Information Technology in the Tri-County Workplace:

A Report on Occupations, Industries, and Opportunities

Prepared by the Center for Individual & Organizational Effectiveness (C4IOE.com)
for the Tri-County Workforce Investment Board – Butler, Pennsylvania
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This Report accompanies a Graphic Model and a Descriptive Model of Information Technology Career Pathways & Skill Standards, which are all available on the Tri-County Workforce Investment Board website.

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Purpose of Project and Report

This report was developed as the culmination of a research and development project sponsored by the Tri-County Workforce Investment Board, based in Butler, Pennsylvania, who contracted with consulting firm Center for Individual & Organizational Effectiveness, based in Pittsburgh, Pennsylvania, to address key research questions around demographics of the region, IT/Technology industry trends and occupational trends on a national, state, regional, and local level, career pathways, training needs, and skill standards (including credentialing) for key IT/Technology occupations.

Objectives of the project included: (1) develop industry surveys for the TCWIB to use annually with the industry partnerships regarding their workforce training needs, hiring needs, and occupational and industry trends, (2) research and develop IT / Technology career pathways (career models for occupational groups/options) and skill standards (education/training and credentials required for the occupations), (3) research workforce, occupational, and industry trends specifically related to the IT/Technology occupations identified and the training required for those roles, and (4) provide some recommendations related to workforce development/training and career paths for the identified key occupations in the develop IT / Technology industry.

Executive Summary

This report presents a summary of national, state, southwestern PA (regional) and Tri-County's (local – Butler, Indiana & Armstrong counties in Pennsylvania) current IT / Technology workforce, opportunities, challenges, and suggests recommendations for creating a more robust and competitive labor force for the local region. Several factors, including aging baby boomers, limited ability to fulfill the demands of new skills and knowledge bases, and evolving ways of defining work and the work place are just some of the challenges the Tri-County region, Pennsylvania, and most of the U.S. are experiencing.

The Pittsburgh region reflects a disparity of economic opportunity. There is a concentration of high-wage, high skill occupations with relatively low unemployment such as Information Technology (IT) and Engineering. However, there are also 32,000 long-term unemployed residents, most commonly in occupations such as Production or Administrative Support with slower than average growth prospects. While the region must continue to expand innovation and growth of high-skill roles, it needs to redouble its efforts to address the skill and workforce needs of residents who are not currently on pathways to high-wage jobs (Burning Glass 2015).

It is important to note that a large percentage of IT occupations / employment occur across most of the industry sectors in Pennsylvania. IT is a "support sector" with the skills of those employed in the IT sector, needed across industries. Therefore, IT industry partnerships and employer groups would likely benefit from focusing across industries for potential members / support / participation, rather than limiting to IT related companies.

In addition to a limited number of actual jobs available in the IT / Technology sector in the Tri-County region, there is a shortage of skilled workers to fill ones that do exist. The regional K-12 pipeline alone is not large enough to meet the projected growth in workforce demand. There is a gap of nearly 8,000 workers between the projected annual demand of 34,000 new workers and the number of high school seniors per year, 26,000, who would be entering the workforce at some point following high school and/or post-secondary training (Burning Glass 2015). Often employers in the Tri-County import talent from other cities such as Pittsburgh to fill a role.

