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The Changing Manufacturing Workforce in the Shenandoah Valley:

A Look at Regional Issues Related to Worker Upskilling and an Aging Workforce

Prepared for **Shenandoah Valley Workforce Investment Board**

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Manufacturing Industry and Labor Trends

This study assesses the state of the manufacturing labor force in the Shenandoah Valley (the Valley) in the Commonwealth of Virginia. The region faces some economic and labor market challenges given its large geographic span and mixed rural-to-urban population mix. Its 512,628 residents are above the median age (39.1) of those in the rest of the state (37.5) and in the United States (37.2). The aging population is particularly acute as employers seek to replace retiring workers with younger job seekers. The highly-specialized skills that are required in these positions are often absent in the contemporary workforce.

The educational attainment levels for the Valley's residents are, in part, contributing to the skills issues. At every level of achievement, the Valley is trailing both the state and the nation. This trend, coupled with the aging population, highlights the need for both community and regional strategies to reverse the achievement gaps—both in education and in the demand for specialized skills. This study, "The Changing Manufacturing Workforce in the Shenandoah Valley," is provided to the Shenandoah Valley Workforce Investment Board so they can begin to help the region transition from the 'as is' workforce to the 'to be' workforce—where gaps between the demand for specialized labor and the supply of highly-skilled workers can progressively become smaller.

Overseas competition for labor coupled with increasing automation in manufacturing operations has changed the demand equation for skilled workers among American manufacturers.

When the last recession ended in 2009, the Shenandoah Valley region shed more jobs than were added during the previous employment expansion that began in the third quarter of 2003. As of the latest data available (2013 Q1), year-over-year employment in manufacturing has mostly been in decline with a couple of growth spurts in the Valley in 2011 and again in the latest quarter of 2013 (1.8%), which outpaced the state (1.0%) and the nation (0.9%). Employment gains in the Valley are expected to continue in manufacturing at a modest annual average pace of 0.6% over the next decade.

Current Situation

As of the first quarter 2013, there are roughly 32,300 manufacturing jobs in the Valley, making up 16% of all regional employment. And, there are currently 72% more manufacturing workers per capita than the national average.[1] Average wages for manufacturing workers in the Valley are about $46,500, which exceeds the regional average by $10,300. Also, manufacturing wages are growing slightly faster than in the Valley's other industries. Food manufacturing is the largest sector, with more than 10,000 employees, or one-third of total manufacturing employment. With a jobs multiplier of 2.46, manufacturing's indirect and induced impacts support an additional 15,000 jobs in the region. These trends require a workforce plan that can support a growing manufacturing footprint for the Shenandoah Valley.

[1] The location quotient (LQ) of manufacturing is 1.72 in the Shenandoah Valley region. Location quotient and average wage data are derived from the Quarterly Census of Employment and Wages, provided by the Bureau of Labor Statistics and updated through 2012 Q4 with preliminary estimates by Chmura updated to 2013 Q1. Forecast employment growth uses national projections from the Bureau of Labor Statistics, forecasts for 2010-2020, adapted for regional growth patterns by Chmura. Zip code-based industry employment is per the NETS database.

Employment Forecasts

Over the next ten years, it is projected that area manufacturers will need approximately 9,000 workers—1,900 due to growth and 7,000 due to replacement demand—as workers retire or change occupations. Chmura's 10-year projection shows a 0.6% annual average job growth in the manufacturing sector in the Valley.

Business survey respondents expected 2.6% annual average job growth over the coming three years. This compares to Chmura's 10-year projection of about 0.6% annual average job growth in the manufacturing sector in the Valley. As an alternative forecast, assuming 29% of manufacturing employment in the region meets the growth expectations from the survey and the remaining 71% grow at the baseline expectation of 0.6% per year, the total manufacturing sector in the region would grow at a 1.1% annual average pace over the coming three years.

65% of [survey] respondents expected employment to increase, 29% expected employment to stay the same, and just 3% expected a decline (with the remaining 3% replying "don't know").

Technology: Change Agent in Manufacturing

The 0.6% annual growth rate for manufacturing in the Valley creates a dichotomous message for workforce planners and career counselors in the region. The wages in manufacturing are an attractive incentive. However, specialized skills and requirements are complicated by gaps in curriculum, equipment, and industry-recognized credentials.

Technology is perhaps the single most dominant enabler allowing manufacturers to keep labor costs low enough to achieve their targeted profits. Said differently, technology leads to efficiency gains through the continuous improvement in processing designs. The downside for workers is that upward trends in productivity are most often accompanied by continuous declines in the number of workers needed. In fact, many new production methods in the future of manufacturing will require fewer people working on the factory floor. In fact, lights-out manufacturing[2] is now possible in some aspects of automation. In terms of talent development, the role of technology in manufacturing is one of the defining specialized skillsets job seekers need to navigate the many career pathways in manufacturing.

1.2. Summary of Key Findings

An Aging Workforce and its Impact on Manufacturing

Over the next ten years, the age mix of the workforce is expected to gradually shift toward older workers. This projection is due, in part, to the aging baby-boom cohort. Consequently, young, first-time workers are going to make up a smaller portion of the total workforce. Further, the 16-to-24-years-old cohort accounted for an estimated 15.1% of workers in the Valley in 2013— this is projected to drop to 13.3% by 2023.

[2] Lights-out manufacturing stemmed from the fears by autoworkers in the 1980s that Japanese competitors would displace them in their marketplace. The idea was that factories would become so highly automated that robots could build cars with the lights off in the plant. http://news.thomasnet.com/IMT/2012/11/06/lights-out-production-the-new-late-night-shift/

Manufacturing in the Valley comes in at second place for the five-year projections for retirement rates (13.7%). These projections vary from 17.7% in chemical manufacturing to a 10.7% in printing and related services. Business focus groups revealed greater challenges with retirements for the larger, more established companies. Employers saw an anticipated 2.4% annual retirement rate. Consequently, Chmura estimated a revised annual rate of retirement of 2.7% for manufacturing over the next five years.

The forecast for a growing manufacturing footprint in the Valley points to occupations needed to sustain growth. Of the top manufacturing occupations in the Valley, some of the highest five-year retirement rates are expected for machinists, industrial production managers, truck drivers, industrial machinery mechanics, maintenance and repair workers, and first-line supervisors of production workers.

While the recession and changing attitudes toward retirement have softened the impact of worker retirements in the Valley, manufacturing has an older worker profile with 26% of workers age 55 or above.

Critical Demand Occupations

When the Valley's labor market trends are considered—projections and retirement impact—the most critical shortages are expected to occur in seven key knowledge-based occupational clusters: engineering technologies, electrical technologies, machining, mechanical technologies, welding, pipefitting, and computer occupations. Jointly, these clusters represent more than 10,000 current employees with a combined forecast demand of 541 newly-trained annual workers. Computer occupations comprises a small, but growing group of jobs within manufacturing. Notably, manufacturers are competing with other industries in attracting this talent. Manufacturers are likely to hire new workers with high exposure to and demonstrating competencies in STEM (science, technology, engineering, and math) education and training.

Training Capacity and Academic Alignment to Demand Occupations

Another expected trend is an increase in the average educational attainment of the workforce. The number of jobs in all cohorts is expected to grow in size over the next ten years in the Valley; the exception is for the group with less than a high school diploma. The overall labor supply is forecast to expand 17.0% over the next ten years with quicker growth expected among those workers with graduate degrees (27.6%), associate's degrees (31.1%), and some college (21.4%). The need for workers with bachelor's degrees is expected to expand over the next ten years by 21.4%.

Over the last five years, the region's academic institutions were responsible for more than 1,628 academic awards in programs aligned with the critical demand occupations. When the computer occupations group is excluded, the number falls to 620 awards. Community colleges contributed approximately 30% of total awards. There is ample capacity to train workers in some, but not all needed academic fields. The Valley's education and training capacity is deficient in both critical training infrastructure and programs that are aligned with the machining, welding, and pipefitting clusters.

Chmura identified more than 60 different training programs in the area's educational facilities that roughly aligned with the critical demand occupations. Offerings include high school vocational programs, varying levels of credentials at area community colleges, and bachelor's and advanced degrees. Customized training for industry is also available to the workforce. Even though the Valley has a variety of program offerings, career pathways are not articulated well to the jobseeker. And further, a proliferation of new program offerings might further confuse career messaging to the Valley workforce, as well as devalue industry-validated credentials. Adding new training programs can be expensive due to equipment cost and

Survey findings reveal that the children of manufacturing workers generally rate manufacturing more highly as a career alternative and have more

space requirements. As part of the Chmura report, a preliminary inventory of current training equipment is provided; furthermore, recent and planned investments for adding equipment capacity are part of the education and training offerings in the coming semesters. Specifically, local community colleges have expanded investments in welding and multi-craft technician programs.

Employers in the Valley embrace apprenticeship as a valued training option. Currently, there are 322 active apprenticeships that align toward the critical demand occupations. Over the past five years, 260 individuals have completed apprenticeship programs designed to prepare them for careers in manufacturing.

The Talent Pipeline –Attitudes about Manufacturing

In the Valley, 13.2% of all people collecting unemployment classify themselves as production workers. In numerical terms, this is equivalent to more than 290 people. Chmura estimates there are an additional 1,200 people unemployed with manufacturing experience not accounted for in the unemployment (UI) recipient data. Although manufacturing is a growing industry in the Valley, the talent needed to sustain this growth is expected to come from the shrinking younger generation of workers. Further, manufacturers are looking for entry-level workers whose work-ready skills are described as STEM-like with the ability to troubleshoot manufacturing processes.

Historical data suggests that alternative career pathways models can help workforce and training professionals manage career expectations for both jobseekers and employers.

Based on surveys and focus groups with high school students, there are low levels of awareness or interest in manufacturing careers. Manufacturing ranked last when students were asked to select occupational groups from within which they would most likely pursue a career.

The implication that students in the Valley are particularly uninterested in manufacturing careers is a serious regional issue and one that can stymie the growth of manufacturing in the future. This situation is further complicated by trends that suggest the region is at risk of losing its younger population—the future workforce. For example, 44% of surveyed high school students reported they are unlikely to live and work in the Valley. This perception can be compounded by the 46% first-time workers in the Valley that have a high school diploma or less.

Regional demographic trends suggest that young, first-time workers are going to form a smaller portion of the overall workforce in the future. The 16-to-24-years-old cohort accounted for an estimated 15.1% of workers in the Valley in 2013, but this group is projected to drop to 13.3% by 2023. Primary data from the surveys also suggests that students often lack critical career planning information. One in five community college students report that they have received little or no information about the local job market. Further, students from both the focus groups and surveys indicated stronger interests in healthcare over manufacturing careers.

Shrinking trends in the younger generation of the future workforce poses many threats to the communities in the Valley. However, positive perceptions were uncovered with the older student groups that suggest these trends are not irreversible. For example, community college students are more motivated to stay in the region and value the opportunities that manufacturing offers – their responses included “doing something I’m good at”, “good earnings” and “good benefits”.

Educators’ Impressions and Insight

Key insight into the education and training capacity were augmented with surveys to community college faculty and career and technical educators (CTE) at local school districts across the Valley. The process led to a general understanding that public school instructors are less confident than community college teachers about how regional schools are preparing students for skilled manufacturing. Additionally, community college faculty reported giving more focus to technical content and problem-solving/troubleshooting whereas the public school teachers surveyed reported more focus on work ethic and communication skills development.

Educators were divided almost equally into thirds on whether local educational institutions and manufacturers were communicating sufficiently about training needs. Of the 62 respondents, 34% thought communication about training needs was sufficient, 35% said communication was not sufficient, and the remaining 31% said they did not know. Further, most of the educators (61%) that were surveyed reported having personal contact with regional employers. And, the verbatim comments for the surveys suggest there is a real interest for more frequent and coordinated interactions with the manufacturing community.

Like businesses, educators identified lack of soft skills and a lack of basic problem-solving skills as the most pressing workforce challenges in the Valley. However, they did not rank technical skills above business skills as a critical challenge for their operations in the Valley.

Employers Weigh in on Skills Requirements

Basic work readiness was cited as the most pressing concern facing manufacturers in the Valley. The data with which to gauge this feedback against is quite sparse. In fact, these data are limited to a narrow selection of assessment data. However, the available data suggest workers in the Valley are actually more prepared than other workers in the Commonwealth. Adults who attempted the Career Readiness Certificate (CRC) in the Valley had a higher pass rate than the state average, as was also the trend with the CTE students using the Department of Education (DOE)-endorsed Workforce Readiness System (WRS) certification.

In addition to lacking basic work-readiness skills, employers cited a lack of basic mechanical skills as a challenge in their recruitment efforts. According to businesses (surveys and focus groups), their most difficult-to-fill positions are engineers, electricians, maintenance workers, welders, and mechanics.

When asked if training providers in the Shenandoah Valley are meeting manufacturers' needs, businesses gave mixed results— 44% responded "yes" and 41% responded "no." The largest companies in the sample were more likely to express dissatisfaction: four of the six firms with over 500 employees said that training providers in the region were not meeting their needs.

2. Introduction

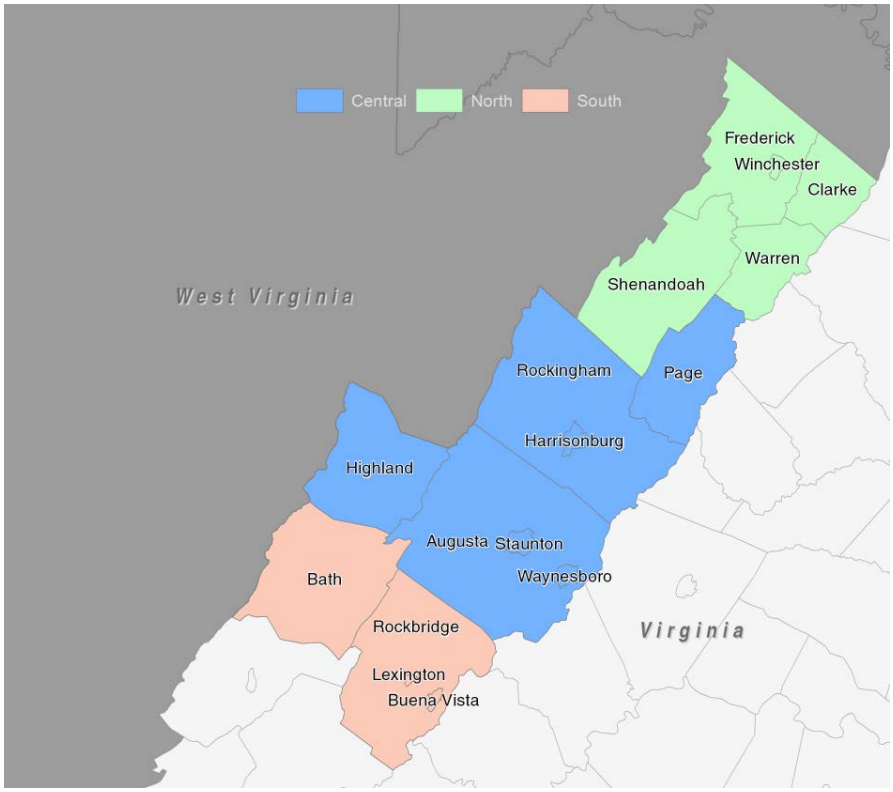
2.1 Background for the Analysis

Chmura Economics & Analytics (Chmura) was retained to help the Shenandoah Valley Workforce Investment Board (SVWIB) and its partners in private industry, higher education, and government better understand the current trends in their manufacturing labor market. "The Changing Manufacturing Workforce in the Shenandoah Valley" report follows several related studies over the past five years including the 2007 statewide report "Skilled Trades Gap Analysis Report," the 2008 "A Master Plan for 21st Century Workforce Transitions in Shenandoah Valley," and the 2010 "Report on the Feasibility of a Satellite Site of the Commonwealth Center for Advanced Manufacturing in the Shenandoah Valley." Based on prior studies, the SVWIB identified the following overarching issues that remain as either perceived or real concerns for the businesses in the Valley:

- Perceptions regarding workforce upskilling; the older workforce and the potential for "brain drain"
- Assessments of business impacts of an older workforce and impending worker retirement
- Preparedness of industry leaders regarding an aging workforce and the transfer of knowledge and skills between worker cohorts

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

Figure 2.1: Shenandoah Valley Region and Sub-Regions



Northern
Clarke
Frederick
Shenandoah
Warren
Winchester

Central
Augusta
Harrisonburg
Highland
Page
Rockingham
Staunton
Waynesboro

Southern
Bath
Buena Vista
Lexington
Rockbridge

2.2. Findings of Previous Studies

Three studies that were conducted over the last six years with regard to manufacturing are reviewed here. The first was conducted for the state and the second two studies are specific to the Valley.

2.2.1. "The 2007 Skilled Trades Gap Analysis Report" [3]

"The 2007 Skilled Trades Gap Analysis Report" (STGAR) produced for the Virginia Manufacturers Association, the Virginia Workforce Council, and the Virginia Manufacturing Advisory Council, looked at the Commonwealth's educational pipeline for skilled-trades workers and included some capacity insights for the community colleges in the area of skilled-trades training. The study was conducted in 2 phases: the first phase's findings were based on a review of Bureau of Labor Statistics (BLS) employment data as well as a review of aligned training capacity within the Virginia Community College System. Phase 1 estimated the shortfall in skilled-trades workers to be 12,894 between 2007 and 2012, which translates into an annual gap in trained workers of 2,441. Phase 1 of the report did not separate the number of jobs in the gap that were caused by growth, retirements, or individuals leaving manufacturing for other industries. The report evaluated 12 skilled trade occupations and found two where the statewide needs met was zero (chemical equipment operators and chemical technicians). In six occupations (extruding and drawing machine setters; machine maintenance specialists; multiple machine tool setters, operators, and tenders, metal and plastic; stationary engineers and boiler operators; tool and die makers; and welders) the percentage of statewide needs met fell below 25%.

Phase 2 of the study involved a statewide survey of 456 manufacturers that led to additional refinement of the definition of skilled trades and provided more detail on the most relevant occupations for further study. The nine occupations were decided by the Virginia Manufacturing Advisory Council's Skilled Trades Committee and advanced to the survey respondents to determine the actual number of skilled trade openings between 2007 and 2010. This new list of occupations included manufacturing technicians that is not part of the BLS occupation inventory. Respondents were anticipating as many as 46,870 openings over that period, with 23.1% due to retirement. According to the report, these findings suggested that the Phase 1 report could have understated employer demand significantly. The Phase 2 study cumulative gap estimate was 11,751 openings.

The statewide report suggested some imbalances in the labor market at the regional level which it defined as local workforce investment areas. In the case of the Shenandoah Valley, the gap analysis report suggested the potential for unmet needs in the following two occupations: 1) multiple machine tool setters, operators, tender, metal and 2) plastic and printing machine operators. The report does not provide further insight into the regional disparity between labor supply and demand.

2.2.2. "A Master Plan for 21st Century Workforce Transitions in Shenandoah Valley" [4]

"A Master Plan for 21st Century Workforce Transitions in Shenandoah Valley" report commissioned by the Commonwealth of Virginia through the Virginia Economic Development Partnership considered the region's top workforce issues in light of the changing global economy. The methodology for this study's primary data gathering phase from April 2007 through January 2008 involved SRI staff members that targeted key individuals and organizations representing a cross-section of the community in the counties of Augusta and Rockingham and the cities of Waynesboro, Staunton, and Harrisonburg.

[3] Virginia Manufacturers Association (2007). *Skilled Trades Gap Analysis Report: Final Report*. Virginia Manufacturers Association, Virginia Workforce Council & Virginia Manufacturing Advisory Council, Richmond, VA.

[2] SRI International (2005). *A Master Plan for 21st Century Workforce Transitions in Shenandoah Valley.* SRI International, Policy Division, Harrisonburg, VA.

SRI interviewed more than 160 individuals, including elected officials, social service providers, law enforcement officials, community-based organizations, faith-based service providers, schools, universities, employers, workforce system specialists, and government economic development specialists. SRI analysts examined extant social and economic data from a variety of sources that framed the themes emerging from the interviews.

The report's purpose was to evaluate the larger workforce system in the Valley and make recommendations regarding strategies for improvement. The report's recommendations included seven strategies; enhancing work-readiness for high school students; creating more support for youth outside of school; bringing unattached workers at all levels back into the pipeline; addressing workforce challenges of immigrant populations; expanding business retention and expansion program efforts; and supporting workforce upskilling. SRI's report recommended the creation of a number of tasks forces dedicated to one of the issues identified and a related action plan.

2.2.3. "Report on the Feasibility of a Satellite Site of the Commonwealth Center for Advanced Manufacturing in the Shenandoah Valley"[5]

In 2010, the Virginia General Assembly directed the Virginia Economic Development Partnership (VEDP) to create the "Report on the Feasibility of a Satellite Site of the Commonwealth Center for Advanced Manufacturing in the Shenandoah Valley." At the time, stakeholders concluded that "it would not be prudent at this critical stage in CCAM's gestation and early development to divert attention from ensuring a successful start-up for CCAM." Stakeholders further believed that there was significant interest among some manufacturing businesses in the Shenandoah Valley that could benefit from becoming CCAM members. The report recognized that the Valley has significant assets in the pharmaceuticals industry that could serve as an anchor for further research and development in the Valley.

Despite not being approved at the time for the Valley, the report concluded that the CCAM model remains worthy of consideration as regional stakeholders develop partnerships and initiatives. CCAM is a unique public-private partnership that allows businesses to jointly conduct basic underlying research using the expertise of college and university researchers and students. The primary objective of CCAM is to accelerate the application of new technology to applications in the marketplace. The partnership benefits all parties, as the research creates technology businesses can use to create new products or improve existing products while also lowering their research costs. The research facility creates a hands-on workforce development training center for aspiring engineers and scientists, and the entire Commonwealth benefits from the increased economic output and new jobs created by these businesses. CCAM relies on sponsorship from several large manufacturers including Rolls Royce, Canon, and Newport News Shipbuilding, as well as participating postsecondary institutions including the University of Virginia, Virginia State University, and Virginia Tech.

2.3 The Changing Manufacturing Workforce (2012-2013)

Overseas competition for labor coupled with increasing automation in manufacturing operations has changed the demand equation for skilled workers among American manufacturers. In the past, skill specialization was typically tied to high productivity and that cohort made up a smaller portion of the total workers in a manufacturing establishment. The demand for higher-skilled workers now characterizes the entry-level job seeker. Manufacturing employers both in the Valley and the U.S. need skilled workers that at one time were held by only the most specialized employees. Some of these occupations included programmable logic controls (PLC), troubleshooting, and electronics. The onslaught of technology as an enabler in

[5] Virginia Economic Development Partnership, *Report on the Feasibility of a Satellite Site of the Commonwealth Center for Advanced Manufacturing in the Shenandoah Valley,* 2010.

manufacturing has resulted in a large-scale shortage of skilled manufacturing workers in the Valley in industries ranging from food production to aerospace manufacturing.

On a national scale, skilled-production workers are in high demand, and the demand is expected to grow in coming years. For example, a 2011 nationwide business survey conducted by Deloitte and the Manufacturing Institute revealed that 83% of respondents have a moderate to severe shortage of available skilled-production workers. [6] Companies expect little improvement; 56% anticipate the shortage to grow worse in the next three to five years. Despite having job openings, 5% of manufacturers reported having jobs that remain unfilled because they cannot find people with the requisite skills. Further, 75% of manufacturers report that the category of skilled-production workers is expected to be impacted most by upcoming retirements.

The composition of workers in manufacturing has vastly changed over the past thirty years, providing more mid- and high-wage careers within the industry**.** According to a report produced by the Federal Reserve Bank of New York, between 1983 and 2003, the proportion of jobs that are mid-skill and high-skill rose by six percentage points, from 57% to 63%.[7] There is also reason to believe that manufacturing has a bright future in the United States. U.S.-based manufacturing is becoming more competitive due to increasing labor costs in developing nations, supply chain risks, and other costs. Recently, a report by the Boston Consulting Group concluded that by 2015, manufacturing for many consumer goods will be just as economical in the United States as it is in China.[8]

Despite these encouraging trends, most workers have a negative impression of manufacturing and show little interest in entering the field**.** Only 17% of individuals who responded to a recent survey conducted by the Manufacturing Institute said that their parents encouraged them to pursue a career in manufacturing; furthermore, among seven industries surveyed, manufacturing ranked fifth as a preferred industry to enter if people were beginning their careers today.[9]

Workforce challenges in manufacturing are particularly important in the Shenandoah Valley because manufacturing makes up 16% of all jobs compared with 9% in the nation. According to a survey of area manufacturers conducted for this report, 62% cited new hires' lack of mechanical skills as one of their primary workforce issues. Furthermore, 35% of respondents considered impending retirements to be a major issue for their businesses. There is a potential that future skills shortages become more acute as young people leave the area after high school. A recent survey of high school students conducted as part of this research indicates that 27% plan on leaving the Valley at the completion of their education.

[6] Deloitte and The Manufacturing Institute "Boiling point? The skills gap in U.S. manufacturing," (October, 2011): 7. "Skilled production workers" includes machinists, operators, craft workers, distributors, and technicians.

[7] Richard Deitz and James Orr, "A Leaner, More Skilled U.S. Manufacturing Workforce" Federal Reserve Bank of New York (Volume 12, Number 2, February/March 2006).

[8] Harold Sirkin, Michael Zinser and Douglas Hohner, "Made in America, Again," (August 25, 2011): 5.

[9] Deloitte and The Manufacturing Institute "Leadership wanted: U.S. public opinions on manufacturing," (October, 2012): 11-12.

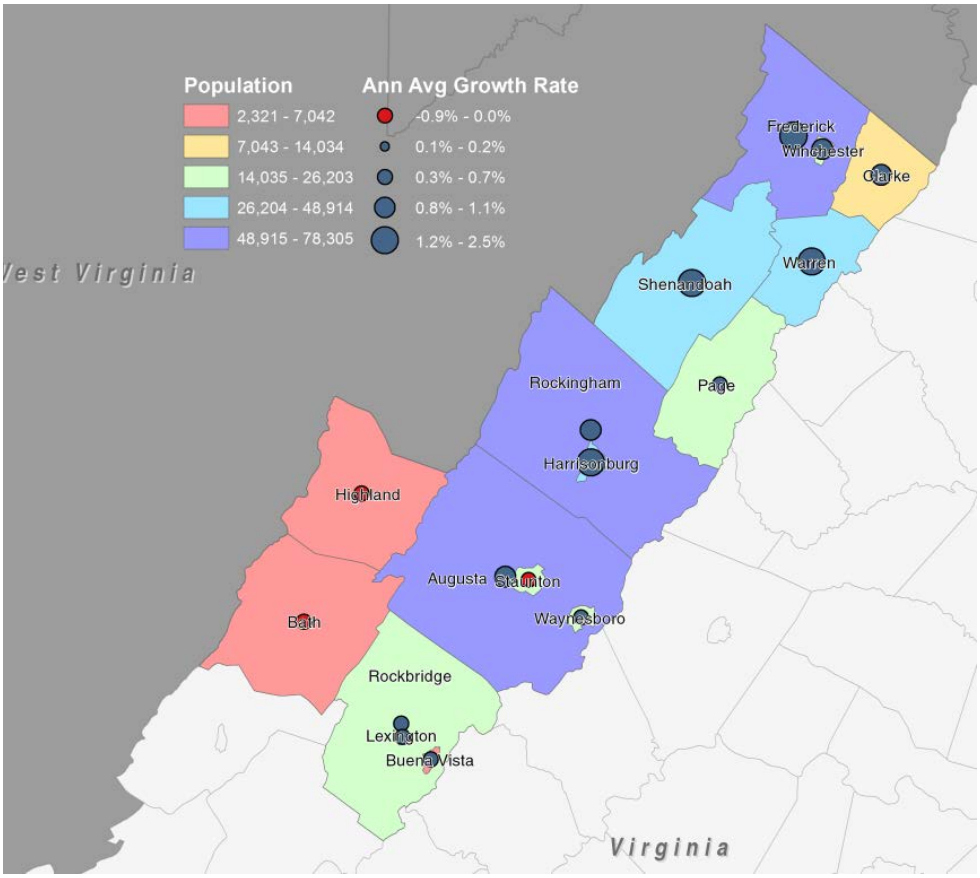
3. Socio-Economic Profile

A socioeconomic profile of the Valley provides a broad overview of the region's labor market characteristics, as well as the industries, in addition to manufacturing, that are competing for talented workers.

3.1 Demographic Characteristics

The Valley's population was 508,933 in 2010. Between 2000 and 2010 the population increased at an annual average rate of 1.3%, considerably faster than the United States (0.9%) and slightly faster than Virginia (1.2%).

Figure 3.1: Population and Population Growth in the Valley, 2000 – 2010



The relatively faster growth rate was sustained by several counties that have grown rapidly in recent years; particularly Frederick and Harrisonburg as shown in Figure 3.1 (see also Table A1 in the appendix). The relative growth rates in the figure to the left are shown in the circles for each county. Of the 16 counties, 13 experienced positive population growth between 2000 and 2010. Counties that decreased in population include Staunton, Highland, and Bath. The largest counties are Frederick, Rockingham, and Augusta, which each have populations greater than 70,000.

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 region are slightly higher the national average. At the sub-regional level, the Northern Region is on par with the nation at 10%. The Central and Southern Regions have poverty rates of 14% and 16%, respectively.

Table 3.1: Shenandoah Valley Demographic Characteristics

		Northern		Southern		
	SV	SV	Central SV	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: Chmura Economics & Analytics and JobsEQ®, Census 2011 and American Community Survey 2007-2011

3.1.1 Educational Attainment

The percentage of residents with only a high school education is higher in the Valley (36%) when compared with the state (26%) and the nation (29%). Post-secondary education is lagging both the state and the nation in the four categories that are typically used to describe a region's education inventory ranging from some college classroom participation (no degree) to post-graduate degrees conferred as shown in the table below.

Table 3.2: Shenandoah Valley Adult (25+) Educational Attainment Levels

	Amount	**Percent**		
	SV	**SV**	**Virginia**	**USA**
No High School Diploma	60,600	18%	13%	15%
High School Graduate	119,800	36%	26%	29%
Some College, No Degree	59,400	18%	20%	21%
Associate's Degree	18,400	6%	7%	8%
Bachelor's Degree	47,900	14%	20%	18%
Post-Graduate Degree	28,300	9%	14%	10%

Source: Chmura Economics & Analytics and JobsEQ®, Census 2011 and American Community Survey 2007-2011

3.2. Labor Market Characteristics

The largest major occupation group[10] in the Valley is office and administrative support with 30,000 workers, followed by sales and related employment (21,436) and production workers (20,661). The table below identifies the major occupation groups, their annual average wages per worker, along with the location quotient for the Valley as of the first quarter of 2013. 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 (1.53), education, training, and library (1.26), and transportation and material moving occupations (1.24). The region has low

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

employment concentrations in legal occupations (0.51), computer and mathematical occupations (0.57), and architecture and engineering occupations (0.64).

Table 3.3: Employment and Earnings by Major Occupation Groups, Shenandoah Valley, 2013 Q1

SOC	Title	Employment	Annual Average Wages per Worker	Location Quotient
43-0000	Office and Administrative Support	30,000	$31,500	0.88
41-0000	Sales and Related	21,436	$31,500	0.98
51-0000	Production	20,661	$32,700	1.53
35-0000	Food Preparation and Serving Related	19,638	$20,600	1.07
53-0000	Transportation and Material Moving	17,149	$31,900	1.24
25-0000	Education, Training, and Library	16,334	$40,500	1.26
29-0000	Healthcare Practitioners and Technical	11,173	$77,000	0.93
11-0000	Management	9,167	$93,700	0.9
47-0000	Construction and Extraction	8,003	$37,200	1.01
49-0000	Installation, Maintenance, and Repair	7,981	$40,900	1.01
37-0000	Building and Grounds Cleaning and Maintenance	7,783	$22,900	1.07
13-0000	Business and Financial	6,615	$60,200	0.67
31-0000	Healthcare Support	6,036	$25,100	0.95
39-0000	Personal Care and Service	5,740	$23,200	0.92
33-0000	Protective Service	4,780	$39,700	0.96
15-0000	Computer and Mathematical	3,164	$68,400	0.57
21-0000	Community and Social Service	2,974	$43,000	0.99
17-0000	Architecture and Engineering	2,373	$72,900	0.64
27-0000	Arts, Design, Entertainment, Sports, and Media	2,165	$41,200	0.79
19-0000	Life, Physical, and Social Science	1,521	$62,300	0.88
45-0000	Farming, Fishing, and Forestry	1,472	$26,900	1.07
23-0000	Legal	802	$90,600	0.51

Source: Chmura Economics & Analytics and JobsEQ®, Bureau of Labor Statistics

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 0.5 percentage points higher than those occupations typically requiring a high school education or less. In addition, occupations that typically require a bachelor's degree or higher have lower unemployment rates than those requiring a high-school education.

Table 3.4: Employment by Entry-Level Education Required in the Shenandoah Valley

BLS-Typical Entry-Level Education	Employment 2013 Q1	Average Annual Wages	Unemployment Rate	2013 Q1—2023 Q1 Annual Average Growth Rates
Doctoral or professional degree	6,308	$88,200	2.0%	1.9%
Master's degree	3,045	$64,600	1.9%	2.0%
Bachelor's degree	26,228	$62,200	2.7%	1.6%
Associate's degree	10,618	$70,100	2.7%	1.7%

Postsecondary non-degree award	9,074	$37,100	4.3%	1.8%
Some college, no degree	893	$41,700	4.4%	1.8%
High school diploma or equivalent	85,574	$36,600	5.6%	1.5%
Less than high school	65,231	$22,800	8.8.%	1.6%

Source: Chmura Economics & Analytics and JobsEQ®, Bureau of Labor Statistics

3.2.1. Workforce Readiness

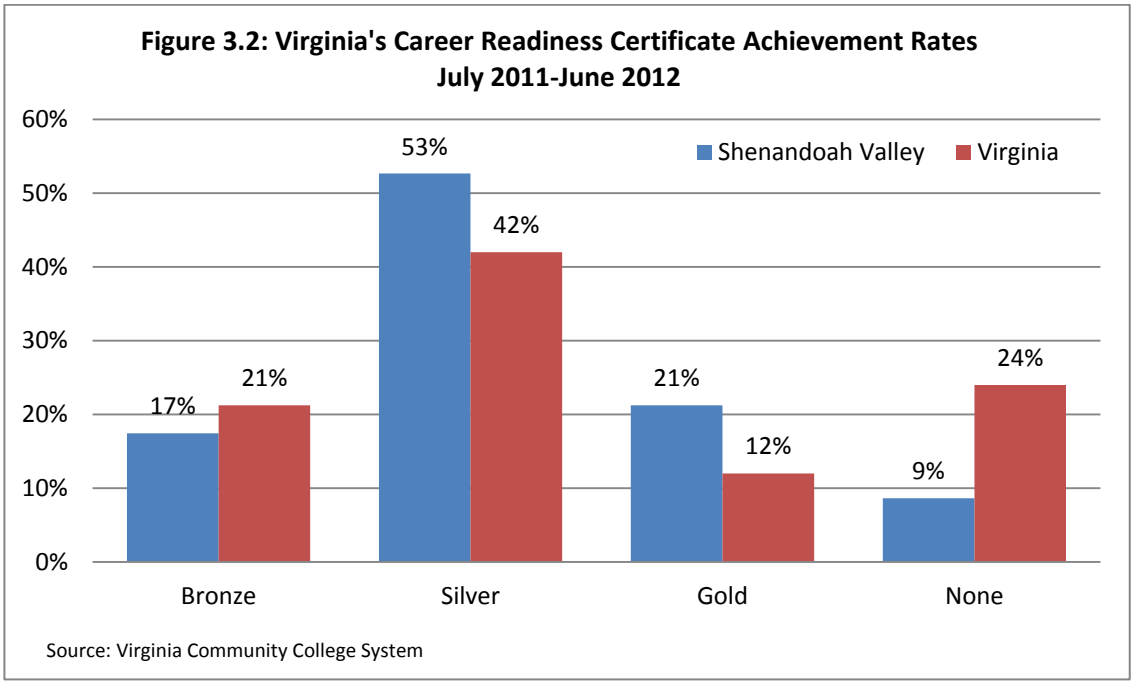
It is difficult to define and measure the overall work readiness of the labor force beyond basic educational attainment. Work readiness skills most often broadly refer to a set of skills and behaviors needed to be successful in the work environment. These are often referred to as "soft skills" and typically include basic literacy as well as interpersonal skills, communication, leadership, and problem-solving skills. Workforce practitioners in the Valley generally deploy two different tools that assess the work readiness of students and workers in the Valley. Collectively, the Virginia Career Readiness Certificate (CRC) and the Workplace Readiness Skills (WRS) assessment tools, which are explained in more detail below, have been administered to more than 3,200 individuals in the Valley over the last two years. Survey findings and focus group discussions summarized in sections 5 and 10 of this report provide deeper insights into the work readiness of the pipeline of workers in the Valley.

3.2.1.1. Virginia Career Readiness Certificate

Between July 2011 and June 2012, 1,238 individuals in the Valley either attempted or obtained a CRC. The CRC is a credential created by ACT and is based on testing and scoring assessments that measures an individual's competencies in three primary areas: reading for information, applied mathematics, and locating information. These testing areas were chosen after determining that they were used by almost all employers across all sectors. The assessment tool, related job profiles, and gap training modules have been developed in partnership with business and industry using ACT's WorkKeys® system. The assessment has been endorsed by the Commonwealth launched under signature by the Governor in 2008.

Individuals passing the Career Readiness Certificate are awarded one of three credentials—bronze, silver, or gold-level awards—based on their score. The levels correlate to the percentage of jobs profiled nationally that the individual test taker could be expected to be successful in. Bronze indicates a level three score in all testing areas and suggests that the individual could qualify for 35% of the jobs profiled by ACT. Silver credential holders (level four) are expected to be successful in 65% of the jobs profiled nationally, and gold-level individuals (level five) would likely be successful in 80-90% of the jobs profiled.

The testers in the Valley make up 6% of the state total for CRC candidates. Overall, the region's CRC testers have a pass rate of 91%, meaning 91% complete the three core tests and obtain either a bronze, silver, or gold certificate compared to the state's pass rate of 76%. This suggests that those test takers in the Valley are better equipped than the state test takers with some of the basic skills needed to be successful in a work environment. The CRC assessment was primarily administered to working-age adults in both the Shenandoah Valley and the state. The following chart shows the distribution of bronze, silver, and gold awards, as well as the percentage of individuals who attempted the test, but did not obtain a credential.



3.2.1.2. Workplace Readiness Skills for the Commonwealth

Area high schools have adopted an assessment which came out of extensive research conducted by the Weldon Cooper Center at the University of Virginia that began in in 1997. This study for Virginia was built on work previously published by the Partnership for 21st Century Skills entitled *Framework for 21st Century Learning.* It represented a seminal piece of research that emphasized the importance of integrating workplace readiness skills into curriculum and further defined the skills needed for student success. The Career and Technical Education Consortium of States worked with the Weldon Cooper Center to refine and validate the skill requirements with employers and supported the development of the initial test which included 13 workplace readiness skills and piloted the initial assessment as well as the online delivery system.

In 2010 the Workplace Readiness Skills (WRS) assessment was revised and a new list of 21 skills was formally endorsed by the Virginia Department of Education as the measure of workplace readiness. With the support of the CTE Resource Center, the WRS became an integrated part of every career and technical education course in the state. The WRS assessment measures proficiencies across 21 skill areas grouped into three test segments: personal qualities and people skills, professional knowledge and skills, and technology knowledge and skills.

Of the sixteen school districts in the Valley, eleven reported pass rates for the 2011 academic year. Of the more than 1,700 students in the Valley who attempted the WRS assessment during that period, 73.7% passed. This compares favorably with the statewide pass rate of 66.9% and suggests that CTE students in the Valley taking the assessment are slightly more prepared than the state average student. The following table presents the scores for each district in the Valley in the 2010 and 2011 academic years. The number of schools and students being assessed using the WRS has increased dramatically and that trend is expected to continue.

Table 3.5: Work Place Readiness Examination Pass Rates for Selected School Divisions

	2010-2011			2011-12		
School Division Name	Attempted	Passed	Percent Pass	Attempted	Passed	Percent Pass
Augusta County	0	0	N/A	724	529	73.10%
Bath County	0	0	N/A	0	0	N/A
Buena Vista City	0	0	N/A	22	15	68.20%
Clarke County	0	0	N/A	0	0	N/A
Frederick County	214	160	74.80%	326	275	84.40%
Harrisonburg City	2	2	100.00%	19	14	73.70%
Highland County	0	0	N/A	0	0	N/A
Lexington City	0	0	N/A	0	0	N/A
Page County	0	0	N/A	57	28	49.10%
Rockbridge County	0	0	N/A	0	0	N/A
Rockingham County	115	96	83.50%	265	205	77.40%
Shenandoah County	0	0	N/A	95	66	69.50%
Staunton City	0	0	N/A	97	73	75.30%
Warren County	20	15	75.00%	45	39	86.70%
Waynesboro City	0	0	N/A	29	29	100.00%
Winchester City	0	0	N/A	93	33	35.50%
Shenandoah Valley Totals	351	273	77.80%	1,772	1,306	73.70%
State Totals	3,658	2,412	65.90%	20,342	13,605	66.90%

Source: Virginia Department of Education Office of Career and Technical Education

N/A = not applicable

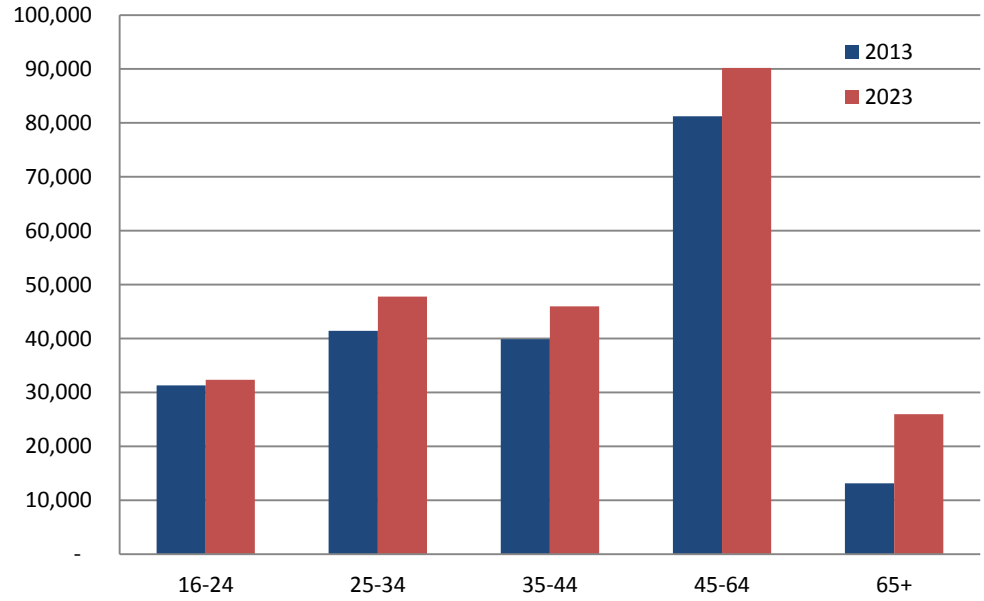
3.2 2. Labor Force Projections

Changes in the workforce vary due to a number of reasons including population growth, age distribution, participation rates, gender, educational attainment, and industry demand. In fact, some of these trends interact. For example, people with higher education levels are more likely to remain in the workplace than those with lower educational attainment. Demand by businesses for skilled labor impacts the education level of the supply of workers as they seek job opportunities. Further, workers will sometimes relocate to a region when residents and commuters don't have the skills needed by employers. Likewise, if employment contracts in a region, then some workers may eventually leave to seek employment elsewhere.

The ten-year baseline forecast for this study was developed by Chmura through its JobsEQ® system and is based upon historical industry growth trends in the region along with expected population trends, especially among working-age cohorts. According to this forecast, total employment is expected to grow 1.6% per year over the next 10 years.

The age mix of the workforce is expected to gradually shift towards older workers over the next ten years, in part due to the aging baby boom cohort. One consequence of this trend is that young, first-time workers are going to make up a smaller portion of the total workforce; this same cohort is going to be competing against a more experienced group of workers. The 16-to-24-years-old cohort accounted for an estimated 15.1% of workers in the Valley in 2013; however, this percentage is projected to drop to 13.3% by 2023.

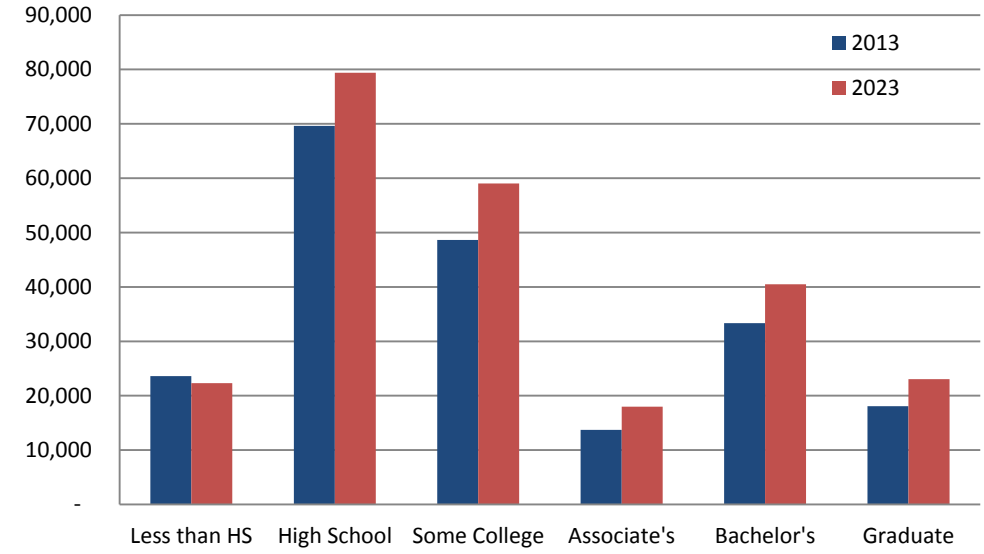
Figure 3.3: Shenandoah Valley Labor Supply Forecast by Age



Source: Chmura Economics & Analytics and JobsEQ®

Another significant trend is an expected increase in the average educational attainment of the workforce. The number of jobs in every educational attainment cohort is expected to grow in size over the next ten years in the Valley with the exception of the group with less than a high school diploma. The overall labor supply is forecast to expand 17.0% over the next ten years with quicker growth expected among those workers with graduate degrees (27.6%), associate's degrees (31.1%), and some college (21.4%). The need for workers with bachelor's degrees in the study area is expected to expand over the next ten years, by roughly 21.4%.

Figure 3.4: Shenandoah Valley Labor Supply Forecast by Educational Attainment

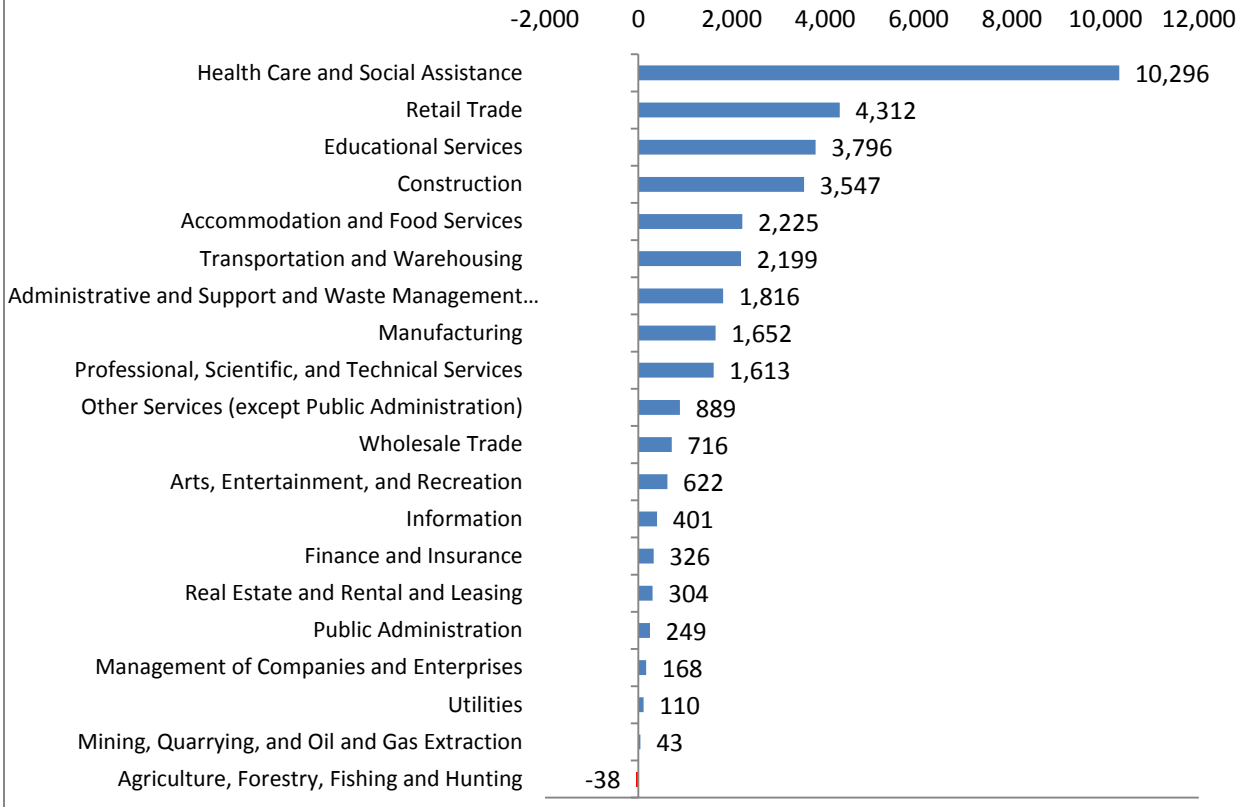


Source: Chmura Economics & Analytics and JobsEQ®

3.3. Industry Overview

Overall, employment in the Shenandoah Valley is projected to expand 1.6% per year over the next ten years beginning with the first quarter of 2013 for an addition of 35,600 jobs.[11] Just over two-thirds of this growth is expected to occur in five sectors: health services (+10,296 jobs), retail (+4,312), educational services (+3,796), construction (+3,547), and accommodation and food services (+2,225). The transportation, warehousing, and utilities sector, which is anchored by interstate I-81 in the Valley, is expected to add 2,310 jobs. The manufacturing sector is likely to grow very modestly and add only 1,652 jobs over the next ten years. Only the agricultural sector is expected to contract in employment over the next ten years.

Figure 3.5: Ten-Year Projected Employment Growth, Shenandoah Valley, 2013Q1-2023Q1



Source: Chmura Economics & Analytics and JobsEQ®

Although manufacturing ranks eighth in the number of jobs it is expected to create in the region over the next ten years, it is currently the largest employer in the Valley. As of the first quarter of 2013, there are 32,300 manufacturing jobs in the region—16% of all regional employment (see the table below). Moreover, the location quotient (LQ) for manufacturing is 1.72, which means that there are 72% more manufacturing workers per capita than the national average. Manufacturing also pays average wages of $46,500, which is higher than the average for all industries in the region and the highest among

[11] These projections do not include replacement demand, but rather employment growth alone. Industry employment projections in this section are based upon two items: total regional employment projections from JobsEQ and individual industry projections based upon Bureau of Labor Statistics forecasts for national industries.These industry-specific forecasts overlay the JobsEQ baseline forecast which incorporates historical trends as well as labor supply growth as influenced by such factors as population growth and participation rates.

industries where the majority of workers have less than a bachelor's degree. Notably, this includes healthcare and social services, which pays an average of $42,585 annually.

Healthcare has grown at an average annual rate of 2.7% and is the second-largest industry sector with 28,840 workers, or 14% of total employment. Other important industries in the Valley include educational services, transportation and warehousing, and professional and technical services. The educational services sector employs 25,452 workers, and is 35% more concentrated per capita than the national average. Transportation and warehousing makes up 5% of employment with 10,043 workers, pays an average wage of $43,300, and is second only to manufacturing for wages among industries dominated by people with less than a bachelor's degree. Moreover, transportation and warehousing is linked to manufacturing in terms of providing a distribution network for that sector's goods. The professional and technical services sector is relatively small in terms of total employment, but is the second-highest paying industry in the region and has shown gradual but steady growth in recent years.

