders	58	$32,000	8	-1	8
51-9193	Cooling and Freezing Equipment Operators and Tenders	57	$27,100	6	1	7
51-2023	Electromechanical Equipment Assemblers	57	$33,600	6	-2	6
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	54	$96,800	5	-1	5
51-9191	Adhesive Bonding Machine Operators and Tenders	54	$36,200	8	-2	8
51-2031	Engine and Other Machine Assemblers	53	$39,000	5	-1	5
51-9081	Dental Laboratory Technicians	52	$39,500	7	2	9
51-2091	Fiberglass Laminators and Fabricators	51	$30,500	7	-2	7
17-3013	Mechanical Drafters	51	$47,900	5	-3	5
51-9021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	51	$31,200	6	-2	6
19-4011	Agricultural and Food Science Technicians	48	$34,100	10	0	10
51-9022	Grinding and Polishing Workers, Hand	46	$32,700	5	-2	5
13-1081	Logisticians	43	$72,000	3	-1	3
51-9031	Cutters and Trimmers, Hand	42	$30,300	9	-4	9
19-1012	Food Scientists and Technologists	41	$62,800	6	1	7
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	40	$44,600	9	-4	9
17-2071	Electrical Engineers	40	$81,900	5	-2	5
11-3061	Purchasing Managers	39	$105,500	5	-1	5
17-3023	Electrical and Electronic Engineering Technicians	37	$58,900	4	-2	4
11-3121	Human Resources Managers	37	$105,400	6	-1	6
51-9051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	37	$46,000	6	-2	6
51-4051	Metal-Refining Furnace Operators and Tenders	34	$48,000	8	-1	8
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	34	$51,400	3	-2	3
17-2199	Engineers, All Other	32	$92,600	3	-1	3
51-6093	Upholsterers	32	$27,900	6	-2	6
51-4012	Computer Numerically Controlled Machine Tool	32	$54,600	4	3	7

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
	Programmers, Metal and Plastic					
51-9197	Tire Builders	31	$45,100	6	0	6
17-2041	Chemical Engineers	31	$89,400	4	-1	4
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	30	$36,900	5	-4	5
51-4193	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	30	$33,500	5	-3	5
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	29	$41,400	3	-4	3
17-3027	Mechanical Engineering Technicians	29	$48,400	4	-1	4
51-4199	Metal Workers and Plastic Workers, All Other	29	$39,900	3	-4	3
51-7021	Furniture Finishers	29	$29,500	3	0	3
51-6062	Textile Cutting Machine Setters, Operators, and Tenders	28	$29,200	6	-5	6
29-9011	Occupational Health and Safety Specialists	28	$57,600	3	-1	3
43-9051	Mail Clerks and Mail Machine Operators, Except Postal Service	26	$25,700	4	-4	4
19-4021	Biological Technicians	25	$41,300	3	0	4
51-6099	Textile, Apparel, and Furnishings Workers, All Other	24	$29,100	3	-4	3
27-1021	Commercial and Industrial Designers	24	$47,200	4	-1	4
49-9044	Millwrights	24	$48,300	2	0	2
41-9011	Demonstrators and Product Promoters	23	$31,100	4	0	4
51-6061	Textile Bleaching and Dyeing Machine Operators and Tenders	23	$29,100	4	-4	4
17-3029	Engineering Technicians, Except Drafters, All Other	22	$59,700	3	-1	3
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	22	$37,500	4	-2	4
51-7099	Woodworkers, All Other	21	$37,200	4	-1	4
11-9121	Natural Sciences Managers	21	$117,600	2	0	2
51-8021	Stationary Engineers and Boiler Operators	20	$53,500	3	-1	3
17-2072	Electronics Engineers, Except Computer	20	$92,100	2	-1	2
43-3061	Procurement Clerks	20	$39,900	3	-2	3
17-2031	Biomedical Engineers	19	$79,400	3	3	6
51-9123	Painting, Coating, and Decorating Workers	19	$32,200	2	-1	2
19-1022	Microbiologists	18	$63,900	3	0	3
19-1021	Biochemists and Biophysicists	18	$76,600	3	0	3
51-4194	Tool Grinders, Filers, and Sharpeners	18	$32,000	2	-2	2
17-2131	Materials Engineers	15	$79,800	3	-1	3
51-9141	Semiconductor Processors	15	$36,100	4	-1	4
51-9083	Ophthalmic Laboratory Technicians	15	$36,200	2	0	2
17-2061	Computer Hardware Engineers	14	$100,900	1	-1	1
51-9082	Medical Appliance Technicians	14	$37,600	2	1	3
41-9031	Sales Engineers	14	$111,000	2	0	2
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	13	$63,400	3	0	3

5-Year Industry/Occupation Mix for Manufacturing in Shenandoah Valley

SOC	Title	Current Employment	Regional Average Wage[1]	5-Year Replacement Demand	5-Year Growth Demand	5-Year Openings
43-9031	Desktop Publishers	13	$43,900	2	-2	2
45-4022	Logging Equipment Operators	13	$30,600	2	1	3
51-2021	Coil Winders, Tapers, and Finishers	12	$30,300	2	-1	2
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	12	$77,500	2	0	2
51-4192	Layout Workers, Metal and Plastic	11	$47,200	1	-1	1
13-1021	Buyers and Purchasing Agents, Farm Products	11	$54,400	1	0	1
51-9194	Etchers and Engravers	11	$32,200	2	-1	2
45-2011	Agricultural Inspectors	11	$43,700	1	0	1
51-8099	Plant and System Operators, All Other	10	$56,100	2	0	2
45-4023	Log Graders and Scalers	10	$36,500	4	0	4
51-4061	Model Makers, Metal and Plastic	9	$48,100	1	-1	1
51-4052	Pourers and Casters, Metal	8	$34,100	2	-1	2
17-3019	Drafters, All Other	7	$47,200	0	0	0
51-4071	Foundry Mold and Coremakers	7	$34,200	1	-1	1
29-9012	Occupational Health and Safety Technicians	7	$45,600	1	0	1
17-3024	Electro-Mechanical Technicians	6	$45,100	1	0	1
19-2032	Materials Scientists	6	$98,000	1	0	1
51-6051	Sewers, Hand	6	$29,900	3	-1	3
43-9081	Proofreaders and Copy Markers	5	$33,400	1	0	1
29-2091	Orthotists and Prosthetists	5	$75,500	0	0	1
51-6092	Fabric and Apparel Patternmakers	4	$46,600	1	-1	1
19-1032	Foresters	4	$53,500	1	0	1
51-7031	Model Makers, Wood	4	$37,100	1	0	1
49-9093	Fabric Menders, Except Garment	3	$23,800	0	-1	0
51-4062	Patternmakers, Metal and Plastic	2	$39,200	0	0	0
51-2093	Timing Device Assemblers and Adjusters	2	$43,200	0	0	0
53-7041	Hoist and Winch Operators	2	$42,300	0	0	0
49-9095	Manufactured Building and Mobile Home Installers	2	$28,100	1	0	1
51-7032	Patternmakers, Wood	2	$40,000	0	0	0
17-2021	Agricultural Engineers	1	$68,800	0	0	0
49-9045	Refractory Materials Repairers, Except Brickmasons	1	$45,900	0	0	0

Source: JobsEQ®

1. Occupation wages are as of 2015 and represent the average for all Covered Employment