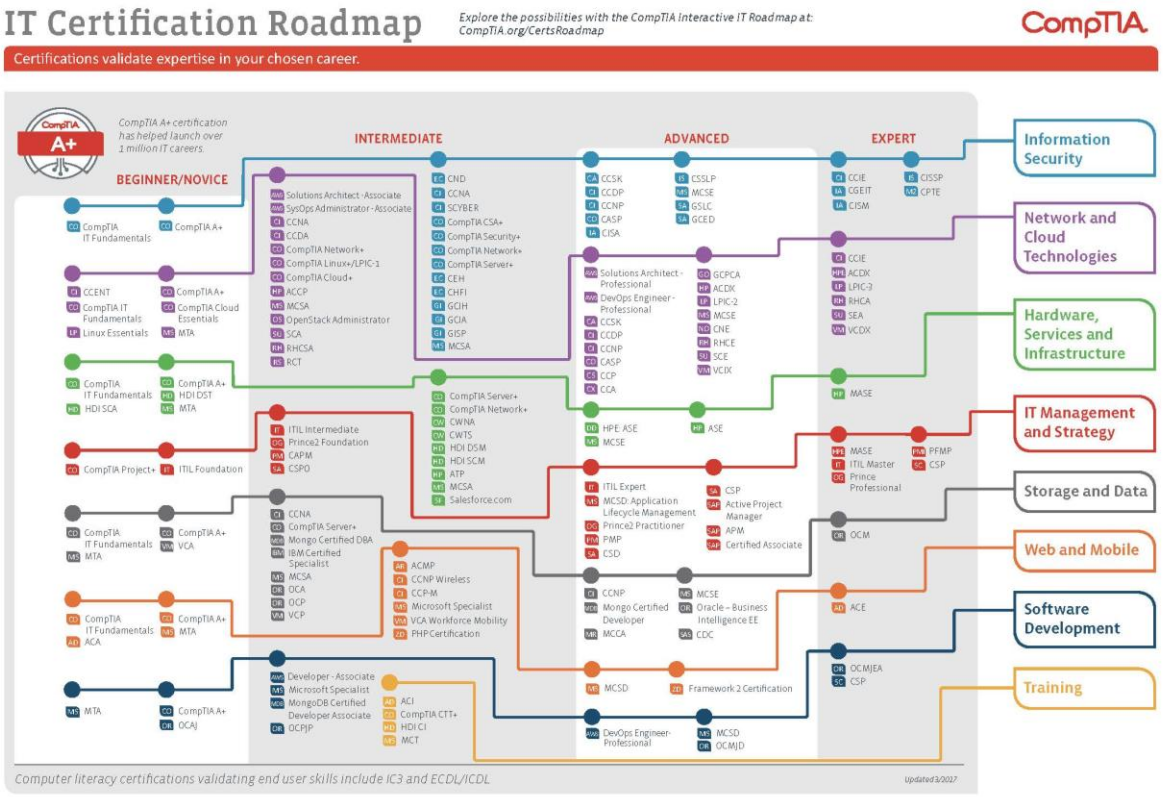
Conventional career pathways, while still in existence, are not as prevalent as they once were in the IT / Technology fields. This is due mainly because of the trend of mapping career opportunities, especially with regard to entry level and intermediate positions, by specific certification pathways, experience and expertise, as opposed to career/occupation pathways in specific industries. Fresh entrants to the workforce now expect a winding, unpredictable progression of jobs in a variety of industries. The economic forces that led so many of their predecessors to see themselves as "company men" (or women) hold far less sway over new hires (New Republic 2014).

IT training programs and certificate programs open doors for people to a wider variety of occupations and careers across multiple industries – people can pick and choose where they want to work more freely, rather than choosing a specific profession with a sector. Certifications have become the common, recognized, and trusted 'badge' of competency, allowing the certificate holder to access multiple entry points. New technological advances in IT / Technology have become the driving force behind industry advancement.

Training job seekers to meet employers' needs is especially challenging in the rapidly

changing technology world. The needs of an employer, or the field in general, can change even in the time it takes for a student to complete a program. The creation of a new coding language, like Swift, or WordPress's shift to JavaScript, can change market demand. As new coding languages gain prominence, programs struggle to find ways to anticipate the changes and adapt to ensure they are producing employable graduates (Freedman). Because of this rapid pace of change, many employers, traditional schools and colleges, and training programs are struggling to keep pace with the demand for relevant training, to say nothing of being able to monitor their success while responding to a constantly moving target.

Additionally, the rapid pace of change is also impacting career choices and advancement, and challenging the very nature of conventional linear pathways to a career. IT career pathways are often interrelated and skills acquired, can be cross-applied to other IT career clusters. For example, this IT Certification Roadmap from CompTIA clearly lays out basic possible clusters within IT/Technology, and their levels of certification needed to advance. These certifications will apply to just about any industry, and most occupations in the IT and Technology fields.



One key take away from the research conducted for this report is the need to align workforce needs, opportunity, education and talent in an accessible, supported pipeline or continuum. In a quote from Virginia Rometty, the current chairman, president and CEO of IBM, "Technology is the silver thread running through the jobs of the future". This especially rings true in the Tri-County workforce region of Pennsylvania, where many traditional non-tech jobs have been disappearing, replaced by jobs with some aspect of technology and information science. As such, most of the technology-based high school and technical schools in the Tri-County region have national certification programs such as CompTIA as part of their curriculum core standard.