Table 3.6: Employment and Earnings by Industry Sector in the Shenandoah Valley

						2012 Q1 – 2013 Q1	
NAICS	Industry	2013 Q1 Employment	Percent of Employment	Avg. Annual Wages	Location Quotient	Employment Change	Growth Rate
31	Manufacturing	32,301	16%	$46,533	1.72	-115	-0.4%
62	Health Care and Social Assistance	28,840	14%	$42,585	0.98	761	2.7%
44	Retail Trade	26,861	13%	$24,207	1.14	216	0.8%
61	Educational Services	25,452	12%	$36,219	1.35	184	0.7%
72	Accommodation and Food Services	21,271	10%	$15,079	1.14	208	1.0%
23	Construction	10,315	5%	$39,385	1.14	-257	-2.4%
48	Transportation, Warehousing	10,043	5%	$43,298	1.25	190	1.9%
56	Administrative, Support, Waste Mgmt., Remediation	8,291	4%	$25,942	0.65	195	2.4%
92	Public Administration	8,174	4%	$43,587	0.72	159	2.0%
54	Professional, Scientific, and Technical Services	5,760	3%	$61,535	0.46	108	1.9%
42	Wholesale Trade	5,648	3%	$45,664	0.63	69	1.2%
81	Other Services (ex. Public Admin.)	5,536	3%	$26,741	0.77	0	0.0%
52	Finance and Insurance	4,516	2%	$47,539	0.51	153	3.5%
71	Arts, Entertainment, and Recreation	3,185	2%	$18,113	0.86	-122	-3.7%
51	Information	3,163	2%	$47,141	0.72	-108	-3.3%
55	Management of Companies and Enterprises	2,329	1%	$66,059	0.74	14	0.6%
53	Real Estate, Rental, Leasing	2,038	1%	$33,199	0.65	24	1.2%
11	Agriculture, Forestry, Fishing, Hunting	1,904	1%	$26,275	1.02	62	3.4%
22	Utilities	1,053	1%	$56,806	0.83	-9	-0.9%
21	Mining, Quarrying,	290	0%	$46,439	0.23	7	2.6%
	Total All Industries	206,970		$36,455		1,740	0.8%

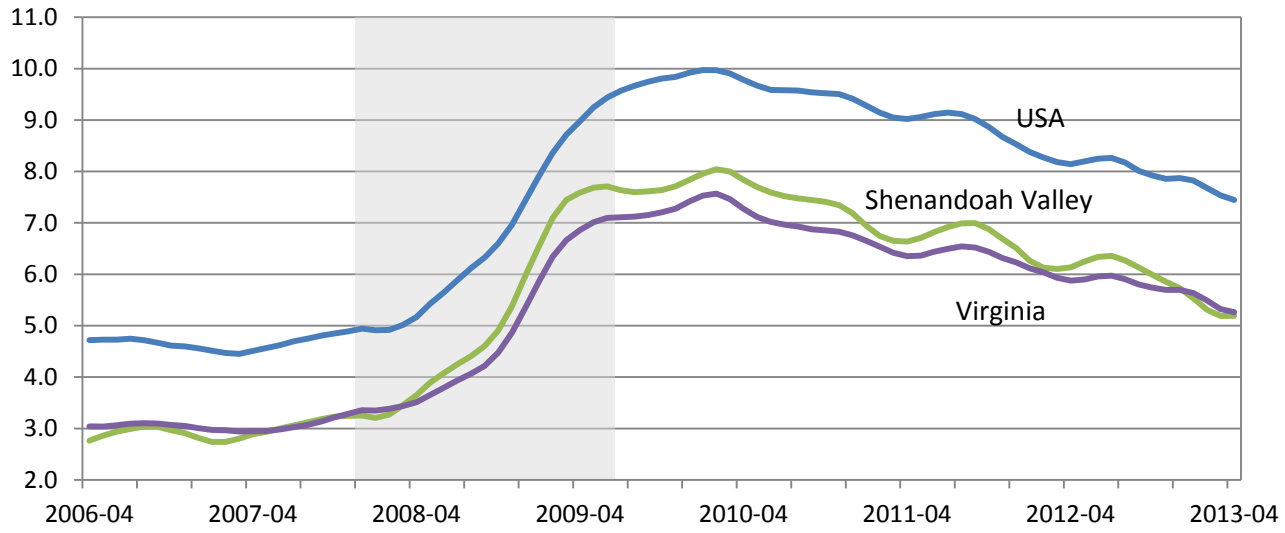
Source: Chmura Economics & Analytics and JobsEQ® , Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Employment and earnings by industry is generally similar in all three regions within the Valley, with a few exceptions. In the Southern Region, manufacturing is a smaller percentage of total employment. It makes up 14% of all jobs and trails both educational services and accommodation and food services. Average earnings for manufacturing are highest in the Northern Region but relative to wages in other industries, manufacturing workers are paid a higher premium in the Central Region.[12] The difference in manufacturing wages is largely due to the types of manufacturing performed in each region, a topic that is covered in the next section. Detailed sector-level data for each county and sub-region is in Table A2 of the appendix.

3.4. Unemployment

Unemployment rates in the Valley have historically been below the national average and on par with the state. The figure below shows the regional unemployment rate before, during, and after the Great Recession (indicated with the gray shaded area). Between April 2006 and April 2013, unemployment rates in the Valley have been one to two percentage points lower than that of the United States. Compared to the state, unemployment rates have been slightly higher since early 2008. The unemployment rates for each county follows similar patterns and are available in Table A8 of the appendix.

Figure 3.6: Seasonally Adjusted Monthly Unemployment Rates
April 2006 to April 2013

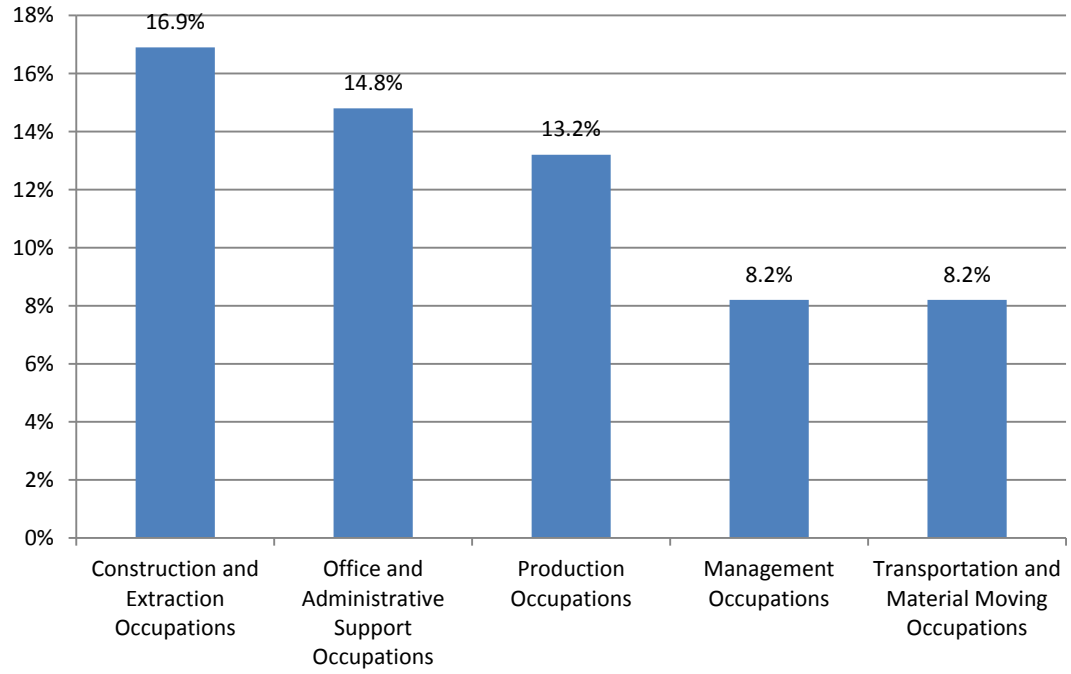


Source: Local Area Unemployment Statistics, Bureau of Labor Statistics

When evaluating unemployment by occupation, production workers make up the third-largest percentage of all workers receiving unemployment insurance in the Valley. Based on data from April 2013, 13.2% (292) of unemployed workers receiving benefits classify themselves as production workers.

[12] Average manufacturing wages are 24% higher than the regional average in the Northern Region, and they are 32% higher than the regional average in the Central Region.

Figure 3.7: Unemployment Insurance Benefit Recipients by Occupation in the Valley - April 2013



Source: Chmura Economics & Analytics and JobsEQ®, Bureau of Labor Statistics, ES203

As noted earlier, workers in manufacturing are older, on average, than workers in other industries. The demographics of manufacturing workers are also reflected in the unemployment data. People 45 years and older are making up a steadily larger proportion of all people receiving unemployment benefits. In early 2004, this group made up 42% of workers collecting benefits, and that proportion has now moved to 47%. Unemployment by age is shown in the table below.

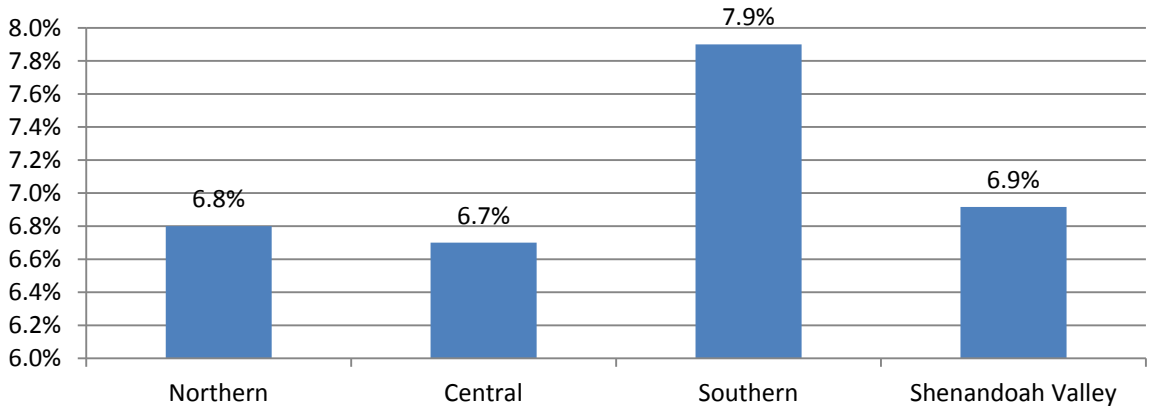
Table 3.7: Unemployment by Age in the Shenandoah Valley, April 2004-April 2013

	Under 24 Years	25 to 34 Years	35 to 44	45 to 54	55 to 64	65 Years and Over	45 and Over
2004	9%	21%	28%	25%	15%	2%	42%
2005	9%	22%	25%	27%	15%	2%	44%
2006	8%	19%	27%	28%	16%	2%	46%
2007	8%	19%	26%	28%	16%	3%	47%
2008	8%	21%	24%	28%	16%	3%	47%
2009	8%	21%	23%	27%	17%	4%	47%
2010	8%	21%	22%	27%	18%	4%	49%
2011	8%	21%	22%	27%	18%	4%	48%
2012	7%	19%	20%	25%	17%	4%	46%
2013	7%	19%	20%	25%	18%	4%	47%

Source: Chmura Economics & Analytics and JobsEQ®, Bureau of Labor Statistics, ES203

Not all unemployed individuals are recorded by the state's unemployment insurance benefit system, therefore it is necessary to impute the unemployment rate at the occupational level. Occupation unemployment data are derived from a synthetic data set produced by Chmura Economics & Analytics, compiled from various data inputs including county-level unemployment rates, commuting patterns, and national-level unemployment trends by industry and occupation. Using this method, the regional average unemployment rate for production workers is 6.9%, which is 0.9 percentage points higher than the regional average for all occupations. The Southern Region has the highest rate among the sub-regions at 7.9%; the Northern Region has the lowest at 6.8%. Unemployment data for each county are contained in Table A8 of the appendix.

Figure 3.8: Unemployment Rate for Production Occupations, 2013Q1



Source: Chmura Economics & Analytics and JobsEQ®, Bureau of Labor Statistics, ES203

4. The State of Manufacturing

4.1. Manufacturing in the Shenandoah Valley

This section provides an overview of 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.

4.1.1. Manufacturing Employment and Earnings by Sector

The industries within Shenandoah Valley's manufacturing cluster vary across its three sub-regions, which is beneficial because diverse industry sectors tend to buffer local economies through regional economic downturns. Food manufacturing is the largest industry employing 10,000 workers or 31% of the total manufacturing workforce. Two other sectors employing 10% or more of total employment are plastics and rubber products and printing and related support. Manufacturing sectors paying relatively higher annual wages are chemicals ($91,891), and beverage and tobacco products ($62,481). Overall industry employment has decreased 3.3% over the past year; however, beverage and tobacco products and paper have both added employment between 2012 Q1 and 2013 Q1.

Table 4.1: Employment and Earnings by Industry Sector, Four Quarters Ending with 2013 Q1

						2012 Q1-2013 Q1	
NAICS	Manufacturing Industry	Employment 2013 Q1	Percent of Manufacturing Employment	Avg. Annual Wages	Location Quotient	Avg. Annual Growth	Avg. Annual Growth Rate
311	Food	10,106	31%	$38,582	4.4	-42	-0.4%
326	Plastics and Rubber Products	3,677	11%	$56,753	3.63	-240	-5.5%
323	Printing and Related Support Activities	3,127	10%	$42,124	4.34	-131	-3.7%
332	Fabricated Metal Product	2,576	8%	$46,598	1.16	-51	-1.9%
325	Chemical	2,069	6%	$91,891	1.68	-53	-2.4%
321	Wood Product	1,640	5%	$32,299	3.07	-141	-6.9%
333	Machinery	1,545	5%	$51,650	0.9	-22	-1.4%
327	Nonmetallic Mineral Product	842	3%	$42,138	1.48	-123	-10.4%
337	Furniture and Related Product	780	2%	$30,089	1.42	-129	-11.4%
339	Miscellaneous	793	2%	$48,341	0.87	-2	-0.2%
312	Beverage and Tobacco Product	731	2%	$62,481	2.45	19	2.8%
322	Paper	712	2%	$47,288	1.2	17	2.6%
331	Primary Metal	677	2%	$44,119	1.08	-7	-1.0%
334	Computer and Electronic Product	594	2%	$43,522	0.35	-33	-4.7%
324	Petroleum and Coal Products	101	0%	$48,288	0.57	-15	-10.7%
335	Electrical Equipment, Appliance, Component	101	0%	$41,555	0.17	-69	-25.6%
313	Textile Mills (nd)*	nd	nd	nd	nd	nd	nd
314	Textile Product Mills (nd)*	nd	nd	nd	nd	nd	nd
315	Apparel (nd)*	nd	nd	nd	nd	nd	nd
316	Leather and Allied Product (nd)*	nd	nd	nd	nd	nd	nd
336	Transportation Equipment (nd)	nd	nd	nd	nd	nd	nd
31	**Manufacturing**	**32,301**		**$46,533**	**1.72**	**-1192**	**-3.3%**

Source: Chmura Economics & Analytics and JobsEQ®

*nd = non-disclosed data. The NAICS sector is made up of 3 or less firms, or 1 firm makes up 80% of total employment in the NAICS sector.

4.1.2. Manufacturing Employment for the Three Sub-Regions

The three charts to the right show the largest manufacturing industry sectors (3-digit NAICS) in 2013 within each of the three sub-regions of the Shenandoah Valley. Each region has a slightly different mix of industries. Despite being ranked differently, the top five industries for the Northern Region and Central Region are the same: food, plastics and rubber products, printing and related support activities, fabricated metal, and chemicals. The Southern Region, on the other hand, has a very different composition of industries; textile product mills, machinery, and wood products are the predominant industries.

The food industry is highly developed in the Northern and Central Regions particularly due to the presence of numerous chicken processing companies as well as the location for large employers such as Hershey, McKee, and HP Hood. Plastic and rubber is the second-largest industry in the Northern Region and the fifth-largest in the Central Region. Rubbermaid and Trex are the largest companies in the Valley in this industry.

Printing and related support activities maintain a solid presence in the Northern and Southern Regions with RR Donnelley & Sons and Berryville Graphics as large employers. There are a number of large to mid-sized companies in the fabricated metal products industry, including Energizer and Cadence. Chemical manufacturing, one of the highest-paying of all production industries in the Valley, is the fourth-largest in the Central Region and the fifth-largest in the Northern Region.

The largest employers in the Southern Region are Munters and Modine (machinery manufacturing) and Mohawk (textile products).

Further detail on industry employment for the sub-regions is contained in Tables A2 and A3 in the appendix. County-level data are in appendix Table A4 while Table A5 lists the largest companies in the region along with their corresponding 3-digit NAICS category.

Figure 4.1: Northern Region Employment in Manufacturing, 1st Quarter 2013

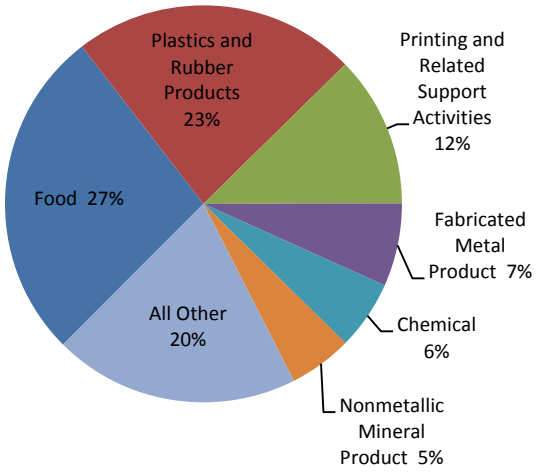


Figure 4.2: Central Region Employment in Manufacturing, 1st Quarter 2013

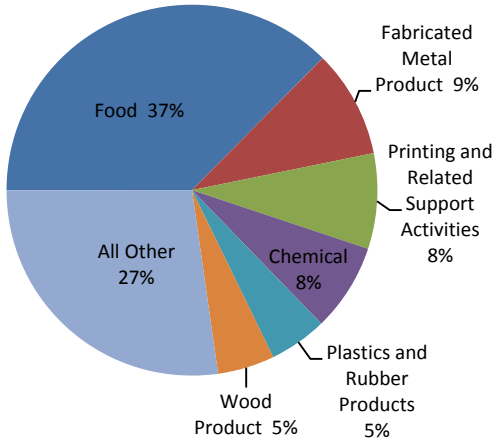
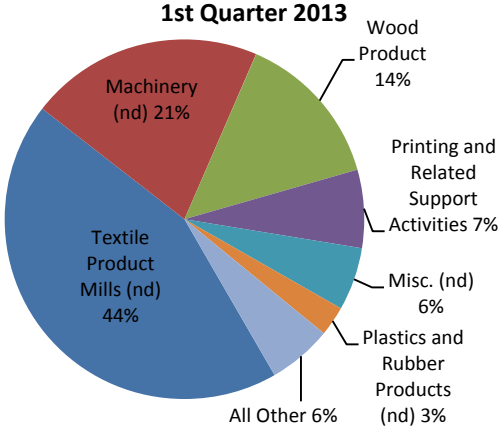


Figure 4.3: Southern Region Employment in Manufacturing, 1st Quarter 2013



4.1.3. Industry Wage Summary

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 $46,500, which exceeds the regional average by $10,000. Manufacturing wages are also higher than average overall wages for all three sub-regions. If manufacturing jobs were becoming less critical to employers, wages would be expected to trail average wage growth over time—but this is not the case. Between 2008 and 2013, wages in manufacturing for the Shenandoah Valley grew by 2.1%, compared to 1.9% for all industries in the region as a whole. This pattern did not hold for the Southern Region—where manufacturing wages grew 0.9% compared to 1.8% for all other industries in the Southern Region.

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 the national cost of living. These figures are helpful for comparing wages between each of the sub-regions, the state, and the nation. 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 phenomenon is true for all job types, not just manufacturing.

Table 4.2: Wages in Manufacturing Compared to Average Wages

	Average Wages		Average Annual Wage Growth Rate		Purchasing Power (US = 100)	
	Four Quarters Ending 2013 Q1		2008 Q1-2013 Q1		2013 Q1	
	Manufacturing	Regional Average	Manufacturing	Regional Average	Manufacturing	Regional Average
Shenandoah Valley	$46,533	$36,455	2.1%	1.9%	$45,590	$35,717
Northern Region	$47,545	$38,398	2.4%	1.9%	$42,480	$34,307
Central Region	$46,822	$35,694	2.2%	1.9%	$48,330	$36,843
Southern Region	$39,285	$32,092	0.9%	1.8%	$41,211	$33,664
Virginia	$54,237	$51,082	2.2%	2.0%	$48,229	$45,423
United States	$59,769	$48,573	2.1%	1.6%		

Source: Chmura Economics & Analytics and JobsEQ®

4.1.4. 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 2006 and 2013.[13] 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.[14] Eighty-one percent of the total job losses reported through the WARN system in the Valley were in manufacturing.

The table below details manufacturing job losses reported by WARN by county and sub-region for the Shenandoah Valley between 2006 and 2013. A ratio of manufacturing job losses to average manufacturing employment between 2006 and 2013 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 more than 3,100 jobs.

Counties that have seen the highest ratio of manufacturing job losses include Staunton (45%), Clarke (44%), and Waynesboro (43%). These counties all experienced a major closing or reduction by companies such as INVISTA, American Woodmark Corporation, and UNIFI. Of the three sub-regions, the Northern Region had the highest manufacturing job loss ratio at 13%.

Table 4.3: Impact of Manufacturing Job Losses by County Based on Worker Adjustment and Retraining Notification Act (WARN), 2006-2013

	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
Staunton	145	320	45%	5%
Clarke	387	890	44%	12%
Waynesboro	747	1,740	43%	23%
Shenandoah	760	3,630	21%	24%
Winchester	447	3,140	14%	14%
Page	92	970	10%	3%
Augusta	465	5,750	8%	15%
Buena Vista	29	560	5%	1%
Rockbridge	47	1,750	3%	1%
Frederick	50	4,460	1%	2%
Rockingham	11	7,610	0%	0%
Northern Region	**1,644**	**13,130**	**13%**	**52%**
Central Region	**1,460**	**19,620**	**7%**	**46%**
Southern Region	**76**	**2,380**	**3%**	**2%**
Shenandoah Valley	**3,180**	**35,130**	**9%**	**100%**

Source: Virginia Economic Development Partnership and Chmura Economics & Analytics

[13] The data used for this section are from Virginia's Job Closings database, hosted by the Virginia Economic Development Partnership (VEDP). http://virginiascan.yesvirginia.org/ResourceCenter/Closings.aspx

[14] 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.

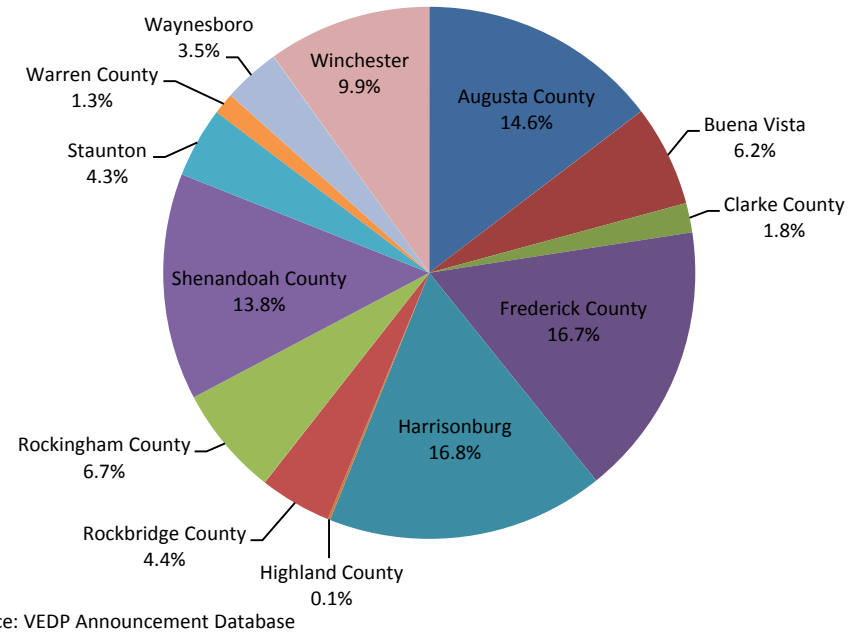
4.1.5 Manufacturing Economic Development Project Announcements in the Valley

Between January 2006 and June 2013, VEDP announced 175 economic development projects in the region that generated 7,597 jobs and resulted in $1.8 billion in new capital investment.[15] This investment was made by 121 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, 132 (or 75%) have been in manufacturing (29 companies made more than one project announcement during this period). Of the total new jobs created, 4,690 (or 61%) have been in the manufacturing industry. The jobs gains were fairly distributed across the three 2-digit NAICS manufacturing subsectors, and each manufacturing project resulted in an average gain of 36 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 (2,157) representing 46% of the total. This was followed closely by the Northern Region (2,039), representing 42% of the manufacturing job gains announced. The Southern Region added 494 new jobs in manufacturing over the same period. This represented 7% of the announced job gains during the referenced period.

Figure 4.4: Job Gains - VEDP Manufacturing Project Announcements in the Shenandoah Valley January 2006-June 2013



Source: VEDP Announcement Database

The figure above shows the percent distribution of the manufacturing job gains reported by VEDP at the county level. Frederick County and Harrisonburg County were the biggest winners in the region, each receiving nearly 17% of the announced manufacturing jobs. Respectively, they represent 14% and 9% of the region's total manufacturing employment.

[15] The data used for this section are from Virginia's Announcements database, hosted by the Virginia Economic Development Partnership (VEDP). http://virginiascan.yesvirginia.org/ResourceCenter/AnnouncementsWeb.aspx

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 engage 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.

4.2. High Impact -Technology Enabled (HITE) Manufacturing in the Valley

Many economists now classify industries as either traditional or high-tech. Traditional industries are typically thought to include low-skilled labor-intensive operations, while high-tech industries are typically cleaner and more technology-dependent in their operations. The Congressional Office of Technology Assessment describes high-technology firms as those that are engaged in the design, development, and introduction of new products and innovative manufacturing processes, or both, through the systematic application of scientific and technical knowledge.[16] A 2005 report in the Monthly Labor Review detailed the methodology of identifying high-tech industries across all sectors. The author asserted that high-tech industries are those that employ technology-oriented workers, a category that includes technical managers, computer specialists, engineers, and scientists. Using the BLS National Staffing Employment Matrix, the author determined high-tech employment concentration across all sectors and selected those sectors that had at least twice the average of the nation as a whole. This resulted in a list of 46 sectors that comprise the high-tech sector. This list included 20 different manufacturing industries. The author also recognized the critical role of R&D (research and development) and evaluated the intensity of R&D spending in a review of the Industrial Survey of R&D published by the National Science Foundation.

The National Science Foundation's 2010 Business and R&D and Innovation Survey found that nationally, manufacturing businesses perform nearly 70% of private sector research and development. These industries have the highest R&D intensity, measured as the ratio of domestic R&D to domestic net sales when compared to any sector in the national economy. Innovations produced through research and development activities can take the form of process innovations or product innovations, and both have the potential to allow companies to improve performance and grow through productivity gains or increased sales.

While the research and resulting definition of high-tech industries at the national level is informative, no set of NAICS codes can perfectly capture high-tech manufacturing at the regional level. It is as much about regional high-tech employment concentration and wages, the competitive advantage afforded by regional sector concentration, the utilization of technologically advanced processes and equipment, as well as investment in research and development. For that reason Chmura chose to expand on the BLS definition to identify the region's unique portfolio of high-tech manufacturing firms.

4.2.1. Definition of HITE Manufacturing

This section supports the identification of 23 manufacturing subsectors that are strategically important to the Valley. This assessment was determined by evaluating each manufacturing sector at the four-digit NAICS level using a five-factor review process. Industries meeting two of the five criteria were included in a newly-defined High Impact-Technology Enabled (HITE) manufacturing group. The development of this special industry group was based on a review of the following variables: 1) the industry's regional location quotient, 2) average wages, 3) employment concentrations in high-tech occupations at the regional level, as well as the 4) national level, and 5) investment in research and development determined through a review of historical patent activity. The following table lists those sectors. A more detailed view of the evaluation criteria can be found in the appendix.

[16] Hecker, Daniel E. "High-Technology Employment: a NAICS-Based Update." Monthly Labor Review, July 2005.

Table 4.4: High Impact-Technology Enabled (HITE) Industries in the Shenandoah Valley

NAICS	Industry Description
3113	Sugar and Confectionary Product
3115	Dairy Product
3119	Other Food
3121	Beverage
3141	Textile furnishing mills
3241	Petroleum and Coal
3251	Basic Chemical
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments
3254	Pharmaceutical and Medicine
3255	Paint, Coating, and Adhesive
3259	Other Chemical Product and Preparation
3261	Plastics Product
3262	Rubber
3322	Cutlery and Handtool
3326	Fabricated wire product
3332	Industrial Machinery
3333	Commercial and Service Industry Machinery
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment
3336	Engine, Turbine, and Power Transmission Equipment
3344	Semiconductor and Other Electronic Component
3345	Navigational, Measuring, Electromedical, and Control Instruments
3353	Electrical Equipment
3391	Medical Equipment and Supplies

Source: Chmura Economics & Analytics

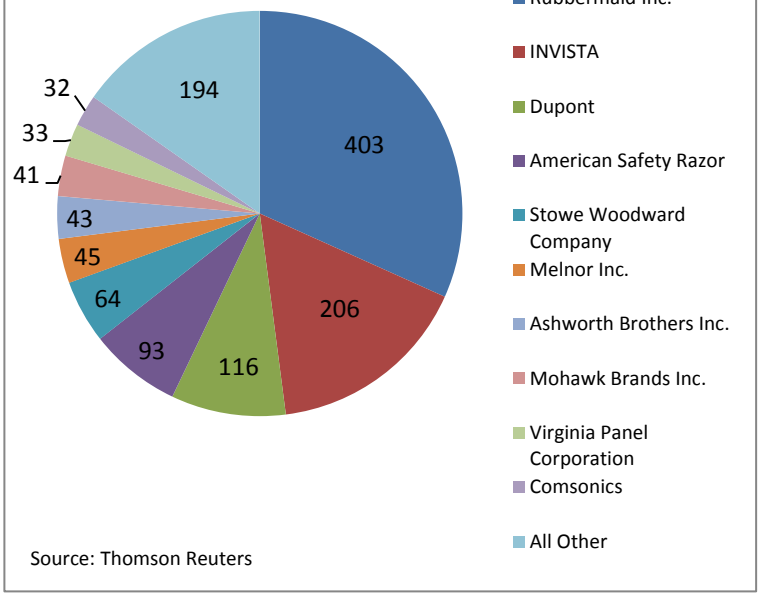
The location quotient of an industry is a measure of the relative size of an industry in a region compared to the average size in the nation. It identifies the degree to which an industry is concentrated in a region. Size is measured in terms of employment; an industry location quotient greater than 1.25 suggests that a region has a competitive advantage in that industry. That advantage could come from a variety of sources - a strategic location relative to its customers, access to a raw material critical as an input, an integral downstream supply chain network, or unique labor market characteristics. The positive effects of economies of agglomeration that occur when closely-related firms cluster in a geographic area are well recognized. For the purpose of selecting high impact-technology enabled firms, a location quotient of 2 or more was used. This resulted in a list of 22 firms: the top three are textile mills (10.4), sugar and confectionary product manufacturing (8.76), and animal slaughtering and processing.

Wages are also an important factor in identifying HITE manufacturers in the Valley. Those industries which pay higher-than-average wages tend to utilize more highly-specialized equipment and require more highly-trained labor than their non-HITE counterparts. In the Valley, the average annual manufacturing wage is $46,533. The 30 industries considered for inclusion in this HITE manufacturing group all pay wages in excess of this regional wage threshold.

In creating the evaluation matrix, Chmura included the list of 20 high-tech industries that the Bureau of Labor Statistics identified at the national level and then conducted an additional level of analysis by applying the same BLS methodology at the regional level. Beginning with the list of high-tech occupations, Chmura used the same National Staffing Employment Matrix to identify those sectors in the Valley that employed high-tech workers at two times the rate of the region overall, which is 3.4%. There were nine sectors meeting those criteria. This included ventilation, heating, air conditioning and commercial refrigeration equipment manufacturing; motor vehicle parts manufacturing; and medical equipment and supplies manufacturing. Together these firms employ more than 3,000 individuals and almost 200 high-tech workers.

Finally, Chmura reviewed patent activity in the Valley as an indicator of R&D spending. To prevent overemphasizing large companies that have significant research and development operations in areas outside of the Shenandoah Valley, the search was limited to patents filed by people within the Shenandoah Valley. The possibility always exists that the technology created by the new patent will be primarily used in another area, but even in these cases the creation of that patent within the Valley would require a significant commitment of resources, and would likely have employed several people for a period of time.

Figure 4.5: Patents Generated in Shenandoah Valley 1990-2012



Source: Thomson Reuters

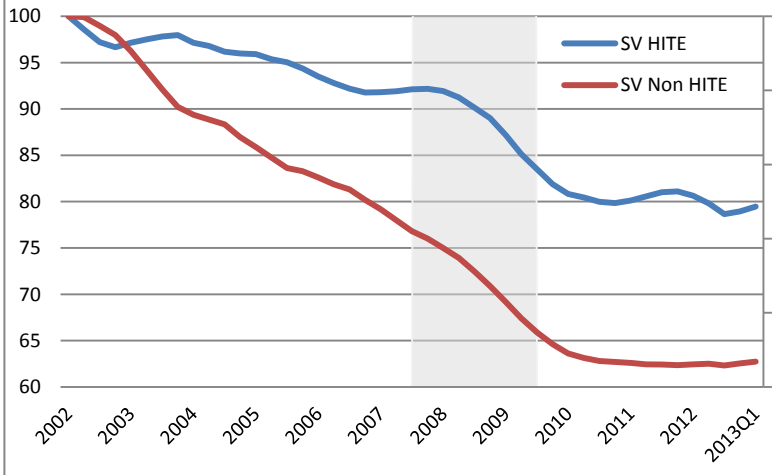
The analysis of patent data was done by using the Thomson Innovation patent research database. A search of all product development and manufacturing-related patents originating from the Shenandoah Valley region was performed to take an assessment of patent innovation. Certain patents related to manufacturing and R&D efforts in HITE manufacturing may have been omitted from the search if their abstract did not contain the following terms: manufacturing, production, sensor, sensors, robots, product, products, product design, manufactured, manufacturing process, factory, industrial, assembly, apparatus. Additional analysis of the patent data took inventory of sector and company patent totals.

Results from the patent assessment show that the top five innovators in the Shenandoah Valley region are Rubbermaid, INVISTA, DuPont, American Safety Razor, and Stowe Woodward Company with each having 403, 206, 116, 93, and 64 patents, respectively (Figure 4.5). Rubbermaid and INVISTA are responsible for nearly half of all patents generated within the region. Additional results yielded the top sectors in patent innovation: plastics product manufacturing (455); resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing (244); paint, coating, and adhesive manufacturing (116); cutlery and hand tool manufacturing (93); and navigation, electro-medical, and control instruments manufacturing (83).

4.2.2. Employment Trends in Manufacturing in the Valley

As shown in the accompanying figure, employment in HITE manufacturing industries has not declined as dramatically as non-HITE manufacturing industries in the Valley since 2003. In Figure 4.6, employment in the first quarter of 2002 is indexed at 100. The percent change from that point shows HITE industries have declined 20.5% compared to 37% for non-HITE industries. Employment in non-HITE industries decreased more rapidly during the recession than for non-HITE employment—non-HITE employment declined at an annual average rate of 6.6% compared to HITE employment at 4.4%.

Figure 4.6: SV HITE Manufacturing Employment Compared to Non-HITE Manufacturing Employment



Source: Chmura Economics & Analytics and JobsEQ®

This trend will be especially pronounced in Virginia. Over the past eleven years, employment in non-HITE manufacturing industries has decreased at a rate 1.7 times faster than in HITE industries. At the national level, non-HITE manufacturing employment has also fallen more dramatically than HITE— a difference of almost nine percentage points (see Table A7 in the appendix for details).

4.2.3. HITE Wage, Growth, and Openings Comparisons

Even though the wage disparity between manufacturing jobs and other career fields has been discussed previously, HITE industries offer more competitive wages than non-HITE industries. The table below compares HITE wages in the Shenandoah Valley with non-HITE industries. The industries chosen for comparison are those that were mentioned most often as potential career fields by students who took Chmura's survey: healthcare, education, and professional and technical services.

In the Valley, HITE pays an average of $59,500, which is $16,900 more than average wages in the healthcare industry, $23,300 more than average wages in education, and just $2,000 less than professional and technical services. Though it is not well recognized, there are many jobs in the healthcare industry paying less than entry-level manufacturing jobs—including home health aides and licensed practical nurses. In terms of growth, HITE is projected to grow at a modest rate of 0.5% annually, which is lower than all three of the other groups. However, due in part to the large number of retiring workers, there are many replacement jobs available in manufacturing. When these positions are added to the projected new jobs, the total number of expected annual openings is 370. This is greater than the openings anticipated in for the professional and technical services field.

Table 4.5: Comparison of Average Wages, Projected Growth, and Annual Job Openings 2013Q1-2023Q1

	Wages	Average Forecast Annual Percentage Growth	Forecast Annual Growth (number of jobs)	Total Forecast Annual Job Openings Including Retirements
Industry Comparisons				
SV HITE Manufacturing	$59,500	0.50%	70	370
SV Healthcare	$42,600	3.00%	980	1550

SV Education	$36,200	1.10%	300	850
SV Professional & Technical Services	$61,500	2.50%	160	280
	Regional Comparisons			
SV All Jobs	$36,500	1.60%	3,640	8,570
Virginia All Jobs	$51,100	0.70%	n/a	n/a
United States All Jobs	$48,600	1.40%	n/a	n/a

Source: Chmura Economics & Analytics and JobsEQ®
n/a = not available

These data show that HITE-specific industries are very competitive with other industries in terms of wages, and far surpass average wages in all industries in the Shenandoah Valley, Virginia, and the United States. Although HITE industries are not projected to generate as many new jobs as healthcare, education, and professional and technical services, it offers many job openings due to replacement jobs.

5. Survey Results

5.1. Business Survey

5.1.1. Overview

To better understand the workforce issues and skills gap of manufacturers in the Shenandoah Valley, Chmura conducted a survey of manufacturing businesses in December 2012. Company contacts were obtained primarily with the help of partnering organizations in the Shenandoah Valley who had contact lists of manufacturing businesses within their service areas. This list was supplemented with additional contact information from Hoover's.

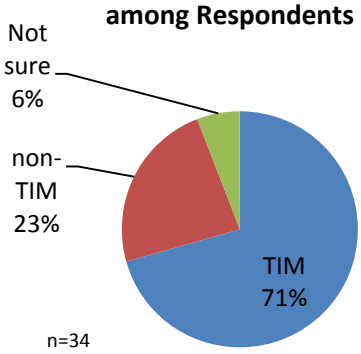
With the help of these partnering organizations, Chmura sent a web-based survey to approximately 380 manufacturing businesses. Contacts were encouraged by local stakeholders to fill out the survey, with the explanation that it would benefit each company by improving workforce and economic development services. The contacts where given two and a half weeks to complete the survey, during which time several reminder emails where sent out to elicit further responses. A total of 34 responses were received, which resulted in a 9% response rate and equivalent to roughly 6% of all manufacturing businesses in the Shenandoah Valley. However, since businesses that employ large numbers of people were more likely to respond, the survey covered firms with employment equal to roughly 29% of total manufacturing employment.

5.1.2. Self-Identification with Advanced Manufacturing

No attempt was made to focus specifically on businesses within the HITE cluster to avoid a too-narrow sample size. Moreover, because all businesses are somewhere within the spectrum of "advanced manufacturing," it is critical to understand the labor needs of businesses within all stages of this process.

Most business representatives reported that they consider their organizations to be advanced manufacturing. As shown in Figure 5.1, 71% of respondents answered positively when asked if their firm was

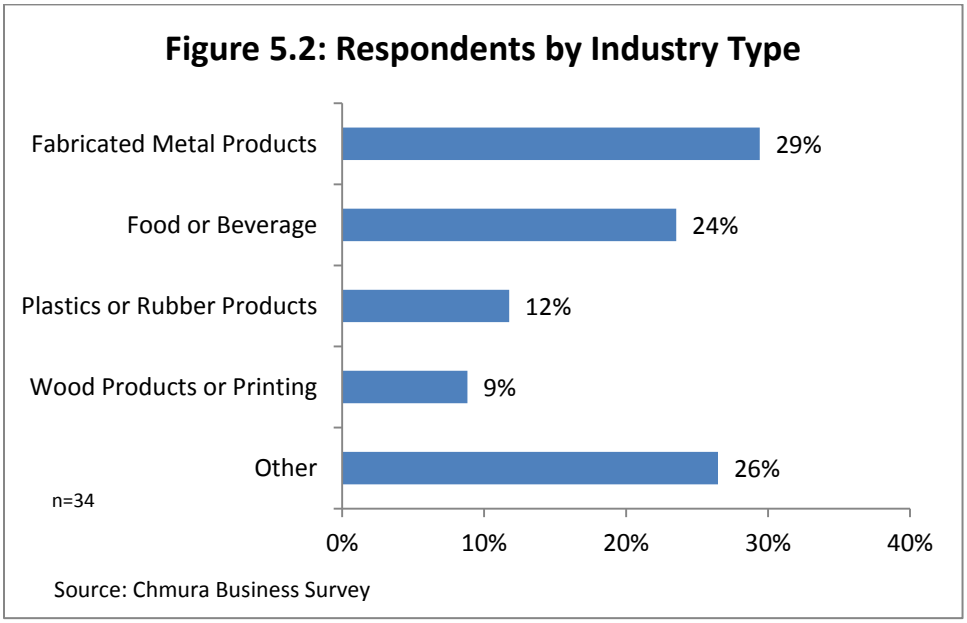
Figure 5.1: "Advanced" or "Technology-Intensive" Manufacturers among Respondents



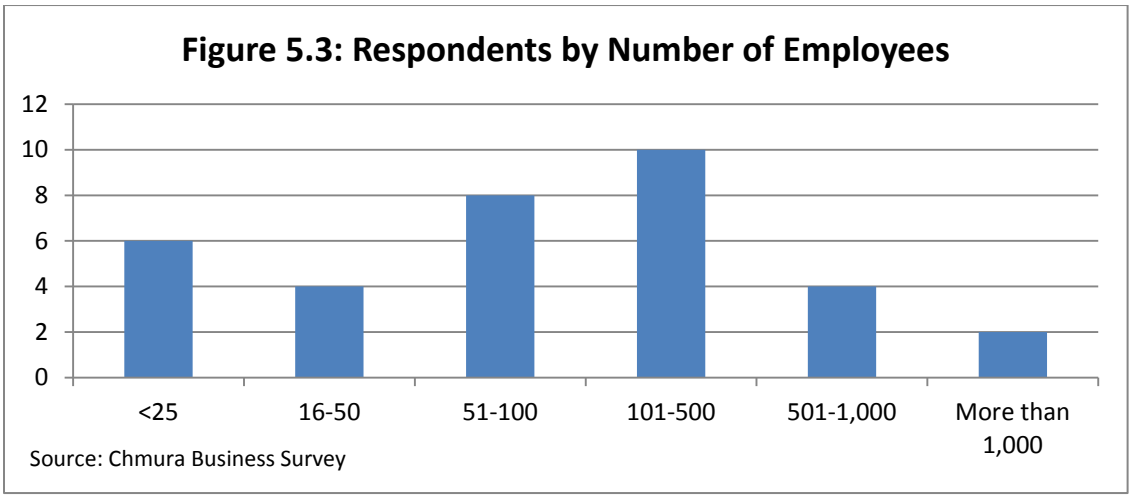
"advanced" or "technology-intensive" manufacturing while only 23% responded "no." The survey gathered responses from all types of industries—some in the NAICS-defined HITE sector and others outside. Even within industries that are only partially within the HITE sector, such as food and beverage manufacturing, the majority of respondents considered their firm to be advanced. These results point to the fact that secondary data sources can only go so far in describing what is occurring on factory floors.

5.1.3. Business Characteristics

Responses came from an array of industry groups, with the greatest number coming from Fabricated Metal (29%) and Food or Beverage (24%). Several respondents wrote in their own responses, which included "medical" and "refrigeration," responses which are included in the "other" category in the chart below.



The firms surveyed also represented small-, medium-, and large-sized manufacturing businesses. The average respondent firm employed 276 people; 18 of the firms employed less than 100 people; the remaining 16 employed 100 or more.



When asked about their firm's employment growth over the next three years, 65% of respondents expected employment to increase, 29% expected employment to stay the same, and just 3% expected a decline (with the remaining 3% replying "don't know"). Respondents were asked to estimate the size of the job increase or decrease over this time period. Based upon these responses,[17] the respondent cohort overall expected 2.6% annual average job growth over the coming three years. This compares to Chmura's 10-year projection of about 0.5% annual average job growth in the manufacturing sector in the Shenandoah Valley. As an alternative forecast, assuming 29% of manufacturing employment in the region meets the growth expectations reported in the survey and the remaining 71% grow at the baseline expectation of 0.5% per year, the total manufacturing sector in the region would grow at a 1.1% annual average pace over the coming three years.

Table 5.1: Expected Employment Growth of Respondents

	Number of Responses	Current Employment	Expected Change	Annual Average % Change
Increase	22	5,979	790	4.2%
Decrease	1	320	-30	-3.2%
Stay the Same	10	3,023	0	0.0%
Don't Know	1	62	0	0.0%
Total	**34**	**9,384**	**760**	**2.6%**

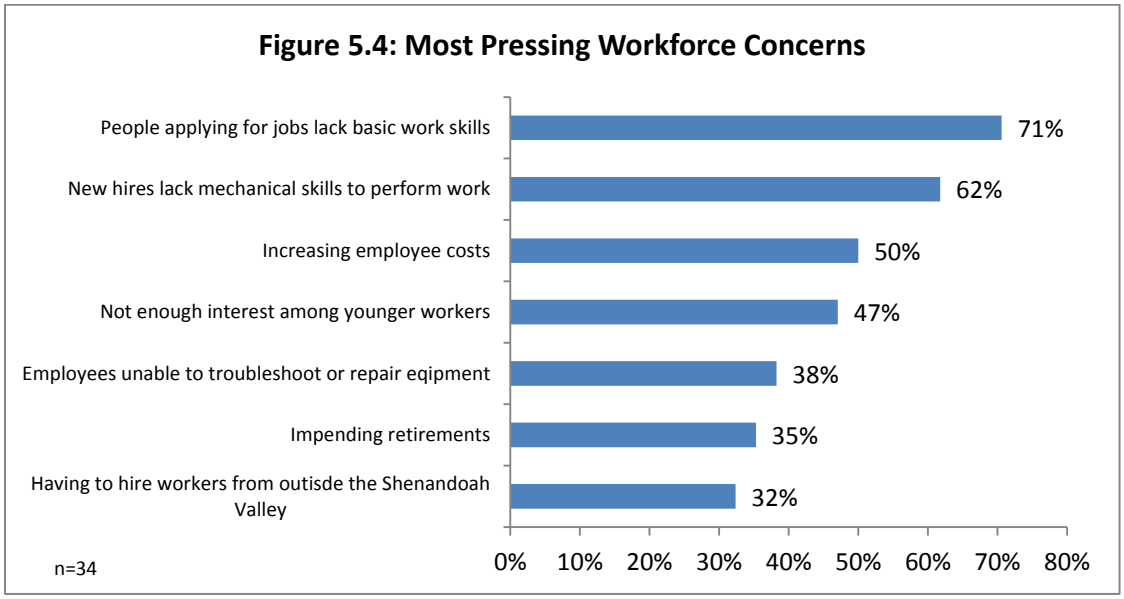
Source: Chmura Business Survey

5.1.4. Most Pressing Workforce Problems

A prime objective of the survey was to discover what firms consider their largest workforce challenges. One very direct question on this topic provided a list of seven options that represent some of the most common workforce issues both inside and outside of the manufacturing industry. Respondents were asked to check the boxes that best applied to their situations.

Employers showed a great deal of concern for the preparedness of incoming workers. Seventy-one percent of respondents agreed that "people applying for jobs lack basic work skills," 62% said that "new hires lack the mechanical skills to perform the work," and 47% said that there is "not enough interest among younger workers." Another problem that applied to 38% of employers was that new or current "employees are not able to troubleshoot or repair equipment."

[17] It was assumed the "don't know" respondent firm had employment stay the same. It was also assumed, so as to generate a conservative estimate, that one respondent replying "increase" who could not specify the size of job gain had a zero gain.



Compared to other concerns, "impending retirements" was not as high on the list, with 35% of employers responding that this was one of the most pressing issues. This suggests that for many Shenandoah Valley manufacturers, retirements are not as pressing an issue as simply finding qualified people to fill their existing jobs.

According to anecdotal information gathered during focus groups, some businesses hire a good number of workers from outside Shenandoah Valley who either commute from other places (such as West Virginia) or who relocate for the job. This issue, while relevant to 32% of businesses, was not as universal a problem in comparison to worker preparedness issues.

To further explore this issue, company representatives were also asked to identify the top job titles that are hardest to fill at their firms. This question was an open-ended format, allowing respondents to write in up to three job titles. The information was categorized according to broader occupational categories, which are shown in the table below. Answers to this question stretched across the educational spectrum, with some positions that require 4-year degrees or greater and others that require just a high school diploma. The majority, however, were among skilled trades. These occupations were engineering, maintenance and repair, electricians and electronics technicians, welders, computer numerical controlled (CNC), and machine operators.

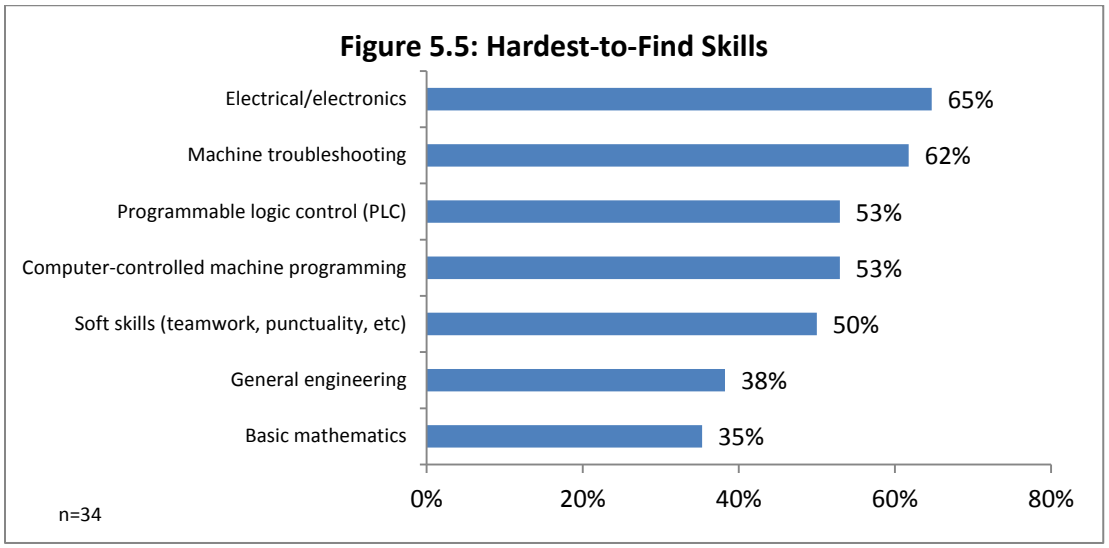
Table 5.2: Top Occupations That Are Hardest to Fill

Occupation Title	Count
Engineering	10
Electricians	6
Maintenance	6
Welders	6
Mechanics	5
CNC	3
Customer Service	3
Electronics technicians	3
Machine Operator	2
Management	2

Truck drivers	2

Source: Chmura Business Survey

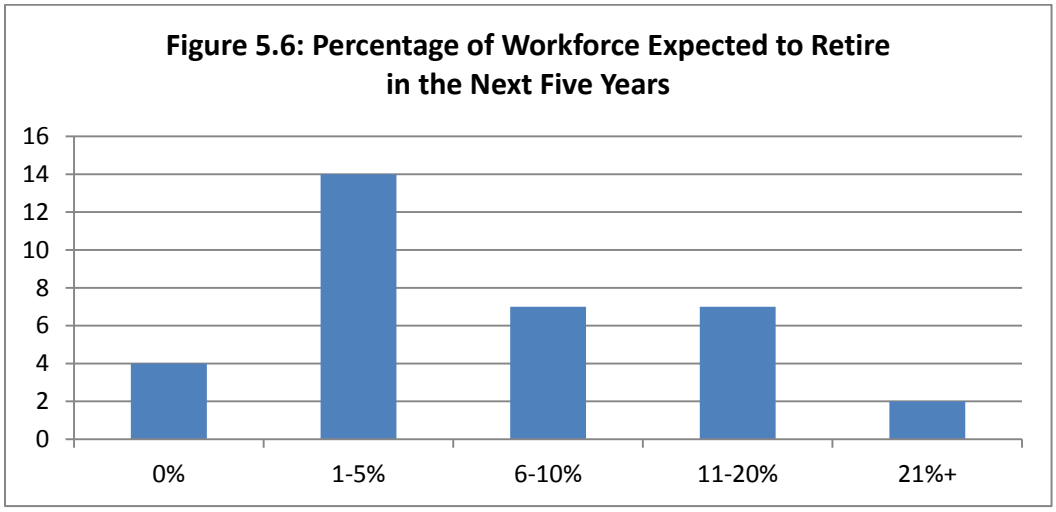
Business representatives also provided information on the skills that are most difficult for their firms to find. The two hardest skills to find among the survey respondents were electrical/electronics (mentioned by 65%) and machine troubleshooting (62%). Other hard-to-find advanced production skills were programmable logic control (53%) and computer-controlled machine programming (53%). Basic mathematics and soft skills were noted as gaps during the focus groups and 35% and 50% of survey respondents, respectively, noted that these skills were difficult to find. This latter response is consistent with the 2007 STGAR report which indicated that almost half of businesses rated the soft skills of entering workers to be fair, poor, or very poor.[18]



5.1.5. Retirement Issues

As noted above, 35% of respondents were concerned about impending retirements. To discover more about this issue, several more questions were posed on this topic. The first question asked about the percentage of workers expected to retire within the next five years. The largest group of respondents, 14, anticipated from about 1-5% of their workforce to retire within five years. Another seven respondents each expected retirements to range from 6-10% and from 11-20%. Two firms expected retirement rates above 20%—specifically, between 40-50%; moreover, each of these firms employed over 100 workers. If such expectations come to fruition, these firms and others like them are facing a daunting task for replacing and retraining their workforce within the next five years.

[18] STGAR, page 47.



To best gauge the retirement expectations of the survey respondents, the individual retirement expectations were translated into actual retirements by accounting for the employment size of each respondent firm. Of the roughly 9,384 manufacturing workers employed by respondent firms, 1,190 retirements were expected over the next five years for a five-year retirement rate of 12.7%. This is equivalent to a 2.4% annual rate of retirement and is similar to the calculated 2.7% retirement rate for manufacturing in the Shenandoah Valley as detailed in Section 6.

The survey respondents from the fabricated metal group expected the most retirements over the next five years—19.1% of their workforce. (This high rate is actually quite reasonable as discussed in Section 6). The food or beverage group expected a lower-than-average rate of retirements at 11.1% over five years. Combined, all other respondent groups (including plastics and rubber products) expected a 9.9% retirement rate over the coming five years. Respondents who considered themselves to be a "technology-intensive" manufacturer—the majority of survey respondents—reported an overall expectation of a 12.5% rate over the next five years, just a little under the expectations of all manufacturing respondents.

Table 5.3: Reported Retirement Rates by Survey Respondent Groups

Sector	Expected Retirements in the Next 5 Years	Current Employment	5-year retirement rate	1-year retirement rate
Food or Beverage	522	4,707	11.1%	2.2%
Fabricated Metal	423	2,216	19.1%	3.8%
All others	244	2,461	9.9%	2.0%
Grand Total	1,190	9,384	12.7%	2.5%

Source: Chmura Economics & Analytics

Respondents were also asked to indicate which occupation types would be most affected by retirements. For this analysis, Chmura cataloged the responses into the same groups used in the question about top occupational gaps. Maintenance and mechanics were the sources of greatest concern for employers. Also receiving a high number of responses were welders, electricians, and management occupations (including foremen). Electricians, engineering, truck drivers, and sales were also occupations being mentioned by multiple respondents.

Table 5.4: Top Occupations Where Retirements are Most Expected

Occupation Title	Count
Maintenance	8
Mechanics	5
Welders	5
Management	4
Electricians	3
Engineering	3
Truck drivers	3
Foreman	2
Machinist	2
Sales	2

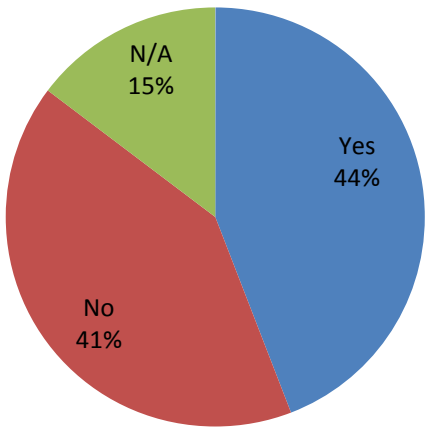
Source: Chmura Business Survey

5.1.6. Educational Issues

Chmura's focus groups provided generally positive reviews of local training providers in terms of helping address occupational and skills needs for manufacturers. Similar questions were asked to the survey audience to determine whether this opinion was widespread and to see what program types are lacking from the current options.

When asked if training providers in the Shenandoah Valley are meeting manufacturers' needs, there were mixed results among business representatives—44% responded "yes" and 41% responded "no." The largest companies in the sample were more likely to express dissatisfaction: four of the six firms with over 500 employees said that training providers in the region were not meeting their needs.

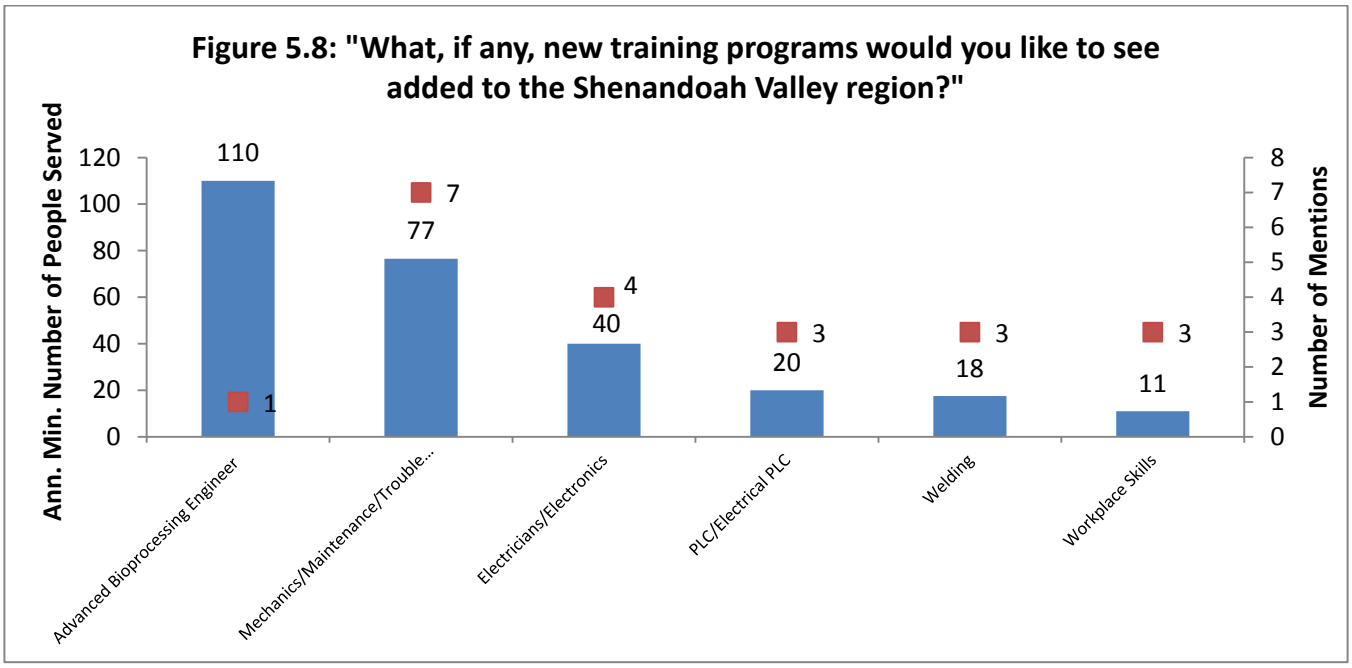
Figure 5.7: "Are training providers in the Shenandoah Valley meeting your needs?"



n=34

After following up on this question, respondents were asked to list up to three programs that they felt should be offered in the Shenandoah Valley.[19] Respondents provided 30 unique responses that were classified into eight general categories. This question also asked business representatives to provide the average number of program graduates their firm would hire per year, and the average number of employees per year expected to use the program. Summing these two numbers leads to the annual minimum number of people served, shown in Figure 5.8 below. On the opposite axis is the number of mentions by respondents to the business survey.

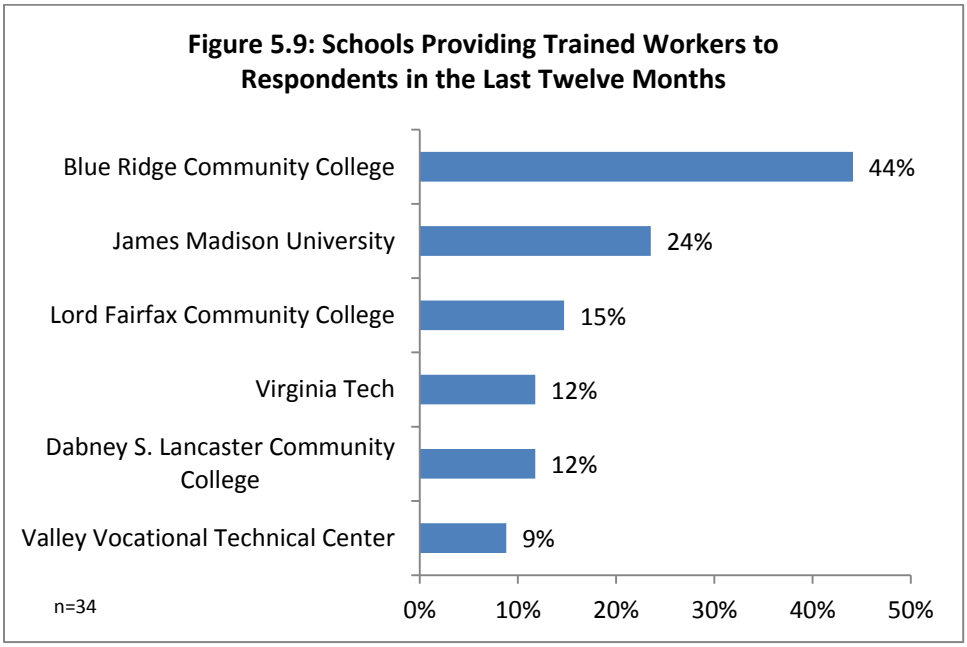
The program expected to serve the most students would be Advanced Bioprocessing Engineering, which although only mentioned by one respondent, would serve at least 110 students per year. Programs in the realm of Mechanics/Maintenance/Troubleshooting were most mentioned, with seven respondents, and are expected to serve at least 77 students per year. Electricians/Electronics was similarly popular, with four unique mentions, and an expectation to serve at least 40 students per year. The other three programs—PLC[20]/Electrical PLC, Welding, and Workplace Skills—were all mentioned three times and would serve 20, 18, and 11 students per year, respectively.



To determine which schools' students are being hired for manufacturing jobs, it was asked which local educational/training institutions had provided new hires in the past twelve months. The results of this question (shown below) indicate that Blue Ridge Community College (BRCC) was the most popular origin for workers, hired by 44% of respondent firms. Others ranking high on the list were James Madison University (24%), Lord Fairfax Community College (15%), Dabney S. Lancaster Community College (12%), and Virginia Tech (12%). The fact that most students with two-year degrees came from BRCC is likely correlated with the fact that most survey respondents were from the Central Shenandoah Valley region. The fact that James Madison and Virginia Tech appear on this list shows that they are also serving as workforce trainers for the manufacturing industry and should therefore also be involved in workforce development initiatives.

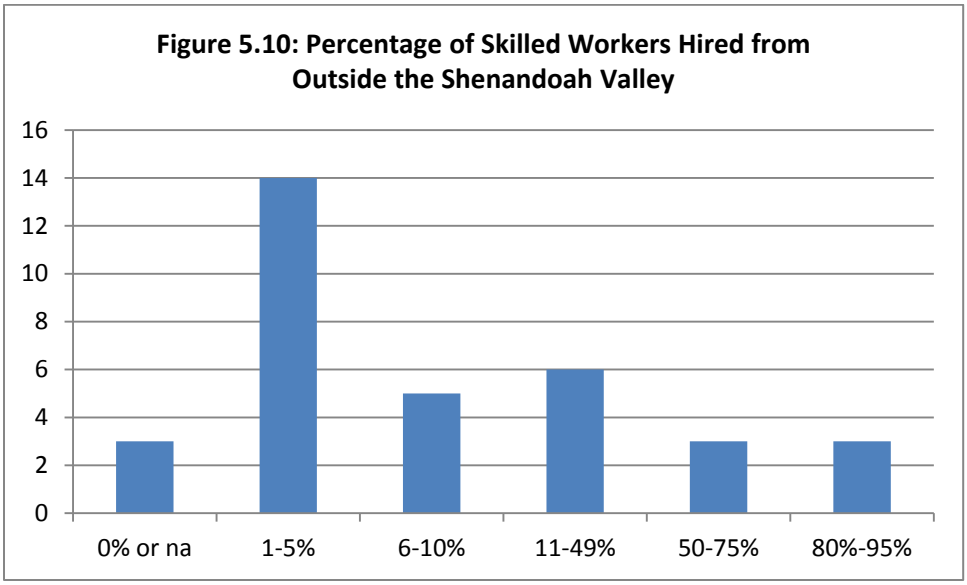
[19] Since the region spans across three community college districts, it is possible that respondents mentioned programs that are offered by other community colleges, but not within their sub-region.

[20] PLC is programmable logic controls.



5.1.7. Other Issues

A minority of respondents mentioned having to hire workers from outside of the Shenandoah Valley as a pressing issue (32%). While this may not be one of the region's most widespread problems, it does occupy the minds of some business leaders. While half of respondents reported that 5% or fewer of their skilled workers originate from outside the Shenandoah Valley, six respondents said from half to 95% of their skilled workers come from outside the region. When combining survey results and employment size, it is estimated that about 11% of skilled manufacturing workers for this sample originate from outside the Shenandoah Valley.



When measuring business representatives' interest level in extending CCAM to the Shenandoah Valley, the following question was posed: "If a regional consortium of manufacturers were formed to share training costs, and offer access to research and development services, do you think that your firm would participate?" To this, 12% responded "absolutely;"

39% responded "probably," and 48% responded "possibly." Though it was given as an option, zero responses checked the box saying "no." It is considered likely that businesses would be concerned with location, cost, and protection of company assets and trade secrets. The fact that about one in eight companies answered "absolutely" indicates that there is a nucleus of companies with intense interest that might help fill the core of business sponsors needed if SVCAM is pursued in the future.

5.2. High School Student Survey

Overview

The student survey was intended to gather first-hand information regarding students' thoughts about future careers, their perceptions on manufacturing, and their interest levels in topics related to manufacturing. In November and December of 2012, Chmura conducted a survey of juniors and seniors at Fort Defiance High School in North River, Virginia and Sherando High School in Stephens City, Virginia. The sample was limited to juniors and seniors because they are closer to completing high school and thus more likely to be thinking about their future plans. The schools were selected because partnering organizations were familiar with staff at these schools that would be willing to assist, and because they fairly represent the demographics of the Shenandoah Valley. The students were given 10 minutes to complete the survey, which was judged to be ample time to answer all fourteen questions.

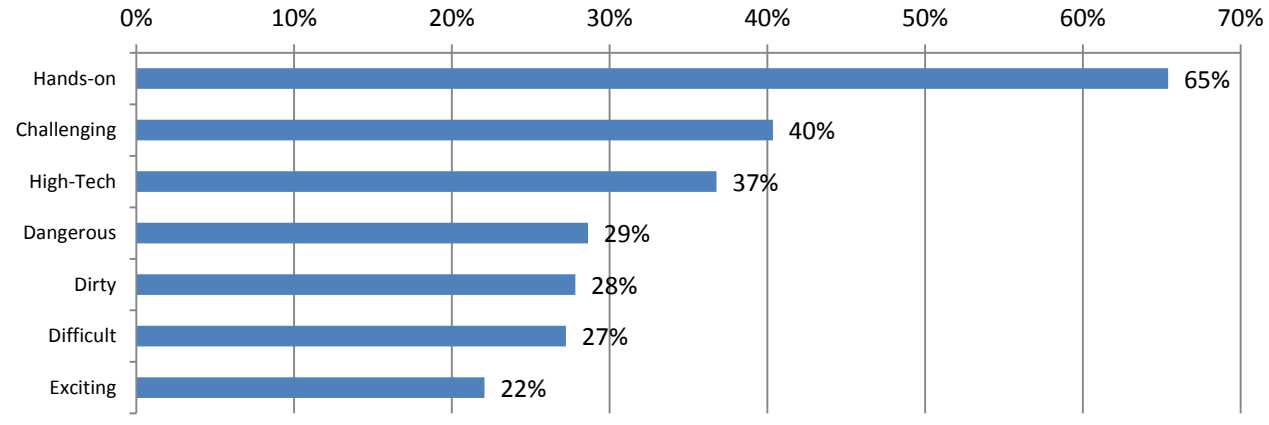
A total of 534 responses were received. The exact number of senior and juniors in the Valley is not known, but using data from the Virginia Department of Education, Chmura estimates that this accounts for 1.5% of all those in the region. Though this accounts for a smaller proportion of those analyzed for the business survey, due to the generally representative sample of the two high schools, the survey likely represents opinions of most students relatively well. Of the students surveyed, 46% were seniors and 54% were juniors. By school, 43% attend Sherando High School and 57% attend Fort Defiance High School. Students in the sample area are likely to have greater knowledge of manufacturing due to their backgrounds—25% indicated that they have one or more parent working in the manufacturing industry. Most students had a least one parent who had attended college or is currently attending college (63%).

Student Survey Summary

Manufacturing-Related Questions

Many of the questions were designed to gauge student's feelings about manufacturing and their interest in fields related to manufacturing. Many students had negative perceptions of manufacturing, expressed by words such as "dirty" and "dangerous." However, a higher proportion considered manufacturing to be "high-tech" and "challenging." Students were given seven words and asked to check those that "best describe" their feelings about manufacturing. The survey showed that

Figure 5.11: "Check the boxes that best describe your feelings about manufacturing."

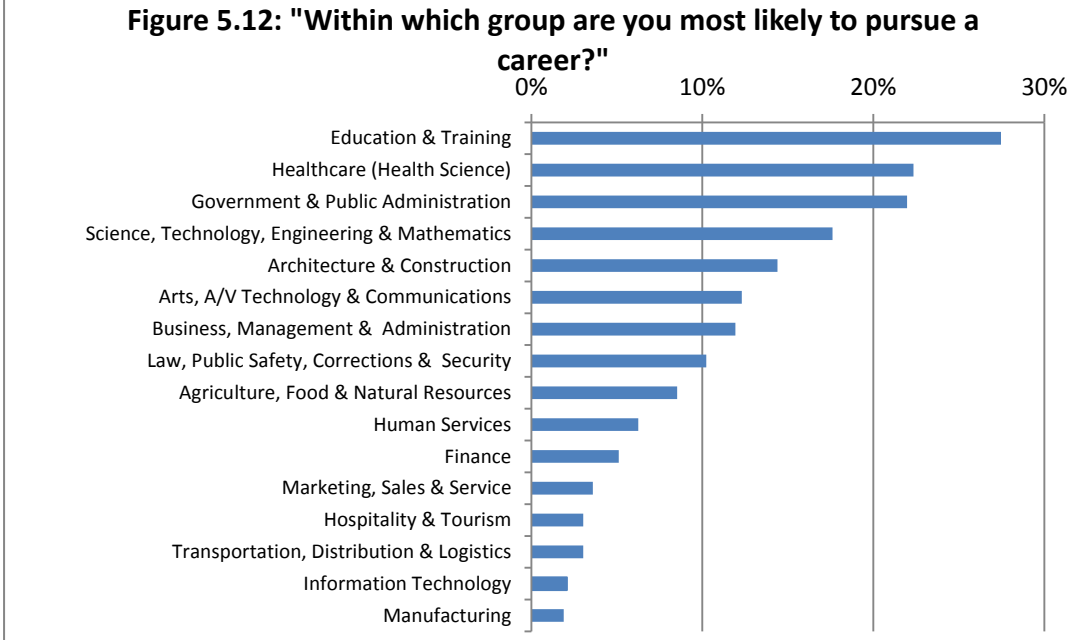


N=503
Note: Totals do not sum to 100% because respondents could choose multiple options

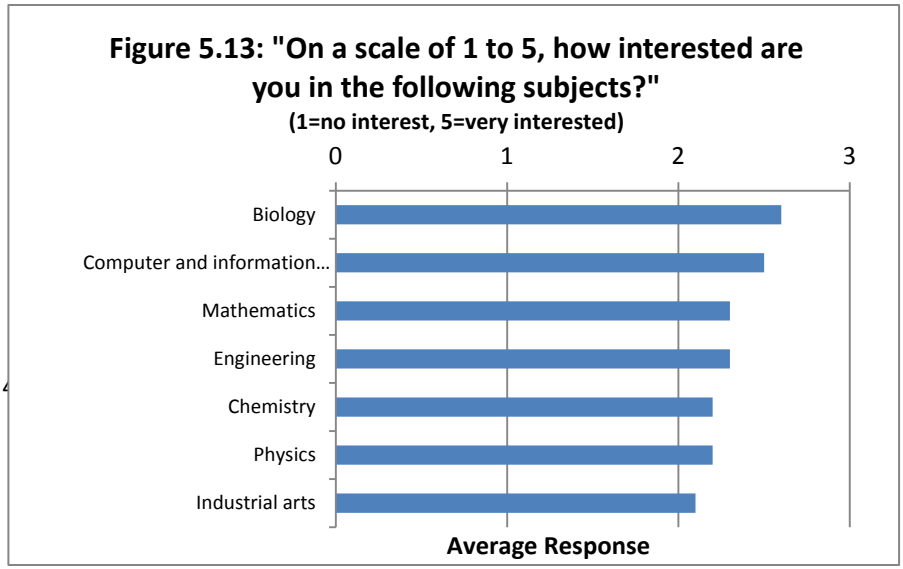
the majority of students consider manufacturing to be "hands-on" (65%), a sign that students are aware that manufacturing involves very tactile skills, which differentiates it from many other career paths and for some students is a benefit. There were two highly-positive words within the group—"high-tech" and "exciting." "High-tech" was the third-highest ranking word, being selected by 37% of students. Conversely, "exciting" was the lowest-ranking word, being selected by just 22%. Three expressly negative words were provided—"dangerous," "dirty," and "difficult"—which were each selected by between 29% and 27% of students.

Students with at least one parent working in manufacturing had a significantly better impression of the industry. For example, among that group only 19% marked "dirty" compared to 29% for all others; and 27% marked "exciting" compared to 19% of all others.

When it comes to career options, students showed the highest interest in the fields of education and training, healthcare, and government and public administration. Manufacturing ranked last among sixteen options being selected by just 2% of students as a potential career path. Science, technology, engineering and mathematics, (STEM), another field closely tied to manufacturing ranked quite high, receiving 18% of students' votes. Students with parents working in manufacturing were no more or no less likely to choose manufacturing as a career option.



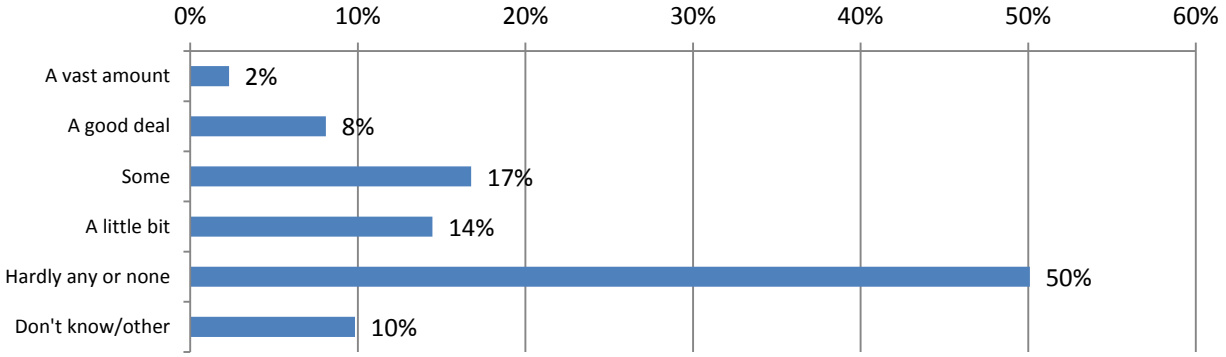
The student focus groups and educators' focus groups revealed that high school students are not likely to have a well-developed sense of what manufacturing is, or the types of skills it requires. In the survey, Chmura also investigated the interest levels of students in some of the skill areas that are most important to advanced manufacturing. Students were given a list of seven skills and asked to indicate their interest on a scale from 1 to 5. This included categories relevant to specific types of manufacturing (e.g.: biology and chemistry are most relevant to



biotechnology and chemical manufacturing), and those that were common to all types of manufacturing (e.g.: mathematics and industrial arts). The average scores for each were all between 2 and 3, with biology and computer and information systems scoring highest on the list (2.6 and 2.5, respectively). Industrial arts scored lowest (2.1) but was only separated from the highest scoring category by 0.5 points.

The previous questions were designed to measure student interest levels, but another critical factor that determines students' career paths is experience. To measure this factor Chmura asked "How much experience do you have using and/or repairing large and complex machinery?" To this question 50% responded "hardly any or none," just 10% responded that they had either "a vast amount" or "a good deal." Students with at least one parent in the manufacturing industry were twice as likely to select "a vast amount" or "a good deal."

Figure 5.14: "How much direct experience do you have using and/or repairing large and complex machinery?"



N=519

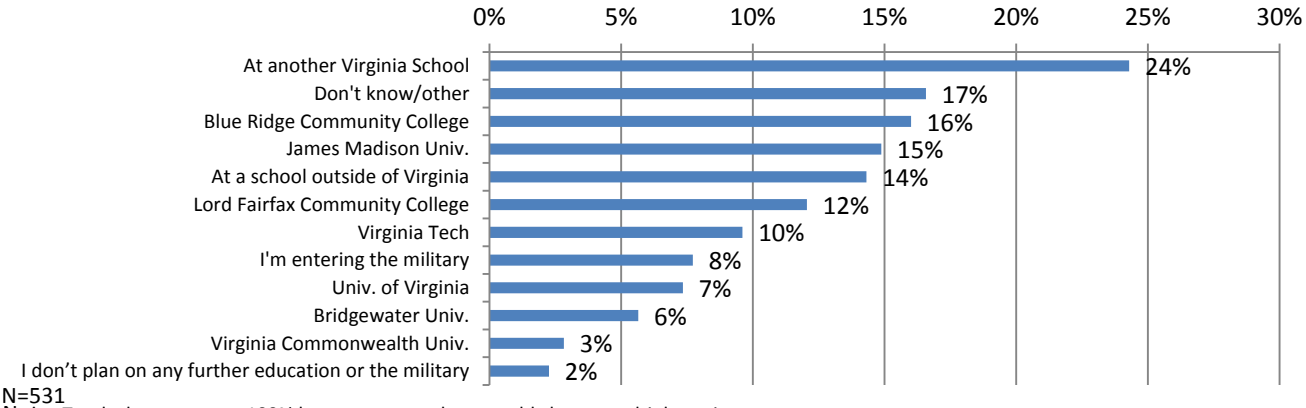
With regard to students' awareness of the demand for manufacturing workers, students were asked: "Are you aware that many companies in your area are currently seeking to hire manufacturing workers?" One-third responded "Yes." The majority responded "No," and the remainder responded "don't know/other."

Education and Ideas about the Future

An expressed concern by the stakeholders is the potential for "brain drain"; a term commonly used to describe impacts on regions as students leave to pursue careers elsewhere. To determine the extent of this problem Chmura asked a series of questions about what students are planning on doing after high school and where they are planning on living.

The survey indicated that the majority of juniors and seniors had thought about their future careers; 73% responded with a seven or higher on a scale from one to ten. To pursue their future plans, the majority of students expect to attend a college in

Figure 5.15: "After high school, where will you most likely continue your education?"

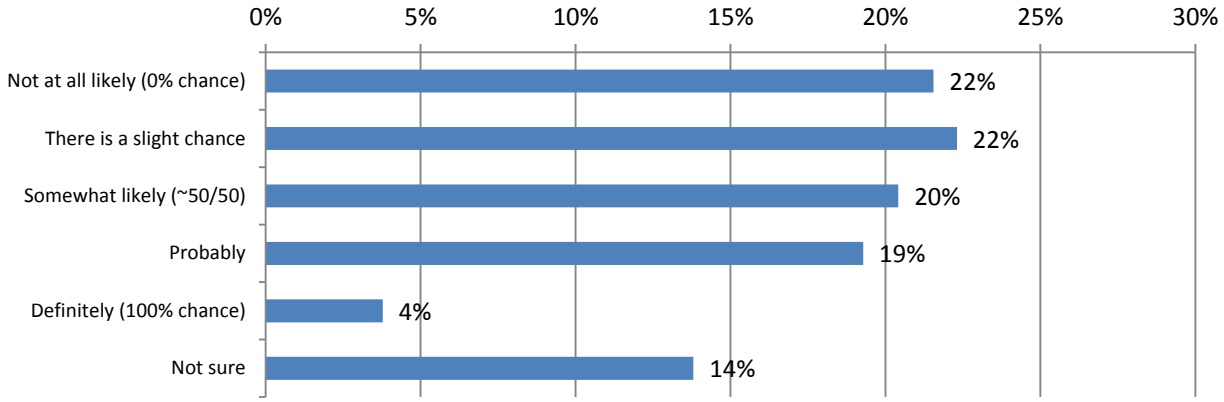


N=531
Note: Totals do not sum to 100% because respondents could choose multiple options

Virginia. The school receiving the highest number of selections was Blue Ridge Community College (16%) followed by James Madison University (15%) and Lord Fairfax Community College (12%). Some schools outside of the Shenandoah Valley made this list as well including Virginia Tech (10%) and the University of Virginia (7%).

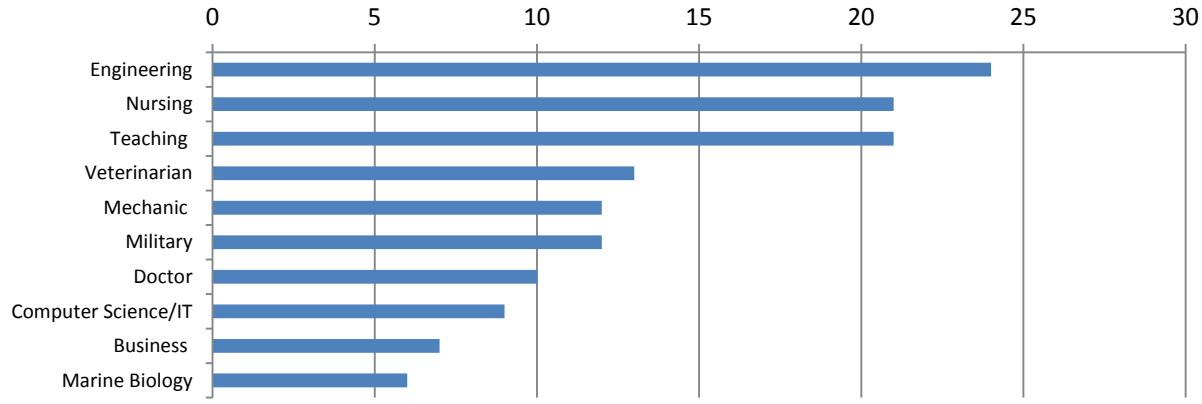
Through Chmura's focus groups and discussions with regional leaders, evidence on students' desire to remain in or return to the Shenandoah Valley was inconclusive. Some estimated that about a half were likely to remain, and others estimated closer to a third. In the high school student survey, when asked "after you finish your education, how likely is it you will work in the Shenandoah Valley?", about 22% answered "not at all likely" and another 22% said "there is a slight chance." Combined, these two answers indicate 44% of the whole consider it unlikely that they will live and work in the Shenandoah Valley region. On the other end of the scale, 23% indicated "probably" or "definitely."

Figure 5.16: "After you finish your education, how likely is it you will work in the SV?"



Students in the Shenandoah Valley also seem to have surrounding support structures that encourage them to think about the future. The majority of students reported that they have discussed future careers with their parents or teachers (81%) while just 16% said that they had not. The list of careers that parents or teachers had discussed with them is instructive about fields that they and their mentors consider to have the best future potential. The top ten responses are shown in Figure 5.17.

Figure 5.17: "What careers have your parents or teachers discussed with you?"



Chmura's educator focus groups indicated that students were drawn to careers that either appear flashy—often as portrayed in the media or via entertainment—or those which they have been exposed to through their parents or personal experiences. This insight seems to hold true as some occupations on the list are routinely dramatized in movies or on television—such as doctors or those in business or military occupations. Students may also be drawn to occupations that they have seen or heard about in other ways. For example, students know about teachers through daily interactions with them, and they know about nurses by going to doctor's offices.

It is encouraging that several of the occupations on the list have some applications to manufacturing, including engineering and mechanics. Both of these occupations seem to break the mold of being either commonly dramatized or commonly seen in day-to-day interactions. A few other occupations mentioned—though less frequently—have some manufacturing applications, including welders and electricians. The increasingly computerized nature of manufacturing also could draw the attention of some of the nine students who mentioned computer science/IT.

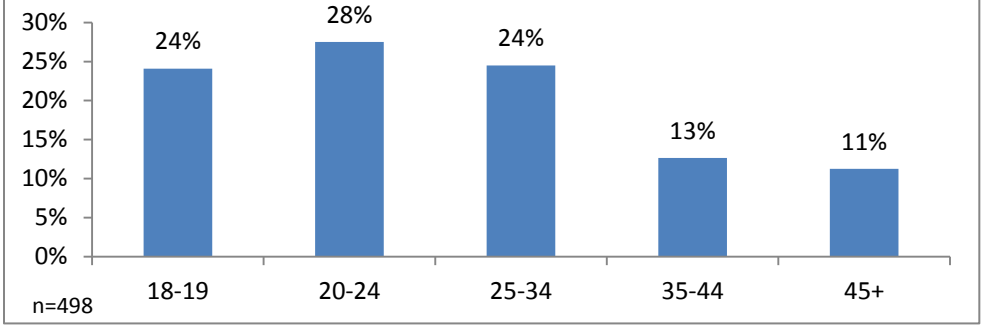
When asked what skills they thought were most important for the workforce today, students put greater emphasis on soft skills and problem-solving skills than on technical skills. Of the seven options provided, students most commonly selected communication and work ethic, each selected by 80% of students. According to the business survey, necessary soft skills were the greatest gap among younger workers, but the student survey indicates that students are quite aware of these needs. The problem must result in a difference in perception between employers and young people about what "work ethic" and "communication skills" mean. Several skills that were explicitly mentioned by business representatives were included among the seven options, including "mathematics" and "problem-solving skills." Also, Chmura used the composite term "technical skills" to account for any job specific skills that were not mentioned in the other categories. Students seemed to value most skill areas less than employers, with 52% reporting "technical skills" and just 44% selecting "mathematics" as skills important for today's workforce. The exception was "problem-solving skills" which was selected by 70% of students.

5.3. Community College Student Survey

An online survey of community college students was conducted in February 2013. Students from Blue Ridge Community College and Dabney S. Lancaster Community College were sent invitations for this survey. Lord Fairfax Community College did not participate

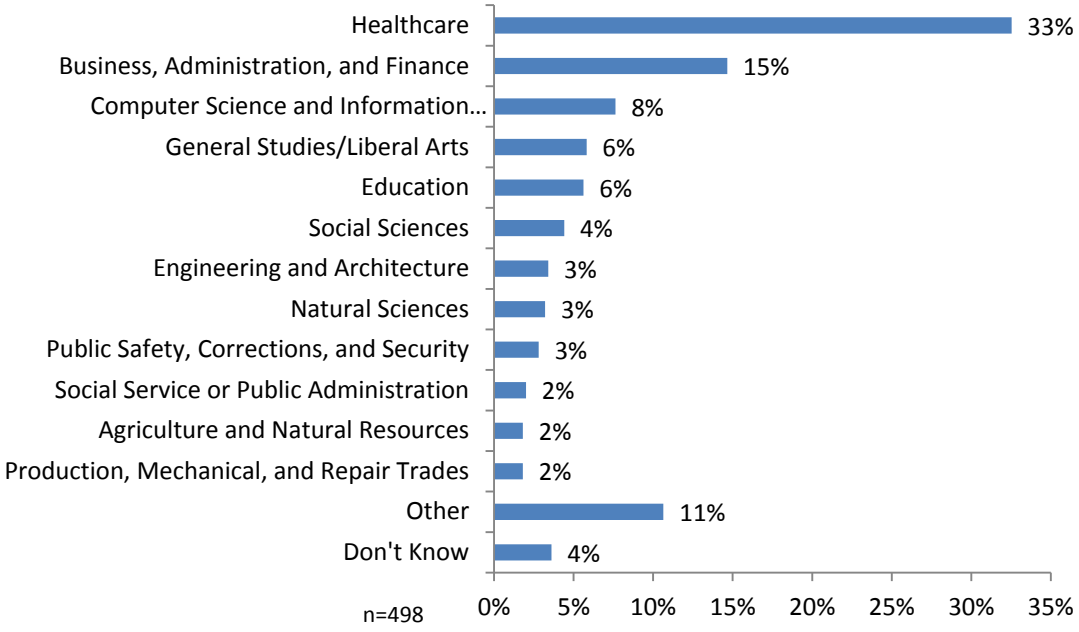
A total of 498 responses were recorded. About half were age 24 or younger and nearly a quarter were age 35 or older. By class, 34% were freshmen, 32% sophomores, and the remaining 35% classified themselves as "other." The gender mix was tilted towards females with only 32% of the respondents being male. Also, 20% of the respondents said at least one of their parents work in the manufacturing industry.

Figure 5.18: Age Mix of Community College Student Respondents



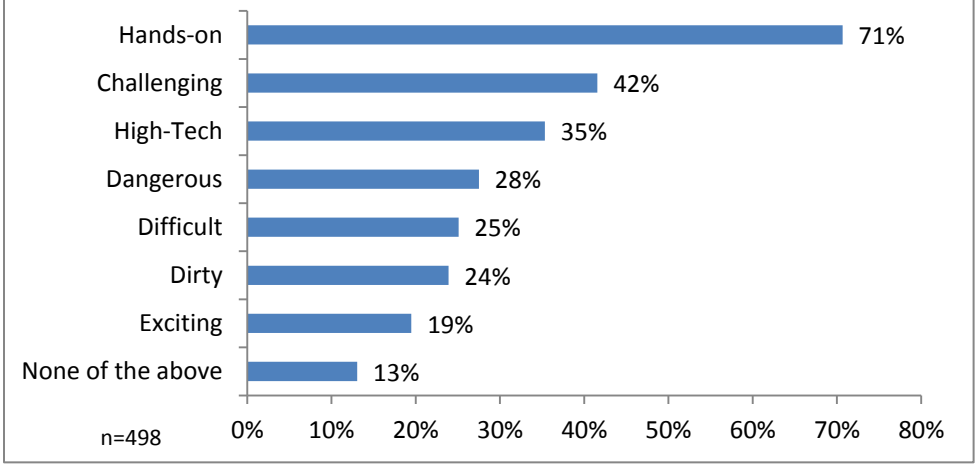
The most popular major/topic of study among the respondents was healthcare, the field of study for a third of the respondents. Engineering and architecture was the field of study for 3% of respondents, and production, mechanical, and repair trades was the field of study for 2% of respondents. Of the nine students in this latter group, three were age 45 or over and one was within the 25-34 age group.

Figure 5.19: Major/Topic of Current College Studies

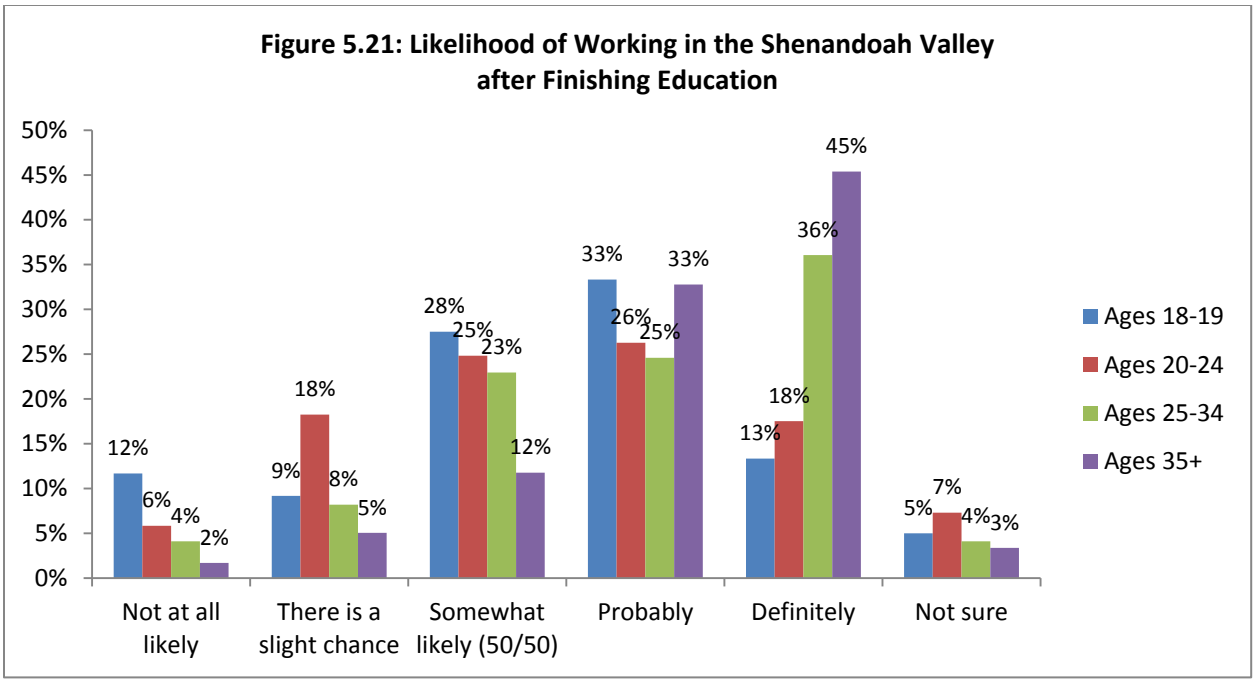


When asked to describe their feelings about manufacturing, results were similar to those expressed by the high-school students. Answers varied by age for the respondents. The most popular description was “hands-on” (71%) followed by “challenging” (42%). Ages 18-34 were more likely to feel manufacturing was dangerous (30%) compared to ages 35+ (19%). Ages 18-21 were more likely to feel manufacturing was difficult (31%) compared to ages 22+ (21%). Ages 22-34 were more likely to feel manufacturing was dirty (31%) compared to those younger or older (31%)

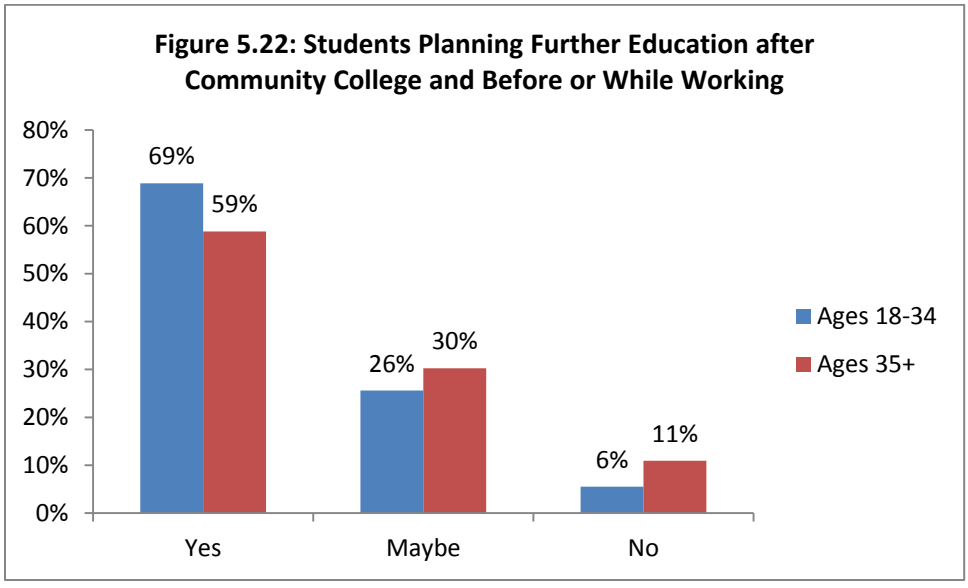
Figure 5.20: Descriptions of Feelings about Manufacturing



Nearly half or more of every age cohort among the community college students answered they would likely work in the Shenandoah Valley after finishing their education. The perceived likelihood of staying in the region, however, generally increases with age. For example, 21% of 18-19 year olds consider that there is a slight chance at best that they will work in the Shenandoah Valley after education; this compares to just 7% of students age 35 and up.



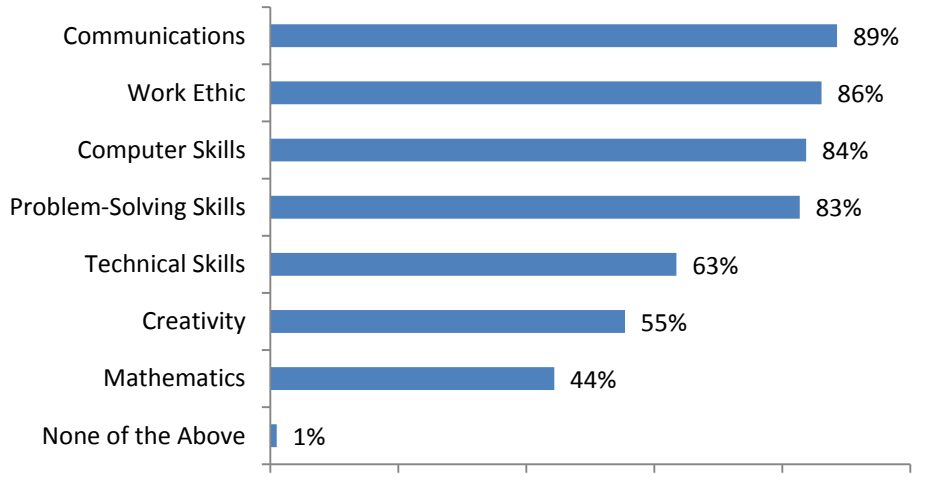
Most of the students who were surveyed reported they were planning to continue their education after finishing their community college studies. Of those students in the 18-34 age group, 69% said they planned to further their education before or while working, and 59% of those age 35+ also planned to continue their education. Among all those planning to further their education after community college, 68% planned on pursuing a bachelor's degree; in addition, 14% planned on pursuing a postgraduate degree, 7% planned on an associate's degree, 2% on something else, and 10% did not know.



About a quarter of the students reported being aware that regional companies are seeking to hire manufacturing workers. This awareness was higher (37%) among those with a parent working in manufacturing compared to all other respondents (23%).

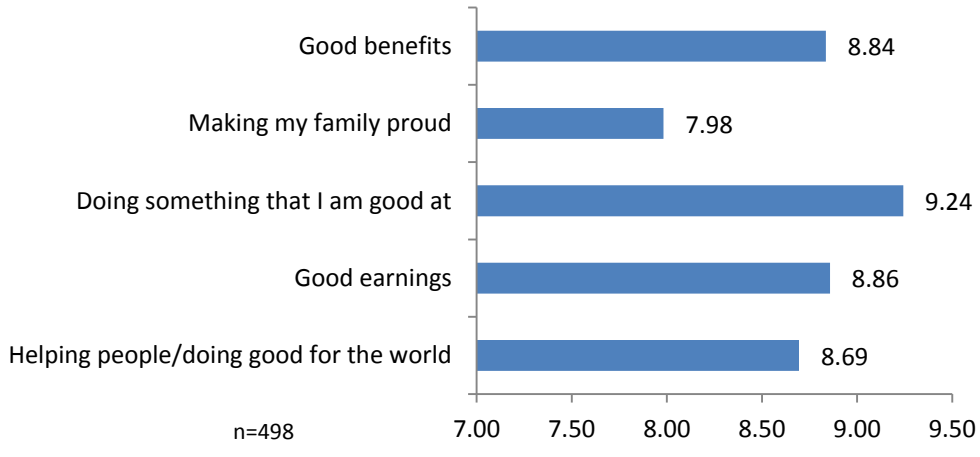
When asked about skills considered important for the workforce, the skills mentioned most often were communications (89%), work ethic (86%), computer skills (84%), and problem-solving skills (83%).

Figure 5.23: Skills Considered Important for the Workforce



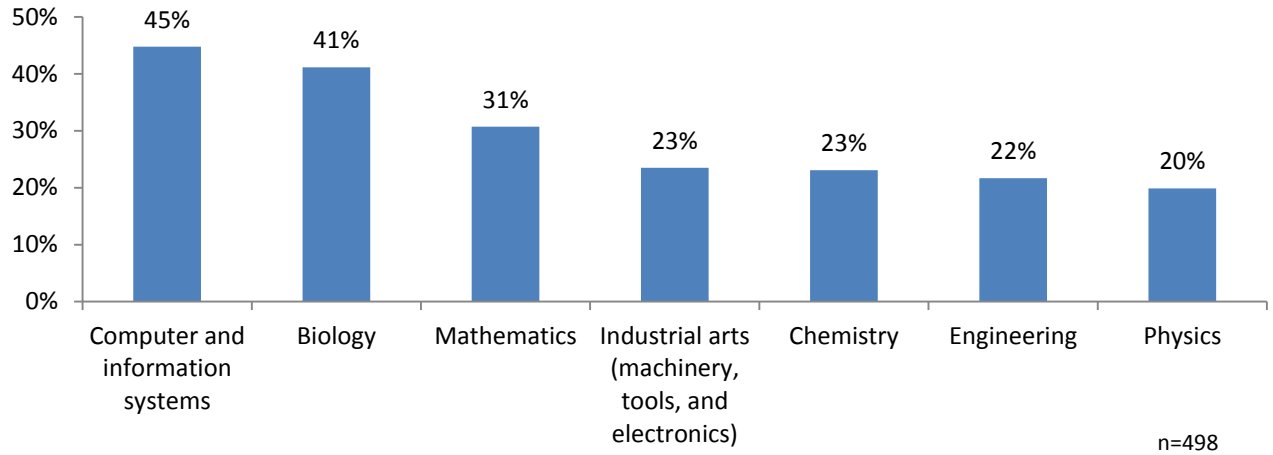
When asked to rate the importance of career aspects, "doing something that I'm good at" was the highest-rated, being graded highest on a scale of importance. The next most important aspects were "good earning" and "good benefits," receiving very similar ratings. These were followed in importance by "helping people/doing good for the world" and "making my family proud."

Figure 5.24: Importance of Career Aspects
(on a scale of 1 to 10; 1=not important at all and 10=very important)

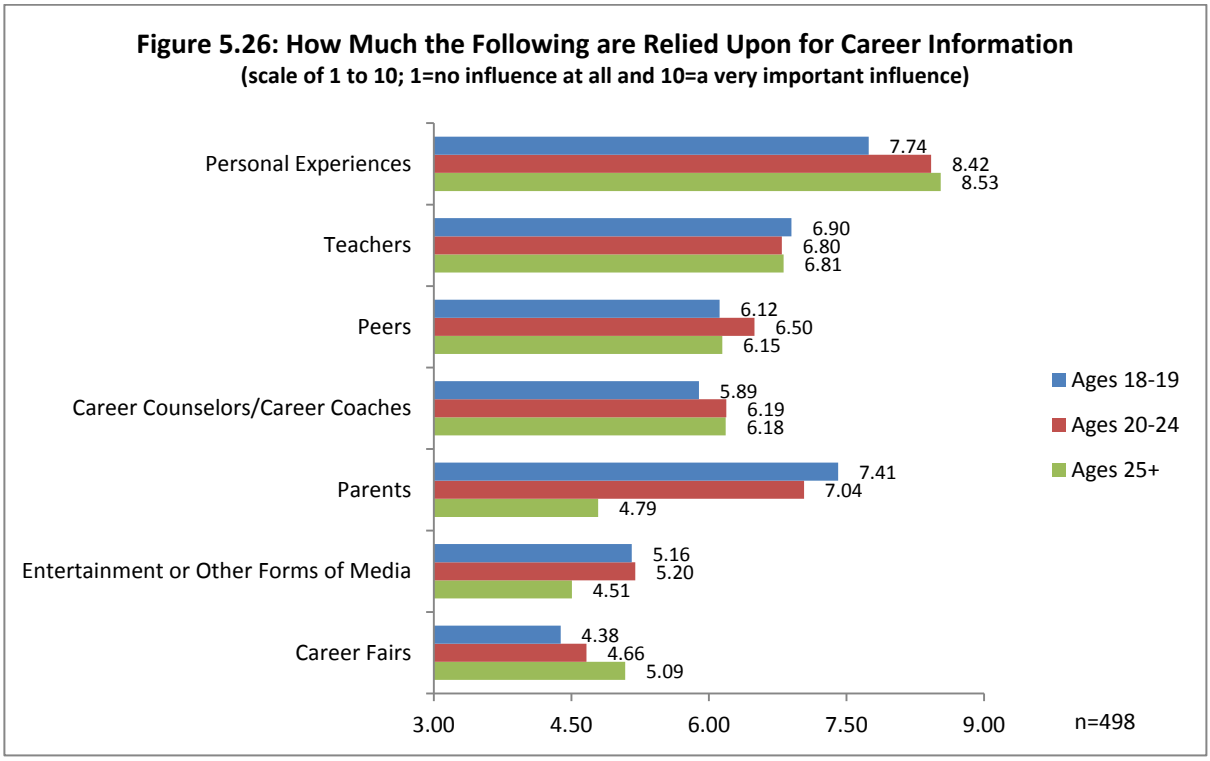


To gauge general subject interest, seven fields of study were presented to community college students to rate on a scale of 1 to 5, with "5" meaning "very interested." Defining a "high level of interest" as a 4 or 5 on this scale, a high level of interest was greatest for computer and information systems (45%) and lowest for physics (20%). Industrial arts had a high level of interest from 23% of the students and engineering had a slightly lower interest level at 22%.

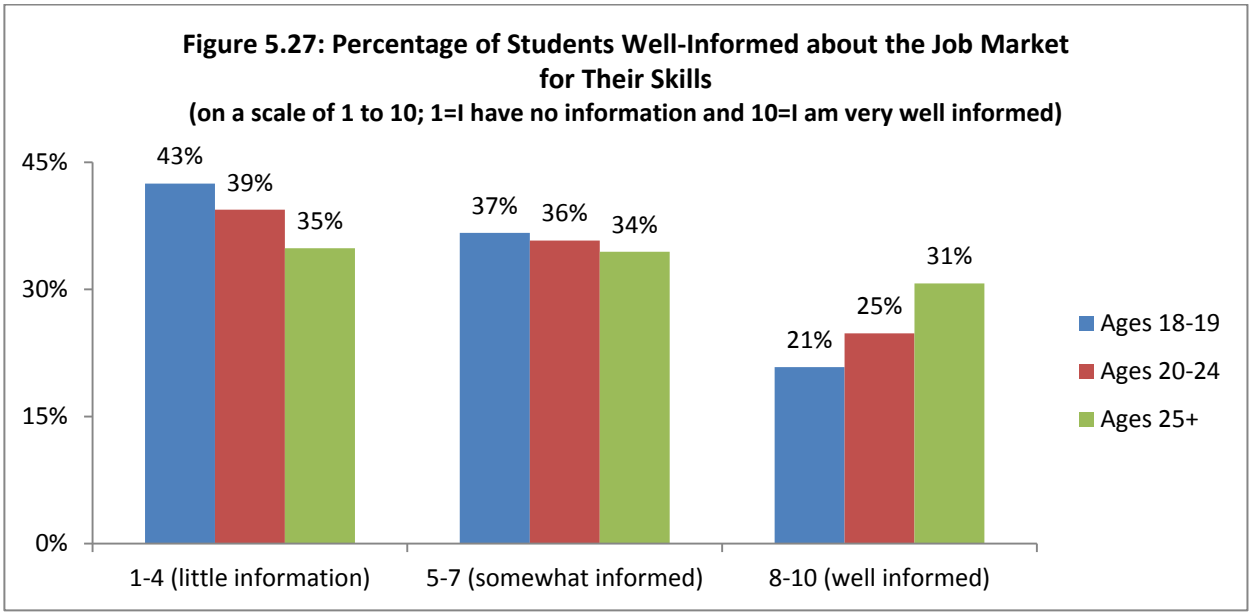
Figure 5.25: Subject Interest Ratings
(subjects rated 4 or 5 on a scale of 1 to 5 with 5=very interested and 1=no interest)



While community college students generally rely on personal experiences more than anything else for career information, the weight of this factor and others tends to vary with age. For example, the influence of personal experiences tends to increase somewhat with age while the influence of parents decreases dramatically with age. For students under age 25, after personal experiences and parents, the most influential sources for career information are teachers and peers followed by career counselors/career coaches.