Organizations (colleges, private training organizations, employers, etc.) across the country have created programs to quickly teach individuals the skills they need to do these jobs, in some cases in as little as 10 weeks. Those with the money and time can join a coding bootcamp and learn programming skills in only a few months. Other programs are training help desk workers and cybersecurity professionals. People from many backgrounds, including some without bachelor's degrees, are using these programs to find steady, middle-skills jobs. The response to fill a growing demand for tech skills in workers comes from a variety of sectors. Nonprofits, government, and employers are converging on the market with the goal of creating educational opportunities to fill the increased demand for these skills. (Freedman)

Because Technology threads through all industry sectors in some manner, creating a unified consortium of leadership, employers, professionals, and educators will be instrumental to the future success of the Tri-County region. For example, according to the 2017 State of the Industry Report in teQ, the Pittsburgh Technology Council's regional business journal, research indicates that over the past three years, specific industry clusters* have shown positive growth, with Information Technology in the lead. While the other clusters have occupations and career pathways that may not directly use IT / Technology, there are many more key careers within those industries that do.

The main industry clusters in the region are:

1. **Information Technology**
2. Healthcare & Life Sciences
3. Manufacturing & Advanced Materials
4. Environmental Technology
5. Energy Technology
6. Business & Finance
7. Engineering
8. Agriculture

The career pathways in this report are samples of what is conventionally available to job/career seekers. As the IT / Technology field continues to evolve, so too will the conventional ways in which hierarchical career paths are pursued, especially by a generation of younger workers. Today, a career path is less about specific measured steps taken in linear order, and more about interrelated opportunities for advancing interests, skills, and personal passions within organizations where the on the job skills and job performance are the focus.

I. Current Landscape: Workforce and IT Trends and Developments

A. Overarching Workforce Trends

As the global economy continues to evolve, there is increasing anxiety among employers and employees, to meet the changing demands for talent, skills, and knowledge in all occupational sectors, and across all regions of the country. In the recent publication "Report on Findings" by Shift: Commission on Work, Workers, and Technology, its authors state that "the future of work will shape cities and regions ... the richest cities are pulling away from the rest." Commission members from non-coastal areas and smaller towns pointed to discrepancies in education, technology, access to capital, and networking opportunities (Shift, 2016).

As the Southwestern Pennsylvania Tri County region, Armstrong, Butler, and Indiana counties look to create a prosperous and progressive 2018 and beyond, the ability for community and business leadership to make confident decisions and intelligent investments will be dependent on relevant, accessible data reflective of the larger workforce ecosystem with regard to skills, talent, priority occupations, trends, markets, demographics, and, most importantly, the needs of the community and its residents.

The US Workforce is Aging:[1] According to the Bureau of Labor Statistics (BLS), by 2024 nearly 25 percent of the workforce is expected to be 55 or older – double the percentage in 1994 (BLS, 2015). The oldest of the country's estimated 77 million baby boomers began turning age 65, the traditional retirement age, in 2011. Baby boomers, born between 1946 and 1964, have begun to reach retirement age in staggering numbers: approximately 10,000 *a day* (Heimlich, 2010). As those workers leave, so goes decades of experience and institutional knowledge. According to *U.S. News & World Report*, "the U.S. economy will experience a shortfall of 5 million workers with the necessary education and training to fill expected job openings by 2020" (Bidwell, 2013).

The fastest-growing segment of the workforce is, and will continue to be, older workers, as the middle to end of the baby boom generation still has over a decade before many will reach retirement age. Even then, many people are working longer (out of both need and choice) than in the past. This is reflected in BLS projections that the number of workers over the age of 65 will continue to increase from 18.6% in 2014 to 21.7% in 2024; at the same time the labor rate for those 16-24 years of age will decrease, from 13.7% in 2014 to 11.3 in 2024.

Education Gap: By 2020, 65% of an estimated 165 million jobs in the U.S. economy will require some postsecondary education or training beyond high school. (Coulombe, 2016). While nationally there has been a long-term trend of an increasing percentage of the population attending 2 and 4-year colleges, this breaks down unevenly across regions. There is a significant amount of polarization – even at the micro level of city neighborhoods, with some areas increasingly sending children to college and other areas remaining flat or even declining. Metro areas are disproportionately college educated, and white residents still far outpace minorities in college completion rates, though there has been a steady uptick in the number of disadvantaged students attending colleges. Even with areas of progress, it is widely expected that companies will face a persistent skills shortage among

[1] Of note is that many emerging economies have the opposite demographic shift – their workforces are youth heavy and will remain so.

highly specialized technical workers and senior managers and executives.