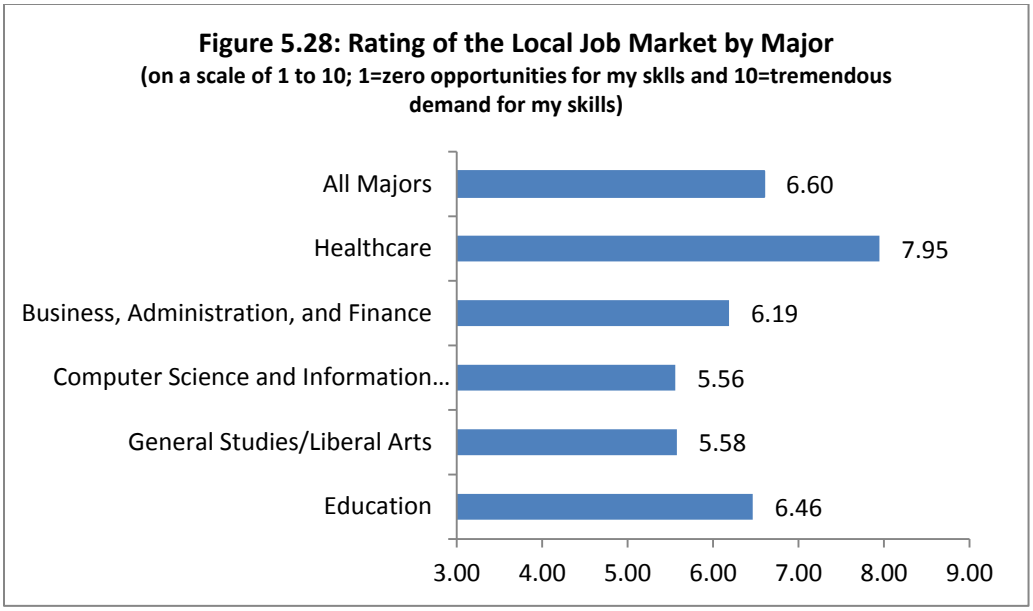


Most community college students did not consider themselves well-informed about the job market according to their skills. About 31% of students age 25 and higher considered themselves well-informed and this percentage was lower among younger students. Using a scale of 1 to 10, only 8% of all students answered a "10" meaning that they were "very well informed" about local job opportunities relevant to their skills.

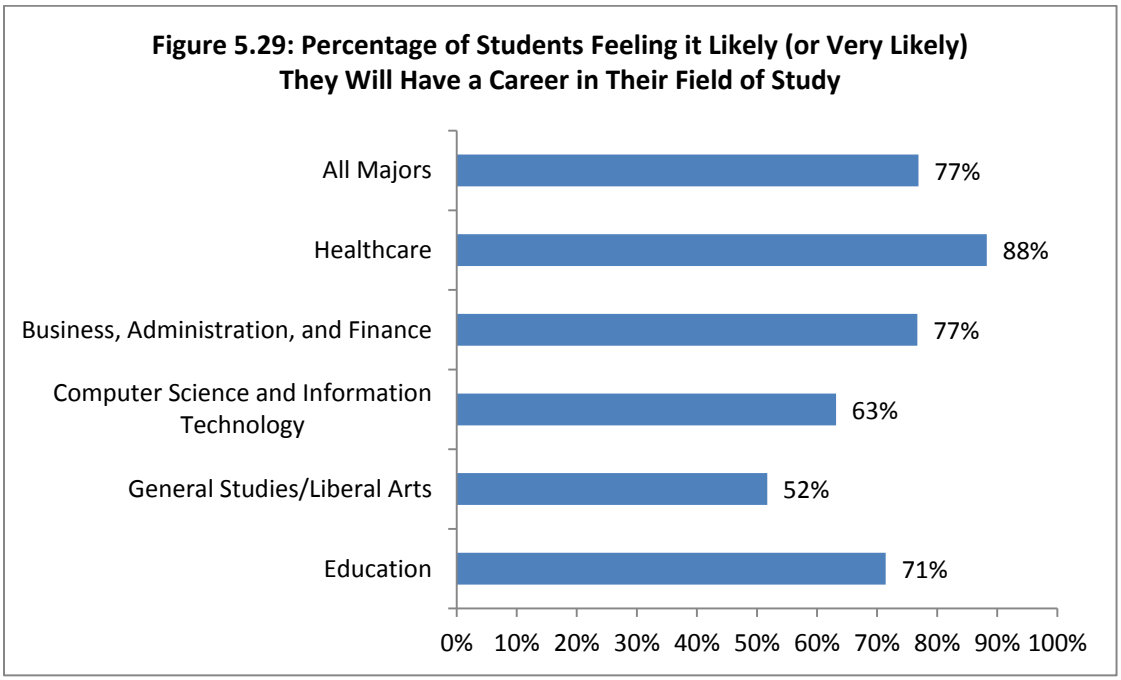


Students were next asked how good they thought the local job market was for their skills; this was ranked on a scale of 1 to 10 with "1" meaning "zero job opportunities" and "10" meaning "tremendous demand for these skills." Only 12% of students rated the local job market a 10 though slightly over half rated it at least a 7. Consequently, 7% rated the market no higher

than 2 and 19% rated it a 4 or lower. Ratings varied by major with healthcare students rating the local job market highest on average (7.95). Engineering and architecture majors rated the job market a 7 on average, though this was only based on 14 responses. Production, mechanical, and repair trades students rated the local job market a 6 on average, though this was based on only 9 responses.

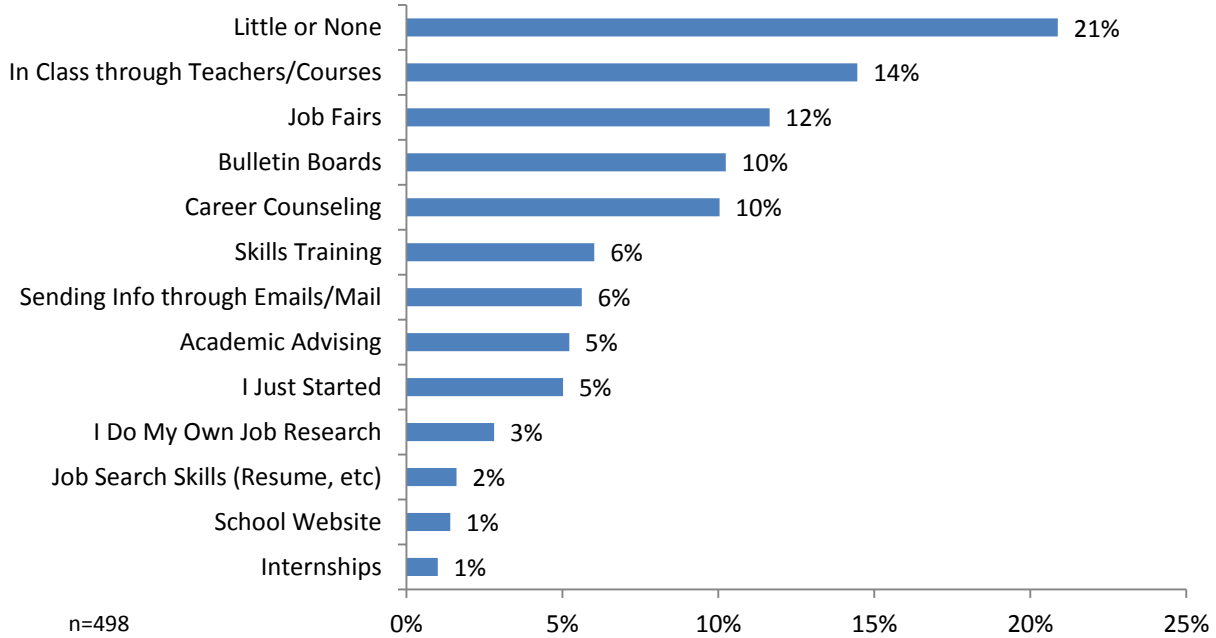


Of those students with a known major, most (77%) considered it likely that they would have a career in their field of study. This certainty was more prevalent among some majors, such as healthcare (88%), compared to others, such as computer science and information technology (63%). When asked about plans if they cannot get a job in their field of study, 31% said they would pursue an alternative career and 22% said they would try further education.



Finally, it was asked how community colleges have given students information on the local job market. Over a fifth of students reported to have received little to no local job market information from the schools. The most prevalent ways this information was passed on was in class through teachers (14%), through job fairs (12%), bulletin boards (10%), and through career counseling (10%).

Figure 5.30: Ways Community Colleges Have Given Students Information on the Local Job Market



5.4. Educator Survey

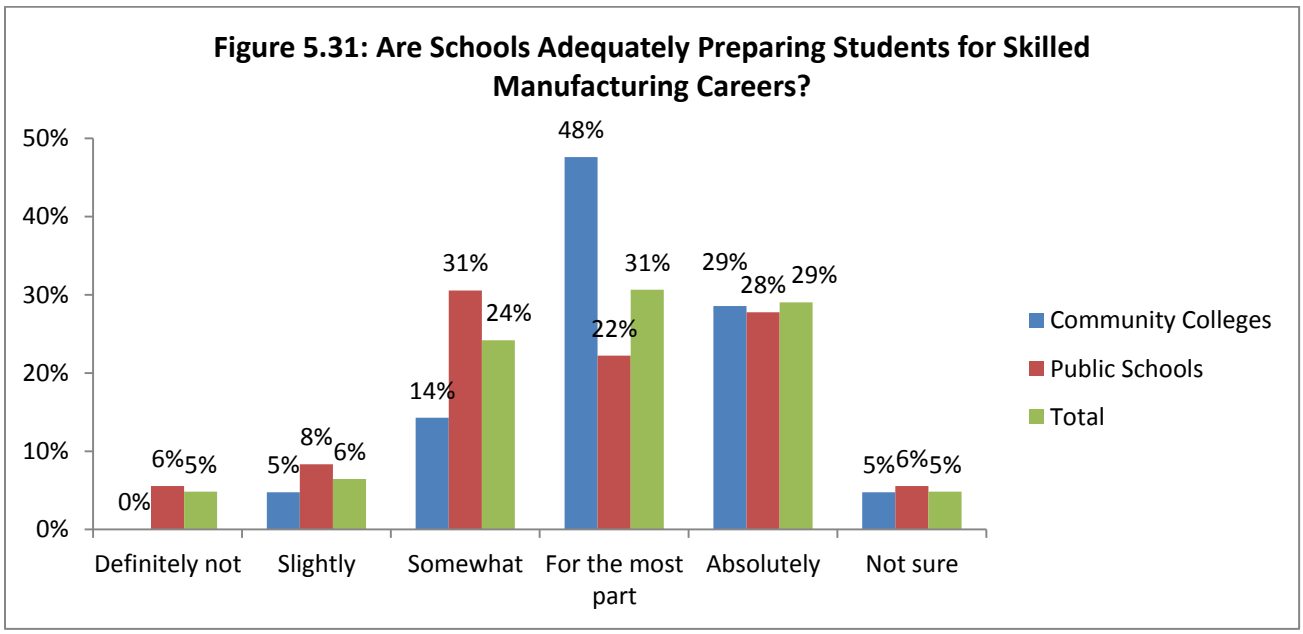
An online survey was conducted among area educators in March 2013. Sixty-two complete responses were split between community colleges and public school systems. About two-thirds (66%) of respondents said they were associated with a public school system and 58% said they were associated with a community college in the region (since respondents could be associated with more than one school or school system, this percentage sums to more than 100%). The vast majority of respondents were teachers (90%) with a small portion being in administration (8%) or other roles (5%). Among teachers, various fields of specialization were present; 23% were from the field of computer science/IT and 18% were in manufacturing or other skilled trades. The majority of respondents (59%) had worked ten or more years in the Shenandoah Valley as an educator.

Table 5.5: Educational Institution or District of Primary Affiliation of Respondents

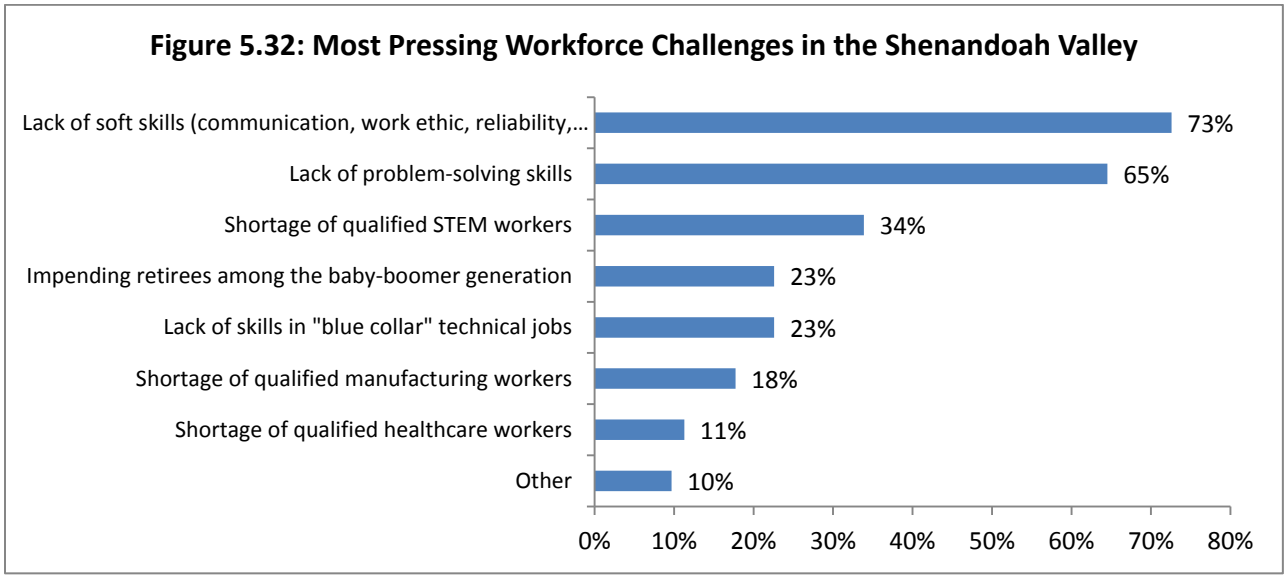
Lord Fairfax CC	23%
Frederick County PS	23%
Blue Ridge CC	21%
Shenandoah County PS	13%
Staunton City PS	6%
Waynesboro City PS	6%
Rockingham County PS	5%
Warren County PS	5%
Winchester City PS	5%
Harrisonburg City PS	3%
Dabney S. Lancaster CC	2%
August County PS	2%
Totals	
Community College	**58%**
Public Schools	**66%**
Multiple Schools	**8%**
	n=62

Source: Chmura Online Survey

Most respondents felt that Shenandoah Valley schools are adequately preparing students for skilled manufacturing careers that are in demand locally. This opinion was stronger among community college educators than among those from public schools. Roughly three-fourths of community college educators thought regional schools were absolutely or for the most part adequately preparing students for skilled manufacturing, compared to only about half of public school educators holding the same opinion. In addition, community college teachers said on average that 36% of their students were exposed to career and technical (CTE) courses in high school or through extracurricular activities.

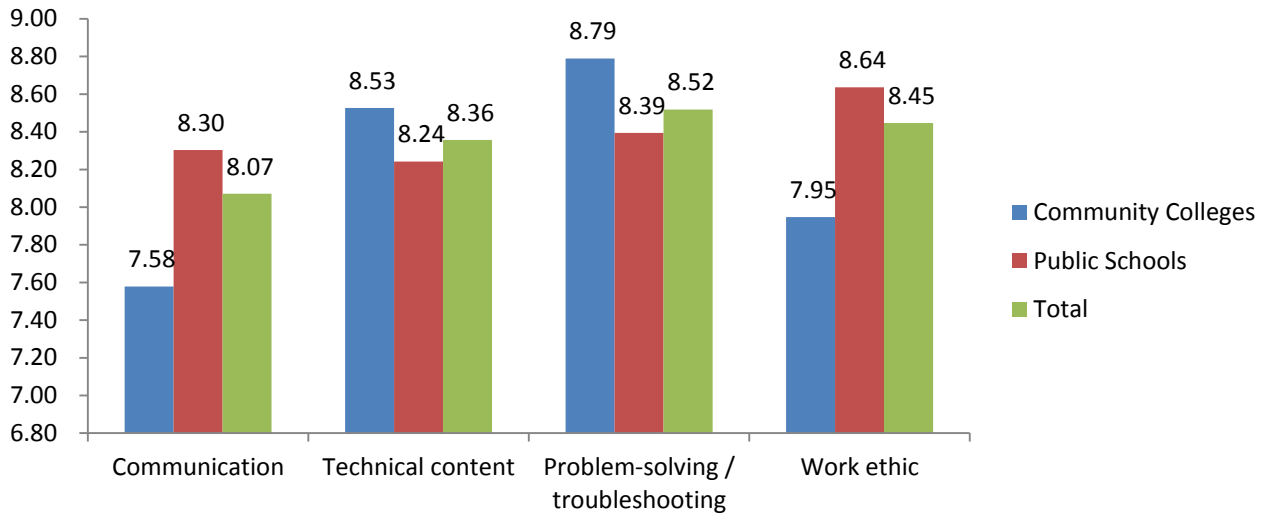


When asked what they consider to be the most pressing workforce challenges in the Shenandoah Valley region, most educators thought it was the lack of soft skills (73%), a result very similar to the business survey—where 71% of businesses said their most pressing workforce concern was that job applicants lack basic job skills. However, there was less correlation regarding the availability of manufacturing skills. Among educators, 23% said they thought one of the most pressing challenges was lack of skills in "blue collar" technical jobs and 18% thought one of the most pressing concerns was a shortage of qualified manufacturing workers; this compares to 62% of manufacturing businesses who said a pressing concern was that new hires lack the mechanical skills to perform the work. However, some of this difference in perception may be due to the context of the questions: educators were commenting on overall workforce challenges in the region while manufacturers were commenting on the most pressing concerns of their individual businesses.



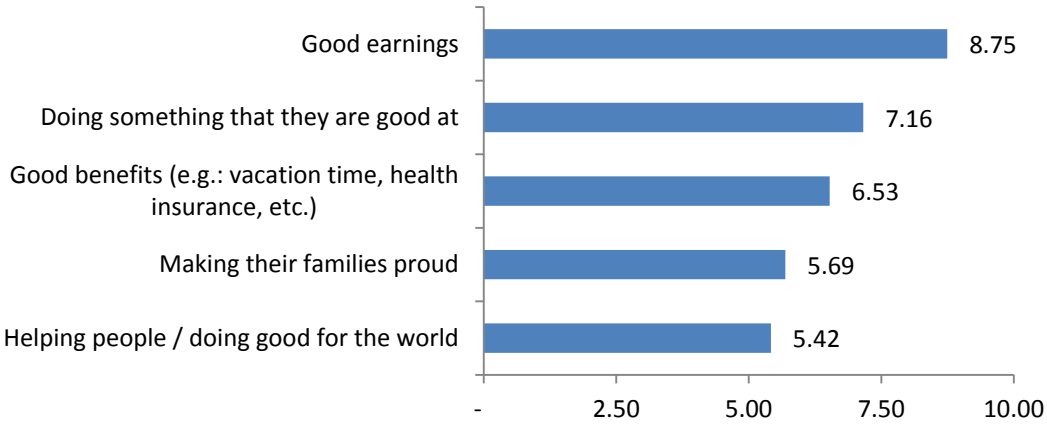
Teachers in the survey revealed that they focus differently on teaching critical skill sets depending upon their affiliation. Community college teachers reported more focus on technical content and problem-solving/troubleshooting whereas public school teachers reported more focus on work ethic and communication.

Figure 5.33: Degree of Focus on Teaching Critical Skill-Sets
(asked of teachers only; scale of 1 to 10; 10="top priority" and 1="no time at all")

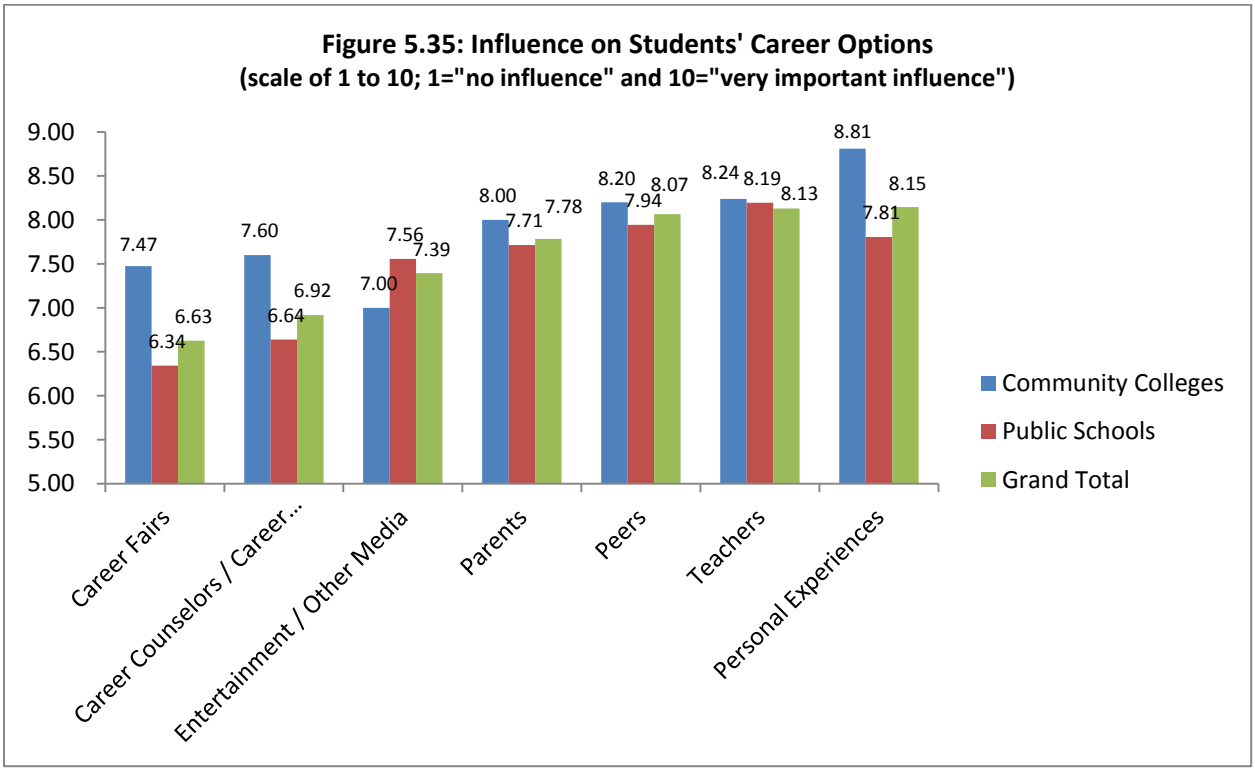


Educators ranked "good earnings" as the top driving factor that students are looking for in a career. This does not correlate with community college survey results, however, which ranked "doing something I'm good at" as the top factor. Further, educators ranked "good benefits" fairly low, whereas community college students ranked it nearly as high as "good earnings."

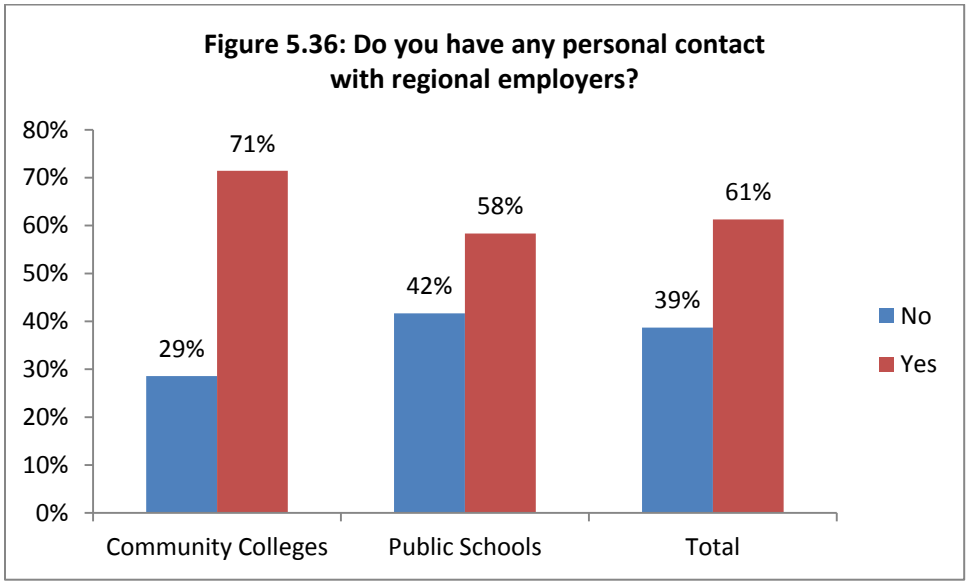
Figure 5.34: What Students Are Looking For Most in a Career
(asked of teachers only; scale of 1 to 10; 10="top driving factor" and 1="not considered at all")



Community college educators attributed personal experiences as the top influence on student's career options, an opinion in agreement with what the students reported. However, the influence of career fairs was overrated in importance by community college educators compared to how the students rated that influence.



Educators were divided almost equally into thirds on whether local educational institutions and manufacturers were communicating sufficiently about training needs. Of the 62 respondents, 34% thought communication about training needs was sufficient, 35% said communication was not sufficient, and the remaining 31% said they did not know. Regardless, most of the educators (61%) that were surveyed reported having personal contact with regional employers.



Additional questions were asked in the educator survey, especially regarding specifics as to the communication between regional educational institutions and local employers. These questions were asked in open-ended format to elicit extended and detailed replies from the respondents. These answers, as well as answers to other verbatim questions in the survey, are provided in full in the appendix.

6. Impending Worker Retirements

6.1. Background

Some claim that the impending retirement boom will not be as harsh as has been previously reported. The recent recession proved that many people who intended to retire remained in the workforce longer, either by choice or necessity. Furthermore, general improvements in health have caused many to postpone their retirements so as to expand their retirement funds. A recent study shows that 35% of respondents age 45-80 claimed that "retirement does not apply" to their situation. Furthermore, 31% of people who have yet to retire said they will continue to work full-time during their retirement either in the same position or a different position.[21]

Nevertheless, the Valley has an older population than both the state and the nation.[22] Plus, the manufacturing sector has an older workforce profile compared to the average age for all industries. And furthermore, many manufacturing occupations require physical labor which is relatively more difficult to perform for older workers compared to less physically demanding occupations. It is thus reasonable to expect that manufacturers in the Shenandoah Valley could very well be facing more difficult retirement issues than other sectors.

It was anecdotally revealed in Chmura's focus group events that companies that have been in the area for more than 25 years tend to be more concerned with retirements than companies that started up more recently—likely due to the average age profile of workers in such firms. Thus, the number of retirements expected in the region will likely be disproportionately distributed among firms. Companies that have both a large number of retirements and a heavy reliance on firm-specific skills (skills unique to that firm or niche business line) could face particular difficulties in retooling their workforce as the retirements play out.

Data in this section were compiled and derived from the Quarterly Workforce Indicators—a synthetic data set derived from a multitude of sources—provided by the U.S. Census Bureau. These data were subsequently transformed by Chmura's industry/occupation analysis and age occupational analysis of Current Population Survey data to derive an occupation age cohort data set. In addition, both industry and occupation age spread data were combined by Chmura along with retirement and mortality patterns to model retirement rates for both industries and occupations within the Shenandoah Valley; these data are sourced to Chmura. Moreover, there are multiple data sources that make up this data set. Also, the retirement rates are calculated based upon "complete" retirement, that is, when a person stops work altogether. These rates, therefore, do not capture when a person "retires" from a full-time job (in manufacturing, for example) but then resumes work in a "post-retirement" job (such as a part-time job in retail). As a consequence, these rates may understate the total rate at which employees may leave manufacturing due to age.

6.2. Industry Retirement Profile

Before retirement rates are considered, we first look at the typical spread of workers' ages among sectors in the Shenandoah Valley. Among all industries in the region, 16% of workers are age 55-64 and 7% are age 65 or over. Manufacturing is right at the regional norm in its mix of workers age 55-64 (16%); however, 10% of the manufacturing workforce is age 65 or older, more than in any other sector. The "age pipeline ratio" statistic is the ratio of workers age 25-34 to workers age 55-64; the lower the ratio, the generally fewer younger workers compared to older workers. The education sector has the lowest age

[21] Society of Actuaries, "2011 Risks and Process of Retirement Survey: Working in Retirement," July 2012

[22] The median age in the Shenandoah Valley was 39.1 years (U.S. Census 2010) compared to 37.5 in Virginia and 37.2 in the nation.

pipeline ratio (0.79) in the Shenandoah Valley while it is highest in the leisure sector (2.34—not surprising given the number of very young workers in food service establishments). Manufacturing has a 1.02 age pipeline ratio, lower than average, though certainly not the worst in the region. However, this ratio does not capture the high percentage of workers age 65 and above in manufacturing which, as we shall see, significantly affects its rate of retirement.

Table 6.1: Age Cohort Profiles, Shenandoah Valley Sectors, 2011 Q4

	Percent of Workers by Age					Age Pipeline Ratio
	<25	25-34	35-54	55-64	65+	Ratio of Workers 25-34 to 55-64
Education	13%	16%	42%	21%	8%	0.79
Wholesale	9%	18%	47%	19%	7%	0.93
TWU	10%	17%	49%	18%	6%	0.97
Health Services	14%	19%	41%	19%	8%	0.98
Government	6%	20%	47%	20%	7%	1.01
Manufacturing	16%	16%	42%	16%	10%	1.02
Information	21%	17%	39%	16%	8%	1.06
Nat. Resources	14%	19%	40%	18%	9%	1.09
FIRE	9%	21%	44%	19%	7%	1.15
Other Services	14%	19%	42%	16%	9%	1.18
Retail	19%	20%	39%	15%	7%	1.30
Construction	8%	20%	52%	15%	5%	1.36
PBS	11%	24%	43%	16%	6%	1.50
Leisure	33%	22%	31%	9%	5%	2.34
TOTAL	**16%**	**19%**	**41%**	**16%**	**7%**	**1.16**

Source: Chmura Economics & Analytics

Within the manufacturing sector, and among its largest industry groups, the fabricated metal industry has the lowest age pipeline ratio (0.88)—not surprising given the high retirement rate this group expected in the survey. The largest manufacturing industry in the Shenandoah Valley (food or beverage) has a slightly lower mix of workers in the age groups 55-64 and 65+, compared to the remaining manufacturing industries in the region. Chemical manufacturing, however, has a very high mix of workers age 65 and over (16%) in the Shenandoah Valley, which will highly impact expected retirements over the near term.

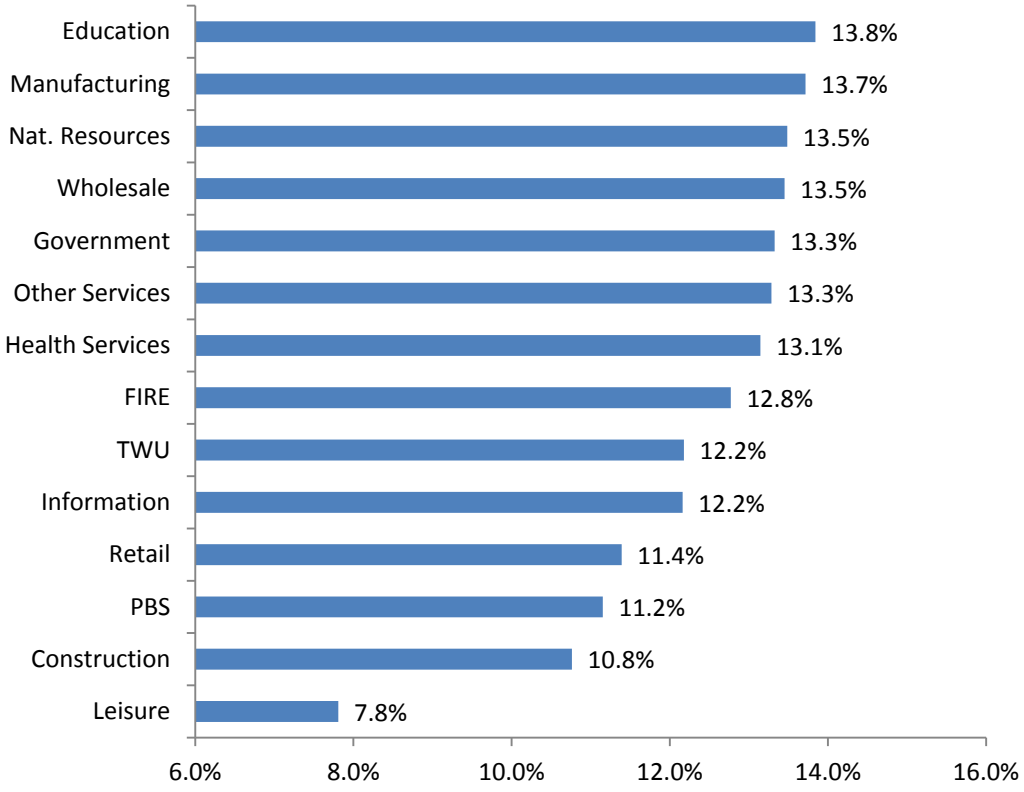
Table 6.2: Age Cohort Profiles, Shenandoah Valley Manufacturing Groups, 2011 Q4

		Percent of Workers by Age					Age Pipeline Ratio
		<25	25-34	35-54	55-64	65+	Ratio of Workers 25-34 to 55-64
321/2	Food or Beverage	14%	18%	45%	15%	8%	1.16
326	Plastics or Rubber Products	16%	15%	44%	16%	8%	0.93
323	Printing and Related	8%	18%	54%	16%	4%	1.14
332	Fabricated Metal	20%	15%	36%	17%	11%	0.88
325	Chemical	20%	15%	32%	16%	16%	0.93
321	Wood Product	14%	20%	42%	16%	8%	1.22
333	Machinery	19%	12%	42%	13%	13%	0.93
	Manufacturing TOTAL	**16%**	**16%**	**42%**	**16%**	**10%**	**1.02**

Source: Chmura Economics & Analytics

The Valley is projected to have an overall 12.1% rate of retirement over the next five years. The manufacturing sector is expected to have the second-highest retirement rate at 13.7%. As previously noted, this is a "complete" retirement rate (that is, it does not include workers that leave the manufacturing sector due to age to take jobs in another sector—jobs that may be part-time or less strenuous) and thus the number of aging workers departing the manufacturing sector may be even higher than this. The sector with the largest expected retirement rate in the region over the next five years is education (13.8%) and the lowest rate belongs to leisure (7.8%), which includes food services establishments.

Figure 6.1: Five-Year Retirement Rates by Sector, Shenandoah Valley Region, 2011 Q4



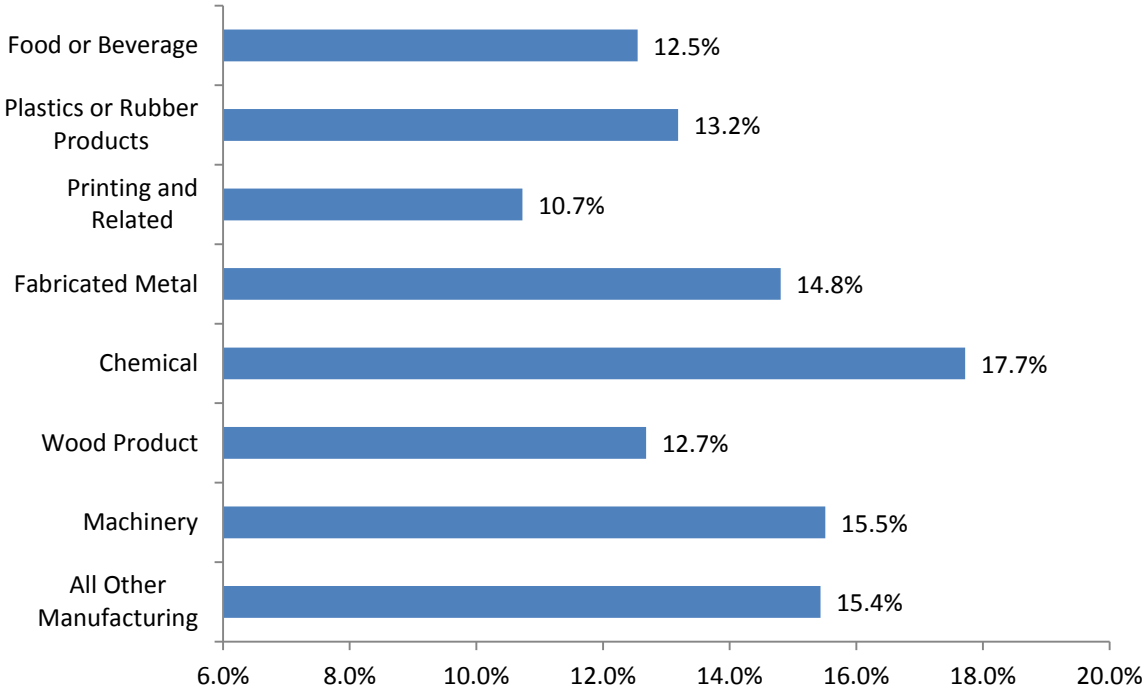
Source: Chmura Economis & Analytics

Within the manufacturing industry groups in the Valley, expected five-year retirement rates vary from a high of 17.7% in chemical to a low of 10.7% in printing and related services. The chemical industry, as shown earlier in this section, has a very high cohort of workers age 65 and above, contributing to its high expected retirement rate. The fabricated metal group is projected to have a 14.8% retirement rate—which is relatively high compared to some of the other large manufacturing sectors, though not as high as the expected 19.1% respondents from this group reported in the survey. Nevertheless, these calculated employment rate data illustrate that the 19.1% survey expectation certainly is not unreasonable for some

respondents in that industry, especially when adding in the "complete" retirements described in this section to the age-related departures that many firms consider as "retirements" from their perspective.

Among the other manufacturing groups, several of the largest have below-average expected retirement rates for manufacturing, but above-average rates compared to all industries: food or beverage (12.5% five-year retirement rate), plastics or rubber products (13.2%), and wood product (12.7%). Machinery registered an above-average rate of 15.5% for the coming five years. The remaining manufacturing industries combined for an expected 15.4% retirement rate over the next five years; these other manufacturing industries include industries such as textile products, nonmetallic mineral product, and transportation equipment.

Figure 6.2: Five-Year Retirement Rates by Manufacturing Group, Shenandoah Valley, 2011 Q4



Source: Chmura Economis & Analytics

6.3. Occupation Retirement Profile

Before looking at retirement rates by occupation, we first examine the age profiles of the occupation groups that account for most manufacturing workers in the Shenandoah Valley. We are examining here the "minor occupation groups" which are based on the SOC codes at the 3-digit level. The table below contains details on the 16 minor groups that together account for about four-fifths of manufacturing workers in the region.

Among these occupation groups, there are many with age ratios less than one (indicating more 55-64 year olds than 25-34 year olds). The lowest age ratios are found among supervisors of production workers (0.67); textile, apparel, and furnishings workers (0.67); and motor vehicle operators (0.64). With ratios a bit higher though still less than one, there are metal workers and plastic workers (0.87); other installation, maintenance, and repair occupations (0.83); sales representatives, wholesale,

and manufacturing (0.89); and business operations specialists (0.83). In addition, several groups have very high mixes of workers age 65 and above, notably: metal workers and plastic workers (11%); textile, apparel, and furnishing workers (15%); and motor vehicle operators (12%).

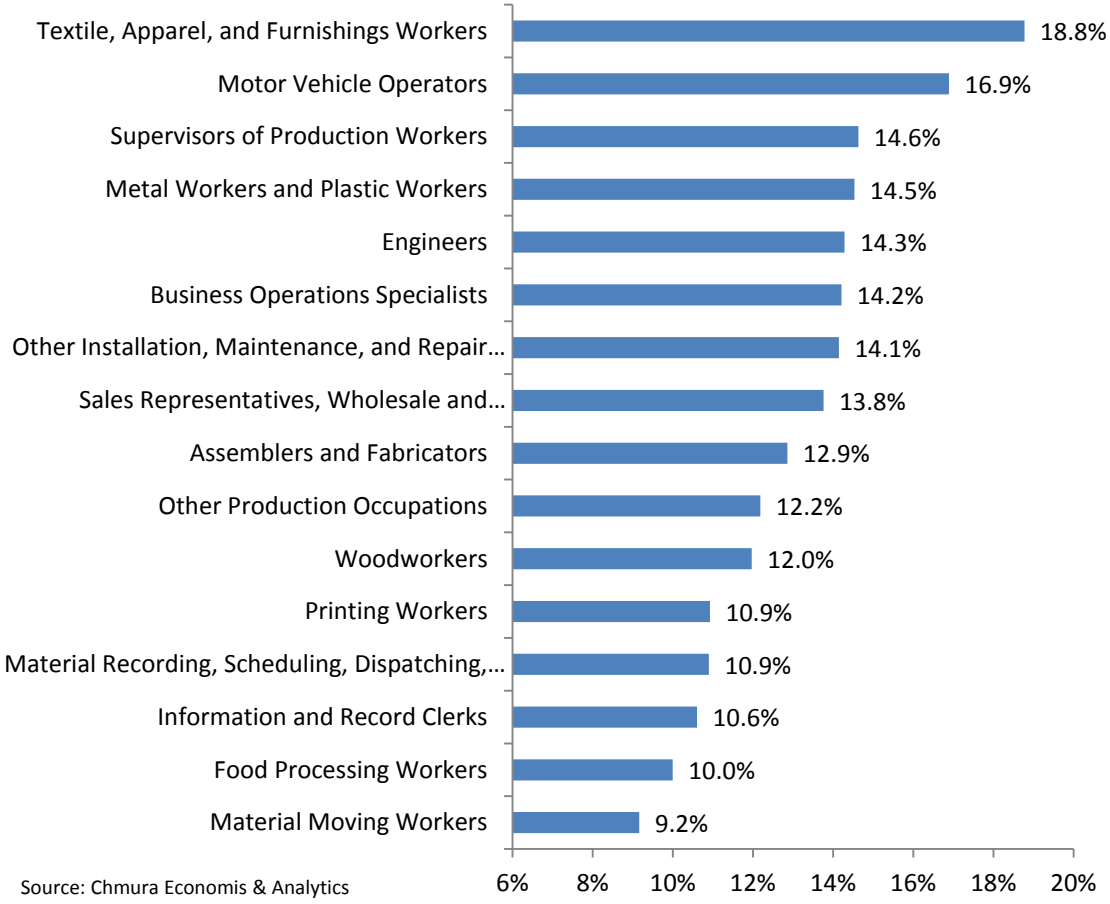
Table 6.3: Age Cohort Profiles, Shenandoah Valley, Largest Minor Occupation Groups in Manufacturing, 2011 Q4

			Percent of Workers by Age					Age Pipeline Ratio/
		Share of Mfg. Employ-ment	<25	25-34	35-54	55-64	65+	Ratio of Workers 25-34 to 55-64
51-9000	Other Production Occupations	16%	20%	17%	40%	14%	9%	1.23
51-3000	Food Processing Workers	10%	13%	21%	48%	14%	5%	1.50
53-7000	Material Moving Workers	10%	23%	21%	39%	12%	5%	1.73
51-4000	Metal Workers and Plastic Workers	9%	17%	15%	40%	17%	11%	0.87
51-2000	Assemblers and Fabricators	6%	19%	17%	40%	15%	9%	1.16
49-9000	Other Installation, Maintenance, and Repair Occupations	4%	10%	16%	47%	19%	9%	0.83
51-5000	Printing Workers	4%	8%	18%	53%	16%	5%	1.08
51-1000	Supervisors of Production Workers	4%	4%	14%	53%	21%	8%	0.67
43-5000	Material Recording, Scheduling, Dispatching, and Distributing Workers	3%	18%	20%	40%	16%	6%	1.26
51-6000	Textile, Apparel, and Furnishings Workers	3%	14%	13%	38%	20%	15%	0.67
53-3000	Motor Vehicle Operators	2%	5%	13%	49%	21%	12%	0.64
41-4000	Sales Representatives, Wholesale and Manufacturing	2%	7%	17%	49%	19%	8%	0.89
43-4000	Information and Record Clerks	2%	21%	21%	37%	15%	6%	1.35
13-1000	Business Operations Specialists	2%	6%	18%	48%	21%	8%	0.83
51-7000	Woodworkers	2%	14%	20%	42%	17%	7%	1.18
17-2000	Engineers	2%	7%	21%	43%	19%	9%	1.09

Source: Chmura Economics & Analytics

Looking at these same manufacturing-intensive occupation groups, there are a wide range of expected retirement rates over the coming five years in the Shenandoah Valley. The highest expected five-year retirement rates are projected for textile, apparel, and furnishing workers (18.8%) and motor vehicle operators (16.9%). Among production occupations, the highest retirement rates are forecast for supervisors of production workers (14.6%) and metal workers and plastic workers (14.5%). The lowest expected retirement rates for the Valley's production workers are found among printing workers (10.9%) and food processing workers (10.0%).

Figure 6.3: Five-Year Retirement Rates by Minor Occupation Groups, Shenandoah Valley Region, 2011 Q4



Source: Chmura Economis & Analytics

The table to follow indicates the projected retirement rates for the forty detailed occupations most used in Shenandoah Valley's manufacturing sector. Twenty-two of these are production occupations with the rest from other occupation groups such as maintenance and repair, management, and transportation and material moving.

Among production occupations, the highest retirement rates are anticipated for machinists (19.3%) and sewing machine operators (19.8%). First-line supervisors of production workers has a relatively high retirement rate of 14.6%, not surprising given that multiple survey respondents reported this as an area of concern. Welders are projected to have a 10.6% retirement rate; this was mentioned by a significant number of survey respondents indicating expected retirements in this occupation is hitting some employers especially hard. The relatively low projected retirement rates for food processing workers (meat, poultry, and fish cutters and trimmers; slaughterers and meat packers; and food batchmakers) is consistent with the survey results from the food or beverage group expecting lower-than-average overall retirement rates.

Among non-production occupations, high retirement rates are found among industrial production managers (16.0%) and heavy and tractor-trailer truck drivers (15.7%), two occupations mentioned as areas of concern by survey respondents. Moreover, in the maintenance and repair group, the two occupations with relatively high retirement rates are industrial machinery mechanics (15.6%) and maintenance and repair workers, general (15.5%). Again, this is consistent with the survey results where respondents reported maintenance and mechanics as two of the top occupations of concern in terms of expected retirements.

Table 6.4: Top Manufacturing Occupations in the Shenandoah Valley
Employment Numbers and Retirement Rates

SOC	Title	Employments 2012 Q4	Retirements (1 year)	1-year Retirement Rate*	5-year Retirement Rate*
11-1021	General and Operations Managers	2,593	62	2.4%	11.9%
11-3051	Industrial Production Managers	339	11	3.2%	16.0%
17-2112	Industrial Engineers	298	8	2.6%	13.1%
37-2011	Janitors and Cleaners, Except Maids and Housekeeping	3,618	114	3.2%	15.8%
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	1,878	51	2.7%	13.6%
43-3031	Bookkeeping, Accounting, and Auditing Clerks	2,382	87	3.7%	18.3%
43-4051	Customer Service Representatives	2,523	44	1.7%	8.6%
43-5061	Production, Planning, and Expediting Clerks	420	12	2.8%	14.2%
43-5071	Shipping, Receiving, and Traffic Clerks	1,245	25	2.0%	10.1%
43-5081	Stock Clerks and Order Fillers	3,228	64	2.0%	9.9%
43-9061	Office Clerks, General	4,105	113	2.7%	13.7%
49-9041	Industrial Machinery Mechanics	656	20	3.1%	15.6%
49-9071	Maintenance and Repair Workers, General	2,115	65	3.1%	15.5%
51-1011	First-Line Supervisors of Production and Operating Workers	1,338	39	2.9%	14.6%
51-2092	Team Assemblers	1,714	43	2.5%	12.6%
51-2099	Assemblers and Fabricators, All Other	402	9	2.3%	11.3%
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	1,347	24	1.8%	9.1%
51-3023	Slaughterers and Meat Packers	878	16	1.8%	9.0%
51-3092	Food Batchmakers	522	12	2.3%	11.6%
51-4011	Computer-Controlled Machine Tool Operators, Metal and	212	6	2.6%	13.2%
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	305	8	2.6%	13.0%
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	421	8	2.0%	9.9%
51-4041	Machinists	467	18	3.9%	19.3%
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	425	12	2.7%	13.6%
51-4121	Welders, Cutters, Solderers, and Brazers	407	9	2.1%	10.6%
51-5112	Printing Press Operators	786	16	2.0%	10.1%
51-5113	Print Binding and Finishing Workers	298	7	2.5%	12.3%
51-6031	Sewing Machine Operators	385	15	4.0%	19.8%
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	358	10	2.7%	13.3%
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders	213	5	2.4%	11.8%
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	907	26	2.9%	14.3%
51-9111	Packaging and Filling Machine Operators and Tenders	1,246	26	2.1%	10.4%
51-9196	Paper Goods Machine Setters, Operators, and Tenders	216	6	2.7%	13.3%
51-9198	Helpers--Production Workers	1,084	30	2.8%	14.0%
51-9399	Production Workers, All Other*	731	16	2.1%	10.7%
53-3032	Heavy and Tractor-Trailer Truck Drivers	3,763	118	3.1%	15.7%
53-7051	Industrial Truck and Tractor Operators	1,415	22	1.5%	7.7%
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	4,206	71	1.7%	8.4%
53-7063	Machine Feeders and Offbearers	421	9	2.2%	10.8%

53-7064	Packers and Packagers, Hand	1,588	35	2.2%	10.9%

*Retirement rates are based on 2011 Q4 age data.
Source: Chmura Economics & Analytics

7. Occupation Skills Gap Analysis

7.1 Occupational Cluster Identification

Chmura's gap analysis builds upon data uncovered with the 2007 Skilled Trades Gap Analysis report (STGAR) commissioned by the Virginia Manufacturers Association, the Virginia Workforce Council, and the Virginia Manufacturing Advisory Council. Phase 1 of this report offered an empirical analysis of the supply and demand for skilled trade workers in the following twelve categories:

1. Chemical Equipment Operators
2. Chemical Technicians
3. Computer-Controlled Machine Tool Operators
4. Electricians and Electrical Technicians
5. Extruding and Drawing Machine Setters
6. Machine Maintenance Specialists
7. Machinists
8. Multiple Machine Tool Setters, Operators, and Tenders
9. Printing Machine Operators
10. Stationary Engineers and Boiler Operators
11. Tool and Die Makers
12. Welders

The STGAR reported that the state would experience an annual shortage of trained skilled manufacturing workers of at least 2,441 and possibly as high as 11,751 between 2007 and 2010. The numbers differ based on the source, with the lower number depending on secondary data sources, and the higher number depending on survey data. The estimated percent of need met by community colleges and other training providers was between 33% and 12%, depending on the data source. Furthermore, skilled trades were projected to grow by 4.1% annually and experience an average annual retirement rate of 3.9%. Because the STGAR was primarily designed to analyze gaps at the statewide level, specific data for the Shenandoah Valley are not reported. However, numbers regarding growth rates, retirement rates, and percent of need are compared with the statewide numbers from the STGAR region in Table 7.1 below.

Table 7.1: Chmura Occupation Clusters and the STGAR Report (2007) Clusters

Chmura Clusters	STGAR Clusters
Electrical Technologies Cluster	Electricians and Electrical Technicians
Mechanical Technologies Cluster	Machine Maintenance Specialists
Machining Cluster	Computer-Controlled Machine Tool Operators
‘’	Machinists
‘’	Tool and Die Makers
Pipefitting Cluster	Stationary Engineers and Boiler Operators
Welding Cluster	Welders
Engineering Technologies Cluster	New
Computer/IT cluster	New
N/A	Extruding and Drawing Machine Setters

N/A	Chemical Equipment Operators
N/A	Chemical Technicians
N/A	Printing Machine Operators

Of the twelve categories covered in the STGAR report, not all are equally relevant to the Shenandoah Valley; Chmura chose to focus on the occupations that could naturally be clustered within 5 broad skill/occupations clusters that represented approximately 9 of the 12 STGAR occupational groupings, plus Chmura included two new occupational clusters—engineering technologies and computer/information technologies. Chmura then analyzed recent growth trends, wage trends, current estimates of unemployment by occupation, long-run growth forecasts, and an assessment of whether recent graduation rates for industrial and engineering programs in the region were sufficient to meet demand. Based on these inputs, Chmura identified those select occupations that are highly relevant to the manufacturing sector: 1) jobs that require high levels of mechanical and electrical system competency and are utilized intensively in the current manufacturing clusters; 2) jobs highly likely to either be in short supply currently or are most likely to become a constraint on growing the manufacturing sector through either existing business expansion or new business attraction.

Chmura identified nearly 70 separate occupations (> 10,000 employees) that clustered naturally into seven occupational groupings that required specialized training and coordination from the community colleges and other technical training providers. With the exception of the computer/IT cluster, the manufacturing sector represents overwhelmingly the typical industry of employment for the vast majority of the occupations that comprise the remaining clusters.

Table 7.2: Occupation Cluster Assessment in the Valley

Occupation Cluster	Current Employment - Select Cluster Positions	Annual Demand - Newly Trained* Workers	Potential Unmet Demand Based on Program Completion*	Enrollment Capacity at Regional Schools	Active Regional Apprenticeships[23]
Electrical technologies cluster	1,587	81	80% to 90%	Sufficient	48
Mechanical technologies cluster	3,238	157	70% to 80%	Sufficient	121
Machining cluster	1,046	56	90% to 100%	Low	125
Pipefitting cluster	757	44	90% to 100%	Low	1
Welding cluster	407	18	70% to 80%	Low	23
Engineering technologies cluster	1,194	53	50% to 60%	Sufficient	4
Computer/IT cluster	3,036	132	0% to Slight Surplus	Sufficient	N/A

Source: Chmura Economics & Analytics
*Postsecondary degree (associate's or bachelor's) or professional credential/certificate

The Valley has made meaningful and measurable progress in alleviating skill shortages across several technical and skilled-trades occupations as documented in the earlier STGAR workforce study. This analysis indicates the largest potential shortfall—and the most candidates for a group of occupations that could hamper business attraction and expansion—are the

[23] If you simply examine postsecondary degree/certification completions there are several occupations within each cluster with substantial shortfalls. This is further complicated by the fact that the region's apprenticeship earners' credentials are not counted in the National Center for Education Statistics.

engineering technologies occupational cluster that features 4-year (or higher) degreed engineers and some engineering technician positions that typically require at least an associate's degree in an engineering-related field.

Figure 7.1: Relevant Factors in Skills Gap Analysis

2-Year Growth Trend: This factor identifies those occupations that have experienced above trend (>1.2%) growth in the 4-quarter moving average of employment by occupation from the period Q4-2011 to Q4-2012.

Unemployment Rate: This factor identifies those occupations that currently have below trend (<5.6%) unemployment rates as of Q3-2012.

Potential Local Education Shortage: This factor identifies those occupations in the Shenandoah Valley region where the training concentration score—a measure of local graduates in specific occupation-related programs to national norms—is below 75% in 2012.

Potential Virginia Education Shortage: This factor identifies those occupations in Virginia where the training concentration score—a measure of local graduates in specific occupation-related programs to national norms—is below 80% in 2012.

Local Emerging Skills Gap: This factor identifies those occupations in the SV region where Chmura's model project and supply gap will emerge in the coming 5 years. This estimate is based on long-run estimates of supply and demand for each occupation based on industry employment trends. Employment supply and demand projections are based on employment data as of Q4-2012.

5-Year Growth Trend: This factor identifies those occupations that currently have above trend (>1.6%) 5-year growth rates from JobsEQ's baseline forecast.

Average Wage: This factor identifies those occupations that currently have above-average (>$39,200) annual wage estimates

7.1.2 Electrical Technologies Cluster

This occupational cluster represents a group of occupations that manipulate, repair, and troubleshoot various electrical systems, predominantly in an industrial setting. The occupations within this cluster require high levels of knowledge, skills, and abilities related to electrical technologies, including: electrical system troubleshooting, circuitry design, basic electrical principles, and elements of robotics. Several of these positions will require training on specialized equipment including programmable logic control (PLC) systems, although nationally, a significant number of incumbent workers in these occupations do not have any formal education beyond high school. However, industry trends and the complexity of new technologies is increasingly requiring new entrants into many of these positions to have undertaken at least some postsecondary education—most typically in the form of an associate's degree or a professional certificate program. The occupations shown below each are likely to be either expanding at an above-average rate over the next five years or are in current short supply in the region relative to demand or both. These findings are generally consistent with earlier studies that looked at deficiencies in select "skilled trade" occupations; however, the current unmet need for these occupations—given the existing size of the region's manufacturing cluster—is modest compared to some of the previous studies. Many of these positions at their current employment levels could become a binding constraint on attracting new manufacturing industries to the region or on large-scale expansions of existing companies in specific sectors.

There are also a few additional electrical oriented positions—such as electrical and electronics repairers, commercial and industrial equipment (49-2096); and electric motor, power tool, and related repairers (49-2093)—that would share in the equipment and curriculum related to the electrical technologies cluster occupations shown in table 7.3. However, the current growth characteristics and recent job trends suggest these workers are not in being employed at the same rate as the positions noted in this section. In general, the related occupations not included in the charts below generally have lower skill levels and occupy positions that are more prone to automation and technological obsolescence.

Table 7.3: Electrical Technologies Cluster

SOC	Title	Employ-ment	Average Annual Wage	Average Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual Demand	Above-Average Job Gains 2-Years	Low Unemploy-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Some Post-secondary
47-2111	Electricians	861	$43,700	24	22	46			✓	✓	✓	✓	44.4%
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	174	$48,500	4	4	8		✓	✓	✓	✓	✓	52.6%
47-3013	Helpers--Electricians	114	$30,900	3	4	7			✓	✓	✓		16.3%
49-9052	Telecommunications Line Installers and Repairers	129	$49,300	4	3	7			✓	✓	✓	✓	46.7%
49-2098	Security and Fire Alarm Systems Installers	56	$43,100	2	2	4			✓	✓	✓	✓	44.2%
49-9051	Electrical Power-Line Installers and Repairers	100	$57,400	4	2	5	✓		✓	✓	✓		41.6%
49-9062	Medical Equipment Repairers	32	$47,200	1	1	2		✓	✓		✓	✓	52.9%
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairers	11	$45,400	0	0	1			✓	✓		✓	52.6%
17-3024	Electro-Mechanical Technicians	16	$55,600	0	0	1	✓	✓	✓	✓			56.2%
49-2091	Avionics Technicians	12	$54,900	0	0	1	✓	✓	✓	✓		✓	61.6%
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	21	$34,200	1	0	1	✓	✓	✓	✓			48.7%
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	23	$63,000	1	0	1		✓	✓	✓			53.1%
49-2092	Electric Motor, Power Tool, and Related Repairers	24	$41,200	1	0	0		✓	✓	✓			40.8%
49-9069	Precision Instrument and Equipment Repairers, All Other	14	$53,500	1	0	1		✓	✓	✓			52.9%
	All Electrical	1,587	$47,707	43	38	81							

Numbers may not sum due to rounding
Source: JobsEQ & Chmura Economics & Analytics

7.1.3 Mechanical Technologies Cluster

These occupations relate to a variety of occupations that manipulate, repair, and troubleshoot various mechanical systems—most generally in an industrial setting. This cluster of occupations requires high levels of knowledge, skills, and abilities related to mechanical maintenance technologies, hydraulic and pneumatic system troubleshooting, system design, basic mechanical principles, and elements of robotics. Several of these positions will require training on specialized equipment and may require completing semi-customized troubleshooting modules. While a significant number of incumbent workers in

these occupations (at the national level) do not have any formal education beyond high school, industry trends and the complexity of technologies is demanding more from these workers. For new applicants, these jobs are now requiring at least some postsecondary education—most typically an associate's degree or a professional certificate program. Each of the occupations shown below is likely to be either expanding at an above-average rate over the next five years or is in short supply in the region relative to current demand, or both. These trends are fairly consistent with the deficiencies for skilled trade occupations from previous studies in the Valley; however, the current unmet need is rather modest given the size of the Valley's manufacturing cluster. Moreover, at the current employment levels—particularly for industrial machinery mechanics (49-9041)—certain positions could be a constraint in new business attraction and expansion.

There are also additional mechanical maintenance-oriented positions—motorcycle mechanics (49-3052) and millwrights (49-9044)—who also share in the equipment and curriculum related to mechanical technologies cluster occupations (Table 7.4). However, current growth trends suggest they are not being employed at the same rate as the positions noted in this section. In general, the related occupations not included in the table below generally have lower skill levels and occupy positions that are more susceptible to long-term automation and even obsolescence.

Table 7.4: Mechanical Technologies Cluster

SOC	Title	Employ-ment	Avg. Annual Wage	Average Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual Demand	Above-Average Job Gains 2-Years	Low Unemploy-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Some Post-secondary
49-3023	Automotive Service Technicians and Mechanics	1,107	$36,300	29	20	49	✓	✓	✓	✓			31.0%
49-9041	Industrial Machinery Mechanics	656	$44,700	23	16	29		✓	✓	✓	✓	✓	39.2%
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	385	$40,400	9	6	15		✓	✓	✓			31.8%
49-3021	Automotive Body and Related Repairers	231	$39,700	6	4	10	✓	✓	✓	✓	✓	✓	22.3%
49-9098	Helpers--Installation, Maintenance, and Repair Workers	192	$27,700	9	4	13			✓	✓	✓		18.5%
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	163	$39,500	5	4	9		✓	✓	✓	✓	✓	33.4%
49-3011	Aircraft Mechanics and Service Technicians	116	$55,000	4	3	7	✓	✓		✓	✓	✓	56.3%
49-9043	Maintenance Workers, Machinery	189	$42,600	7	2	9		✓	✓	✓			37.3%
49-3053	Outdoor Power Equipment and Other Small Engine Mechanics	56	$31,700	2	1	3	✓		✓	✓			30.4%
49-3041	Farm Equipment Mechanics and Service Technicians	52	$37,300	1	1	2	✓	✓	✓	✓			33.4%
49-3022	Automotive Glass Installers and Repairers	25	$35,200	1	1	1	✓	✓	✓	✓			24.8%
49-3092	Recreational Vehicle Service Technicians	15	$36,300	0	0	1		✓	✓	✓			19.8%

	Control and Valve Installers and Repairers, Except								✓	✓	✓			
49-9012	Mechanical Door	51	$49,000	1	0	1								42.1%
	All Mechanical	3,239	$39,646	96	61	157								

Numbers may not sum due to rounding
Source: JobsEQ & Chmura Economics & Analytics

7.1.4 Machining Technologies Cluster

As with the previous clusters, the machining technologies cluster has a high propensity for skills that perform well in precision machining technologies, quality control, blueprint and engineering drawing interpretation, manufacturing cell design, and in basic metalworking. Also common to the previously discussed clusters is the trending of these workers into robotics competencies. Further, training is expected to be best accomplished on specialized equipment as with the previous clusters of skills around specialty equipment. Also applicable to these occupations is the trend for a higher baseline in post-secondary education—associate's degrees and higher.

While these findings are fairly consistent with earlier manufacturing studies in the Valley, their demand is considered moderate due to the size and type of manufacturing jobs in the Valley. A sense of urgency exists for precision machining workers—computer-controlled machine tool operators, metal and plastic (51-4011) and tool and die makers (51-4111).

There are also other machining-type positions—such as lathe and turning machine tool setters, operators, and tenders, metal and plastic (51-4034) and milling and planing machine setters, operators, and tenders, metal and plastic (49-4035) who also share in the equipment and curriculum related to electrical technologies cluster occupations shown in Table 7.5. The relatively modest growth characteristics and recent employment trends suggest that these occupation clusters are not being employed at the same rate as the positions noted in this section. Typically, the related occupations not included in the charts below generally have lower skill levels and occupy positions that are approaching obsolescence.

Table 7.5: Machining Technologies Cluster

SOC	Title	Employ-ment	Avg. Annual Wage	Average Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual Demand	Above-Average Job Gains 2-Years	Low Unemploy-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Some Post-secondary
51-4041	Machinists	467	$39,200	19	5	24	✓	✓	✓	✓			36.5%
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	212	$34,700	6	5	11	✓		✓	✓	✓		39.8%
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	77	$36,400	3	1	4		✓	✓	✓			18.2%
51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	69	$27,800	3	1	4			✓	✓	✓		23.3%
51-4111	Tool and Die Makers	133	$42,300	7	1	8	✓	✓	✓	✓			49.4%
51-4051	Metal-Refining Furnace Operators and Tenders	41	$38,200	1	1	1	✓	✓	✓	✓			23.3%

	Computer Numerically Controlled Machine Tool Programmers, Metal and								✓		✓	✓		
51-4012	Plastic	30	$46,000	1	0	1								39.8%
51-4052	Pourers and Casters, Metal	17	$33,700	0	0	0			✓	✓	✓	✓		23.3%
	All Machining	1,046	$37,287	41	15	56								

Number may not sum due to rounding
Source: JobsEQ & Chmura Economics & Analytics

7.1.5 Pipefitting/Plumbing Cluster

Pipefitters and plumbers are generally grouped together as the majority of their training, technologies, and tools are common between the two positions. A pipefitter typically can layout, assemble, fabricate, maintain, and repair mechanical piping systems. Pipefitters usually work in an industrial setting and on piping that is under high pressure, which requires specialized metals that are fused together through precise cutting, threading, Victaulic grooving, bending, and welding. Plumbers tend to concentrate on lower pressure piping systems for commercial and residential application. This cluster of occupations require high levels of knowledge, skills, and abilities related to piping and plumbing systems, quality control, testing equipment, blueprint and engineering drawing interpretation, pipe threading, welding techniques and equipment, and heating, ventilation, and air conditioning technologies. Several of these positions will require training on specialized equipment such as various welding technologies. While a significant number of incumbent workers in these occupations nationally do not have any formal education beyond high school, forthcoming pipefitting and plumbing workers will be required to obtain postsecondary training—an associate's degree or a completion of a professional certificate program. The occupations shown below each are likely to be either expanding at an above-average rate over the next five years or are in current short supply in the region relative to demand or both.

These findings are generally consistent with earlier studies that looked at deficiencies in select "skilled trade" occupations, however, the current unmet need for these occupations—given the existing size of the region's manufacturing cluster—is modest compared to some of the previous studies. Many of these positions at their current employment levels are unlikely to become a binding constraint on attracting new manufacturing industries to the region or large-scale expansions of existing companies. This will remain as long as the residential and commercial construction sector remains depressed, as many of these occupations are employed in this sector as well.

There are also additional non-pipefitting positions—such as heating, air conditioning, and refrigeration mechanics and installers (49-9021)—which would also share in much of the equipment and curriculum related to plumbing and pipefitting technologies cluster occupations shown in table 7.6, but whose current growth characteristics and recent job trends suggest they are not being employed at the same rate as the positions noted in this section. Usually, this occupation is most commonly employed in construction and is unlikely to be in "high demand" until this sector moves into a cyclical hiring phase.

Table 7.6 Pipefitting and Plumbing Cluster

SOC	Title	Employ-ment	Average Annual Wage	Average Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual Demand	Above-Average Job Gains 2-Years	Low Unemploy-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Some Post-secondary
	Plumbers, Pipefitters, and								✓	✓	✓	✓	
47-2152	Steamfitters	576	$39,500	17	16	33							29.3%

47-2151	Pipelayers	63	$35,200	2	2	4	✓		✓	✓	✓			29.3%
47-2011	Boilermakers	31	$53,600	1	1	2			✓	✓		✓		28.7%
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	87	$28,300	2	4	6			✓	✓	✓			16.3%
	All Pipefitting	757	$39,150	22	22	44								

Numbers may not sum due to rounding
Source: JobsEQ & Chmura Economics & Analytics

7.1.6 Welding Cluster

Welders are tradesmen who specialize in fusing metals—steel, aluminum, brass, etc.—together through high heat and/or electric current. The term welder can be a general term to describe several different but related occupations—welders, brazers, cutters, and solders—which share a common tools and techniques. In general, this cluster of occupations requires high levels of knowledge, skills, and abilities related to welding technologies, quality control, testing equipment, blueprint and engineering drawing interpretation, basic metallurgy, and computer numeric control technologies. Several of these positions will require training on specialized equipment such as various welding technologies (MIG & TIG) and computer numeric controlled welding cells. On a national level, a significant number of current welders do not have any formal education beyond high school. However, industry trends and technology advancement makes it necessary for new entrants of these positions to acquire an associate's degree or a complete a professional certificate program. The occupations shown below each are likely to be either expanding at an above-average rate over the next five years or are in current short supply in the region relative to demand or both. These findings are generally consistent with earlier studies that looked at deficiencies in select "skilled trade" occupations, however, the current unmet need for these occupations—given the existing size of region's manufacturing cluster—is modest compared to some of the previous studies. Welders at their current employment levels are unlikely to become a binding constraint on attracting new regional manufacturing industries or large-scale expansions of existing companies. As long as residential and commercial construction remains depressed, this will hold true since many welders are employed in this sector as well.

Table 7.7: Welding Cluster

SOC	Title	Employ-ment	Average Annual Wage	Average Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual Demand	Above-Average Job Gains 2-Years	Low Unemploy-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Some Post-secondary
51-4121	Welders, Cutters, Solderers, and Brazers	407	$37,200	11	7	18			✓	✓	✓		23.9%

Numbers may not sum due to rounding
Source: JobsEQ & Chmura Economics & Analytics

7.1.7 Engineering Technologies Cluster

The engineering profession is composed of individuals that apply scientific knowledge, math, and testing technologies to design materials, structures, and systems to solve complex problems. This occupational cluster consists of practitioners of various engineering concepts and disciplines, such as mechanical systems, electrical systems, aeronautical systems, etc. This cluster of occupations requires high levels of knowledge, skills, and abilities related to various engineering disciplines, quality control theories, utilization of advanced testing equipment, blueprint and engineering drawing creation and interpretation, various industrial technologies, and software related to design and testing. Most of these positions require at least a 4-year bachelor's level degree; however, a few technician-level positions can be filled by individuals with an associate's degree or a professional certificate. The occupations shown below each are likely to be either expanding at an above-average rate over

the next five years or are in current short supply in the region relative to demand or both. These findings are generally consistent with earlier studies that looked at deficiencies in select "skilled trade" occupations, however, the current unmet need for these occupations—given the existing size of region's manufacturing cluster—is modest compared to some of the previous studies. For most of these positions, their current employment levels are highly likely to become a binding constraint on attracting new manufacturing industries to the region or large-scale expansions of existing companies. Supply in this region is particularly constrained for mechanical engineers, electrical engineers, and electronics engineers, except computer.

There are also a few additional engineering oriented positions—such as industrial engineers (17-2112) and industrial engineer technicians (17-3026)—which would also share in the equipment and curriculum related to the other engineering cluster occupations shown in Table 7.8, but whose current growth characteristics and recent job trends suggest they are not being employed at the same rate as the positions noted in this section.

Table 7.8: Engineering Technologies Cluster

SOC	Title	Employ-ment	Avg. Annual Wage	Average Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual De-mand	Above Avg. Job Gains 2-Years	Low Un-employ-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Bachelor's or Graduate Degree
17-2051	Civil Engineers	283	$73,500	9	6	14	✓	✓			✓	✓	85.1%
17-1011	Architects, Except Landscape and Naval	92	$76,200	3	2	5	✓	✓	✓	✓	✓	✓	89.2%
17-2071	Electrical Engineers	129	$86,400	4	2	6		✓	✓	✓			77.9%
17-2031	Biomedical Engineers	28	$97,000	1	2	3	✓	✓	✓		✓	✓	72.0%
17-2072	Electronics Engineers, Except Computer	96	$99,200	3	1	4		✓	✓	✓			77.9%
17-3013	Mechanical Drafters	76	$46,200	2	1	3		✓	✓	✓			24.5%
17-2081	Environmental Engineers	47	$77,600	2	1	3		✓	✓	✓		✓	88.3%
17-3022	Civil Engineering Technicians	78	$46,400	2	1	3	✓	✓	✓	✓			17.2%
17-2061	Computer Hardware Engineers	42	$106,200	1	1	2	✓	✓	✓				71.3%
17-2011	Aerospace Engineers	33	$109,800	1	1	2	✓	✓				✓	83.3%
17-3012	Electrical and Electronics Drafters	28	$59,200	1	0	1		✓	✓	✓			24.5%
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	30	$83,100	1	0	1		✓	✓	✓			68.4%
17-3011	Architectural and Civil Drafters	100	$49,800	2	0	2	✓	✓	✓	✓			24.5%
17-2161	Nuclear Engineers	16	$109,600	1	0	1		✓	✓	✓			87.3%
17-1021	Cartographers and Photogrammetrists	12	$62,700	0	0	0	✓	✓	✓			✓	75.2%
17-3019	Drafters, All Other	21	$50,300	1	0	1		✓	✓	✓			24.5%
17-3029	Engineering Technicians, Except Drafters, All Other	62	$59,100	2	0	2	✓	✓	✓	✓			17.2%
17-3025	Environmental Engineering Technicians	21	$50,900	1	0	1	✓	✓	✓	✓		✓	17.2%
	All Engineering	1,194	$74,622	34	19	53							

Numbers may not sum due to rounding
Source: JobsEQ & Chmura Economics & Analytics

7.1.8 Computer & IT Cluster

The occupations in this cluster relate to a broad array of information technology workers that utilize computer systems and software to solve problems and perform specific tasks. This cluster of occupations requires high levels of knowledge, skills,

and abilities related to various computer and information technology disciplines, computer programming languages, database and network architecture, and increasingly advanced statistical and data analysis techniques. Most of these positions require at least a 4-year bachelor's level degree; however a few positions are likely to be filled by individuals with an associate's degree or a professional certificate. In manufacturing, 279 individuals are employed in computer and mathematical occupations. This represents 1% of total manufacturing employment in the Valley; however, due to increasing sophistication in equipment, the expectation is for the percentage of computer and IT workers in manufacturing to increase.

In addition, individuals pursuing these fields tend to be exposed to and have an aptitude in STEM disciplines. Other industries employing these workers represent competition for manufacturers in the Valley.

The occupations shown below each are likely to be either expanding at an above-average rate over the next five years or are in current short supply in the region relative to demand or both.

These findings are generally consistent with earlier studies that looked at deficiencies in select "skilled trade" occupations; however, the current unmet need for these occupations—given the existing size of the region's manufacturing cluster—is modest compared to some of the previous studies. Most of these positions at their current employment levels could become a binding constraint on attracting new manufacturing industries to the region or on large-scale expansions of existing companies. The supply mix of local graduates in several IT-related fields in the region is overweight at the sub-baccalaureate level, and underweight at the bachelor's degree level.

Table 7.9: Computer and IT Cluster

SOC	Title	Employ-ment	Avg. Annual Wage	Avg. Annual Replace-ment Demand	Average Annual Growth Demand	Total Annual Demand	Above-Average Job Gains 2-Years	Low Unemploy-ment Q3 2012	Potential Local Education Shortage	Potential VA Education Shortage	Local Emerging Skills Gap	Long-run High Growth Potential & High Wage	Typical % w/ Bachelor's or Graduate Degree
15-1132	Software Developers, Applications	469	$81,100	8	13	21	✓	✓	✓		✓	✓	82.5%
15-1150	Computer Support Specialists	667	$43,600	18	12	30	✓	✓	✓		✓	✓	41.7%
15-1133	Software Developers, Systems Software	292	$104,300	5	10	15	✓	✓			✓	✓	82.5%
15-1142	Network and Computer Systems Administrators	373	$64,700	6	10	16	✓	✓			✓	✓	51.1%
15-1121	Computer Systems Analysts	403	$72,700	12	8	20	✓	✓			✓	✓	65.4%
15-1179	Information Security Analysts, Web Developers, and Computer Network Architects*	234	$70,900	4	5	9	✓	✓				✓	56.7%
15-1131	Computer Programmers	292	$62,600	7	3	10	✓	✓	✓				69.8%
15-1141	Database Administrators	108	$65,800	2	3	5	✓	✓			✓	✓	67.4%
15-1799	Computer Occupations, All Other*	170	$71,900	4	1	5	✓	✓		✓			65.4%
15-1111	Computer and Information Research Scientists	28	$85,500	1	1	2	✓	✓		✓		✓	65.4%
	All Computer	3,036	$72,310	67	65	132							

Number may not sum due to rounding

Source: JobsEQ & Chmura Economics & Analytics

8. Workforce Pipeline

8.1 Academic Program Maps

Overall, there is relatively good alignment between the capabilities, technology available, and the capacity of the region's major postsecondary training providers. For the occupations typically filled with individuals with less than a 4-year degree, the main training providers are Blue Ridge Community College, Lord Fairfax Community College, a satellite campus of Dabney S. Lancaster Community College, and the Woodrow Wilson Rehabilitation Center. Both the Virginia Military Institute and Washington & Lee University offer several engineering programs, and almost all postsecondary education providers offer programs related to computer science and information technologies.

The following table summarizes the prevalence of offerings in the postsecondary environment with the identified occupational clusters.

Table 8.1: Occupational Clusters and Aligned Training Providers in the Shenandoah Valley

Occupational Cluster	Regional Education Providers
Electrical technologies	Blue Ridge Community College Dabney S Lancaster Lord Fairfax Community College
Mechanical technologies	Blue Ridge Community College Dabney S Lancaster Lord Fairfax Community College Woodrow Wilson Rehabilitation Center
Machining	Blue Ridge Community College Lord Fairfax Community College
Pipefitting	
Welding	Dabney S Lancaster Blue Ridge Community College Lord Fairfax Community College
Engineering technologies	James Madison University Virginia Military Institute Washington & Lee University
Computer/IT	Blue Ridge Community College Bridgewater College Dabney S Lancaster Eastern Mennonite University James Madison University Mary Baldwin College Shenandoah University Southern Virginia University Virginia Military Institute Washington & Lee University Woodrow Wilson Rehabilitation Center

In addition to the postsecondary program offerings, the Valley is home to 10 dedicated technical centers offering programs in 27 different focused areas of study for high school students. In addition, other area high schools not referenced below offer courses which provide exposure to technical coursework. The following chart shows the program distribution by both region and school. The only cluster not represented is the pipefitting cluster. The welding cluster, also identified as critical, has only one program offering available.

The strength of the Shenandoah Valley economy in the future will be determined by how prepared today's students are upon entering the workforce. Growth projections among jobs requiring some postsecondary education outstrips other jobs. During the current decade, a bachelor's degree, associate's degree, and postsecondary vocational award are expected to grow by 17%, far better than the 13% for jobs requiring less than a college degree, according to the Bureau of Labor Statistics.[24] This trend includes manufacturing jobs; by 2018, 38% of jobs in the manufacturing industry will require at least some college. This represents a huge gain over the past several decades, as in 1983 just 26% of workers in the industry required at least some college.[25] Ensuring that the students who successfully complete one of these programs transition to a postsecondary program is vital.

Table 8.2 Technical Centers in the Shenandoah Valley & Cluster Program Availability

Region	School District	School	Computer/IT	Electrical Tech	Engineering Tech	Machining	Mechanical Tech	Pipefitting	Welding
Central	Multi	Massanutten Technical Center	x	x	x	x	x		x
Central	Page County Public Schools	Page County Technical Center		x			x		
Central	Multi	Valley Vocational Technical Center	x	x		x	x		x
Northern	Warren County Public Schools	Blue Ridge Technical Center	x	x	x		x		x
Northern	Frederick County Public Schools	Dowell J. Howard Center	x	x		x	x		
Northern	Multi	Mountain Vista Governor's School			x				
Northern	Shenandoah Valley Public Schools	Triplett Tech	x	x		x	x		
Southern	Multi	Floyd S. Kay Technical Center					x		

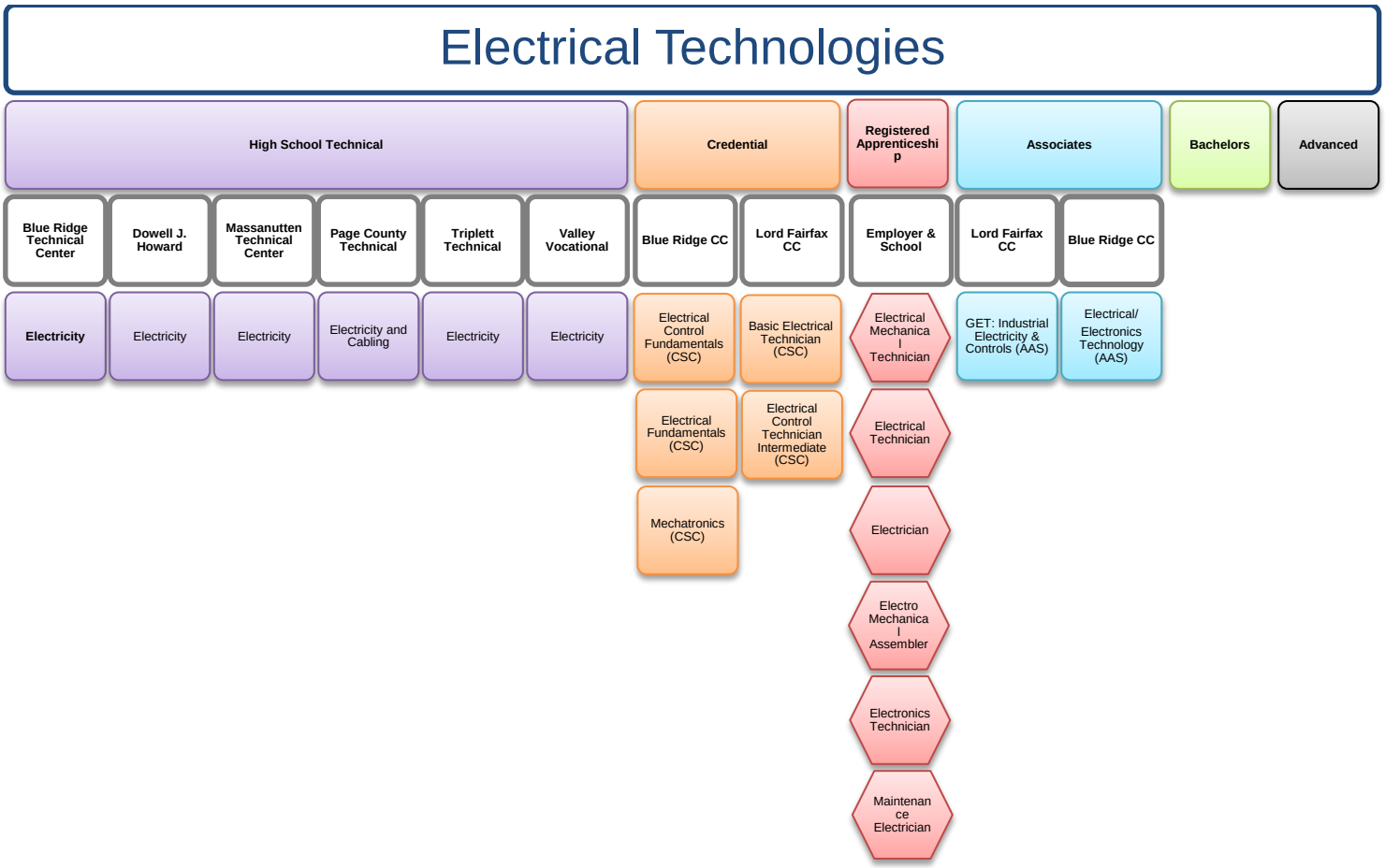
The following illustrations provide a visualization of the Valley's program offerings alongside their alignment with each of the region's targeted clusters. However, it doesn't reflect the availability of all customized workforce training programs; or, in some cases, the ability to obtain a noncredit industry-recognized credential at local community colleges. Still, it does include the secondary and postsecondary program offerings as well as the active internships (nontraditional experiential learning programs sponsored by employers). The maps are not intended to be linear representations of how students move through the career pathways system, but instead show the programs available.

[24] Dixie Sommers and Teresa L. Morisi, "Employment projections through the lens of education and training," *Monthly Labor Review, (*April 2012): 21.

[25] Anthony P. Carnevale, Nicole Smith, and Jeff Strohl, "Help Wanted: Projections of Jobs and Education Requirements through 2018" (June 2010): 83.

8.1.1 Electrical Technologies Program Map

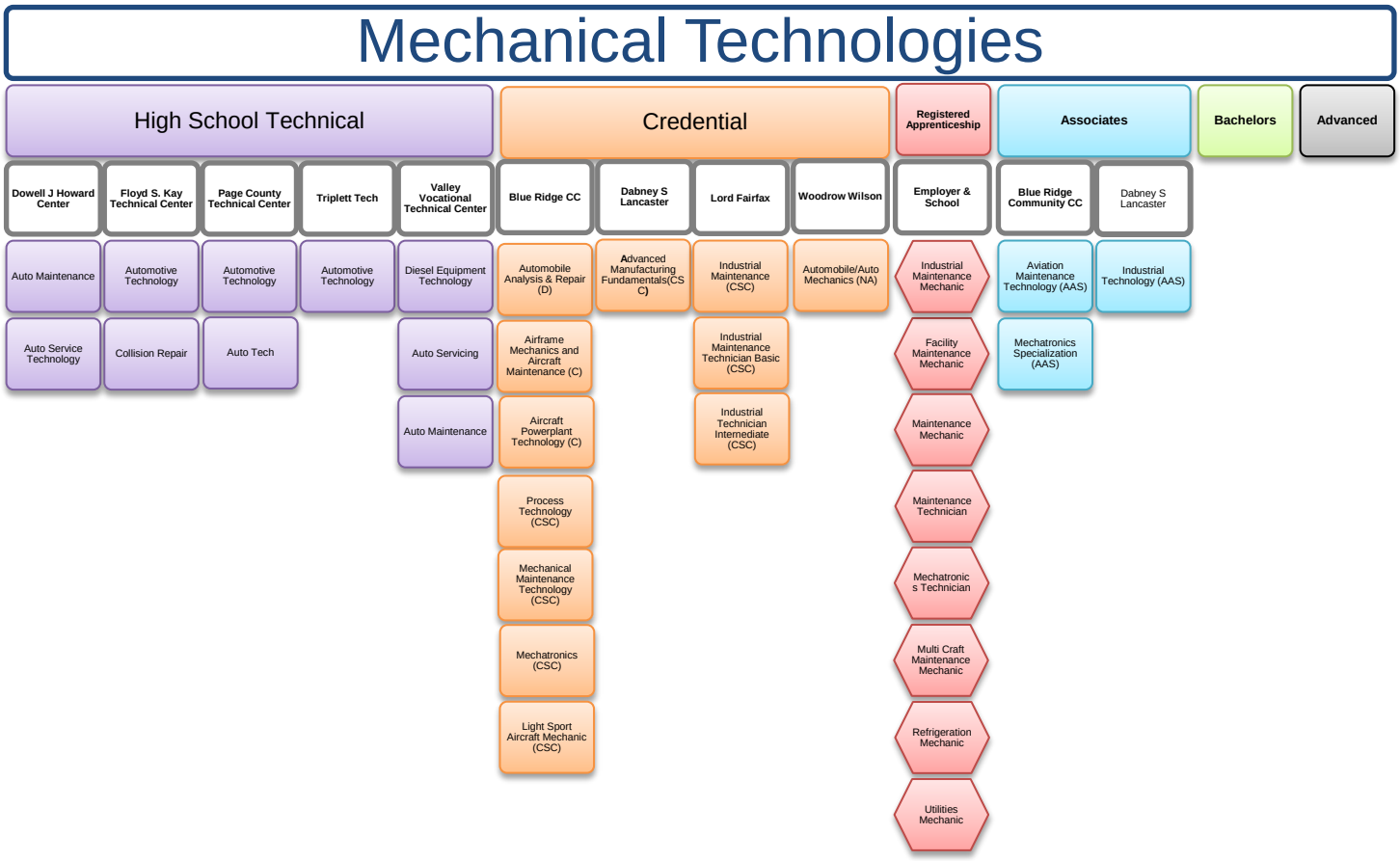
The electrical technologies program map is well developed at the high school technical level, with six area schools offering programs aligned with the cluster occupations. Blue Ridge and Lord Fairfax have programs that result in the attainment of a Career Studies Certificate. According to the Virginia Department of Labor and Industry, there are six active registered apprenticeship programs in the Valley. At the Associate's degree level, Both Lord Fairfax and Blue Ridge community colleges offer programs.



Sources: National Center for Education Statistics (IPEDS), State Council of Higher Education for Virginia (SCHEV), School and College websites, Virginia Department of Labor and Industry (DOLI).

8.1.2 Mechanical Technologies Program Map

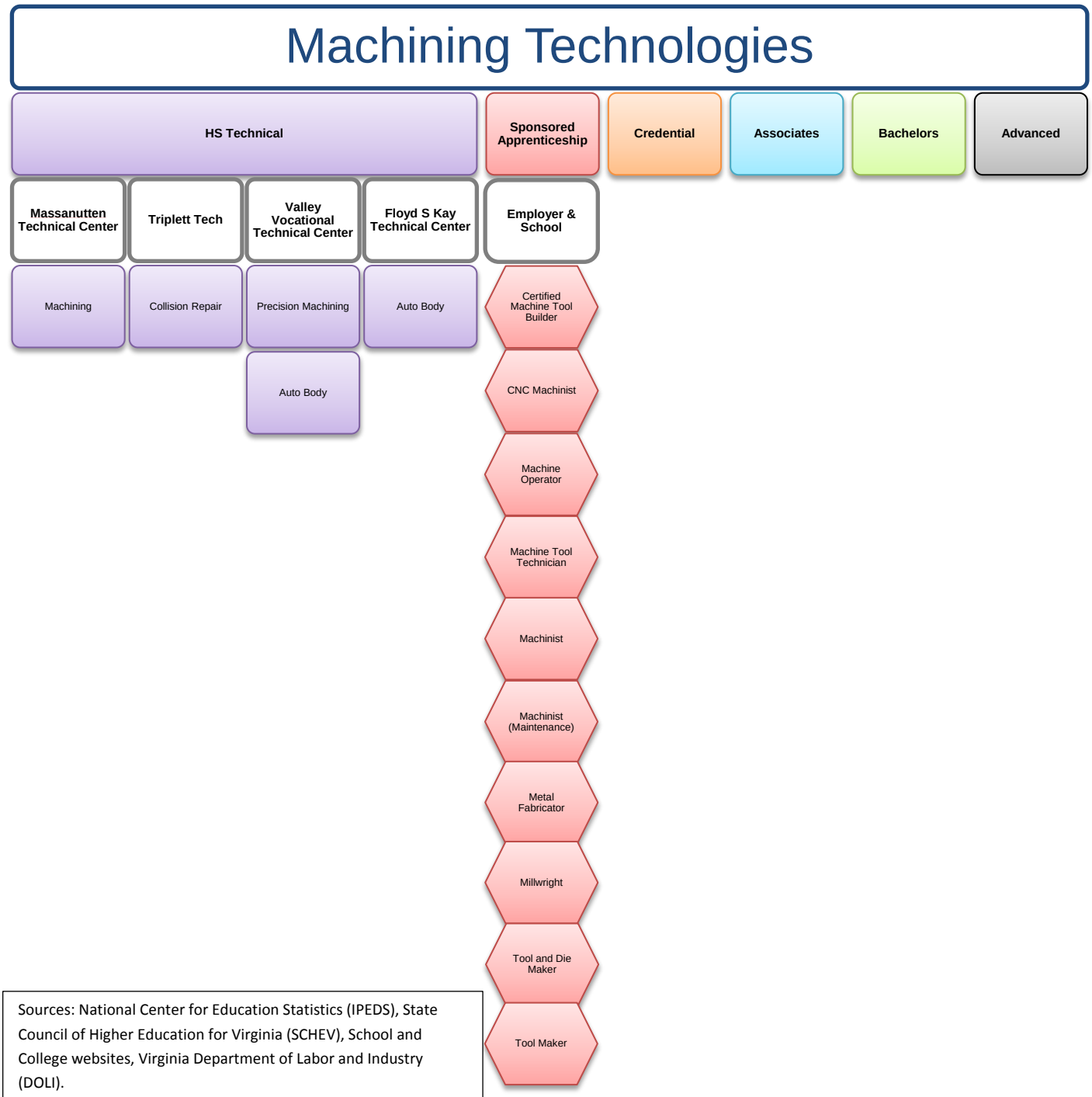
Chmura identified more than 30 programs aligned with the 13 occupations in this cluster. At the high school level, five area schools offer a total of 10 programs, the majority in the auto technician and auto servicing areas. The three area community colleges all offer some type of program that could prepare an individual for employment in one of the critical demand occupations. These range from a Certificate to a Career Studies Certificate, which involves a more extensive course curriculum. There are 8 active registered apprenticeship programs in the Valley, most focused on the preparing mechanics in various specialty areas. Blue Ridge and Dabney S Lancaster offer Associates degree programs that support this cluster.



Sources: National Center for Education Statistics (IPEDS), State Council of Higher Education for Virginia (SCHEV), School and College websites, Virginia Department of Labor and Industry (DOLI).

8.1.3 Machining Cluster Programs Map

The machining cluster program map primarily consists of programs at the high school technical-level and registered apprenticeship programs in the Valley. There are 10 active apprenticeship programs according to the Virginia Department of Labor and Industry, the most of any of the clusters. Massanutten and Valley Vocational offer machining specifically as a focus area, while the remainder of the technical programs develops skills in collision repair and auto body repair.



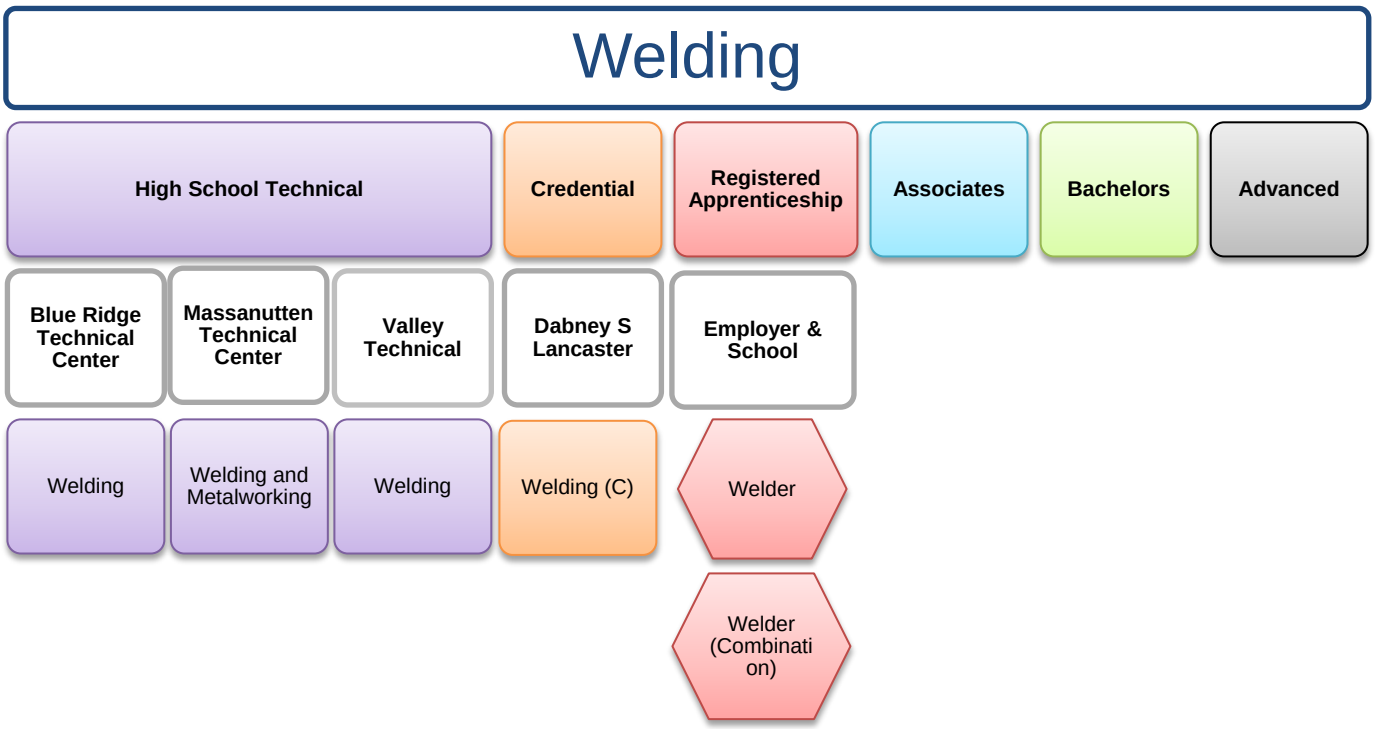
Sources: National Center for Education Statistics (IPEDS), State Council of Higher Education for Virginia (SCHEV), School and College websites, Virginia Department of Labor and Industry (DOLI).

8.1.4 Pipefitting Cluster Programs Map

There are no academic programs aligned with the Pipefitting cluster. There is an active apprenticeship program in the Valley.

8.1.5 Welding Cluster Programs Map

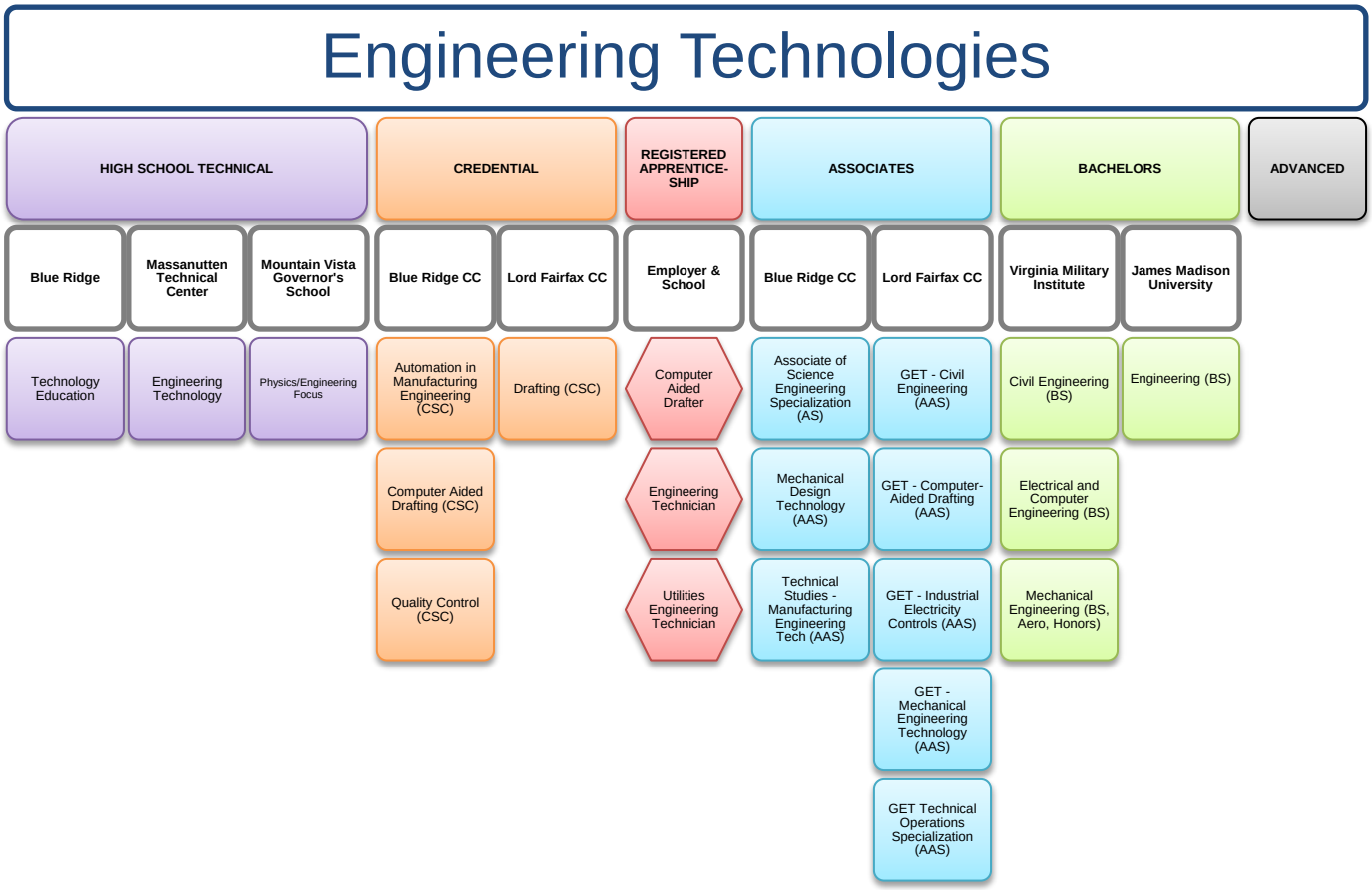
Three area vocational schools offer programs aligned with the welding cluster. Massanutten's program includes other aspects of metal working and could also provide experienced workers for some jobs in the machining technologies cluster. Only Dabney S Lancaster offers a certificate credential in welding. There are 2 active registered apprenticeship programs in the Valley and no credentialing programs at the Associate's degree level or beyond.



Sources: National Center for Education Statistics (IPEDS), State Council of Higher Education for Virginia (SCHEV), School and College websites, Virginia Department of Labor and Industry (DOLI).

8.1.6 Engineering Technologies Cluster Programs Map

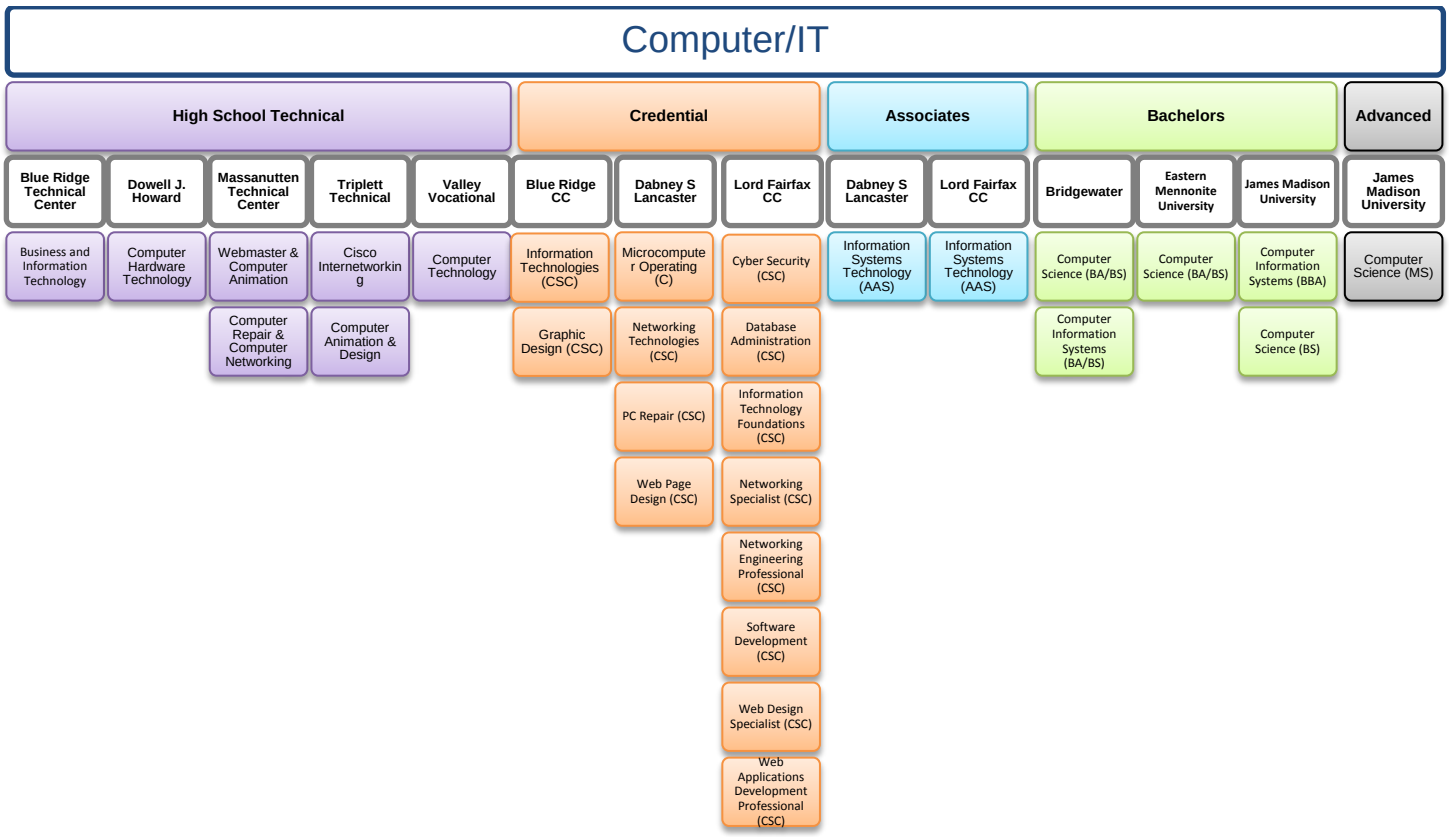
The engineering technologies cluster map has a broad range of options, from the secondary to the Bachelor's degree level. Occupations in this cluster typically require some post-secondary education. These 22 programs range from engineering and technology education at the high school vocational level, to Bachelor's degree offerings at Virginia Military Institute and James Madison University.



Sources: National Center for Education Statistics (IPEDS), State Council of Higher Education for Virginia (SCHEV), School and College websites, Virginia Department of Labor and Industry (DOLI).

8.1.7 Computer/IT Cluster Programs Map

The computer/IT occupational cluster includes occupations that require a broad range of educational attainment. The region has a fairly robust menu of program offerings. Five of the region's technical centers offer programs aligned with the target occupations in this cluster. Further, the three community colleges support certificate and careers studies certificate programs. Bridgewater, Eastern Mennonite University and James Madison University offer Bachelor's degree programs in Computer Science and Computer Information Systems. James Madison offers a Master's degree program in Computer Science. There are no active apprenticeship programs in the Valley for occupations in this cluster.