Disappearing Soft Skills: There is also what some call a crisis in the lack of soft skills, especially communication skills, among new hires, regardless of educational background. One oft-cited reason for this is the increased use of technological means of communication, rather than face to face conversations. These and other trends have prompted educators and employers to question if traditional education paths are preparing young people well enough for workforce needs. Similarly, there is doubt that traditional classroom-style education and training can keep pace with changes in the workplace.
Geographic Polarization: Another long-term trend that has accelerated is that wealthy zip codes are getting wealthier and poorer zip codes poorer. More college educated populations live in cities, especially coastal cities. There are growing opportunity and income gaps across the country caused, in part, by growing gaps in average incomes across regional labor markets, with rural areas faring the worst.

Declining Business Creation and Employee Mobility: Among economists and researchers there is no agreement for why there has been a decline over 20 years in the number of people starting businesses, changing jobs or moving for a new job, but it is clear that this trend has increased since the recession of 2007. It is widely felt that a less dynamic economy will make adaptation to changes like automation more difficult.

Technology Innovation: Past advances in technology have clearly brought knowledge and productivity gains and a higher standard of living – but have also spurred worker displacement and chaotic periods of transition. What is different about this current period of innovation is the unprecedented pace and scope of the changes being wrought by digital technology and automation. This is forcing a structural shift in thinking about work itself, the economy and how we use our resources – all foundational building blocks of our society.

As stated in the recent New America / Bloomberg report *Shift: The Commission on Work, Workers and Technology*, “How much and what kind of work will be available over the coming decades will steer our economic growth, our technological progress, our social health, our physical geography, and our political stability” (New America / Bloomberg, 2017).
Automation: While automation has been around for a long time, the present technological leaps in Artificial Intelligence combined with a number of now affordable digital technologies have a number of experts agreeing this time it is different.

A widely reported 2013 study out of Oxford University estimated 47 percent of total US employment is at risk of being automated over the next decade or two. The University of Redlands School of Business did a follow-up study that was published in May 2017, finding nearly all large US metro areas could lose over 55 percent of their current jobs due to automation. According to the analysis the Pittsburgh area’s share of jobs facing automation by 2035 is between 58 and 61 percent. A point however, made by a number of researchers, is that many of the present day jobs will evolve into other jobs, so employment is not necessarily falling by huge amounts. Whether there will be a net gain or loss in employment is not clear.

New Training Opportunities: Advances in Virtual Reality and Augmented Reality are increasingly being viewed as offering a new platform for learning/ training. A number of educators point to these technologies, plus online learning in general, as ways to make training more accessible and affordable to more people.

Social / Health Crises: A convergence of social and health issues are detrimentally affecting the workforce, such as high incidents of obesity, diabetes, suicide, prescription drug / opioid

abuse, and depression/ anxiety. One of the most startling social developments is the falling life expectancy for middle-aged working class white American males since the 1990s. Nowhere else in the developed world is a group of people losing years off of their life expectancy (Boddy, 2017).

Research by Princeton University's Anne Case and Angus Deaton points to distress from globalization and technological change as the probable cause for the phenomenon. They cite the cycle of despair experienced by many in this group as "rooted in the massive shifts in the labor market" that left many in the working class unable to find sustaining employment, though many aspects of life feed into the problem (Boddy, 2017).

*Capital and Talent Concentration***:** The wealthier and globally connected cities are increasingly nationally and internationally networked and offer more varied and better employment opportunities than the rest of metro areas. This serves a strong pull factor for brain drain to top cities. Movement from more rural to more urban opportunities has been happening for a long time. What is different is that the competition among metro areas for the best and brightest is shaking out to favor a few super-cities that are particularly attracting the millennial generation. This exacerbates issues with regional income equality and access to opportunities.

Employment and Income Structures: There has been a half century trend away from how much of an individual's earnings are made from a job, versus how much is made through other means, such as financial and real estate investments, task-based work and government programs like Medicaid and social security. According to recent data from the US Bureau of Economic Analysis (BEA), employees earned two-thirds of their income through wages and salaries in the 1960s, and today earn only one-half this way (BEA, 2017).

Uncertainty About the Future of the Job Market: It remains unclear how automation and technology will affect employment structures. What educators and technologists are clearer about is some jobs *will* go away permanently – particularly any job that entails repetitive motion or binary decision-making. But other jobs will be created, for example in designing, operating, maintaining and programming the technology. What is also clear is that this shift in job types, particularly in manufacturing, is continuing to move upward in skill level.

Another unknown is whether work and careers will remain concentrated in full time occupations for most workers, or continue to trend towards tasks, projects and "the gig economy" (typically contract employment) where workers often have less security but more flexibility. The percentage of workers in flexible of task-based employment rose from 10 percent in 2005 to fewer than 16 percent in 2015 (Katz and Krueger, 2016).