Sources: National Center for Education Statistics (IPEDS), State Council of Higher Education for Virginia (SCHEV), School and College websites, Virginia Department of Labor and Industry (DOLI).

8.2. Non-Linear Career Pathways

While the academic program maps suggest a possible linear path towards employment in one of the targeted occupational clusters, household survey data reveals that a significant portion of the workforce pipeline is due to adult worker transitions from one occupation to another. (An occupation that transitions into another occupation is sometimes termed a "feeder" occupation). These patterns are especially important for occupations requiring previous work experience, occupations that are being phased out, and occupations that may undergo extended bouts of unemployment—in these cases, many adult workers would be in need of career transitions.

This section contains examples of pathways for six occupations identified in the preceding sections as being in demand in the Shenandoah Valley region. These pathways are based on survey data and so are depicting actual worker flows. Each pathway does not attempt to depict all worker flows for a given occupation or set of occupations, but rather highlight some of the more popular inter-occupation paths.[26]

The actual web of career pathways that workers take from one occupation to another is both too large and complex to represent fully, especially in static, two-dimensional representations as shown in this report. The approach taken in the six

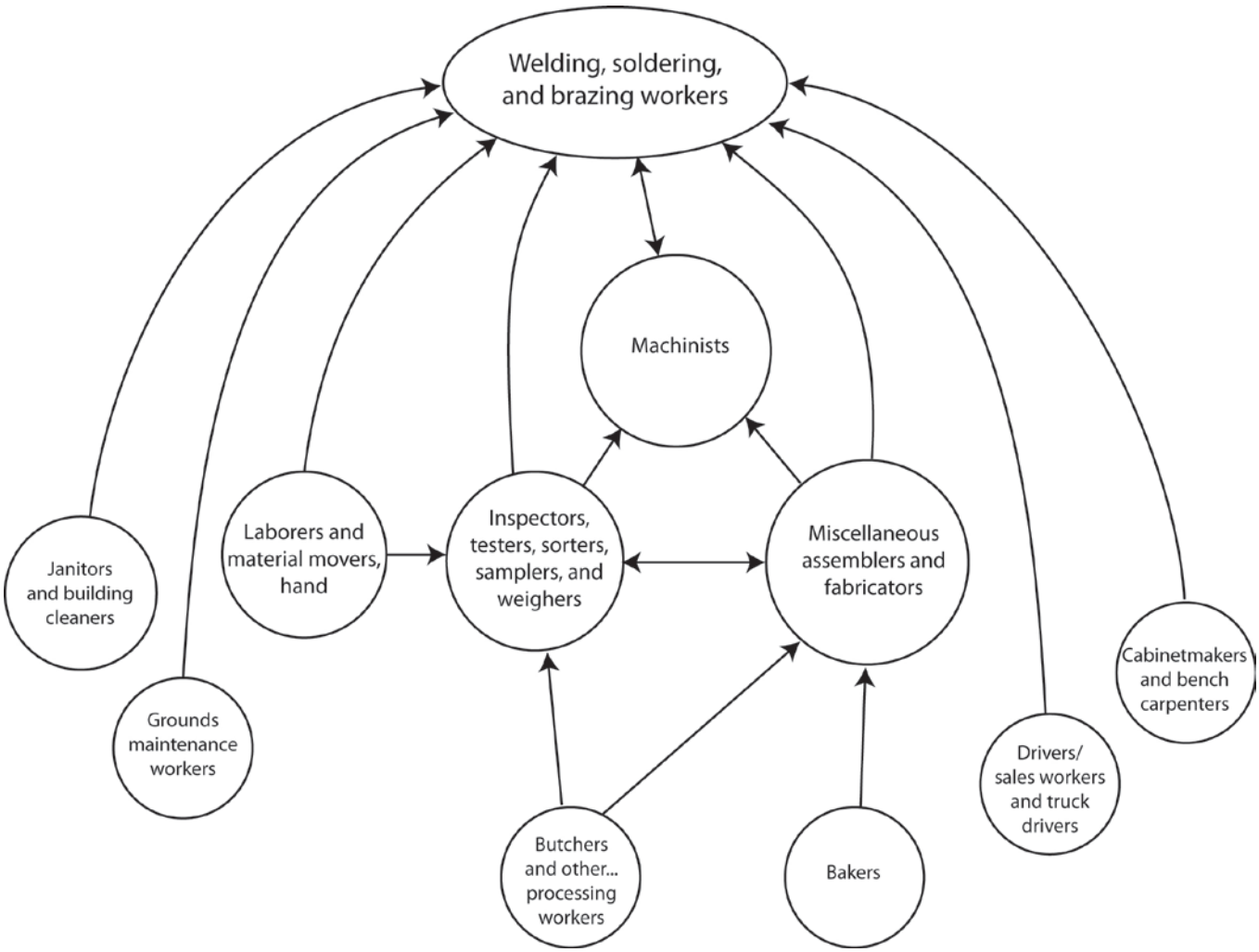
[26] Note that the occupation definitions presented in the pathways are based upon the 2010 Census Codes, described here: http://www.bls.gov/cps/cenocc.pdf. Source data for these pathways are based upon Chmura's analysis of Current Population Survey data.

pathways shown in this section is to display up to the top seven occupations that flow into the target occupation. Furthermore, for each of the top three feeder occupations that flow into the target occupation, the three largest occupations that flow into each of these feeder occupations are also displayed.

8.2.1. Welders' Pathway

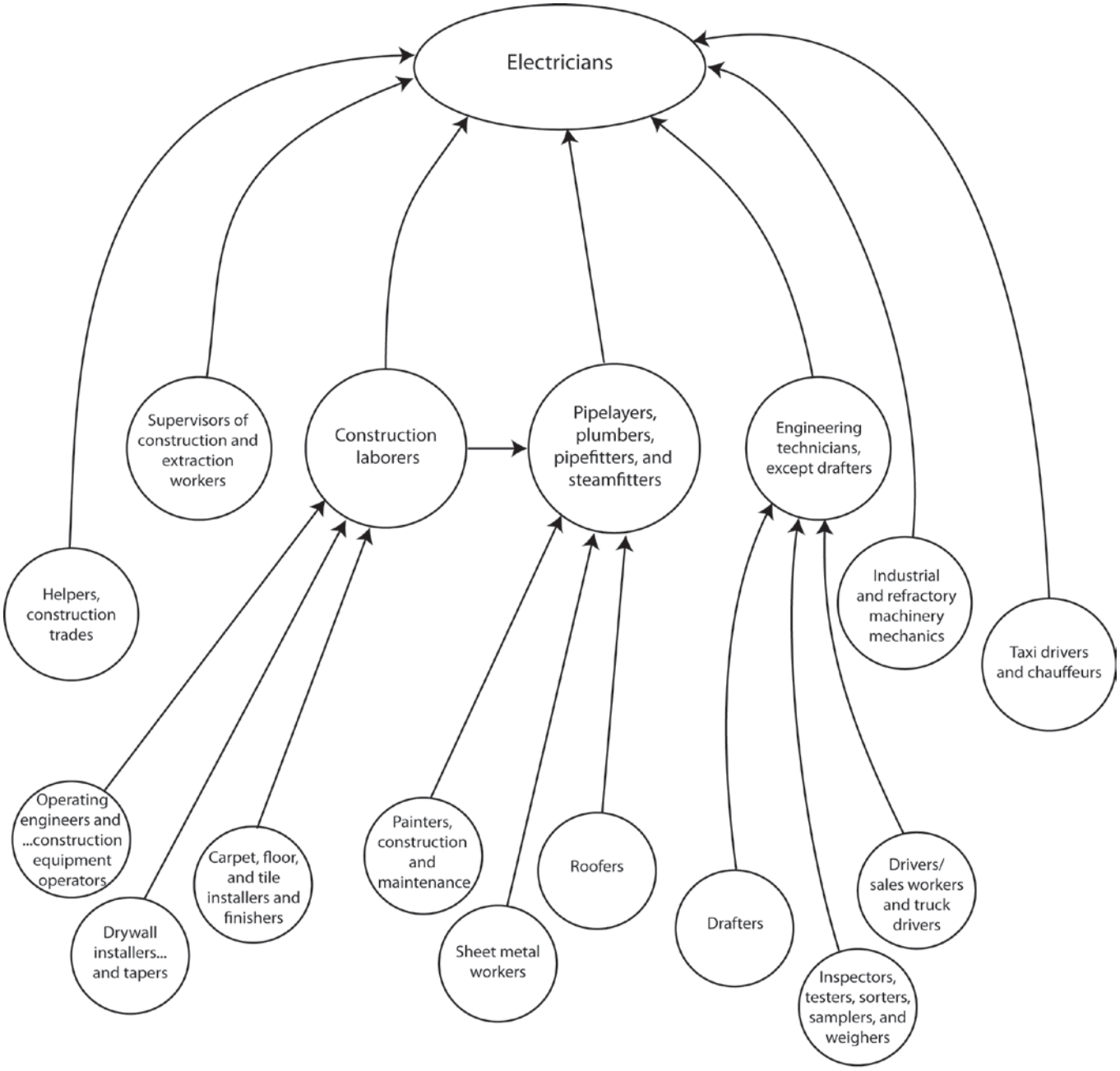
The welding, soldering, and brazing workers occupation includes two SOC-detailed occupations: welders, cutters, solderers, and brazers (51-4121), and, welding, soldering, and brazing machine setters, operators, and tenders (51-4122). The occupations that primarily transition into welding are other production occupations: miscellaneous assemblers; fabricators; machinists; and inspectors, testers, sorters, samplers, and weighers. In fact, these four occupations share a good deal of inter-occupation movement. The top three occupations that flow into machinists, for example are the other three occupations in this group. In addition, assemblers and fabricators as well as inspectors, testers, sorters, samplers, and weighers transition frequently from one occupation to the other.

Occupations from other groups that transition into welding include maintenance occupations (janitors, building cleaners, and ground maintenance workers), transportation and material moving occupations (laborers and material movers—hand; as well as drivers/sales workers and truck drivers), and other production workers (cabinetmakers and bench carpenters.)



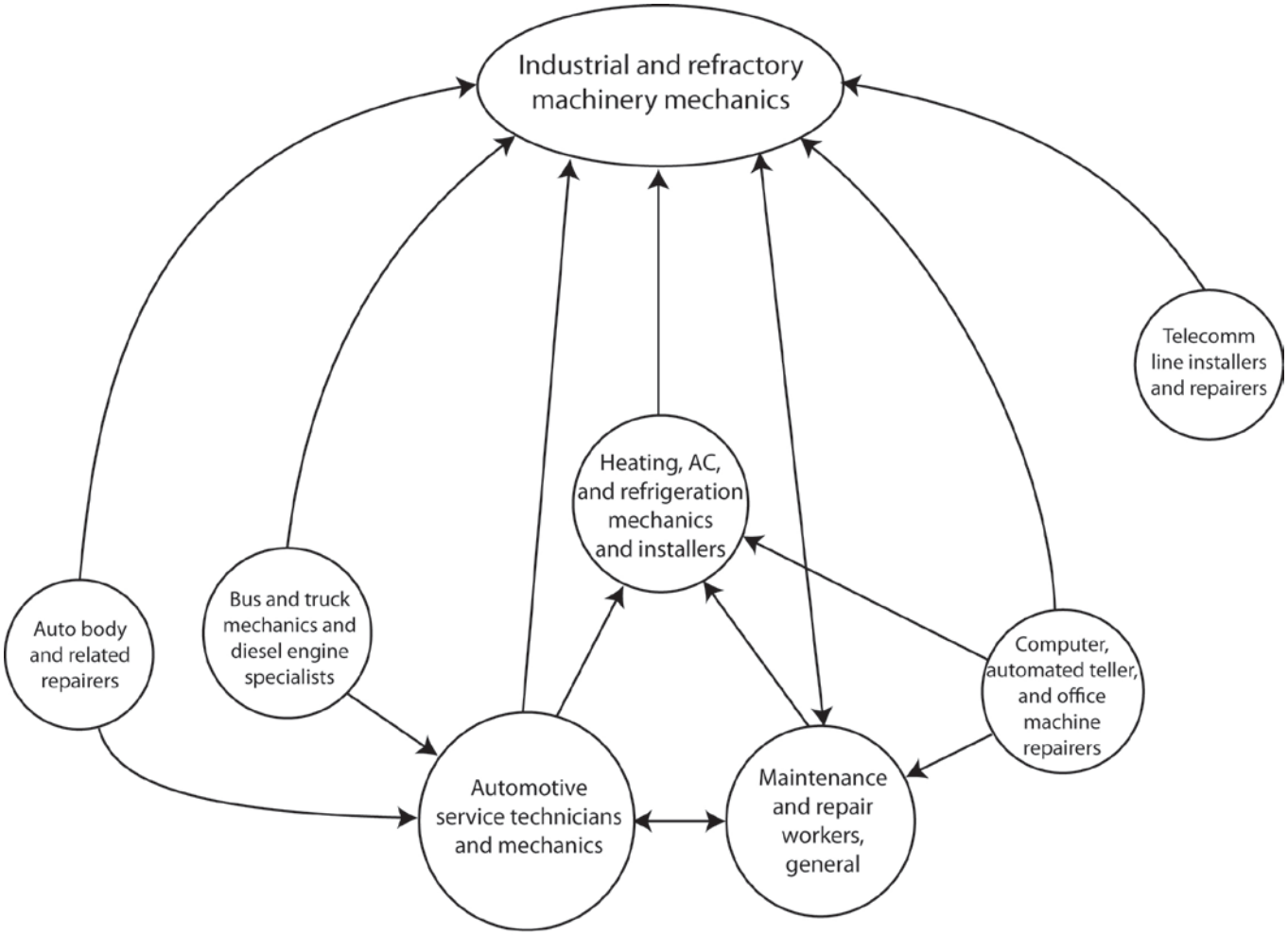
8.2.2. Electricians' Pathway

Compared to the welders' pathway, the electricians' pathway has less inter-occupation movement among the feeder occupations. Many of the occupations that flow into electricians are construction and extraction occupations: pipelayers, plumbers, pipefitters, and steamfitters; construction laborers; supervisors of construction and extraction workers; and helpers, construction trades. Other occupations flowing into electricians are engineering technicians, except drafters; as well as industrial and refractory machinery mechanics.



8.2.3. Industrial Mechanics' Pathway

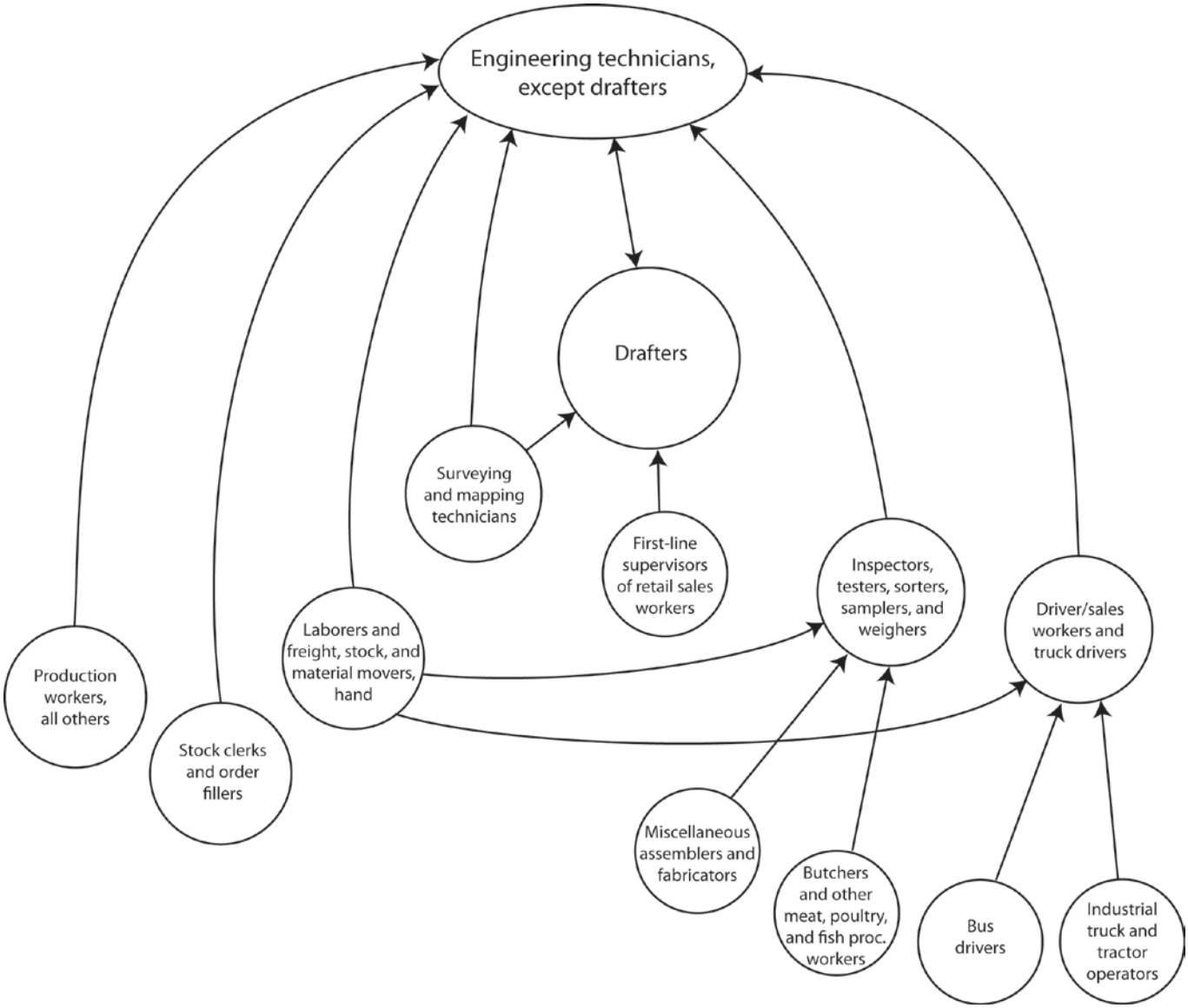
The industrial and refractory machinery mechanics occupation comprises two detailed SOC occupations: industrial machinery mechanics (49-9041), and refractory materials repairers, except brick masons (49-9045). Occupations that flow into this target occupation are primarily other maintenance and repair occupations, most of which readily flow into each other. These occupations include: heating, air conditioning, and refrigeration mechanics and installers; automotive service technicians and mechanics; bus and truck mechanics and diesel engine specialists; and maintenance and repair workers, general.



8.2.4. Engineering Technicians' Pathway

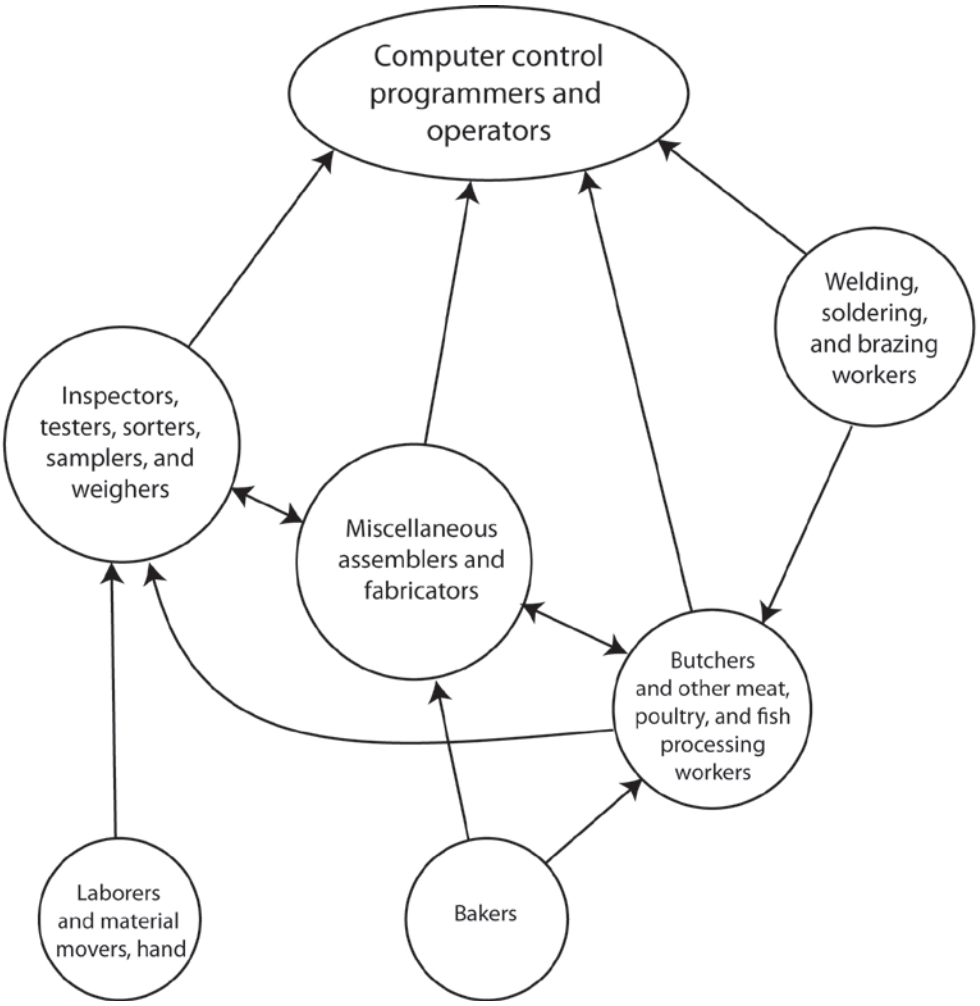
The engineering technicians, except drafters occupation group includes all detailed SOC occupations in the 17-3020 broad occupation group, including: electrical and electronic engineering technicians; civil engineering technicians; industrial engineering technicians; and electro-mechanical technicians. A variety of occupations flow into engineering technicians, with the variety of feeder occupations influenced by the degree of training needed for the target occupation—that is, due to the fact that entry into the target occupation requires more of a formal education background (such as an associate's degree) than necessarily previous work experience.

Some of the occupations flowing into engineering technicians are also from the architecture and engineering occupation group, such as drafters and surveying and mapping technicians. Other feeder occupations include production occupations (inspectors, testers, sorters, samplers, and weighers; as well as production workers, all other) and transportation and material moving occupations (driver/sales workers and truck drivers; as well as laborers and freight, stock, and material movers, hand).



8.2.5. CNC Operators' Pathway

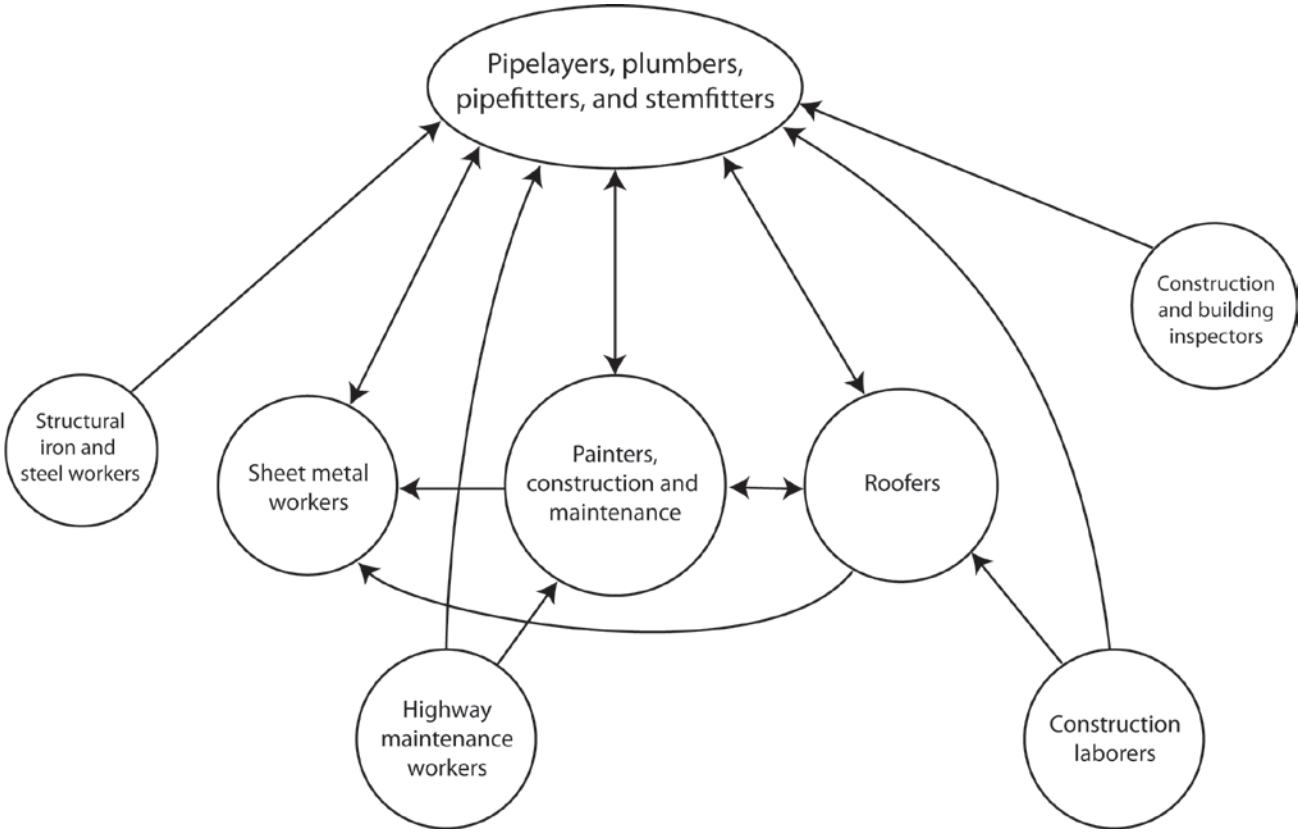
The CNC operators' pathway is smaller than the others in this section partially due to scarcity of data for this occupation. The target occupation computer control programmers and operators comprise two detailed SOC occupations: computer-controlled machine tool operators, metal and plastic (51-4011), and computer numerically controlled machine tool programmers, metal and plastic (51-4012). The primary feeder occupations for this target occupation are other production occupations which largely feed into each other as well: inspectors, testers, sorters, samplers, and weighers; miscellaneous assemblers and fabricators; welding, soldering, and brazing workers; and butchers and other meat, poultry, and fish processing workers. This occupation group comprises about 2,500 workers in the Shenandoah Valley region, over five times the average compared to the rest of the nation.[27]



[27] The location quotient for this occupation group is approximately 4.3 in the Shenandoah Valley region. This occupation group comprises three detailed SOC occupations: butchers and meat cutters (51-3021); meat, poultry, and fish cutters and trimmers (51-3022); and slaughterers and meat packers (51-3023).

8.2.6. Pipefitters' Pathway

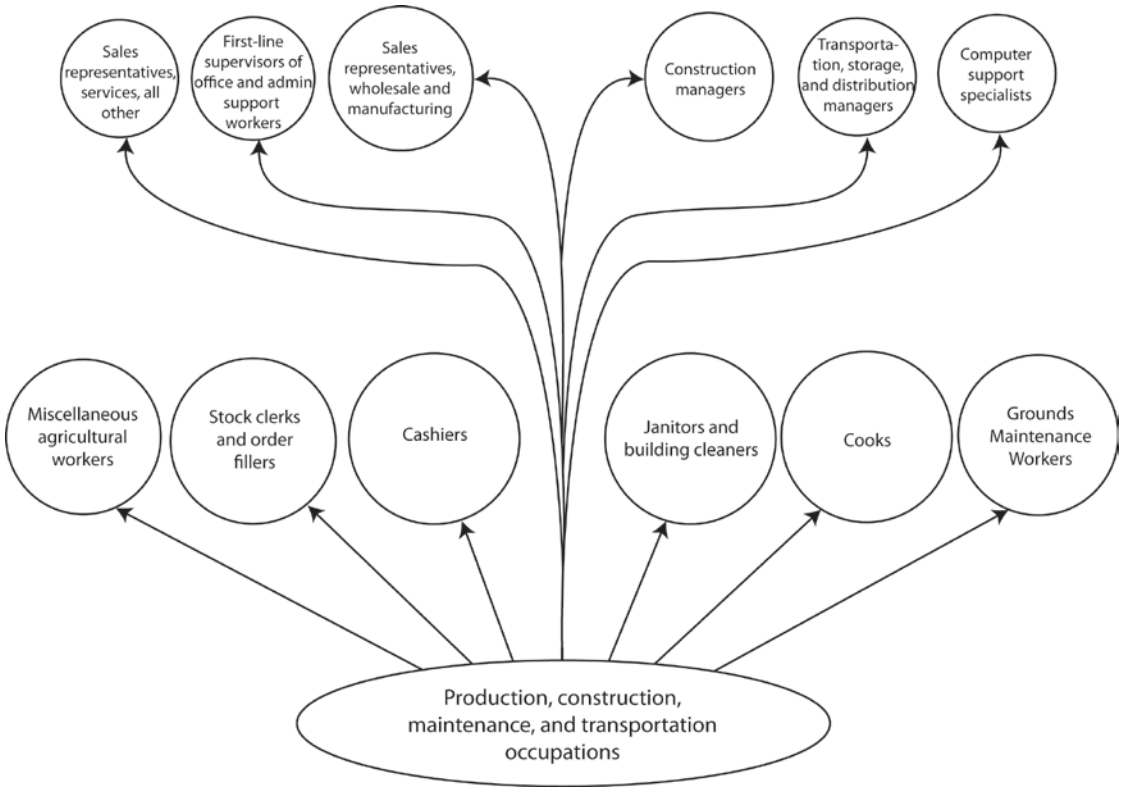
The pathway for pipelayers and plumbers is composed of other construction occupations. By far, the largest influx of workers flow from the painters, construction and maintenance occupation group. Other construction workers that are feeder occupations for pipelayers and plumbers are roofers, construction laborers, highway maintenance workers, and construction and building inspectors. Finally, metal-related construction workers also transition into the pipelayers occupation, namely sheet metal workers and structural iron and steel workers.



8.2.7. Pathways Leaving Occupations Related to Production

As seen earlier in this section, many of the occupations related to production lead to other occupations related to production. In this sub-section, we look at some of the popular pathways from production and related occupations to occupations outside of this realm. For purposes of this analysis, we define "production and related" occupations as all production, construction, maintenance, and transportation occupations, or PCMT occupations for short.[28]

About 73% of PCMT occupation transitions are into other PCMT occupations. The remaining 27% of transitions are into non-PCMT jobs, some of which are shown below. The six occupations shown one level above the PCMT group are the most popular occupation transfers from PCMT occupations. These occupations include cashiers, janitors and building cleaners, and cooks—occupations generally not associated with high wages or growth prospects. The upper row represents the most popular occupation transfers from PCMT occupations to occupations with similar or higher wages, and similar or higher growth prospects compared to the PCMT group. Some of the most popular of these have ties to PCMT occupations, such as sales representatives in wholesale and manufacturing, and managers for construction or transportation, storage, and distribution.[29]



[28] The PCMT occupations comprise the SOC groups: construction and extraction; installation, maintenance, and repair; production; and transportation and material moving.

[29] Note that these data are based on transitions recorded over the course of one year; that is, the survey respondent was in occupation "X" in one year and occupation "Y" in the next year. Thus, job transitions that require multiple years of training (and possibly intermediary jobs held during training) may not be captured. The PCMT pathway chart shown here is not complete; the breadth of jobs transitioned into include other categories as well, such as protective services (security guards and gaming surveillance officers) and healthcare (nursing, psychiatric, and home health aides).

8.3. High School Student Plans

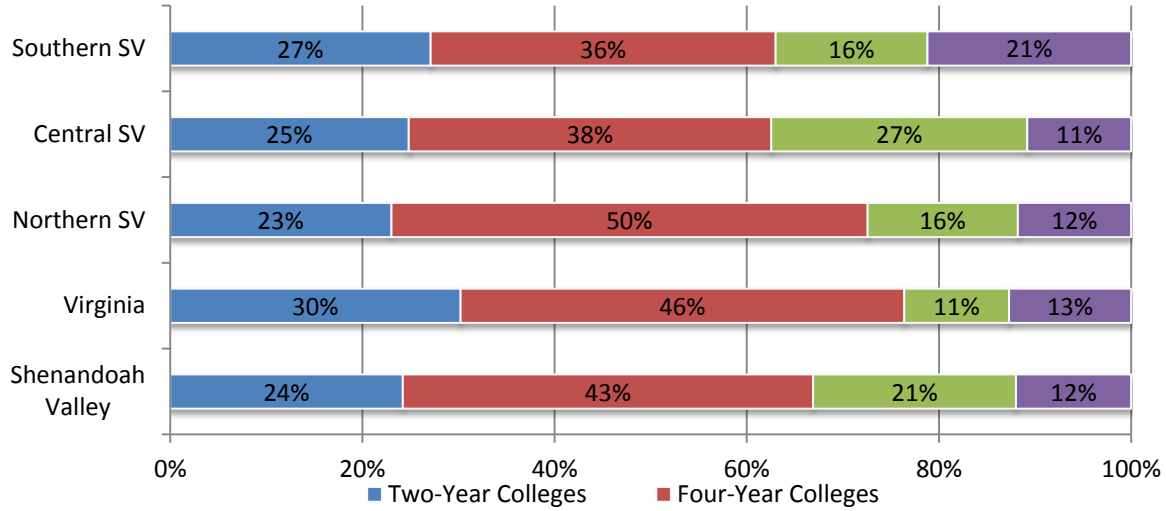
The strength of the Shenandoah Valley economy in the future will be determined by how prepared today's students are upon entering the workforce. Growth projections among jobs requiring some postsecondary education surpasses other jobs. As mentioned in section 8.1, the expectation is for individuals pursuing these jobs in the future to seek higher education.

Understanding what happens to high school students after they graduate needs to be examined in several different ways. One data set from the Virginia Department of Education (VDOE) indicates students' plans after high school, and another shows whether or not those students accumulated a year's worth of college credits within two years of completing high school. The first data set shows the aspirations of students while in high school and the other shows their college-going behavior.

8.3.1. Post-High-School Plans

Figure 8.1 (as well as A.11 in the appendix) shows what graduating students in each of the three Shenandoah Valley regions plan on doing after college. In total, 67% of graduating students plan on pursing higher education; of that number, 23% plan on attending a 2-year school and 43% plan on attending a four-year school. This total is lower than the statewide average, as 76% of graduating students in Virginia plan on attending college after graduation. This is primarily due to the fact that a higher proportion of students in the Shenandoah Valley plan on employment immediately after high school compared to the statewide average (21% compared to 11%). Two-year schools are not the most popular option for students in the Shenandoah Valley as they are with students on a state-wide level. In the Shenandoah Valley, 23% of graduates plan on going to a two-year school compared to 30% in the state. This represents a key opportunity for community colleges to increase exposure to students regarding their degree options in manufacturing and other types of career and technical programs. Many students who are entering the workforce directly or who have no plans after college may not be aware that they could significantly improve their employment opportunities by attending a two-year school.

Figure 8.1: After High School Plans for High School Completing Students



Source: Virginia Department of Education, Diploma Graduates and Completers by

There are a few notable differences in each of the three Valley regions. Students in the Northern Region are more interested in four-year colleges than students in other regions—50% of students in this region plan on attending a four-year college; this

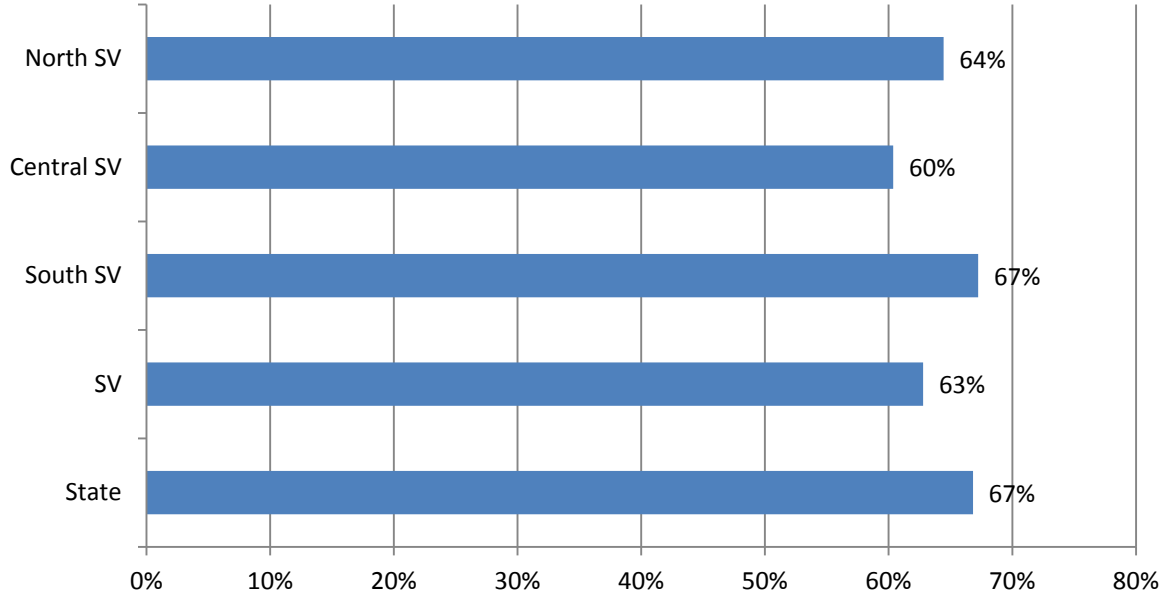
is also higher than the statewide average. Also, the proportion of students in the Northern Region who plan on attending a two-year college is lower than other regions and the state (23% compared to 30%). In the Central Region, 27% of students plan on going directly to employment, a higher percentage than all other regions and the state. Relative to other parts of the Shenandoah Valley and the state, the Southern Region has a notably high proportion of students interested in two-year colleges (27%) and a lower proportion interested in four-year colleges (36%).

8.3.2. Post-High School Actions

Figure 8.2 shows the percentage of students who enrolled in college and accumulated one year's worth of college credits within 16 months of completing high school. Though the terminology is similar to the previous section, the key difference in these data is that the percentages are based on students who have enrolled in college, not just those who have finished high school. If students who did not go to college were included, the percentages would be much lower.

The previous data set indicated that student expectations are slightly lower in the Shenandoah Valley than in the state; it can also be said that student achievement is slightly lower in the Shenandoah Valley than in the state. In the state, 67% of students earn a year's worth of credits within two years after graduation, compared to 63% in the Shenandoah Valley. Reversing the expectations from data on student plans, the Southern SV has a higher percentage of success among students who attend college, as 67% achieved the credit benchmark. They also show that a lower percentage of students in the entire Shenandoah Valley are successful in their first two years (63%) compared to the state (67%).

Figure 8.2: Percent of Graduating Students who Earned One Year of College Credit within 16 months of Graduation



Source: Virginia Department of Education, Postsecondary Achievement Report, 2008

9. Regional Workforce Development Programs

9.1. Northern Region

The Winchester-Frederick Economic Development Commission (EDC) has been hosting Career Awareness Tours for the past 12 years. Initially, the program was designed to raise awareness about manufacturing careers available in the area, but the program has expanded to include tours of other business types such as healthcare, business services, and government. During these tours, middle and high school students along with their teachers and counselors tour one of the area's many businesses. In 2011, 477 students and 183 teachers/counselors attended these events. During Chmura's educators' focus groups, all teachers involved with the tours indicate that these events are extremely successful at raising student awareness about manufacturing careers. Several years ago the EDC also expanded tours to a new audience of politicians, workforce development allies, and education administrators through the VIP Business Tour program. This program helps regional stakeholders see the importance of aligning curriculum for the skills needed in the workforce.

9.2. Central Region

Blue Ridge Community College (BRCC) has a unique and dynamic relationship with regional manufacturing businesses. According to President John Downey, there are several staff members at the college who actively engage with local communities by visiting Chamber of Commerce meetings and other community events. They are regularly approached by manufacturing businesses to help develop programs that use the college's existing manufacturing facilities but require a bit of customization to fit the needs of the specific industry. BRCC makes these training options available to businesses either by having students visit their state of the art Advanced Manufacturing Technology Center, or by delivering training to the students through mobile training modules that can serve up to 12 students at the same time.

For example, BRCC is working with pharmaceutical manufacturer Merck to upgrade their existing workforce via a bioprocessing program. The program launched in the fall of 2012 with about 25 Merck employees serving as the first students. Bioprocessing technicians require a higher level of skill in chemistry, biology, and troubleshooting which will be required as Merck moves toward producing more vaccines in the Shenandoah Valley.

BRCC has several other examples of successful partnerships with local manufacturers. The college has co-developed a four-year mechatronics apprenticeship program with the Hershey Company which trains workers in "controls, electrical, mechanical, and process systems."[30] The program includes four years of curriculum and on-the-job training, during which apprentices are paid to work for Hershey's. The program is best-suited for students with two years of training in a related field such as industrial maintenance, precision machining, or engineering.

BRCC is also working with several packaging companies on a new program. These companies expressed an unmet need for workers to produce custom-made boxes and packaging, and BRCC has developed a program to fit their needs. President Downey explains that in this and other programs it is often one company taking the lead in asking for college assistance, but that oftentimes many other businesses jump on board once the program is up and running.

The proactive approach taken by BRCC has been very successful at building partnerships with regional manufacturers. These programs have undoubtedly helped alleviate some skills shortages, as well as provided education that will lead to promotions or better jobs.

[30] http://www.jobs.thehersheycompany.com/files/3142-686236-Job-Mechatronics-Apprentice.pdf

9.3. Southern Region

Dabney S. Lancaster Community College (DSLCC) has an advanced manufacturing training center in Clifton Forge, Virginia. The college is regularly approached by local manufacturing businesses about customized training needs for new or existing workers. The college has a technology lab in Clifton Forge which houses all career and technical training programs, including industry programs such as welding, millwright training, and industrial technology. Recognizing that many students who are currently in the workforce need a flexible time frame for accessing the lab, students within these programs have 24/7 access to the facility with a personalized key card. The college also provides mobile training solutions to manufacturers within the SV Workforce Investment Board (WIB) service area—including Buena Vista City and Rockbridge counties—through mobile training modules. DSLCC also has a maintenance apprenticeship program through the National Center for Construction Education and Research (NCCER).

As an example of a recent training initiative, DSLCC has offered training for front-line supervisors for Modine Manufacturing in Buena Vista. The primary focus of this initiative is to teach mid-level managers how to manage personnel. In general, DSLCC is observing, and responding to, the need that manufacturers are now acknowledging—training and developing the next wave of leaders as the most seasoned employees consider retirement options.

10. Focus Group Highlights

10.1. Business Focus Group Highlights

Chmura engaged 16 business representatives through the business focus groups and interviews. Chmura asked regional partners to extend invitations to businesses that have a track record of cooperation with economic and workforce development agencies. The focus groups had greater representation among businesses in the TIM category, but Chmura deliberately sought the input of businesses that produce all types of products—some more labor-intensive and some more capital-(i.e.: machine-) intensive. The positions representing the businesses were about one-half human resources employees and one-half from either the production or administrative side. These businesses represented most of the largest manufacturing firms in the Shenandoah Valley (a full list of the individuals who participated is shown in Table A.12 in the appendix). A list of questions and a full summary of answers is also shown in the appendix.

When asked to name the most pressing workforce concerns of their businesses, most respondents claimed a concern over the glut of upcoming retirements or an inability to find workers with the required technical skills to work in the manufacturing setting. A few people also mentioned that enticing workers to come to the Shenandoah Valley can prove to be difficult. Business representatives differed in their expectations of when workers will begin to retire en masse—answers ranged from immediately to five years from now. The "technical skills" lacking among incoming workers were quite similar across different industries. "Mechatronics" technicians, which describe workers with a mixture of skills in electronics, engineering, and computer science, were mentioned by several respondents as the single most difficult job to staff. Another common need echoed by several participants was a need for "middle-skill" workers such as welders, industrial machinery mechanics, machinists, and manufacturing technicians. A few respondents reported that engineers were their biggest concern, particularly programmable logic controller (PLC) engineers. In addition to technical skills, business representatives nearly universally had difficulty finding workers with the "soft skills" requisite for working in a manufacturing setting, in particular: work ethic, problem-solving, punctuality, time-management, professionalism, and communication.

Companies universally agreed that technology in their specific industry is moving very rapidly. One senior-level engineer from a large manufacturer admitted that within five years all the equipment in their plant would be completely obsolete. There are both positives and negatives to these technological advances. It is easy for new workers to operate the machinery, but it is quite difficult to repair.

Regarding the supply of incoming workers, there was no concern for the quantity of potential workers, but quality is typically a problem. Remarkably, one respondent stated that he is only able to hire 1% of people who initially submitted resumes, and is still left with several positions unfilled. Another person lamented that many people will come to interviews claiming they are able to do something even though they know that they cannot. In addition, representatives from both the Northern and Southern Regions employ a larger number of workers from West Virginia.

In all regions, businesses highly regarded the credentials of local training providers, namely Lord Fairfax CC, Blue Ridge CC, and Dabney S. Lancaster CC. However, some complained that credentialing and exit tests were out-of-date and lacked the ability to test for technical skills. Most businesses relied on some form of on-the-job training to supplement the training provided by community colleges. In some cases, on-the-job training is extensive and sophisticated, requiring a long-term apprenticeship or a mentorship program.

Representatives brought up a few other challenges inherent to workforce training in manufacturing. One point was that offering highly technical training either at the community college or at a particular plant is likely to price a worker out of the local market because at that point they can "write their own ticket." Another challenge is that finding common ground

among all forms of manufacturing can be quite difficult. Businesses don't just want generally skilled production workers; they want people who know about their particular means of manufacturing and experience with their types of equipment.

10.2. Educators' Focus Groups

Chmura spoke with seventeen representatives from the education community in the Shenandoah Valley including representatives from secondary schools and postsecondary institutions. Chmura sought to include the input from all forms of education and all levels within the educational system, but the majority of those who elected to attend the focus group meetings were from the career and technical education field. Therefore, it does not come as a surprise that attendants focused mostly on educational and workforce concerns related to industrial and technical careers. Despite this disproportionate representation, the group did include two principals and three superintendents.

When asked to name the biggest workforce concerns of the Shenandoah Valley, representatives pointed to the misalignment of education with jobs that are available in the economy. As one person put it, "there is a big black hole out there and nobody knows how to fill it." Much of this discussion focused on middle-skill technical jobs, such as mechanics, electricians, etc., but other high-demand and underrepresented fields were also mentioned such as healthcare. On a related topic, most individuals mentioned that the overwhelming focus on four-year degrees has helped create a skills gap to some extent. Some individuals also expressed frustration that employers require entry-level workers to have experience, but never provide opportunities for young workers to obtain that experience. Most educators believed that the curriculum is preparing students for today's workforce, but felt that it was not perfectly executed for various reasons. The most commonly cited reasons why students come out of school unprepared were a lack of motivation, a lack of "soft skills" or social skills, a lack of funding that would allow greater emphasis on technical education, and an over-reliance on standardized tests as a means to gauge student capabilities.

When asked how students feel about manufacturing, most educators responded that students have an inaccurate conception of manufacturing—either they do not know that it exists or they think of dirty factories. Students' lack of exposure to manufacturing does not allow them to consider manufacturing as a career option. It is largely seen as a fallback option for people who do not go to college or who drop out of college. More often, students are drawn to fields which they are familiar with either through entertainment or because their parents are in that field. In the first category, students often aspire to occupations such as professional athletes, forensics specialists, and doctors. Parental influence seems to be particularly strong among white-collar professions, whereas blue-collar workers more often want their children to achieve a higher level of education and get a "better job." Some people also mentioned the opposite impulse, particularly in the Southern Region where some parents discourage their children from even completing high school because they see it as unnecessary. When provided with a list of manufacturing-related skills such as engineering, mechanics, and electronics, educators professed that students in their regions had low proficiency in each category. The only exceptions were in mathematics and computer systems design. Educators felt that standardized testing has probably helped improve competency in mathematics, and students seem to have a natural interest in computer-based technology.

Combating the negative stigma against manufacturing is being resolved in numerous ways. Participants cited career fairs, advice from career coaches, factory tours, and student groups as effective methods for changing peoples' perceptions. One strategy that received rave reviews occurs in the Northern Region where students take factory tours to view modern equipment and processes. According to educators in that region, as a result of these tours, students' perceptions of manufacturing is not as negative as it used to be. Most educators expressed a desire for more outreach from manufacturing businesses to help change students' perceptions.

Educators expressed great interest in a facility that would allow students to get hands-on experience using advanced manufacturing equipment. However, there was a general concern that the location would be too far away from school campuses to allow students to visit there regularly.

10.3. Student Focus Groups

Chmura engaged with nineteen juniors and seniors in the Shenandoah Valley. The students fairly represented all demographics within the region as the students were chosen at random by faculty within the school. The focus groups occurred in the Northern and Central Regions. Chmura sought to better understand students' impressions of not only manufacturing, but their general impressions and thoughts about the Shenandoah Valley and their sub-region in particular. By gaining feedback from students, Chmura hoped to better understand the gap between industry needs and the exhibited interests of young people.

Most students were not aware of the jobs available in manufacturing, nor did they understand what a manufacturing business actually does. Overall, students were surprised by the fact that manufacturing is such a large employment sector in the Shenandoah Valley, sometimes the largest single industry employer in some regions, as is the case in the Central Region. One student in this region said he was not surprised by this and mentioned some of the manufacturing companies in the region, such as Hershey's and MillerCoors. Most of the remaining students, however, felt that farming was the largest industry in this region. Students in the Northern Region were even more surprised that manufacturing was such a large sector; no student was able to recall a single manufacturing company in their region. These students seemed to think healthcare would have been the largest single industry employer. Students in the Central Region, who seemed to have a slightly better understanding of manufacturing than students in the Northern Region, had a more negative impression of manufacturing overall.

Students seemed to understand employers' expectations in terms of soft skills. However, there appeared to be a lack of knowledge on the technical skills needed for employment in the manufacturing industry. As mentioned earlier, business leaders in the manufacturing industry expressed frustration over a lack of skills, both "soft" and technical, in the current Shenandoah Valley workforce; these skills seemed to be particularly lacking in the younger generation or the generation now entering the workforce. When asked what skills students felt were most important in the workforce today, almost unanimously students felt that "soft" skills (communication skills, people skills, writing skills, etc.) were most valued by employers. Only one student from the Central Region mentioned basic math skills. Students in both the Central and Northern Regions were unaware of the technical skills requisite for a job in a manufacturing setting.

When asked to list three words that came to mind when they heard the term "manufacturing", students said things like: "tired", "labor", and "difficult." Students in the Northern Region, however, viewed manufacturing in a more positive light. These students used terms like "technology", "intelligent", and "challenging" to describe manufacturing. Apart from one student in the Northern Region, students did not express an interest to pursue a career in manufacturing. Healthcare was the most sought-after field among students in both regions, with at least three students interested in nursing and one student interested in pharmacy.

Finally, students in both regions expressed a desire to leave the Shenandoah Valley upon completion of their education. At least 70% of the students surveyed expressed a desire to move outside of the Valley.

Conclusion

Manufacturing is a significant driver of economic activity in the Shenandoah Valley. Representing 16% of total employment, it provides better-than-average wages for workers while providing diverse career opportunities. A projected annual average employment growth rate of 0.6% (2013 Q1—2013 Q1) together with the threats from impending retirements and continued technology advancements suggests a coordinated workforce planning strategy to support both the short and long-term demands for labor.

The Shenandoah Valley has a growing population. Its workforce is characterized as slightly older and less educated (as measured by the percentage of adults with a postsecondary credential) than in the state and in the nation. While manufacturers and educators agree that lack of basic work-readiness skills is a challenge in the Valley, the data from two vetted assessments reveal that test takers in the Valley actually performed better that those testing statewide.

General awareness of manufacturing as a favorable career option is low and there are opportunities to educate youth and adults about the industry and its income-earning potential as well as career pathway options. Helping adult workers obtain the relevant skills manufacturers need today in tandem with attracting and retaining younger, more highly-educated workers are important workforce planning strategies for the Valley.

Critical demand occupations for manufacturers include those in the following knowledge-based clusters: engineering, electrical technologies, machining, mechanical technologies, pipefitting, welding, and computer/IT. In total, these clusters suggest the workforce has a need for 541 trained workers annually. Manufacturers will need workers in the Shenandoah Valley with more post-secondary education than in the past and credential attainment that aligns with the occupational clusters to ensure an adequate supply of qualified workers in the future.

The Valley is fortunate to have a network of career and technical education options at the high school-level, as well as a highly-responsive and developed community college system network. A number of colleges and universities provide bachelor's degree options as well as advanced degree choices in fields related to the critical demand occupation clusters. Registered apprenticeships in the Valley represent an industry-recognized pathway toward employment in many demand occupations.

The Chmura report acknowledges that alternative career pathways exit and there is significant job mobility between different occupation grouping and between industries. Understanding these patterns can help individuals and employers. For individuals, these alternative career pathways represent possible career progression and help identify alternative employment options building on past work experiences. For employers these pathways present recruiting and development opportunities. Further, the alternative pathways model presents a new understanding of the interdependency of industries in skill-development for the workforce.

Improving the alignment and assessing the capacity of training and workforce development programs in the critical demand occupations will ensure that a prepared and productive workforce will support future economic growth.

Appendices

Demographic Data

Table A1: County-by-County Population Data, 2011

County	Population (2011)	Annual Average Growth Rate	Annual Average Growth (2001-2011)
Augusta County	73,549	1.0%	743
Bath County	4,657	-0.7%	-34
Buena Vista City	6,636	0.3%	28
Clarke County	14,258	1.0%	140
Frederick County	79,666	2.3%	1,831
Harrisonburg City	49,973	1.7%	833
Highland County	2,267	-1.1%	-26
Lexington City	6,995	0.2%	14
Page County	23,958	0.3%	79
Rockbridge County	22,375	0.7%	147
Rockingham County	76,589	1.0%	792
Shenandoah County	42,289	1.5%	645
Staunton City	23,769	0.0%	4
Warren County	37,749	1.5%	553
Waynesboro City	21,311	0.7%	157
Winchester City	26,587	0.9%	236
Shenandoah Valley	512,628	1.2%	6,132
Northern SV	200,549	1.7%	3,405
Central SV	271,416	1.0%	1,021
Southern SV	40,663	0.4%	320
State Total	8,096,604	1.1%	92,197

Source: 2011 Census and American Community Survey, 2007-2011

Industry Employment

Table A2: Employment and Earnings by Industry Sector in Northern, Central, and Southern Shenandoah Valley, 2008 Q1-2013 Q1

		------Northern SV------			------Central SV------			------Southern SV------		
NAICS	Industry Description	Employment	Avg. Annual Growth Rate	Earnings	Employ-ment	Avg. Annual Growth Rate	Earnings	Employ-ment	Avg. Annual Growth Rate	Earnings
31	Manufacturing	11,644	-4.5%	$47,545	18,520	-2.5%	$46,822	2,137	-	$39,285
62	Health Care and Social Assistance	11,734	2.6%	$47,394	15,434	2.3%	$40,319	1,672	-0.5%	$29,179
44	Retail Trade	11,197	-0.8%	$24,806	14,008	-1.6%	$24,005	1,655	-	$21,458
61	Educational Services	8,594	0.7%	$34,407	13,711	1.2%	$35,652	3,147	0.2%	$43,227

72	Accommodation and Food Services	7,352	1.2%	$14,600	11,480	1.8%	$14,561	2,439	-2.7%	$18,760
23	Construction	3,711	-8.6%	$40,580	5,891	-8.1%	$38,697	713	-	$36,039
48	Transportation and Warehousing	3,712	1.2%	$43,636	6,165	1.3%	$43,238	166	-9.4%	$34,715
56	Administrative and Support and Waste Management and	3,943	1.3%	$27,281	4,011	0.3%	$25,250	337	-3.8%	$21,072
92	Public Administration	3,560	3.5%	$50,932	3,871	0.4%	$38,824	743	-	$34,143
54	Professional, Scientific, and Technical Services	2,875	2.4%	$73,059	2,566	-1.5%	$51,220	319	2.4%	$44,520
42	Wholesale Trade	1,990	-3.2%	$50,792	3,527	-2.8%	$43,184	132	-	$34,396
81	Other Services (except Public Administration)	2,417	-1.0%	$28,862	2,633	-1.3%	$24,865	486	-6.1%	$27,421
52	Finance and Insurance	2,124	1.6%	$48,401	2,136	0.1%	$47,792	256	1.2%	$39,743
71	Arts, Entertainment, and Recreation	1,285	-1.4%	$18,603	1,487	-2.0%	$17,370	412	-3.1%	$18,882
51	Information	918	-2.1%	$41,602	2,097	0.3%	$51,887	148	-	$29,287
55	Management of Companies and Enterprises	917	-0.3%	$71,619	1,377	1.4%	$63,572	nd	nd	$28,343
53	Real Estate and Rental and Leasing	726	-5.3%	$35,603	1,150	-4.1%	$32,427	162	-2.2%	$27,777
11	Agriculture, Forestry, Fishing and Hunting	712	3.1%	$24,114	1,098	6.8%	$27,427	94	-1.3%	$30,346
22	Utilities	334	0.9%	$57,372	532	0.7%	$53,030	187	-	$66,185
21	Mining, Quarrying, and Oil and Gas Extraction	142	0.2%	$46,645	101	-9.3%	$48,646	47	nd	$42,765
	Total All Industries	79,886	-0.7%	$38,398	111,796	-0.7%	$35,694	15,287	-	$32,092

Source: Chmura Economics & Analytics via JobsEQ®
nd= information is non-disclosable due to company confidentiality

Table A3: Employment and Earnings by Manufacturing Sector in Northern, Central, and Southern Shenandoah Valley, 2008 Q1-2013Q1

		------Northern SV------			------Central SV------			------Southern SV------		
NAICS	Industry Description	Employment	Avg. Annual Growth Rate	Earnings	Employment	Avg. Annual Growth Rate	Earnings	Employment	Avg. Annual Growth Rate	Earnings
311	Food Manufacturing	3,149	0.5%	$42,076	6,930	-0.8%	$37,372	27	5.3%	$12,114
326	Plastics and Rubber Products	2,688	-5.0%	$60,973	931	-7.1%	$45,175	57	-2.7%	$51,538
323	Printing and Related Support Activities	1,437	-5.6%	$42,910	1,540	-1.8%	$42,613	150	-2.6%	$31,131
332	Fabricated Metal Product	786	-0.8%	$45,817	1,738	-2.5%	$47,060	52	5.6%	$38,109
325	Chemical	654	0.4%	$70,080	1,415	-3.6%	$103,02	1	0.1%	$62,431

321	Wood Product Manufacturing	419	-12.5%	$32,261	920	-5.2%	$30,984	300	-1.8%	$36,796
333	Machinery	346	-2.9%	$43,720	750	0.6%	$57,568	449	-3.0%	$47,789
314	Textile Product Mills	13	3.7%	$19,487	30	4.6%	$25,299	937	-4.2%	$37,978
327	Nonmetallic Mineral Product	597	-8.9%	$44,996	240	-13.6%	$35,640	6	-6.5%	$34,371
339	Miscellaneous Manufacturing	46	2.2%	$38,339	625	-0.4%	$50,728	121	-0.2%	$40,075
336	Transportation Equipment	157	(nd)	$50,601	632	(nd)	$43,701	na	na	na
337	Furniture and Related Product	582	-13.0%	$31,307	190	(nd)	$28,032	8	6.6%	$16,352
312	Beverage and Tobacco Product	93	(nd)	$29,452	626	(nd)	$68,585	11	-1.7%	$15,964
322	Paper	262	18.7%	$43,343	446	0.2%	$49,474	4	-44.2%	$35,678
331	Primary Metal Manufacturing	289	(nd)	$43,169	389	(nd)	$44,824	na	na	na
334	Computer and Electronic Product	92	-2.0%	$34,456	502	-5.2%	$45,318	na	na	na
315	Apparel	3	(nd)	$15,686	231	-1.7%	$31,055	14	-2.5%	$25,540
313	Textile Mills	na	na	na	213	-21.4%	$47,480	na	na	na
324	Petroleum and Coal Products	23	(nd)	$48,607	78	(nd)	$48,155	na	na	na
335	Electrical Equipment, Appliance, and	8	(nd)	$42,204	93	(nd)	$47,004	na	na	na
316	Leather and Allied Product	na	na	na	1	(nd)	$13,307	na	na	na
31	Manufacturing	11,644	-4.5%	$47,545	18,52	-2.5%	$46,822	2,137	-3.8%	$39,285
	Total All Industries	79,886	-0.7%	$38,398	111,7	-0.7%	$35,694	15,287	-2.2%	$32,092

Source: Chmura Economics & Analytics via JobsEQ®
nd= information is non-disclosable due to company confidentiality
na= not applicable because the industry does not exist in the area

Table A4: County-by-County Manufacturing Employment and Growth, 2008-2013

County	2008 Q1 Employment	2013 Q1 Employment	2008 and 2013 Average	Annual Average Growth 2008-2013	Annual Average Growth Rate 2008-2013
Augusta	6,031	5,401	5,716	-126.07822	-2.2
Bath	58	41	49	-3.2548463	-6.4
Buena Vista	596	486	541	-21.977229	-4.0
Clarke	1,077	550	813	-105.43576	-12.6
Frederick	4,781	4,525	4,653	-51.109984	-1.1
Harrisonburg	3,347	3,021	3,184	-65.117087	-2.0
Highland	30	26	28	-0.7526299	-2.7
Lexington	33	21	27	-2.3967901	-8.7
Page	1,126	766	946	-71.974442	-7.4

Rockbridge	1,903	1,589	1,746	-62.847853	-3.5
Rockingham	7,908	7,586	7,747	-64.481796	-0.8
Shenandoah	4,051	3,275	3,663	-155.12594	-4.2
Staunton	422	341	381	-16.117612	-4.2
Warren	1,120	925	1,023	-38.93298	-3.7
Waynesboro	2,179	1,380	1,779	-159.89	-8.7
Winchester	3,604	2,369	2,987	-247.06442	-8.1
Northern SV	14,633	11,644	13,138	-598	-4.5%
Central SV	21,042	18,520	19,781	-504	-2.5%
Southern SV	2,589	2,137	2,363	-90	-3.8%
Shenandoah Valley	38,264	32,301	35,283	-1,193	-3.6

Source: Chmura Economics & Analytics via JobsEQ®

Table A5: Top 25 Largest Manufacturing Businesses in the Shenandoah Valley, 2012 Q3

3-digit NAICS code	Description	Firm	Region	Employment Range	HITE
311	Food	CARGILL MEAT SOLUTIONS CORP	Central	>1000	Y
323	Printing and Related Support	R R DONNELLEY & SONS COMPANY	Central	>1000	N
311	Food	HERSHEY CHOCOLATE OF VIRG INC	Central	500-1,000	Y
325	Chemical	MERCK SHARP & DOHME CORP	Central	500-1,000	Y
314	Textile Product Mills	MOHAWK ESV INCORPORATED	Southern	500-1,000	N
326	Plastics and Rubber Products	RUBBERMAID COMMERCIAL PRO	Northern	500-1,000	Y
311	Food	MCKEE FOODS CORPORATION	Central	500-1,000	Y
311	Food	GEORGES CHICKEN LLC	Northern	500-1,000	Y
311	Food	PILGRIMS PRIDE CORP	Central	500-1,000	Y
311	Food	PERDUE FARMS INC	Central	500-1,000	Y
336	Transportation Equipment	TENNECO AUTOMOTIVE OPERAT	Central	500-1,000	N
311	Food	GEORGES FOODS LLC	Central	500-1,000	Y
311	Food	VA POULTRY GROWERS COOP INC	Central	500-1,000	Y
323	Printing and Related Support	R R DONNELLEY & SONS COMPANY	Northern	500-1,000	N
339	Miscellaneous	HOLLISTER INC	Central	100-499	Y
312	Beverage and Tobacco Product	MILLERCOORS LLC	Central	100-499	Y
311	Food	KRAFT FOODS NORTHERN AMERICA	Northern	100-499	Y
323	Printing and Related Support	BERRYVILLE GRAPHICS INC	Northern	100-499	N
333	Machinery	AAF MCQUAY INCORPORATED	Central	100-499	Y
325	Chemical	PRIVATE LIMITED COMPANY	Central	100-499	Y
311	Food	HP HOOD LLC	Northern	100-499	Y
311	Food	BOWMAN ANDROS PRODUCTS	Northern	100-499	Y
311	Food	WHITEWAVE FOODS CO	Central	100-499	Y
326	Plastics and Rubber Products	OSULLIVAN FILMS INC	Northern	100-499	Y
326	Plastics and Rubber Products	VARIFORM INC	Central	100-499	Y

Source: Virginia Employment Commission and Chmura Economics & Analytics

Table A6: HITE and non-HITE Manufacturing Industries (4-digit NAICS) in the Shenandoah Valley

--------HITE Industries--------		--------Non-HITE Industries--------	
NAICS	Industry	NAICS	Industry
3113	Sugar and Confectionary Product	3111	Animal Food
3115	Dairy Product	3112	Grain and Oilseed Milling
3119	Other Food	3114	Fruit and Vegetable Preserving and Specialty Food
3121	Beverage	3116	Animal Slaughtering and Processing
3141	Textile furnishing mills	3117	Seafood Product Preparation and Packaging
3241	Petroleum and Coal	3118	Bakeries and Tortilla
3251	Basic Chemical	3132	Fabric Mills
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers	3149	Other Textile Product Mills
3254	Pharmaceutical and Medicine	3151	Apparel Knitting Mills
3255	Paint, Coating, and Adhesive	3152	Cut and Sew Apparel
3259	Other Chemical Product and Preparation	3159	Apparel Accessories and Other Apparel
3261	Plastics Product	3169	Other Leather and Allied Product
3262	Rubber	3211	Sawmills and Wood Preservation
3322	Cutlery and Hand tool	3212	Veneer, Plywood, and Engineered Wood Product
3326	Fabricated wire product	3219	Other Wood Product
3332	Industrial Machinery	3221	Pulp, Paper, and Paperboard Mills
3333	Commercial and Service Industry Machinery	3222	Converted Paper Product
3334	Ventilation, Heating, Air-Conditioning, and Commercial	3231	Printing and Related Support Activities
3336	Engine, Turbine, and Power Transmission Equipment	3256	Soap, Cleaning Compound, and Toilet Preparation
3344	Semiconductor and Other Electronic Component	3271	Clay Product and Refractory
3345	Navigational, Measuring, Electromedical, and Control	3272	Glass and Glass Product
3353	Electrical Equipment	3273	Cement and Concrete Product
3391	Medical Equipment and Supplies	3279	Other Nonmetallic Mineral Product
		3313	Alumina and Aluminum Production and Processing
		3314	Nonferrous Metal (except Aluminum) Production and
		3321	Forging and Stamping
		3323	Architectural and Structural Metals
		3324	Boiler, Tank, and Shipping Container
		3325	Hardware
		3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt
		3328	Coating, Engraving, Heat Treating, and Allied Activities
		3329	Other Fabricated Metal Product
		3331	Agriculture, Construction, and Mining Machinery
		3335	Metalworking Machinery
		3339	Other general purpose machinery
		3341	Computer and Peripheral Equipment
		3342	Communications Equipment
		3343	audio and video equipment
		3346	Manufacturing and Reproducing Magnetic and Optical
		3351	Electric Lighting Equipment
		3359	Other Electrical Equipment and Component
		3362	Motor Vehicle Body and Trailer

3363	Motor Vehicle Parts
3364	aerospace products and parts
3369	Other Transportation Equipment
3371	Household and Institutional Furniture and Kitchen
3372	Office Furniture (including Fixtures)
3379	Other Furniture Related Product
3399	Other Miscellaneous

Source: Chmura Economics and Analytics

Table A7: Average Annual Growth Rate for HITE and non-HITE Manufacturing in the Shenandoah Valley, Virginia, and the United States

Period	SV HITE	VA	USA	SV non-HITE	VA non-HITE	USA non-HITE
During Recession (2007 Q4 to 2009 Q2)	-4.4%	-2.4%	-3.0%	-6.6%	-8.0%	-5.9%
After Recession (2009 Q3 to 2013 Q1)	-1.4%	-2.0%	-0.4%	-1.4%	-2.0%	-0.8%
Total Period (2003 Q1 to 2013 Q1)	-2.0%	-2.2%	-1.9%	-4.1%	-4.2%	-2.9%

Source: Chmura Economics and Analytics

Unemployment

Table A8: County-by-County Historic Quarterly Unemployment, 2006-2013

Year	Q#	Augusta	Bath	Buena Vista	Clarke	Frederick	Harrisonburg	Highland	Lexington	Page	Rockbridge	Rockingham	Shenandoah	Staunton	Warren	Waynesboro	Winchester
2006	1	2.8	4.9	3.6	2.6	2.7	3.3	3.3	4.8	5.7	3.0	2.5	2.8	3.3	2.9	3.5	3.0
2006	2	2.6	2.8	3.2	2.3	2.5	3.2	3.2	4.9	4.0	2.7	2.5	2.7	3.0	2.6	3.3	2.6
2006	3	2.7	2.5	3.7	2.5	2.9	3.1	3.1	4.9	3.8	2.7	2.5	3.4	3.1	2.9	3.2	3.0
2006	4	2.4	2.7	3.0	2.4	2.5	2.3	3.0	3.8	5.1	2.5	2.1	3.1	2.9	2.8	2.7	3.0
2007	1	3.0	4.6	4.1	3.0	3.1	2.9	3.8	4.7	6.6	3.0	2.5	3.5	3.5	3.2	3.7	3.5
2007	2	2.4	2.7	3.3	2.5	2.7	2.9	3.1	4.5	4.3	2.7	2.5	3.0	2.9	2.8	3.2	3.0
2007	3	2.6	2.5	3.5	2.7	3.1	3.1	3.2	5.1	4.3	2.8	2.6	3.1	2.9	2.9	3.3	3.3
2007	4	2.6	2.9	3.6	2.6	3.0	2.8	3.4	4.4	5.2	3.3	2.4	3.2	3.1	3.3	3.7	3.1
2008	1	3.2	4.1	4.4	3.1	3.8	3.5	5.2	5.6	7.6	3.8	3.0	4.2	3.9	4.2	4.5	3.9
2008	2	3.2	3.3	4.8	3.2	3.7	4.1	3.9	6.1	5.6	3.5	3.1	4.4	3.7	3.8	4.0	4.1
2008	3	3.7	3.8	5.2	3.5	4.2	4.8	5.1	7.6	5.9	3.9	3.5	5.0	4.4	4.3	4.8	4.6
2008	4	4.5	5.5	6.2	4.1	5.2	4.5	6.3	6.7	8.7	5.5	3.9	5.2	5.3	5.4	6.6	5.8
2009	1	6.8	7.3	8.7	6.3	7.8	6.3	10.0	9.0	14.8	6.9	6.1	8.3	7.4	8.5	9.5	9.0
2009	2	6.6	6.3	8.1	6.5	7.8	7.1	7.5	10.5	10.8	6.7	6.3	8.5	7.1	7.7	8.8	8.4
2009	3	6.2	5.7	8.9	6.8	7.8	7.3	6.3	10.8	10.4	6.2	5.9	8.2	7.5	7.2	8.7	8.3
2009	4	6.7	6.2	9.2	6.3	7.4	6.8	7.1	9.3	11.9	6.6	5.7	8.5	7.7	7.5	8.0	7.5
2010	1	7.9	8.1	10.6	6.6	8.1	8.4	9.8	12.3	14.2	8.2	6.9	9.7	8.6	8.5	9.8	8.0
2010	2	6.7	5.9	9.0	5.9	7.2	8.1	7.2	12.5	10.5	6.8	6.2	8.0	7.6	7.0	9.0	7.2

2010	3	6.4	5.6	9.2	5.6	6.6	7.7	7.1	12.1	10.3	7.4	6.1	7.8	7.6	6.7	9.3	7.6
2010	4	6.1	6.6	8.9	5.2	6.5	7.3	7.6	11.4	11.7	6.6	5.7	7.7	7.6	6.5	9.1	7.2
2011	1	6.2	7.0	9.2	5.4	6.6	7.4	8.4	11.5	13.3	6.9	5.7	7.6	7.3	7.1	8.6	7.4
2011	2	5.8	5.1	7.2	4.8	5.7	7.3	6.6	11.6	9.9	6.2	5.5	6.7	6.7	6.1	7.8	7.3
2011	3	6.2	5.0	7.2	5.1	5.9	7.7	6.5	12.0	10.1	6.4	5.6	6.9	7.0	6.3	7.9	8.0
2011	4	5.7	4.8	8.3	4.5	5.6	6.8	6.4	10.6	10.3	6.3	5.1	6.6	6.5	6.0	7.4	8.0
2012	1	5.9	5.5	7.8	4.9	5.5	6.5	7.4	10.4	11.9	6.4	5.4	6.8	6.4	6.2	7.6	7.4
2012	2	5.3	4.9	7.3	4.6	5.2	7.0	6.0	11.6	9.0	5.4	5.1	6.3	6.0	5.6	6.8	6.6
2012	3	5.4	5.0	7.4	5.0	5.4	7.2	5.6	11.4	8.8	5.9	5.3	6.4	6.6	5.4	6.8	6.9
2012	4	5.0	5.2	6.2	4.9	4.9	6.2	5.7	10.6	9.4	5.6	4.8	6.1	6.3	5.5	6.3	5.9
2013	1	5.3	5.7	6.7	4.7	4.9	6.0	6.3	10.9	11.0	5.8	4.9	6.4	6.4	6.0	6.6	6.3

Source: Local Area Unemployment Statistics, Bureau of Labor Statistics

Table A9: Unemployment by Age in the Shenandoah Valley, September 2004 -September 2013

	Under 24 Years	25 to 34 Years	35 to 44	45 to 54	55 to 64	65 Years and Over	45 and Over
2004	9%	21%	28%	25%	15%	2%	42%
2005	9%	22%	25%	27%	15%	2%	44%
2006	8%	19%	27%	28%	16%	2%	46%
2007	8%	19%	26%	28%	16%	3%	47%
2008	8%	21%	24%	28%	16%	3%	47%
2009	8%	21%	23%	27%	17%	4%	47%
2010	8%	21%	22%	27%	18%	4%	49%
2011	8%	21%	22%	27%	18%	4%	48%
2012	7%	19%	20%	25%	17%	4%	46%
2013	7%	19%	20%	25%	18%	4%	47%

Source: ES-203, Bureau of Labor Statistics

Table A10: Unemployment Rate for Production and Other Occupations, April 2013

County	All Other Occupations	Production Occupations
Augusta	5%	6%
Bath	6%	6%
Buena Vista	7%	8%
Clarke	5%	5%
Frederick	5%	6%
Harrisonburg	6%	7%
Highland	7%	7%
Lexington	11%	16%
Page	11%	12%
Rockbridge	6%	7%
Rockingham	5%	5%
Shenandoah	7%	7%
Staunton	7%	8%
Warren	6%	7%
Waynesboro	7%	8%
Winchester	6%	8%

Source: ES-203, Bureau of Labor Statistics

County-Level Data for High School Students' College-Going Plans and Actions

Table A11: County-by-County Post-High School Plans for High School Graduates, Total 2007-2010

	Two-Year Colleges	Four-Year Colleges	Employment	Other	Percent Not Pursing Postsecondary Education
Augusta County	32%	34%	26%	8%	30%
Bath County	34%	32%	17%	17%	22%
Buena Vista City	27%	37%	16%	20%	27%
Clarke County	22%	52%	19%	7%	24%
Frederick County	11%	65%	14%	11%	20%
Harrisonburg City	31%	37%	27%	6%	30%
Highland County	32%	41%	13%	14%	17%
Page County	35%	20%	40%	5%	43%
Rockbridge County	26%	37%	15%	23%	32%
Rockingham County	12%	51%	22%	15%	29%
Shenandoah County	37%	36%	18%	10%	22%
Staunton City	26%	35%	31%	7%	35%
Warren County	32%	33%	15%	19%	29%
Waynesboro City	29%	23%	27%	22%	31%
Winchester City	29%	43%	18%	9%	24%
SV	24%	43%	21%	12%	27%
State Total	30%	46%	11%	13%	19%

Source: Virginia Department of Education, Diploma Graduates and Completers by School, 2007-2010

Full Summaries of Focus Groups

Focus Group Attendees

Table A12: Focus Group Attendees

Person	Title	Organization
	-------Businesses- Northern-------	
Robert H. Hahn, Jr.	President	Winchester Tool, LLC
Steven Sabol	Manager of Operations	Rubbermaid Commercial Products
Representative	Engineer	Rubbermaid Commercial Products
Preston Blake	Director, Manufacturing	Trex
Representative	Engineering/Maintenance Manager	Kraft
Penny Mathias	Director, Human Resources	Monoflow
Holly Combs	Employment Operations Manager	Southeastern Container
Jeff Haberkorn	Maintenance Manager	HP Hood
	-------Businesses- Central-------	
Steve King	Maintenance Manager	McKee Foods
Leon Humphries	VP, Operations & Finance	Carded Graphics
Connie Chandler	HR Manager	INVISTA
Sandi Weakley	HR Manager	Cadence
Michael Crider	Director of Electrical Engineering	Bryan Tool & Machining Inc.
William C. Meicke, PE	Controls Reliability Engineer	Hershey Foods
	-------Educators- Northern-------	
Dan Hawkins	Lead CTE Teacher	City of Winchester
Steve Straight	Vocational Education Coordinator	Frederick County
Jeanie Clark	Assistant VP of Workforce Solutions and Continuing Education	Lord Fairfax Community College
Brenda Byard	Associate Dean, Business & Technology and Director, High School Outreach	Lord Fairfax Community College
	-------Educators- Central ------	
Sandi Rinker	Assistant Director	Rockingham County
Lisa Shiflett	Curriculum Supervisor	Augusta County
Darla L. Miller	Principal	Valley Vocational Technical Center
Dr. Linda G. Reviea	Superintendent	Staunton City Schools
Dr. Robin G. Crowder	Superintendent	Waynesboro Public Schools
Todd Cooke	Apprenticeship Representative	Virginia Department of Labor and Industry
Reggie Webb	VP for Enrollment Management	Bridgewater College
	-------Educators- Southern Region -------	
Gail Johnson	Assistant to the President for Marketing and Recruiting	Dabney S. Lancaster Community College
Elizabeth Knapp	Associate Provost, Geology Faculty Member	Washington & Lee University
Glenn Spangler	Director	Jackson River Technical Center
Mike Craft	Director of Career and Technical Education	Buena Vista City Public Schools
Sue F. Hirsh	Superintendent	Bath County Public Schools
Sarah Rowe	Bath County High School Principal	Bath County Public Schools
Jan Hobbs	CTE Director	Alleghany County

Source: Chmura Economics & Analytics

Business Focus Group Questions

Q1. What are the most pressing workforce concerns of your business? (can be short-term, long-term, or both)

Q2. 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:

- Manufacturing technicians
- Mechatronics technicians
- Machinists
- Industrial machinery mechanics
- Welders, or welding machine operators
- Machine setters, operators, and tenders
- Computer controlled machine tool programmers/operators
- Mechanical/Electrical/Industrial Engineers

Q3. For your organization's hiring needs, is there a sufficient supply of labor in the region?

- What are the top positions that are the hardest to fill?
- What percentage of your hires comes from within the region?
- Is the pattern different for high-skilled positions than it is for low-skilled positions?

Q4. Are local training resources meeting your needs? What, if anything, is lacking?

Q5. Is an aging workforce a critical issue for your organization?

- Is the issue more acute among certain occupations? Which ones?
- What is your process for skill transfer from older to younger workers? How would you rate its success?

Q6. 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)?

Q7. What knowledge, skills and abilities are most difficult for your firm to find? (Below are some common examples but feel free to be either more or less specific):

- Computer-Controlled Machine Programming
- Mathematics
- Machine Troubleshooting
- Maintenance & Repair
- Soft skills (i.e.: teamwork, ethics, etc.)
- CAD skills
- Work readiness (i.e.: punctuality, focus, etc.)

Q8. In your opinion, what is the best method for handling skills credentialing?

- Are you in favor of a state-wide standardized manufacturing skills credential system?

Q9. What questions do you think we should ask on the survey that have not been addressed in the presentation or the discussion today?

Northern Shenandoah Valley Business Focus Group

Date: 11/08/2012
Location: Winchester—Museum of the Shenandoah Valley

Respondent from Company F mentions that it's not a "one-for-one trade to automate." It shifts the responsibilities of workers. You may lose operating people but gain somebody to fix the equipment.

Businesses mention that facility tours were a lot of work and did not seem to lead to any new employees.

Question 1:

From experienced worker with a plastics company: our skilled labor force is older. Not a "good flow of younger workers" to replace the retiring workers. The big retirement boom is coming in 12-24 months. The workers will be tough to replace, especially given the skill and experience that those workers have. The company is currently doing on-the-job training to replace workers.

Another respondent says that hands-on machinists are still needed, but most are older. The company also needs a number of computer-machine operated workers, who need all of the same skills plus computer skills. This company has "a lot of mentoring going on," but they have to put a lot of effort into recruiting good workers. From interview to being a full-time employee there is a ratio of 6 to 8 applicants for every one good one. Several other issues include that a) workers require a lot of monitoring and b) older workers "go at their own speed."

A respondent from a packaging company says that they need technical level positions, not just folks to operate the machinery any more. Lord Fairfax CC cannot train for "industry specific" machinery. She was not concerned with low-skilled workers but with people who can keep the machinery operating.

Another respondent says that they have such difficulty repairing machinery that they will send workers to the original equipment manufacturer (OEM). This has turned out to be a major cost saver for their company. This can become a problem because while there some workers will be offered a better job working as a consultant for an OEM.

Respondent from a packaging company cites troubleshooting is a big skill gap. She has found that folks trained in mechatronics and testing from LFCC are "much more qualified." Now folks from many of their plants are sent to LFCC.

A food manufacturing representative says that "25 years ago companies would pay three guys just to do one maintenance guy's job. We would pay an engineer, a PLC guy, and a mechanic…Now we want a guy to do it all." He also thinks that a good maintenance worker doesn't need specific machinery training—they just need to understand electronics. The CC gives some general training but not specific detailed technical training. He has been looking for an electrician for two years. Will have people who would accept the job if it were offered to them "knowing darn well that they couldn't do it."

Question 2:

A respondent from the food industry says the biggest occupational needs are PLC troubleshooting, electrical knowledge, and troubleshooting. However, the company could overcome issues of mechanical and electrical knowledge if the workers can troubleshoot.

Another respondent says that all types of engineers are the biggest concern: chemical, mechanical, industrial, etc.

Another respondent says that comprehension is the biggest problem; tests given for certification are old, and not technical enough. Echoing this, a respondent from the plastic industry says diagnosing problems quickly and accurately is the biggest concern. Another respondent adds to this that network engineering and information systems (IS) are rarely trained for at the local CCs. One participant says that their biggest concerns are middle-level skills, such as welders, industrial machinery mechanics and machinists. Another says mechatronics technicians and manufacturing technicians/technologists.

Question 3:

A representative from the food industry says that they receive tons of applications but not high quality options. For example "We were looking for 8 maintenance workers. We received 200 resumes, hosted 15 interviews, tested four people, and only hired two." Another representative explains that electrical understanding for wiring a house is much different than what is needed in an industrial setting.

All agreed that finding lower level workers is not difficult, but finding higher level workers is a big challenge.

There is a fair amount of interchange between workers at various businesses. One said that "the highest dollar" gets the worker.

Several representatives agree that some workers "straight off the farm" without any formal training are good workers and some are not.

One representative explains that workers in manufacturing are split about 50% between workers who live in Winchester, and non-locals. Lower level workers, in particular, are from West Virginia. Proportion of non-locals is higher for some businesses than others. Many people from West Virginia are from coal mines that have shut down. Higher wages tend to draw people from West Virginia, and likewise pull people from Winchester to Northern Virginia. It is hard to get top talent, sometimes businesses have to steal from their own contractors.

Question 4:

General consensus was that Lord Fairfax Community College (LFCC) was a good training partner. When participants were asked about developing a "Center of Excellence" one responded that it's likely to be an issue of marketing it to make it appealing to everybody. Another agrees and says that having students and teachers tour the facility would be essential for changing perceptions.

Question 5:

Most respondents agreed that retiring workers was a big problem. However, three out of eight said that it was not a big problem- two from the food industry and one from plastics & rubber. Others say that it's not hitting yet but that it will soon. Companies that have been in the region for longer tend to have an older demographic profile.

Question 6:

Two companies claim that modeling and simulation is being used for training workers. One company is using National Technology Transfer (NTT); another uses products from Paulson Training Programs, Inc., which they started using 20 years ago.

Question 7:

Top skills gaps were for machine troubleshooting, PLC, electrical knowledge, and maintenance and repairs, though all agreed that work readiness was the foundational skill needed for all industries. Another person mentions reading diagrams as a missing skill as well.

Question 8:

Types of credentialing used include American Welding Society (AWS), American Society for Quality Certification (ASQ), and Association for Operations Management (APICS). One problem cited was a lack of certification for industrial technicians. WorkKeys is not relied upon. Another problem cited was that for somebody to be certified in all the skills that they need would require five or six credentialing systems, which would be prohibitively expensive.

Question 9:

All people present

Question 10:

One respondent mentions the problem of skill set regression or erosion. Another participant responded that high-quality training can actually market the worker out of the industry and the region. After investing public and private funds in education that person could take their skills elsewhere. Another problem related to cost is that each company has its own niche, and a central training facility would not be able to address all of those niches.

Central Shenandoah Valley Business Focus Group

Date: 11/09/2012
Location: Weyers Cave—Blue Ridge Community College

Preliminary Discussions:

Company A, representing the food industry, is struggling to find maintenance and electrical people for apprenticeships; really anyone with technical skills. Fifteen percent of the workforce is maintenance workers who are eligible to retire in the next 5 years.

Hiring at Company B has been at the entry level (operators) this year; next 5 plus years they will be dealing with their aging workforce. They are expecting significant turnover in the next 5+ years; will be looking for a different skill set than they are today.

Each of the manufacturing industries is going to have at least 10% that is high-tech; need a talented workforce to keep equipment going. At Company A, 10% of employees are high-skilled manufacturers (90 maintenance mechanics and 14 electricians of roughly 1,000 employees) .Company B has about 12%; Company C has about 5%.

Question 1:

Respondent with Company D said finding and keeping skilled technicians.

People have to pass a test at Company A. If they interview 10 people 3 might pass the test.

Company E; 95% High Tech. Most people who come through the door have no marketable skills; aren't able to do anything that would fit what they are looking at. They will put an ad in the paper. A lot of people apply but few are even worth talking to.

A respondent with Company C said when they do find qualified people (especially young, right out of school, no work experience) they are missing secondary pieces other than just technical like, attendance, work ethic, discipline, ethics, etc.

Company D is trying to recruit former military or draw from the Norfolk area but people from outside the Valley find this is not the lifestyle they would want (especially young people).

A respondent with Company A said it is not people's first choice to live in the Valley. They would rather hire from within the Valley instead of getting workforce from other regions; but if the needs are not met here; have to go outside the region. In 2013 Company A is hiring more operators; they will be looking for higher trainability skills. Wanting to take their operators and move them to some of the maintenance activities and take their maintenance folks as opposed to doing those activities look at more reliability related issues.

Question 2

Company D; Electronic Techs. This is a small group; takes 12-18 months to become familiar with equipment. Losing a tech takes a lot of time to replace (they have lost 5 in the last year). Businesses in the Valley having been losing workforce to competitors in the region due to higher wages. People moving around a lot in the Valley.

Company A needs mechatronics but no one can match even one of the skills needed, more or less both of them (mechanical and electrical controls). Have been taking candidates to BRCC for cross-training on mechanical and electrical skills. Company A has an arrangement with 4 community colleges to do this. Their equipment is controlled mostly by PLC's and computers (highly technical). There is a $3-$6/hour difference between single-skill and multi-skilled jobs.

Company C; Manufacturing Engineering Technicians. Bottom tier hardest (refer to diagram).

Company A; Mechatronics and Electricians. Welders belong in the lower tier; add electricians to mechatronics technicians; another level of machinists. Electricians are more difficult to find than maintenance mechanics. Manufacturing technician makes 75% of what an industrial maintenance mechanic makes and mechatronic technicians make even more. PLC Technicians Specialists are the highest paid tier.

A respondent with Company D said most of these are non-salary positions except engineers and PLC Technicians.

Question 3

A respondent with Company C said there is a difference between sufficient qualified supply and sufficient supply. There is not enough qualified supply of labor in the Valley. She specifically mentions work ethic here.
Another respondent with Company B said for a long time they've had lots of applicants for openings at their entry level manufacturing jobs. They start the interviewing process, background checks, fiscal ability testing, but then when you get them on the job and they're just "OK". Dependability issues; work ethic issues. Plenty of applicants.

A respondent with Company C said when you look at unemployment statistics, there are a lot of unemployed people in the Valley, but when you start interviewing those people, and talking to those people; are they people who are going to fit your organization?

Company B respondent; or do they want to?

Maggie: What types of people are you bringing in? Are you bringing in only people that have experience in manufacturing? Or are you bringing in people with no experience but are willing to train them?

Company B; we are bringing in people who don't have experience but are willing to train them. We are bringing in high school graduates.

A respondent with Company C; working with BRCC on some of the certificate programs. Last year Company C hired 67 people and the bulk of them were entry level. They have fairly low turnover. The problem is not so much them (the employees) as us (Company C) with them. Twenty years ago there was more longevity. Employees went to a company with dedication. They went there to retire. Discusses bridging the generational gap. More employee friendly work environments; telecommuting; flexible scheduling; day care centers.

Company A respondent; there was a notion in our society that if you went to college and got a degree you'd come out and get a great job, but what is happening now is that if you don't have a certain degree, you're living back home with mom and dad because there is no job for you. I think somewhere people are realizing that there are these great jobs that you can make a good living being an electrician or maintenance mechanic or mechatronics mechanic or whatever on the technical side—you can do pretty well. Most of the people they interview could not get into college. Tell them they need to take a math class and they can't pass it. The people who could have passed it went on to get a degree in a different field.

Question 4

A respondent with Company B said local training is not a factor.

A respondent with Company F said they use manufacturing training a lot but they haven't taken advantage of local training.

Company A said Blue Ridge Community College (BRCC) is a good partner.

Question 5

Company B said it will be over the next 5 years.

Company A; absolutely. Their plant just celebrated their 30th anniversary last month. That day 4 people were having retirement parties. The average age at Hershey's is 49. They have expanded their training organization and put more structure to that process. In anticipation of that need, they have put two full-time people on training.

Company C; absolutely. Not as much as the other 2 (Company B and Company A) but yes.

Company F; not an immediate issue.

Company D; not an issue. Their employees were actually offered early retirement last year as an incentive. The average age at McKee is 42-43.

Company E; not an issue; most employees are in their 30's and 40's. They are trying to get young people, it takes a while for them to get the precision skills needed down.

Question 6

Company E; you have to keep up with it. They bought new equipment, trying to keep up and be competitive. All equipment is becoming more and more technical and complex. Trying to get much as much training as you can along the way.

Company A; will be obsolete within 5 years. There will be two more models by then. They are bringing iPads into the factory so operators can keep track of whether or not they've completed their CIL tasks; repairs are the tough part (people don't know how to trouble-shoot the technical issues).I think we're doing ok with emerging technologies; the equipment is so good that it can be handled by just about everybody. If you can handle a smart phone you can operate a lot (the repair is the tough part).

Brian; do emerging technologies have the possibility of making the labor you have here obsolete?

A respondent with Company C; sure. Fewer employees at your location.

A respondent with Company A; you might have less operators but more mechanics.

Maggie; how often do people get shifted around in roles? Cross-training and promotion?

Company C; we do a lot of cross-training.

Question 7

A respondent with Company B; worker readiness; soft skills; troubleshooting (all but math).

A respondent with Company A; all on the list (math and CAD at bottom). Percentages a problem.

A respondent with Company C; CAD at bottom of list (not as big of an issue).

Maggie; how do you get 15, 16, and 17 year olds interested in math or STEM?

Company C; career coaches in high school need to do a better job of preparing students for what classes they will need to take based on what they want to do. Need to tie something back as to "why" it's important not just saying it's important.

Company B; showing students why it's important by bringing them into the workplace.

Question 8

Company A is not hiring unless they finish certificates. As employers, they are not in a position to really test people. You only have so many ways to screen. One is BRCC or the educational system.

A respondent with Company C; BRCC is really open. They will customize programs to meet specific business needs.

Question 9

Company A; Lester Smith, Career Coaches, Guidance Counselors. Those are the agents of change in saying you don't have to go to college to be successful. Although they still want people who are suited to go to college. These newer jobs are not for people with limited skills.

Company B; how are the high schools educational systems tied into this?

Company E; there is a lot more people out there with limited skills these days. They don't do anything themselves; can't fix anything anymore, can't think through the process or understand the problem stage by stage to work through it.

Company A asks candidates to tell them between 3 and 5 things they have fixed; could be a leaky faucet for example. Some people have no answer.

Question 10

Company B; where people think they've had success. You could have nuggets of success going on.

Company A; we need to be working on issues together, not independently. Put a group together to start addressing these issues. Most businesses have the same problems. One company is not going to solve everything on their own. Company A has received very little help in putting their apprenticeship program together.

Company E; this company is involved in setting up a machinist apprenticeship program in West Virginia. They seem to be pretty willing to do things there.

Education Focus Group Questions

Q1. What do you think are the biggest workforce concerns of the Shenandoah Valley? (can be short-term, long-term, or both)
- Do you think that the manufacturing industry has major workforce concerns?

Q2. Do you feel that the curriculum used in schools is preparing students for today's workforce?
- What about today's manufacturing workforce?
- What competencies or skills are seen as most critical for today's manufacturing workforce?
- What are the strong points of the curriculum for manufacturing-bound students?
- What are the weak points of the curriculum for manufacturing-bound students?

Q3. To what careers are students most often drawn?
- What factors draw students to these careers?
- How often do students have a "realistic" plan for achieving those goals?
- To what extent do parents' careers influence students' career decisions? In what way?

Q4. What are students' impressions about manufacturing?

Q5. How does your school/district encourage students to think about careers in manufacturing and technical fields?
- What are some common characteristics for students who are interested?

Q6. To what extent should career and technical training take place outside of regular school hours?

Q7. How would you rate students' average competency in the following categories:
- Engineering
- Mechanics
- Computer programming
- Basic mathematics (i.e.: percentages, multiplication, etc.)
- Electronics

Q8. What more could businesses in the Shenandoah Valley do to help stimulate students' interest in manufacturing careers?
Q9. If a facility were available nearby where students could get hands-on experience working with advanced manufacturing equipment, do you think that your district/school's students would participate?

Central Shenandoah Valley Educators' Focus Group

Date: 11/19/2012
Location: Weyers Cave—Blue Ridge Community College

Question 1

A Superintendent with School System A asked if the educational institutions are providing the proper instructions students need to enter the workforce.

A respondent from School System B; skill trade areas, plumbers, electricians, etc. They are not in high demand. The age ranges between 18-60, with the average age being between 25-35. A lot of people with a 4 year degree are coming back to learn a skill.

A Superintendent from School System C; "Dirty" skills jobs like machinists, etc. can make a good living in the Valley but these jobs are looked down on by students; this starts in K-12. They push for a 4 year degree instead of showing value in those jobs.

A representative from a state job; dirty, no money. They push college which is a disadvantage to kids. All kids should have a vocational skill first to fall back on.

A representative from a local college; said the top ten jobs in 2010 were not even on the list in 2004. The landscape is changing. Students have a lot of debt, need to see return on investment. It is hard to predict gaps. The landscape is always changing. He said STEM is everything.

Question 2

A Principal at a local Technical Center; yes and no. She mentions funding. Soft skills, work ethic, problem-solving, showing up for work, time-management, professionalism, communication, etc. They have been told by businesses, "Don't worry about training them, we'll train them when we hire them."

A Superintendent with School System C; the only path educators know is 4 year college. This sends a subconscious method to students that college is the only way. Teachers have no idea what's going on at tech centers. Kids aren't exposed to other jobs.

A Superintendent with School System A; creates a caste system.

School System C; this is a female dominated field; salaries would be much higher if it was male dominated.

A respondent from School System B; students have the wrong impression of what is offered (in terms of jobs).

Question 3

A representative from a state job; CSI, Crime-related jobs.

School System A; athletics, healthcare (nursing)

School System D; teaching

A principal at a local Technical Center; cosmetology; auto mechanics (car body work).

School System A; what their parents did. If daddy was a doctor; child becomes a doctor. If daddy is an engineer; son becomes an engineer. If daddy is a minister; son becomes a minister.

A principal at a local Technical Center; students do not have a realistic plan for their future.

School System A; we don't hold children accountable and we need to do a better job of that.

Question 4

A superintendent with School System C; they think of factory workers.

A principal at a local Technical Center; they don't know what manufacturing is. They think of pulling feathers off of chickens. Manufacturing jobs are the "dirty jobs."

School System D; they think of an assembly line.

School System C; they will go to BRCC and end up working for NTelos in sales or something. They seem to really like those types of jobs.

School System A; they are not sure what engineers are. They know what teachers and doctors and athletes look like. They don't really know what engineering looks like or what it does. Unless they have a parent that does it, they don't know what it is.

Question 5

School System D; career inventories is something they are doing in the educational system.

Question 6

A superintendent with School System A; there is a sense of entitlement to athletic and extra-curricular activities and programs.

A superintendent with School System C; could set it up where some students take day classes and some take night classes so they can work, take mentorship, etc. during the day. The Department of Education wants to make all students the same. There is a need for thinking outside the box.

They mention this type of system would be hard due to funding and time. It would be hard to find teachers to want to work in the evenings, plus what they would have to pay them.

Question 7

School System A; students don't know what engineering is.

School System C; It depends on the student. Basic mathematics-strong. Electronics-0. Computer programming-not much. Mechanics-these kids are at Valley VoTech.

School System A; Computer programming is moving to modeling & simulation and gaming.

Question 8

A representative from a state job; we have to come together.

A principal at a local technical center; someone who organizes events. This works better some places than others.

School System C; have a summer Advanced Technology Institute that students have to apply to attend (not college students, not VoTech students, but somewhere in between). It would be a 3 week program and students could still work. It should be promoted as something you have to apply for. If so, students will go. If they think it is something they have to be accepted into, it will give them more incentive. This gives kids a choice and kids love choices. Exposure.

School System B; students touring manufacturing facilities. This gives them an opportunity to see what people do and to see the workers using the machines and that it is not just an assembly line.

Question 9

School System D-Yes
School System C-Sure
A state job representative-Yes

They all said budget is the problem.

Question 10

School System B; you haven't asked any questions at all about students themselves. We take a lot of responsibility on ourselves as educators, but students have a responsibility as well.

A state job representative; if there is any way hard work can be taught. His parents taught that success was not dependent on college or training but on hard work. They were right.

Northern Shenandoah Valley Educators Focus Group

Date: 11/20/2012
Location: Weyers Cave—Blue Ridge Community College

Question 1

Representative A from a local community college; technical skills shortages.

Representative B from a local community college; Employers being able to articulate those needs. What are the certifications they want employees to have? What she's hearing from employers is that it's not so much about certifications, but particular skills they need to have, in particular workplace affective skills they need to have.

A local community college representative; disequilibrium between the certification and skills they are asking for entry level individuals to be trained at. Once those individuals apply for those positions, they are expecting 3-5 years troubleshooting experience. Disequilibrium between what the entry level skills are vs. the entry level hiring requirements.

A representative from School System A; how do you get experience if no one will hire you?

Representative B from a local community college; 4 year college graduates are saying, how do you get experience right out of college?

Representative A from a local community college; CDL Licensure very expensive program; the job placement rate is so low; the insurance carriers require two years driving experience or they won't insure them.

Representative B from a local community college; high schools need to understand about apprenticeships. Articulation by employers on what the entry level skills are. Exposure to apprenticeships.

School System A; from an education standpoint, industry is murky. The business community is pretty clear. I can put kids in web design, computer information systems, and I can get them Microsoft Office, and when they go into a business to apply for a job, they know what those are. They have certifications for industry, but they don't have any mid-level ones kids can take. Unless you have a highly skilled instructor, you can't get the kids there. They have welding in their schools, but they have one instructor at one high school that's highly qualified but the others are not. There are no pathways clear to the kids.

Representative B from a local community college; high school kids need to understand about apprenticeships; we need to be telling kids very specifically about what "technology" looks like. Is it programming, is it Java, is it Web design? Also, what math and sciences should they be taking? What's going to set students up best for success? The bottom line-how much money am I going to make? What does an engineer "look" like to kids? They know what doctors look like.

School System A; mid-level certification; something obtainable by a high school junior or senior after certain level of training. Career awareness tours, employers need maintenance mechanics; hate it when he takes kids on manufacturing tours and all they say is "show up on time." Don't focus on technical skills.

Representative B; define what higher-level skill set looks like.

Question 2

School System A representative; I do. The CTE programs are supported by workforce in the community (or they don't have).

Representative B; Very Proactive Educators Group & Sense of Community.

A representative from School System B; Some students and manufacturers may feel like there is a significant portion of the curriculum they are disconnected from. Students look at the required courses to graduate and say "I'm good." Algebra 2 for example. He taught it for six years and a lot of people wanted to know why they had to take it. Kids need to see the future value of taking these courses.

Representative from School System B; We try to be innovative. Uses an example of an international conference on technology. Model out of Denver, Colorado called "Geometry and Construction". The superintendent said they could teach geometry with construction. They took a geometry teacher and a couple of carpenter teachers together with 16 kids and they taught geometry and construction together and they built a house. Geometry scores went up. You have to connect technology with why we are learning this. Teachers sometimes do a poor job of explaining this to kids. They just say "It's required."

Representative B; A lot of that is teacher training. Nurses need Anatomy & Physiology (Biology 2 at the high school level). Need to know how to convert decimals fractions (have to give the correct dosage of medicine). Students don't know because teachers don't know how to articulate that (they don't know the all the nuances of the various types of careers). She puts in a pitch for career coaches here.

School System A; at a recent panel discussion with industry leaders in the regions, they asked what skills they needed to be teaching and the business leaders said communication skills. Teach them how to write clearly and to talk with one another.

Representative B; says half of all college freshman have never been on a date because they communicate with one another via social media; they don't talk to each other.

Question 3

Representative B from a local community college; nursing; Nursing is a big one. They realize how competitive it is. They know that they can make good money being a nurse and the jobs are there. They understand it is a very competitive process.

School System A; Not connecting curriculum with jobs (Representative B gave an example of students saying they wanted to be a nurse and hadn't taken any of the required courses needed for that like Chemistry). Careers outside the area. A significant portion of their students say they want to get out of the Valley after they graduate. They look for something else somewhere else.

School System A; It's not a quality of life thing; it's a cost of living thing. They think you can make more money elsewhere. You can, but you can't afford to live there. A lot of kids go from here into teaching and business; go on to college (community and 4 year college).

Representative B; Kids don't know what they want to do. They don't know what they want to major in; change their majors a couple of times in college.

School System A: we're not training automotive technicians; we're training kids who think they want to be. We're getting them started and we've either turned them on or turned them off. Which is not bad, if a kid goes through a med tech program at our high school and realizes that's not what they want to do, that's good information to have.

Maggie; do you find a lot of students wanting to do what their parents do?

Representative B; if their parents are educated there may be more of a possibility that they will want to do that. If their parents are not educated and they've never had exposure, then no. They don't know what's out there.

Representative B; there are a lot of kids who do DECA or FBLA (marketing clubs) in the high schools. They want to major in communication because they see themselves on TV and working for the Redskins or someone like that. They see themselves in that kind of glamorous role but not understanding what it takes to get there and understanding there are limited jobs in that field.

School System A; heard a program on NPR that discussed how his generation used to graduate from college and go find a job and move into that community. The millennial generation determines community they want to live in and go to that community and live there and find a job.

Representative B; Kids don't want to do what their parents do; they don't want to be workaholics. When they need to take a day off, they take it. When they need vacation; they take it. The millennial generation is very concerned about society. They are going to focus on what's important to them. Not going to be like their parents where work is the center of their life.

School System B; A lot of the students in this region are the first generation to graduate high school.

Question 4

School System B; Manufacturing is still invisible.

School System A; He and the representative from School System B toured about 500 kids (middle and high school) through 20 different companies in Frederick County; gave a survey that shows kids' impressions of manufacturing is not as negative as it was 10 years ago. Back ten years ago it was seen as dirty, not a good place to work, back-ages, dark.

Representative B from a local community college; they are going to go to college, not going to do this work. They are not realizing you go to college so you can work here.

School System A representative; discusses having to get 33 Gen Ed classes in high school for college. He would rather see technical skills credits that they can apply, because the technology is where the jobs are going to be.

Question 5

School System A representative; Tours, courses.

Representative B from a local community college; A lot of those courses are dual-enrolled with college.

Steve; our technical center. Doesn't have all the programs he'd like to have, but they have Electricity and Auto Maintenance and an ASE Certified Auto Mechanics Program. They have carpentry. Those are the kinds of skills kids are learning at the Tech Center. They do a lot of stuff with CAD. One high school has a 3D printer.

School System B representative; all types of kids. Students who can see themselves in college; students who seem themselves as colonels in the army after West Point. Student now in welding- he is confident he will go to West Point. He wants to have a skill to take into the military. A lot of times it's these entry level courses that will eventually lead to these kinds of careers.

Representative B; its real for them; its integrated. The teacher is more of a facilitator. It's a very applied, facilitated type of learning process.

School System A; agrees, it's all kinds of kids. The engineering kids are mostly college-bound kids. There are graphics kids that just like graphics. Authentic learning is taking place in student organizations. All strong programs have a strong student organization. In DECA, the real learning takes place when the student takes what the teacher has taught such as the 4 P's of Marketing and work with three other students to design a display, to do a project out in the community, to document the project, to report the project, and to compete. That's authentic learning, or communicating, or presenting, or competing.

Representative B; panels judge the kids. There are winners and losers and kids know that going into it.

School System A; Kids love it.

Representative B; trying to get teachers to put in the extra time and work with students on that level- is really hard to find people dedicated enough to do that. National Youth Organization conferences are amazing.

School System A; SkillsUSA. You put 15,000 kids in an arena it is phenomenal. SkillsUSA is the technical competitions. It's the largest student organization in the nation. They have an international competition. They have cars, cosmetology, manufacturing, CAD. There's 60-some different technical competitions these kids can participate in. When he took his kids out of Rockingham County to these competitions in Orlando, Richmond, etc. this was the first time many of them had ever been out of the county. Learning to get along with the group and go with the group is skills employers need and they are the real skills kids learn.

School System B; problem now is kids postponing adulthood. The kids that are attracted to these types of student organizations (or sports) are the types of people employers want.

Question 6

A School System A representative; Frederick County has great support for career and technical education.

Representative B from a local community college; Needs to start at the state level where they mandate other classes that go into graduation requirements. Mandated classes like finance cut into electric programs and takes away from students being able to do CTE. Also, having that recognition from the state level to provide money.

School System B representative; the school district is told you need this course or that course or that but no money to pay for teachers, it comes from non-SOL Courses. It's not a question of the local board trying to free up resources. There needs to be more resources.

School System A; a couple of years ago the legislature passed a law that they have you teach Economics & Personal Finance to every kid before they graduate; the information the students are learning is excellent but they gave them no money to do that with. They wanted all kinds of teachers to teach it. They said the teachers are certified automatically. Certified doesn't mean qualified. No new money means no new teachers. Now, a course that originally had 36 kids in it, this year has 300, next year will have 600 next year, 800 the following. He is losing 1 teacher this year, 2 teachers the following year, and 3 the

following. It'll take 15 sections in each high school (three teachers in each high school) to teach this when it's fully implemented. Where do you get those sections? Cut Computer Information Systems, cut Accounting, and cut Business Law. Fighting for 3 new teachers for next year, but if he doesn't get them, he has to remove curriculum.

School System B; we have 12 CTE teachers in our building, and because of this mandate, 2 out of the 12 of them are going to have to teach that course (Economics & Personal Finance). Each teacher can teach 6 courses a year. Where are those 12 courses going to go? They are disappearing. We have taken 12 CTE courses off the table entirely. This other thing is good, but it deserves its own source of funding.

School System A; if you're going to do it, fund it. It also takes a credit out of the schedule. If the kids are required to take Personal Economics & Financing, they may not have a credit left for Manufacturing.

This is forcing kids in middle school to take more high school credits.

Representative B from a local community college; the appropriate priority for technical education expands beyond the school building. It's community awareness and parents understanding what career and technical education truly is (not thinking of it as it was when they went to high school).

School System B; for the parents and community leaders that hold the power, they think "this" (CTE) is for the "other" kids (for the kids that live on the other side of town). This is not for their kids who are going to college.

School System A; it's in the application courses like engineering, manufacturing, and graphics where kids really learn to think, problem solve, and create. 21st century skills: thinking, problem solving, creating, collaboration, and teamwork.

Representative B; kids can't think past "tell me what to do."

Question 7

Representative B; Basic Mathematics-trend now where more students are knowledgeable on how to do those things because it's expected of them; their school division has been pushing for kids to take math all four years through high school. When she dual-enrolls kids who are in CTE, their placement test scores are comparable to kids who are taking calculus. At least in Math and English skills, the CTE kids are right where all other kids are. They are all pretty savvy with MS Office. Not everybody is going to do Networking. Kids are all pretty engaged with social media and trouble-shooting technology issues (such as how to fix a Blu-Ray player).

School System B; there is a tendency to avoid sticking to a problem-the younger generation is used to things being instant (texting) as opposed to taking a couple of days to work on a problem.

School System A; if you are rating the student population on those kids; very low. We need more kids to take those types of classes. The Networking Computer Systems Design class that we have should be in each high school instead of at the Tech Center. If it were at the high school it would be filled up.

Question 8

Representative B; what she's hearing from her Curricular Advisory Teams in IT and Trades is that employees are not willing to work for what they (the companies) were offering to pay; employers are going to have to start paying people more to keep them from going over the mountain (Loudoun, Fairfax) especially as the workforce shrinks.

School System A; I am a technology educator and we really haven't hit on the thing yet that kids really want. I don't know how you attract kids. Engineering and manufacturing are interchangeable at this level.

School System B; there is a strong desire for students to be with their people, their social group. When you go to industry now and you look around the shop floor, you see equipment, and the people that students are seeing are not people they

can relate to because they are the aging workforce. If even the job is there and it pays well, they might not be able to see themselves at the job.

Representative B; employers are going to have to do things to meet employees where they are. Example, providing gym membership, credit union membership, classes on site, etc. This generation of employees don't want to struggle like their parents did, they need to be shown how they can help themselves (this is what they are looking for).

School System B; manufacturers need to understand there are other places for these people to work that will meet their needs (he uses the example of someone working at COSTCO and making the same amount as working in manufacturing).

Question 9

School System A; if it were in our community. Travel would make it prohibitive; kids won't want to travel. When you take kids away from their home school, they lose credit. If they were in Page County, absolutely not, or even Southern Frederick county (too far away). It depends on where it is in the Valley. Would we support? Yeah, if it were in our community.

Representative B; where would they put it? Couldn't have one center for the whole area. You wouldn't have the traffic if there was one center for the whole region.

Maggie; How do you do that with an area as large as the Shenandoah Valley?

School System A; if you were able to put together "mini-sites," advanced manufacturing isn't as expensive to equip as it used to be. You could even set up a portable site. It could be in Frederick County one year and Rockingham County the next (might be tough curriculum wise).

Maggie; If you had one main site, and then had mini-sites throughout, but also, doing something where kids could do tele-learning, and having some sort of model kids could work on from their school to get the hands-on experience. Then once a month or something, everyone goes to the main site to apply their learning to the equipment or machine. Would something like that work?

School System A; would that work, yes, but whatever you do is going to have to be available to the community. One central site where all the kids come, you're only going to get participants around the site.

Question 10

School System A; probably Technology and Education teachers for sure, and maybe some Agriculture teachers, because they teach welding and stuff like that.

Representative B; we need the State or someone to tell us what are the value added certifications of businesses in the industry so we can all be on the same page.

School System A; there is no certification in Manufacturing and Engineering. He would like a mid-level certification for welders. No real testing for manufacturing, electronics, electricity, carpentry, etc.

Southern Region Shenandoah Valley Educators Focus Group

Date: 11/29/2012
Location: Buena Vista—Dabney S. Lancaster Community College

Question 1

A Principal with a local high school said her dad retired and they didn't replace him or train anyone to take his position, so they outsourced his job (he was an upholsterer at the Homestead for 30 years). They are now calling him back to do work for

them because they have no one to do it. There has become a gap within the educational process for those kinds of services. Before they would take folks and train them into those jobs. You have a workforce of students coming out of high school and going on to college, but they are unskilled labor. The things they need to be skilled, they've let that group age out; there isn't an intermittent age group in this county. There is a black hole no one figured out how to fill. There is a lack of interest in young age groups for those jobs; lack of stability of jobs. No guarantee that position will be there for you to build a home around it and establish some roots.

A CTE Director with School System A said employers say the jobs are there, there is no one qualified to fill them. They (Buena Vista School system) haven't found a solution over the years.

A Director at a local Technical Center said over the years the Department of Education has been pushing for college and they put career and technical education on the side. There is a whole generation of kids right now that are just SOL-based and college-based.

Principal with a local high school said that they are pushing training and certification on kids really fast and they are not ready for it because it's too difficult (mentions ASE & NOCTI tests).

CTE Director; a lot of these certifications are not meant for students, they are meant for people out in the professional field. These tests meet the requirements of the State, but it means nothing to employers. They want kids that are coming out that have a skill. That area (the Southern part of the Valley) has been depressed for a very long time.

A representative from a local community college; you could summarize what we see in the literature. There is a growing disconnect between the jobs that are out there and emerging and the skills of the people that are looking for jobs. There are jobs out there, everywhere, but you can't find the right skill set.

A superintendent with a local high school said that the region's major employer, Homestead, and even though they have jobs, as the hotel has been sold and bought under different management, they have been bringing in a lot of employment from outside the region. There is a lack of on-the-job training (employer) and poor work ethic (employee). Teachers don't want to put in extra time.

A CTE Director with School System B said people are not getting raises in the poor economy. People don't want to put in extra time without being compensated for it. References an article from 2010 on what employers were looking for; the first five were more of those character skills like work ethic, being on time, etc.; reading and writing were number 5 on the list. This discussion was on millennial workforce-training skills vs. training attitude.

Principal; you can train someone a skill; you can't train someone to be a genuine, decent person. I can teach you how to use a screwdriver, I can't teach you to come get the screwdriver.

CTE Director from School System A; spoke with several HVAC shops people who have said they would train people what to do; they just want people they can count on. They just want trustworthy, reliable people in their workforce. It comes from the family.

A representative from a local community college; we should not assume anything anymore and the first part of every curriculum in all disciplines should be soft skills: you go to work, you go to work every day, and you go to work on time. Start with that because we can no longer assume it's taught at home.

Technical Center Director; soft skills are integrated into all of our programs now.

Community College representative; they are not applying it when they get out.

CTE Director with School System A; the State should mandate a workplace readiness class that way that's all they do in that class. When our teachers are working on their skills, they need to get that skill.

Question 2

Principal; the skills are in the curriculum but there are a couple of problems. Workplace readiness is heavily matched in every career competency. Educators don't know how to assess it any differently than on the job training and what they do, but that's not how we're asked to assess it.

Superintendent; we can't assume that all of that is left to the high school. Should start in Kindergarten.

Technical Center Director; the curriculum is pretty comprehensive; the problem is getting kids to take the right courses. We had to change the name of advanced manufacturing to Introduction to Engineering or Introduction to Technology because they wouldn't take the class when it was manufacturing. They got a new teacher and originally had over 40 kids in the class, they have 7 now after two 9 week periods; they all dropped when they found out what it was about. The curriculum is there, the kids want to take the easiest route there. They want to take computer-based so they don't have to get out of a seat. They don't want to get dirty. They don't want to be uncomfortable; that goes back to work ethic, etc.

CTE Director with School System A; parents now want to believe their student for anything and will even lie for their kid.

Superintendent; parents want their kids to drop out of a class when the going gets tough. They want their kids to go to college so it's important for their students to get the best grades they can; so students take the path of least resistance to get the best grades.

Community College representative; think of STEM now; think of the brightest and the best high school you have now. You would hear of counselors and teachers telling students they needed to go to Tech and be an engineer, you need to go to UVA and be an architect. Do you hear, you need to be a plumber? You need to be an auto mechanic. Until we elevate the prestige of the occupational technical trades up there with academics.

Technical Center Director; most of these upper level kids' parents think CTE is for somebody else's kids. They don't see their child being involved in it.

CTE Director with School System A; curriculum is good; hard to apply to a job. Employers want kids with hands-on experience not a certification.

Superintendent; think creatively and solve problems, which is not necessarily encouraged with SOL's. Just bubbling in the correct answers isn't going to do it; the kids need to be able to solve problems.

Principal; her CTE teacher said math is a huge problem; fractions; measurements; any kind of applied math is a huge problem for our kids because of SOL tests (it's get to the right answer, A,B, and C). The instructors who get scared for the SOL results have diminished critical thinking skills in students.

Superintendent; mentoring. Teachers often don't understand STEM—especially the engineering component.

Question 3

Community College representative; the glitzy ones; the one they see on television like sports.

Superintendent; all the kids on the athletic teams think they are going to play professional sports.

CTE Director with School System A; people want instant success; kids want instant salaries. They don't want to work up to it, they want to start off with a nice salary, so that's the jobs they are drawn to.

Principal; kids think base pay (based on surveys) starts at $55,000 a year or higher. They get defeated when they realize what types of jobs those are and the time they have to put in.

Community College representative; everybody likes computers; kids want to study computers because they like to play on computers. They don't know connection between career/salary and skills (ex. Computer Science needs math).

Superintendent; where people want to work; they want to go where the big dollars are ;social life is important. She has to figure out people who are willing to take a slower pace of life, which grew up in a rural area and are content there.

Principal; its a third and a third. She has a third that won't ever leave and the third who are never coming back, and a group down the middle who don't know what they want to do so typically they end up there. She has a group who loves it there and group who's afraid to leave home.

CTE Director with School System B; just hired 10 new teachers; over half was a former student.

Community College representative; you should invest in your local students; "grow your own."

Superintendent; when I interview people I ask if they know what they're getting in to. They need to be the best match for each other. A lot of kids don't have interview skills.

Principal; people are afraid of rejection.

Community College representative; comfortable with what you know.

Question 4

Superintendent; they don't know what it is or they think it's monotonous work. No student has ever asked her about manufacturing. Ever.

Community College representative; they think it's dangerous, low paying dead-end work.

Technical Center Director; they are the jobs students get in to after college doesn't work out and they lose the financial safety net from their parents.

Community College representative; globalization; people need other skills.

Superintendent; she encourages students to look at the military. At least there you learn something.

Question 5

Community College representative; career fairs; career awareness; career coaches (the Technical Center Director said they don't have career coaches in his region anymore due to funding).

Principal; career fairs; community service. Kids at her school don't have the opportunity to shine; community service gives them this opportunity. Kids feel a sense of accomplishment through community service. Students quit too easily and they are not encouraged. You can only learn about something by putting your "feet" in it.

Question 6

CTE Director with School System A; he wishes schools could free up resources. Lately they have lost several faculty members due to funding.

Superintendent; it is hard to track data and analyze, especially with a limited number of resources. They need the correct and the right information, but there is no budget or resources for this.

CTE Director with School System A; his CTE teachers can leave and make more money elsewhere with the experience they have. A lot of his teachers have senior level experience in their trade.

Question 7

Superintendent; all of those below average.

Technical Center Director; there are a generation of kids that have been dumbed down because of standardized testing.

Principal; at her school kids are strongest in computer and electronics skills.

Technical Center Director; kids don't know how things work; they just know how to push a button (referring to technology).

Principal; engineering is at the bottom for her school.

Question 8

Prinicpal; they need to come in more to kids and engage the kids. Kids need to hear something 7 times before it sinks in.

Community College representative; employers need a common language for articulating their needs.

Question 9

Principal; yes.

Technical Center Director; they have a miniature version in his region but they can't get kids over there. Location is very important.

Central Shenandoah Valley Students Focus Group

Question 1a

Answers: 5, 2, 7, 10, 10

Question 1b

Answers:

- Meeting new people
- Finding something to make money with
- Get away from stress; getting out of town
- Finding new opportunities; high school and college are two very different things

Question 1c

- Answers: Two for Nursing, Baking, Military (Navy or Marines; leaning more toward Marines)

Maggie: What about nursing is appealing to you guys?

Answers:

- My mom's a nurse and I love hearing the stories she comes home and tells me.
- I am one of the first people in my family to go to college (different student). Ever since I was little, I've always wanted to do something to where I could help people out.

Maggie: Why do you want to be a baker?

Answer:

- I like to bake stuff that tastes good and I like to make people happy. Stuff that tastes good makes people happy.

Maggie: What about the military? Why did you want to do the military? Is someone in your family in the military?

Answer:

- I've always been interested in it. My dad was in the military back in Honduras.

Question 1d

Answers:

- When you watch the news and its saying it's harder for people with college degrees to get jobs than people with high school degrees it makes you think, but in the end, you have more attributes than people with just high school degrees so in the end it will work out. It makes you think more and more about going to college.
- I'm not worried because everyone is going to get married, everyone is going to have birthdays, and big corporations are always going to have special events where they are going to have pastries, a cooking job is really easy to find, everyone is going to want to eat.
- Go back to the pie chart, food is the most important thing.

Question 2a

Answers:

- Tired (Tiring)
- Labor
- Difficult

Question 2b

Answers:

- I didn't think the largest industry would be food. I thought it would be auto (building cars)
- No, because of all the big manufacturing places we have, like McKee, Hershey, Pepsi and Coors.

Maggie: Does any of your family work in manufacturing?

Answers:

- My dad works for MillerCoors. He stocks.
- My aunt works at Hershey.

Vanessa: When you think about the jobs, what do you think of in terms of the jobs in our area? If it's not manufacturing, where do you think most people work?

Answers:

- Farming.

Maggie: Do you have a lot of farming here?

Answers:

- Yes. One student's family worked in farming.

Question 3

Answers:

- 2 people stay, 7 people leave

Vanessa: Do you guys have a plan on where you want to go?

Answers:

- I want to live in a big city. New York or Charlotte (wants to go in school in Charlotte). I know it's not a big city but I like that's there's a lot to do. Around here, there's nothing to do.
- Florida-Miami
- I'm not sure, just not here.
- Wisconsin. My dad is from there.
- Anywhere but Virginia.

Question 4a

Answers:

- 10
- 3
- 8
- 8
- 6
- 8
- 10
- 5

Maggie: What has made it lower for you (referencing the girl who said 3)?

Answer:

- I don't really look at the future as much as most people do. I usually just focus on right now, not a year from now or 2 months from now.
- The way I look at, if you don't think about it, how are you going to know what you want to do for your future (different student)? It would be better to already have a plan set that way you can already have a head start.

Vanessa: For you guys with the lower numbers in terms of thinking about your future, when you think about your future, what do you think about? Do you have careers you consider or do you just think about the fact that you need to be thinking about it?

Answers:

- I've considered some careers but I don't know what I want to do.
- Just to have a main job I want to do and have back up plans. I want to go to the NFL and be a referee, work my way up to it.

Question 4b

Answers:

- Baking
- NFL
- Nursing
- Military
- Acting or Broadway

(We asked students what they would do in a perfect world, that is when they said acting or play in the NFL, the other careers were answered earlier in the focus group).

Question 4c

Answers:

- Nursing-wants to help people
- Nursing-that's what mom does

- Military-discipline, the US is the best military power in the world; get a lot of advantages.

Question 5

Answers:

- Mom-Nurse; Dad-Blue Ridge Beverage
- Dad-Owns his own business
- Stepdad-Carpet Warehouse; Mom-stays at home
- Dad-owns his own business (repairs people's homes) Mom-stays at home
- Mom-Individual Cleaner; Dad-Manufacturing
- Dad- Sales Manager at Ford Dealership; Mom-Teacher
- Mom-Cleans; Dad-Farmer
- Mom-Bookkeeper; Dad-part time bus driver for Rockingham County
- Mom- Supervisor VDOT; Dad-unemployed

Question 5b

Answers:

- 4 people said yes, their parents did go to college
- The rest did not go to college

Maggie: Where did they go?

Answers:

- My mom went to Blue Ridge for a while
- Virginia Tech
- Lenoir Ryan

Question 5c

Answers:

- Pretty unanimously a "No."

Question 6a & 6b

Answers:

- Yes, the choir teacher. The new one we have, because of her, I feel I've become a better musician. That's why I want to major in choir now. Last year I wasn't even thinking about doing choir as a major.

Question 6c

Answers:

- It shows that I can have leadership in doing music. She said if I follow how I can feel I can do anything when it comes to music.

Question 7

Biology Answers:

- 1
- 1
- 1
- 1
- 1

- 1
- 2

Chemistry Answers:
- 3
- 1
- 1

Physics Answers:
- 4
- 1 (hasn't taken it yet)

Network and Computer Systems Design Answers:
- 6
- 1
- 4
- 2
- 3

Math Answers:
- 5
- 5
- 5
- 9
- I like all sciences and maths

Maggie: What is it about Math that you like vs. Science that you don't like?

Answer: I'm good at Math. My Math grades were all A's.

Electronics Answers:
- 4
- 5
- 2
- 3

Manufacturing Answers:
- 2
- 1
- 0
- 2
- 1

Maggie: What is your favorite subject?

Answers:
- Math
- Math
- Math
- Math
- Math
- English
- Science
- History

- Science

Question 8a

Answers:
- People Skills
- Basic Math Skills
- Communication skills

Maggie/Vanessa: For those of you who have jobs where do you work?

Answers:
- Kroger in Staunton
- TJ Maxx
- Dairy Farm

Question 8b

Answers:
- Social (communicate and work well with others)
- Being able to apply skills

Maggie: Do teachers here help you with practical application of skills?

Answer: Depends on the teacher

A couple of students said they preferred hands-on learning

Question 9

Answers:
- For students you get more people skills because you have to actually work with people to do hands-on things
- We do a lot of hands-on stuff in Math and Science classes and that really helps out

Question 10a

Answer:
- It prepares you for college. There are some college-related classes, but high school only has a certain amount that can get you ready for college.
- I don't think they do as much as they could. Students have to put forth effort too.
- The school could get you to take more classes other than just the minimum. Students need to take more classes they would need for college.

Question 10b

Answers:
- Freshman and sophomore year you are immature and just don't know what you want to do.

Full Summaries of Subject Matter Expert Interviews

Interview with David Lohr

Position: President and Executive Director of the Commonwealth Center for Advanced Manufacturing

Date: May 22, 2012

Attendees

- David Lohr
- Chris Chmura
- Leslie Peterson

Discussion

- Funding discussion
    - $2M from the GF for CCAM
    - $4M from TICRC
        - Disbursed through UVA
        - Dr. Barry Johnson, Former Board Chair for CCAM, UVA faculty
        - CCAM will conduct a footprint analysis before hiring the workforce executive
        - This analysis will help CCAM staff understand the skills needed by the future Workforce Director
            - Probably work with Boston Consulting, PMG, Deloitte-type firms
- Strategic Plan discussion
    - The plan just changed
    - The need for a workforce development officer and an international economic development professional is needed; however, a baseline analysis of the state of workforce in the TICRC footprint is needed before these positions are in place
    - Governor put $2M in the budget to fund these initiatives after the $4M in TICRC funding sunsets
- David provided an example of economic development from an international perspective and in a rural setting (TICRC footprint perspective).
    - Emo, Sweden
    - Sandvick
        - A rural area in Sweden with a world-class factory
        - Fully-integrated robots
        - Technicians maintain the robots
        - An agricultural area
        - State of the art manufacturing facility
        - An engineering group in tooling, materials technology, mining, and construction
        - One hotel and a couple of restaurants
        - This is Danville's real economic development competition

The product by category mix for Sandvick in Sweden:

- Advanced stainless steels, special alloys and titanium
- Cemented-carbide solutions
- Mining equipment and tools

- Construction equipment and tools
- Steel belts and processing systems
- Furnace products and heating systems
- Tools and tooling systems for metal cutting

David identified Brett Vassey as a subject matter expert to manufacturing and related workforce needs.

Q: How can CCAM improve the workforce?

- Best in class manufacturing can lift the bar on education and training expectations
- Can help with college curriculum assessment and alignment (offerings)
- It can help direct what colleges need to be teaching based on demand from manufacturing
- It can help reinforce technical skills and communication skills through the work of self-directed teams

Q: What are some advanced manufacturing firms you suggest we talk with in the Valley?

- Merck
- Hershey
- McQuay

Interview with Debbie Melvin

Position: Project Manager with the Virginia Department of Business Assistance (DBA) & the Virginia Jobs Investment Program

Date: 7/18/2012

Attendants: Leslie Peterson, Brian Points, Debbie Melvin

Debbie is the Valley Project Manager with Virginia's Department of Business Assistance (DBA). She is aware of the CCAM in the Valley project. She is aware of the purpose for the study. She explained her DBA footprint covered Winchester-Charlottesville-Roanoke-Blacksburg.

Q: Can you speak to the state of the workforce in the manufacturing industry in the Valley?

- Debbie spoke briefly about VA Jobs Investment Program
  - Workforce services since 1965
  - Cluster growth in the Winchester area
  - DBA gives funding to expanding firms to offset training costs
  - The expansion has to have capital investment included
  - DBA offers free consulting services
  - DBA offers 'train the trainers' services

Q: What can you tell us about manufacturing businesses in the Shenandoah Valley (SV)?

- Winchester County is busy and active
- DBA is providing new jobs assistance and retraining assistance for companies in manufacturing. The retraining assistance must require a new capital investment on the part of the company, in order to qualify
- There is much concern about the workforce pipeline for manufacturing

Q: What are some key skills shortages in manufacturing in the SV?

- Welders
- Machinists
- Electricians
- Mechatronics (described this as a mix of mechanics and electronics workers)
- The shortage is more acute in the Southern tip of the region

Q: Tell us about the programs that are going on statewide and in the SV?

- Dream it/Do it campaign
  - Debbie and another person are the biggest marketers for this program right now
  - VMA is now promoting the roll-out of the Dream It/Do It licensing options across the state
  - Southwestern Virginia was the "first" region to purchase Dream It/Do It
    - That license was paid for by the Tobacco Commission funds ($9,000 --$10,000 for three years)
    - That (Southwestern VA) license has expired
    - The renewal under the VMA-umbrella is not known at this time
  - In the Valley, DBA includes healthcare and information technology in the Dream It/Do It marketing message
  - Job coaches at local high schools channel students into these fields
  - Career coaches are responsible for promoting the Dream It/Do It tools in the Valley
  - Blue Ridge pays for career coaches out of Blue Ridge funds
- Manufacturing Technology Camps- working on real life manufacturing projects

Q: What are the most technology-intensive companies in the Valley?

- Rubbermaid, Kraft, and Trex

There has been some major job decline in key industries, what's going on?

- Same stuff as everywhere else- some outsourcing, but mostly new technology making old jobs obsolete; the companies in the area are doing pretty well sales-wise
- Some new hiring has been occurring, though not to the level (4500+) that was originally advertised at the time of the STGAR report (2007)

Q: What are the occupations in most demand in the Valley?

- Machinists
- Mechatronics (hybrid skills: electrical, mechanical, troubleshooting equipment and processes)
- Welders
- Automation of processes requires higher skills and knowledge of equipment and process control
- Pemco does mostly on-site training for their employees

Q: What are some of the key area partnerships and alliances?

- Ask Debbie Sullenburger
- The Technology Council
- SCHERM
- Chambers are very retail oriented (confidential statement)
- Also talk to Lester Smith (Blue Ridge Community College) and Brian Brown- doing some industry roundtables, or at least they used to be when Ken Jones was Brian's predecessor.

Q: Are there different workforce needs for different types of manufacturing?

- Probably, but Debbie thinks that training should focus on commonalities because it is most efficient, both in terms of training and in terms of capital investment. Machines are expensive so it's best to just buy those with universal appeal

Do people use the term advanced manufacturing?

- Only Bureaucrats do, because it is useful for marketing a new identity for manufacturing. People in the industry do not use the term and are sometimes insulted by it. Example: David Lohr told somebody from Kraft that CCAM was just focused on "advanced manufacturing," and probably offended the fellow. Some food manufacturers such as Kraft and Hersey's are quite advanced. Most employers in the Valley don't use that term to describe their operations.

When I say advanced manufacturing in the SV, what companies come to mind?

- McKey, McQuay, Rubbermaid, Kraft, Trex, Fabritek, Hollister, PPI Time Zero, Fisher Scientific, Miller-Coors Brewery

What key result would you like to see come out of this project?

- Action-oriented outcomes
- 21st century workforce
- Need to implement an action plan

Interview with Catherine Hart

Position: Senior Project Manager with the Virginia Department of Business Assistance

Date: 7/23/2012

Attendants: Leslie Peterson, Brian Points, Catherine Hart

To begin the interview Catherine emphasized that she does not know very much about the Shenandoah Valley and focuses more on higher level state-wide stuff, continuing that Debbie Melvin is really the best contact. We mentioned that we had talked to her already and that we thought that she could still provide some meaningful input.

Q: What is going on with advanced manufacturing training in the Shenandoah Valley, and Virginia in general?

- A college in the state is now doing some advanced manufacturing curriculum online with a college in Washington (state). (She did not say which colleges were involved but I'm guessing that it's a TAACCCT deal and we can find that info online).

Q: Has progress been made on the advanced manufacturing front since you started working in this field (in 1989)?

- (Sighs) No. There are attempts but typically the funding goes to other areas.

- Example: at Virginia Tech there is a manufacturing center but the machines are all really out-of-date, but meanwhile they are building new buildings for all other types of disciplines.

Q: Can you comment on the difference between CRC (career readiness) and VMA certifications, and which is preferred?

- VMA is much more specific and generally better

- Employers are still calling for something more specific. Example: don't need to know algebra fully just enough to read a schematic.

Q: Is there a gap between training and skills required in the workplace?

- Yes, definitely. Even in the best scenario there will still be some specific training required (e.g.: electricity, hydraulics, etc.)

Q: What are the best areas in the state for advanced manufacturing workforce development?

- Winchester
- (Leslie asked for an update on Southern Boston). Catherine said that, yes they are also doing a good job too.

Q: Do companies prefer work ready workers, or technically trained workers?

- Depends on the sophistication of the company, but generally they do not need "warm bodies"
- Need skills in: robotics; mechatronics; maintenance; and operation

Q: Is Dream it/Do it and career coaching actually working?

- Every little bit helps. But not super-effective.

Q: What would you like to see come out of this project?

- Greater coordination between stakeholders, especially private industry folks.

Gap Analysis Methodological Notes

The gap analysis section of this report discusses the scope and limitations of such an analysis. These issues are explained in more detail below.

- ***Firstly, it assumes that there is not large-scale in- or out-migration from the region of recently-trained students.*** Though some students do leave the region after completing their programs, and others come to the area with credentials from elsewhere, since the Shenandoah Valley does not have an inordinate amount of migration it is safe to assume that most people getting jobs requiring an associate's degree or below are from the region, and most people being trained at community colleges will ultimately get within the SV area.
- ***Secondly, we can only measure students who have completed programs as potential job candidates.*** Although some students are "hired-out" of their program before completion it is not easy to separate those students from those who drop out of the program.
- ***Thirdly, contract training or other forms of non-credit training are difficult to quantify and are therefore not included***. Efforts such as these are generally designed to train people who already have a job in manufacturing, and the gap analysis is intended to address occupational gaps, not the skills gaps in the existing workforce.

Gap Analysis Additional Data

Table A13: Detailed Employment and Demand for Top Manufacturing Occupations, Q12012-Q12022

Skilled Trade Group	SOC	Title	2012 Mfg. Employment	Replacement Demand	Employment Change	Total Demand	Average Annual Demand	Average Annual Wages
Chemical Equipment Operators	51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	126	25	18	43	4	$41,300
Chemical Equipment Operators	51-9011	Chemical Equipment Operators and Tenders	105	26	3	29	3	$52,500
Chemical Technicians	19-4031	Chemical Technicians	66	11	0	11	1	$50,300
Computer-Controlled Machine Tool Operators	51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	210	45	53	98	10	$39,400
Computer-Controlled Machine Tool Operators	51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	29	6	4	10	1	$52,200
Electricians and Electrical Technicians	47-2111	Electricians	107	27	0	27	3	$58,900
Electricians and Electrical Technicians	49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	38	9	-1	8	1	$58,000
Electricians and	17-3023	Electrical and Electronic	42	9	-3	6	1	$63,600

Electrical Technicians		Engineering Technicians						
Extruding and Drawing Machine Setters	51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	306	67	59	126	13	$37,100
Machine Maintenance Specialists	49-9041	Industrial Machinery Mechanics	506	113	132	245	24	$51,500
Machine Maintenance Specialists	49-9071	Maintenance and Repair Workers, General	620	132	39	171	17	$41,400
Machine Maintenance Specialists	49-9043	Maintenance Workers, Machinery	150	32	15	47	5	$45,200
Machinists	51-4041	Machinists	399	85	35	120	12	$44,600
Multiple Machine Tool Setters, Operators, and Tenders	51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	397	52	18	70	7	$34,500
Multiple Machine Tool Setters, Operators, and Tenders	51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	167	36	16	52	5	$36,800
Multiple Machine Tool Setters, Operators, and Tenders	51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	108	21	3	24	2	$36,200
Multiple Machine Tool Setters, Operators, and Tenders	51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	49	18	-3	15	1	$40,800
Multiple Machine Tool Setters, Operators, and Tenders	51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	36	6	-2	4	0	$37,900
Printing Machine Operators	51-5111	Prepress Technician and Workers	177	63	-24	39	4	$44,300
Stationary Engineers and Boiler Operators	51-8021	Stationary Engineers and Boiler Operators	19	4	1	5	1	$57,600
Tool and Die Makers	51-4111	Tool and Die Makers	132	20	6	26	3	$52,800
Welders	51-4121	Welders, Cutters, Solderers, and Brazers	272	72	40	112	11	$41,700
Welders	51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	55	15	3	18	2	$38,700

Grand Total	4,116	897	412	1,309	131	$45,289

Source: Chmura Economics & Analytics

Educator Survey – Verbatim Responses

What are the strongest points of career and technical education curriculum at your school?

Community Colleges

- 1. Real world experiments and hands On Labs. Very little simulation. 2. Custom trainers and PLC processes. 3. Teach current and required technology and review annually with Curriculum Advisory Board.
- Being an adjunct professor leaves me lacking in knowing some of these things. However, I know that many have upped their skills in computer work and accounting and have gone into electronics in the past and also have trained in computer aided design. I feel certain that students have profited greatly in other areas as well but I don't have the details.
- Certifications earned by students upon completion
- Hands on approach to learning where the students actively participate in the process.
- I'm not very familiar with this.
- In specialized fields such as Nursing, Engineering, and computer/information technology, there is emphasis on current trends, methods, and technology.
- Instructors with real-world experience; instructors who stay current with technology and latest business and manufacturing models; and a new technology center.
- Our hands-on classes with actual motor control and PLC trainers and the use and interpretation of the current National Electrical Code
- Personalized attention. Encouragement to produce quality work. High level of expectations.
- Qualified instructors, current knowledge
- Real-world applications; emphasis on critical thinking and problem-solving skills
- Students get jobs
- Students graduate with outstanding skills and knowledge in their field
- Technical training
- The conveyance of technical skills and rational troubleshooting processes.
- The most important is to help the students gain the talent to learn. They also need to be flexible in their understanding because the technology will always be changing. And to be a good team player because they will always be working with others.
- The real world experiences. For nursing, working in a variety of healthcare facilities with real world expectations and responsibilities
- Trying to prepare students for a skilled labor required environment
- Vet Tech Nursing Human Services
- We try to tailor them to the area needs
- Working to provide instruction that meets the needs of local employers.

Public Schools

- Computer sciences and business and personal finance skills
- Computer skills; encourage the students to be realistic about the adult world of work; helping them decide what direction to go after high school
- Diversity of classes offered
- Emphasis is placed heavily on the soft skills as well as skills in the trades.
- Engineering fundamentals and robotics, graphic communication
- Excellent support from Admin. developing problem solving skills, measuring and fine motor skills development
- Exploring career options and teaching skills that are useful throughout life

- Gives students needed job skills
- Gives students real-world problems that allows them to use critical-thinking skills.
- Having up to date technology in the classroom. Being able to teach problem solving and time management within the curriculum.
- High levels of knowledge and practical experience for the curricula we teach.
- I believe that Career Technical Education (CTE) teachers do an excellent job of teaching work ethic and teaching the basic skills in Metals/Welding, Drafting/CAD, Electronics/Electricity, and Carpentry. Students are also able to earn certifications in these areas by successfully passing the tests required. Support by the administration at JHHS and Central Office.
- Industry involvement in the program
- Lots of hands on experience.
- Most students prefer the hands on approach involved in T+I programs and the ability to see a completed project at the end of the day. We offer an opportunity to the students to learn a trade and be a productive member of our community and earn a good living in the future.
- Opportunity to participate in the Co-op program. Just need more local employers to support the schools and students.
- PLTW Pre-Engineering classes
- School to work transition and our ties to the business community.
- Strong teachers that bring real world experience and expectations to their classes.
- Students have the opportunity to participate in a variety of programs/courses and to earn dual enrollment credit.
- Teaching real world solutions to real world problems. Theory is good but putting theory into practice is a much better teaching scenario.
- Teaching work ethic with an emphasis on maintaining education post high school to keep up with industry standards and expectations.
- Technical skills and competencies and industry based certifications
- The fact that I am given freedom in what I teach so I can reinforce job skills in the workplace. My background is Manufacturing and Facilities/Fleet Maintenance (before teaching) so I have first-hand experience in Workplace Readiness Skills.
- The opportunities that we provide for involvement in leadership, competition, and responsibility. As well as the opportunity to work in various areas of the CTE department for guidance in future career opportunities.
- The strongest points are that if we can teach students a needed skill they can use to earn a living, it will enable them to be contributing members of the community.
- The students are actually learning practical skills/knowledge that they will be able to apply in their everyday lives.
- The teachers and the CTE funding.
- The teachers and the programs offered
- The variety in opportunities that we offer to students is one of our strongest points. The other strong point is the strong emphasis that the CTE teachers in our school try to put on the soft skills
- Training for the real world.
- Varied courses that are available
- We have a dedicated teaching staff that supports our students to pursue what they want to do not just follow the '4 year college" track
- Workplace Readiness Skills and certification

Both (CC and PS)

- Good teachers
- Hands on training, working with real cars not simulators, NATEF; AYES; SKILS/USA certified.
- Highly qualified teachers who have a passion for what they are teaching and truly care about student success.
- Real world applications
- We are the "other technical skills" CTE school for. I teach an electrical apprenticeship program

What are the weakest points of career and technical education curriculum at your school?

Community Colleges

- Again, not familiar
- An entitlement mentality on the part of students reinforced by college administrators results in grade inflation, a degradation of academic content.
- effectively marketing college's programs to enroll target populations; funding to maintain and/or upgrade equipment; getting students who are under-prepared for college acumen
- General business understanding soft skills
- Giving the students a variety of conditions in which they will need to work in. Giving the students valuable experiences that they will use once given the chance to work in their chosen field.
- Helping the students see the relevance of their classroom work to their potential careers.
- I really do not know the answer.
- Identifying potential students
- Keeping a few students engaged and motivated who are only attending because their parents want them to attend. Their attendance is marginal and their heart is not in it, i.e. the student.
- Lack of available funding
- Lack of available internships within specific fields
- Lack of motivated students.
- More PLC training is needed
- No opinion
- None
- Not sufficient hands on. Hydraulics, machining, troubleshooting skills. A mechatronics lab is needed.
- Not enough funds for scholarships and for leading technology equipment
- Not enough time to cover all that needs to be covered
- Students do not always have the ethics, work ethics and dedication to the job that they should have.
- Students not having basic math skills and ability to handle difficult material
- We don't actually teach students what is expected of them from life or the job market, most seem to feel entitled and when they fall short, they don't take the responsibility for their own failure. Note: courses that do provide some of this type of instruction exist, but they are allowed to bypass for the sake of pushing folks though to a certificate they may or may not deserve.

Public Schools

- Because we are small, we do not offer every program. Currently, our students are not really exposed to manufacturing.
- CNC machining and plastics production
- Communication with the state DOE.
- Community/industry/parental involvement
- Does not emphasize social, civic, or environmental responsibility.
- Enrollment and marketing the programs are among the weaker points. More students could benefit than currently take advantage of the programs.
- Getting the general school population to take advantage of the courses that are offered.
- Having all the up to date technologies has its drawbacks. It doesn't always run on school equipment or networks. I have had a year and a half trying to make everything work in my room. Not everything is compatible to the county upgrades.

- Having to cave on what we know are the real world's expectations. The rules and regulations in the school are lacking, not enforced and don't prepare students to workplace expectations. My favorite is that no one gets less than a 50% on grading, so the student that does nothing gets a 50%. Where in the real world do you get 50% pay for doing nothing?
- Health care is an area that might be added.
- I don't see any weak points
- Lack of educational materials for my program
- Lack of focus on advanced classes in technical blue collar jobs....lack of importance placed on the CTE classes....students constantly saying we don't need this to graduate... they have a hard time looking forward to careers because they are focused on high school and they don't need credits so it can be hard for them to take the class seriously
- Lack of funding needed to support programs
- Lack of funding prohibits the ability to intern, observe etc. outside of our building
- Lack of funding, lack of equipment. How do you teach a student how to operate a CNC lathe if he has never operated a hand model? How you provide a student a practical application of Problem Solving when you no longer offer an Automotive Elective in HS? Automotive Repair IS ALL PROBLEM SOLVING. We are trying to give our students all high-tech training, but have thrown out the basics. Workers in the past were more skilled out of HS because more hands on skills were offered in HS. Robotics won't help a kid who doesn't even know how to loosen or tighten bolts or read a ruler. Technology Education has thrown the baby out with the bath water.
- Lack of funds for certain opportunities. Such as field trips to employers that may require outside school hours transportation.
- Lack of knowledge by guidance and the administration as to what it is we teach
- Lack of needed supplies to complete all skills competencies.
- Lack of understanding within the guidance department and administration. Focus is on core subjects and understandably so considering that is how they are compensated.
- Not enough options for students
- Not enough resources.
- Overall funding. Our equipment is not modernized like the equipment used in today's workforce.
- Participation
- Resources and funding
- Students are not accountable as they should be
- The required CTE competencies paper trail.
- The students who are not getting the same message about the future at home
- The technology (i.e. computers) are outdated. I am not teaching the students the latest technology.
- The weakest points of our curriculum involve the lack of a support system at higher levels to help us enforce soft skill items like attendance, punctuality, and a sense of self-motivation that are needed to be successful in a job/career.
- Time
- We don't offer enough diverse curricula to meet the local needs. Cost is the main driver, both the cost of additional facilities and additional faculty. We also don't get enough students through the door. Every year we operate at less than full capacity - students don't take advantage of the opportunities they have.
- We need to put more emphasis on soft skills like respect, responsibility, integrity, being on time and present every day. Most employers will tell you they need people to show up every day and they will train them to do the job. We seem to be losing more of these skills every day, and once a generation loses these skills they are gone and not taught to the future generations

Both (CC and PS)

- 1. Up to date software/equipment/textbooks 2. IT support staff
- Flexibility - thinking outside the box.

- Lack of recognition by DPOR for curriculum we are teaching in the construction trade area. Information on starting and running a business. Preparing job applications.
- Not being able to hold students accountable
- Students with below average comprehension skills.

Please describe the current communication between education institutions and manufacturers in the region regarding training needs:

- Advisory committee meetings, Emergency Services Officers Association meetings, Mentorship program and combined use of instructors for training seem to help.
- BRCC partners with manufacturing to make sure the students are getting an education they can get a job in after high school. My high school has a BRCC career coach in the building 4 days a week. She has helped a lot of students go in the right direction.
- BRCC uses an individual program curriculum committee to facilitate this dialog. Community employers are invited to serve on these committees.
- But needs improvement
- Each year, each program has an advisory committee meeting which is comprised of individuals who are currently working in the industry and who ensure that the teachers are training in the areas that the industry is in need of.
- Frequent interaction with our students from companies such as Hershey Foods and Blue Ridge Community College have made a positive impact on our students
- I cannot do that but think that the communication is adequate.
- I frequently receive emails about the progress they are making.
- I think there is good communication from employers with the tech school and BRCC, but I've had little at the high school level. I do promote the industry certifications my students get to local business.
- In some areas yes there is a great deal of communication!
- Local manufacturers work with the economic development coalition and communicate with our content coordinator and then that comes down the line to the teachers and helps us drive our curriculum development workshops
- Many area businesses participate in career awareness tours for staff and students that allows educators to know what to pass on to students and student to see/hear first-hand what skills are needed in the workplace.
- Strong advisory committees
- The Vice President is stepping up the efforts. We have had meetings and he has visited many local industries. We have scheduled Career Days, etc. Our biggest problem is waiting for many manufacturing employers to "Get Back To Us" with information. What is a priority one week is not a priority the next week.
- Through advisory committee meetings
- We have a great advisory committee
- We have good communication with only a portion of the local industry. It would be more beneficial to us and industry if we had a broader relationship.
- Yes
- Yes we have an agreement with many manufacturing companies in the area. I don't remember the name right now but we have tours open to the students and teachers every fall. It has opened the door for students to become more familiar to what is right in their back yard. I take 25 students to two companies for a half day field trip. Everything is set up by the commission and the buses are paid for so it is free to the student. Students learn about available jobs, what the company is looking for in an employee, safety standards, etc. I had one student who went on a tour and after graduation he applied to one of the businesses and got a job. That was impressive!
- Yes, through our workforce development

What needs to be discussed and why isn't it happening now:

- Although some programs have health advisory boards and are well connected with many employers, overall communications and connectedness is sporadic and inconsistent. The college divisions are not well organized with

discipline-related programs spread across more than one dean instead of all related business/manufacturing/computer technology being brought under one dean, a stronger focus. If corrected, the strengths of some programs' excellent connectedness would spill over into the other not-so-connected programs.

- High school students need more awareness of both educational and job opportunities in manufacturing. High schools seem focused only on college prep, and downplay technical skills, trades and manufacturing.
- How we can get funding for our schools/classrooms to update old outdate equipment and technology in these CTE courses. An advisory board meets quarterly but I do not see much come from it on my level. Need more participants on the advisory board from a wider range of employers.
- I believe that manufacturers take very little time recruiting students in our area.
- I believe there needs to be more discussion regarding what businesses are finding in terms of skills and abilities of newer employees (recent students). Schools focus so much on giving students every opportunity to not "fail." Many students are leaving school thinking that multiple chances to do something right are to be expected from all employers along with no requirements for attendance and punctuality.
- I do not think manufacturing has been at the forefront for communication in my school division. In some ways, I think we are sometimes not included in thinking/planning perhaps because we are small and because we do not have any major manufacturing businesses within our city limits. Our students however could easily work at manufacturing locations in Augusta County, Waynesboro, & Harrisonburg. We need to do a better job of getting the word out about the types of jobs available and how to prepare for these jobs. Parents are still somewhat stuck in the "my child has to go straight to college" rut and do not see the possibilities for other routes.
- I never hear about the needs of the workplace.
- It seems as if the two entities never communicate.
- Lack of marketing and promotion
- More communication between the schools and employers are needed. Everyone gets boxed up in their own worlds and then become stagnant.
- Much of the community and industry do not really know what we offer
- Nothing currently as most info is discussed during the tours
- Only because there is such a push for everyone to go to college - 4 year- that a more realistic approach is not always heard
- Requirements aren't being communicated at all. We have a CTE advisory committee, and local manufacturers do not participate. We have a PLTW partnership committee, and DPC Coatings (formerly DuPont) and ERM are the only local businesses consistently represented. ERM will leave after the AVTEX cleanup is finished.
- Students have no idea what is out there and are not really sure as to what they need to know
- The link between students who have learned the skills and a career. This is difficult because local business cannot guarantee students a job.
- The need for classes that focus on the more advanced manufacturing type of job skills...advanced welding and layout...career tours are helping students see some of this but there are no classes for them
- There is very little connection between the local corporations and the students directly.
- Think they are trying, but most industries do want trained folks, but not to the point of making them job marketable to others.
- Very poor communications between department heads (deans) at the college and the current manufacturing needs.
- We need more industry people in the school observing what we teach (more than a snap shot tour)

How often do you have personal contact with regional employers and what is discussed?

- 2 tours each year at different facilities
- Advisory boards, one on one communication
- As needed by company, with some outreach by staff. Current and upcoming needs.
- At least once a year through our advisory committee. We discuss curriculum here and employers' needs
- At least twice a year during our advisory board meetings. We discuss current trends and opportunities in the IT field. What the employers are looking for regarding soft skills and technical knowledge.
- Attended EDC and HR monthly meetings

- Community partnership meeting several times a year
- Contact during PLTW partnership meetings. The PLTW program is focused on engineering training and isn't geared toward local employment immediately after high school.
- Daily - training needs
- Dominion Power/Comsonics/Select Airparts/Clinical Engineering Augusta Health and Rockingham Memorial Hospital/Valley Precision/Hollister. 4 to 8 times a year.
- Employers of co-op students and advisory committee members for our CTE programs. Occurs periodically throughout the year
- Every week- employers' needs, job market, salaries, benefits
- Fairly often - we still talk about problems facing local business.
- Few times a school year. Internship with local IT firm
- Have some connections through personal relationships and occasional advisory board meetings. Also, have had annual connections with many employers during an annual careers expo at the college.
- I have some, through the co-op and mentorship programs I coordinate and also local business leaders I know.
- I have students in most all the dealerships in town and also in independents. I have an active A.Y.E.S. program.
- I network quite often which agencies that have potential opportunities for our students. As often as I can. Perhaps 6 times/year.
- I place students in mentorships.
- I visit or call individuals several times a year
- Limited
- Local business leaders through programs set up by our school district
- Monthly through the Career Pathways group at BRCC. Local trends, HS courses, student credentialing, workplace readiness skills, etc.
- Occasionally, when they are looking for applicants.
- On a regular basis, to recruit help from volunteer station personnel for the mentor program as well as continual contact with local chiefs on progress of our students and the training they are obtaining.
- One recent way is through an alum that came to recruit from the company he works for in Florida. We regularly post ads from companies that contact us looking for potential employees.
- Several times a year
- Some, discuss what employers' needs are
- There are regional groups that meet about 3 times a year.
- Usually it is about 2 times a year for tours and checking in on students that are working in the field
- Virginia publishes Work Place Readiness Skills that addresses current needs. I have reviewed that on my own.
- We have a county advisory committee which meets twice a year to discuss the goals of our programs, what the needs are for CTE as a whole, any areas for growth or change or development based on community needs.
- We have a program advisory meeting once a year. I also talk directly with employers several times each semester
- We have several contacts with local employers due to our graduates and their knowledge of what we do, the internship program we have established and local supervisors because of successfully placing students in local companies. Our advisory committee members are very helpful too. We contact them on bi-monthly basis.
- Weekly
- With a limited number of employers with whom I have an outside relationship the contact is frequent and involves hiring trends, employee performance issues, and available workforce issues.
- Yes, I serve on the Career Pathways consortium and the MTC advisory board. Career Pathways meets once a month, MTC advisory board meets 2 times a year. We discuss job trends and workforce information

What do you think should be done, if anything, to best improve the training of skilled workers in the Shenandoah Valley, especially skilled trades workers?

- Allow students to explore outside of the college track more easily.

- Always work harder to identify true needs
- Apprentice programs, more vocational programs throughout high school
- Being retired and only teaching a couple math classes, I cannot give an opinion on this.
- Better communication with those involved. I feel it is pretty good at the community college level, but lacking in postsecondary
- Clearly articulated skills requirements, career and earnings potential in the trades, image enhancement for the trades among academics who tend to view that trades as an undesirable employment field.
- Continue to encourage these careers beginning in middle school through guest speaker, field trips, etc.
- Continue to focus on soft skills
- Continued communication and cooperation between manufacturing/business and the educational institutions
- Create a high tech lab and a partnership with area manufacturers and the college.
- Determining what the future needs of the Valley will be, communicating, and planning for the schools to educate students to meet these needs.
- Develop working relations between employers and schools.
- Development of partnerships that would provide students with actual work experiences.
- Emphasis on work ethics, punctuality, professionalism.
- Every time college is mentioned from grade school on, skilled trade workers should be mentioned. 90% of students go through school thinking college is the only option after high school. They take courses to "prepare" them for college and then don't go. Trades need to be pushed for job preparation the same way that college is pushed. College is expensive and not for everyone. I believe we should be offering work training for half of our student population. We should be tracking how many students get jobs straight out of high school with the same gusto we track how many get into college.
- Find ways to change the mentality of parents that trade professions are beneath students. Find ways in local newspapers to highlight the jobs and salaries of skilled trade workers along with the educational and licensure requirements of how to get those jobs. Tie this highlight in to what is being offered in local school systems to help students obtain that type of job.
- Get buy in from industries, on a program that supports their skilled training needs as well as a in retaining these trained folks for a certain period of time once trained.
- Have more employers willing to work with students in the cooperative education programs.
- Having employers on the campuses more often in well-organized events/classes that would best connect employer expectations (sole presentations and/or team-teaching formats) to future potential employees (current college students). Their offering real-world relevance to under-motivated adult learners can prove to be a strong inspiration to take their college experience more seriously. Employers reaching out (not wait to be invited) on the college's numerous advisory boards. Partner with the college in promoting more career- path events. Help college administrators discover what is being done in other academic and secular venues to promote improved training.
- I think that the community colleges and tech centers are the key.
- I think they are leaving their programs well trained
- I think we are doing a great job
- Incorporate a CTE cluster into the graduation requirements.
- Keep the CTE programs up to date and have the media help out with letting everyone understand how important CTE programs are.
- Let the schools know what you need! Pay a living wage with benefits, then let the school division (particularly the Career and Technical Education division) what is required for employees.
- Local businesses and school divisions should combine their efforts and share resources. We are repeating many of the same things ... if we combined we could continue what we are doing and MORE.
- Make sure schools are using the same technology or similar. Students need to be able to problem solve so they can figure out more challenging technology. If they get the basics some students can just run with it.
- More communication between industry and college
- More companies should create apprentice/full time positions to train with employees that will be retiring in the next 3-5 years.
- More design based learning. More emphasis on technology and integrative STEM.
- More hands-on experience; job shadowing, internships, co-op, apprenticeships.

- More options for kids in schools to explore careers and other post-secondary options
- More strict ethics with classroom activities as well as with the hands on work.
- Much more involvement on vocational advisory boards by industry members
- Not sure
- Pay skilled instructors and all educators a wage that shows how "important" education and educators are to society. I have to work two jobs in order to pay bills thus taking time away from my primary focus.....educating!
- Promote this job training early and often in high schools. Schools are pushing the idea that you must go to a 4 year college to be successful. The result is many students going to those schools and NOT being successful, then having NO job skills.
- Provide more educational opportunities to train these workers.
- Quality hands-on training with proper up to date equipment.
- Separate dedicated training programs like Dowell J. Howard for plastics, wood craft, and robotics training.
- Since the only University in the area is SU which is arts focused I feel we need to forge partnerships with JMU or UVA and start a satellite campus which is focused on high tech and business. We need to diminish the "brain drain" of local talent moving away from the area after they complete secondary education. Incentives for small business start-ups to provide employment for the above. SusQtech is a great example of the type of business that the area needs in my opinion. Businesses such as these provide high paying jobs for well-trained/educated local talent.
- Start at home with parents making sure kids are getting the extra help they need to master the materials presented at school, especially at the elementary level
- Strengthen the relationships between the employers and the programs relevant at the college. Also strengthen the knowledge of the success of the various programs at the college to the community.
- Students need to have the opportunity to skip mundane high school classes that won't be of much benefit to them and go work or enter an apprenticeship school.
- Support from employers, financial, and encouraging workers to get education
- Use the Community College for either curricular courses or develop specialized courses. Meet with the faculty to assess needs, not always the administrators/continuing ed.
- We need better starting pay for our skilled workers. Electricians start at $10.00, local factory workers start at $12.15. The factory workers are inside and have no tools or certifications to maintain as do the tradesman. Retirement and benefits are also concerns
- We need to go back to more vocational education at the high school level.
- We need to intervene in 9th grade and provide Career Aptitude testing to help students decide their course of study in HS. Most students float through HS not knowing WHAT career areas they have aptitude in. Thus we lose a large influx of easily trained individuals in the technical disciplines. Unfortunately, high schools still are "graded" on the quantity of students that go on to college upon graduation.
- What I think needs to be done is that students are informed of opportunities that are in the Shenandoah Valley for students interested in entering the area of Career and Technical Education. Not all students want to go to college and they need to know of other opportunities that are available to them.