There are several factors affecting the current workforce in the Tri-County region, many of which are also occurring on a national level. Changing demographics: an aging workforce, millennials, and a diverse labor force; evolving technologies: computers, drones, automation and robotics; dynamic new skill demands: a more sophisticated knowledge base, advanced training programs and certifications; and a change in work habits and 'habitats', the 'gig' economy – a single project or task for which a worker is hired, often through a digital marketplace, to work on demand –stability vs. flexibility in a job, and resiliency in the face of change, are all part of this larger shift.

B. National and State IT / Technology Trends and Developments

The job of the future will have very little to do with processing words or numbers (the Internet can do that now). Nor will we need many people to act as placeholders, errand runners or receptionists. Instead, there is going to be a huge focus on finding the essential people and outsourcing the rest. (Godin 2009)

Many of the economic and workforce shifts and trends occurring nationally can be seen playing out in the various counties throughout Pennsylvania. Pennsylvania's population, like the rest of the nation, is growing older; it is currently ranked sixth highest for population over 65, just slightly below Florida. Although retirement is a desired goal for most workers, many baby-boomers, aged 55 or older, are likely to retire within the next *two* decades as opposed to one, creating a substantial gap in the workforce (Gandal, 2009). Investment firm T. Rowe Price calculates that the oldest boomers will have to delay retirement by nearly nine years in order to recover what they lost in the market downturn on 2008 (Gandal, 2009). Workforce patterns and a shifting, more creative work culture suggests that these older workers will remain in the workforce longer than once anticipated, contributing to the necessary skill sets and knowledge bases required of a more demanding, diverse work environment.

When compared to other similar-sized cities and metro areas, the region averaged a loss of about 29 people a day from 2015 to 2016 across 10 counties (teQ V.24 2017). The skill gap in the Tri-County region will not likely be filled only by the millennial generation largely due to a slowing population growth and sometimes challenging skill acquisition or upskilling opportunities. Rather, it will be filled using a diverse workforce consisting of aging, millennial, and Gen X workers (individuals born from 1965 to 1978) open to a creative approach to job sharing, and who are specifically trained in their field of specialization.

In terms of a national trend, technology is the lynchpin that continues to connect sectors, occupations, and individuals, and is only getting stronger. According to consulting giant McKinsey & Co., nearly 85% of new jobs created between 1998 and 2006 involved complex "knowledge work" like problem-solving and concocting corporate strategy. Job opportunities in mathematics and across the sciences are also expected to expand. The U.S. Department of Labor spotlights network systems and data communications as well as computer-software engineering among the occupations projected to grow most explosively by 2016. Over the next seven years, the number of jobs in the information- technology sector is expected to swell 24% — a figure more than twice the overall job- growth rate. (Altman 2009)

While the demand for traditional low tech jobs will remain, the very nature of what constitutes low tech is shifting dramatically across the country. As noted in his 2009 article for Time Magazine's special issue, *Then Way We Work*, Rotman suggests, "Computer technologies are changing the types of jobs available, and those changes are not always for the good" (Rotman 2016). He goes further to explain that the shifting tech economy has all but disenfranchised the working middle class, and has effectively isolated opportunity for growth to those with specialized skill and knowledge, training, and certifications. He also says, "At least since the 1980s, computers have increasingly taken over such tasks as bookkeeping, clerical work, and repetitive production jobs in IT/Technology —all of which typically provided middle-class pay." Moreover, Rotman writes that at the same time, higher-paying jobs requiring creativity and problem-solving skills, often aided by computers, have proliferated.

According to the US Bureau of Labor Statistics the top Technology occupations in the United States are currently:

- Computer and Information and Research Scientists
- Computer Network Architects
- Computer Programmers
- Computer Support Specialists
- Computer Systems Analysts
- Database Administrators
- Information Security Analysts
- Network and Computer Systems Administrators
- Software Developers
- Web Developers

While the demand for these jobs remains high, almost across the board in most states, there is a gap in terms of talent. Similarly, Forbes Magazine listed their top picks for National Trends for IT and tech- related jobs include by way of Robert Half, the award winning professional staffing agency, (Forbes 2017):

- Data Scientist
- Big Data Engineer
- Network Security Engineer
- Network Security Administrator
- Data Security Analysist
- Database Developer
- Software Developer
- Web Designer
- Network Engineer
- Software Engineer

Additionally, NET Developers are predicted to be in high demand across eight of nine U.S. regions. Additional positions predicted to be in high demand are Web Development and Software Engineering. The following graphic breaks out predictions of the five most in-demand positions by region in 2017 (Forbes 2017)

While there are clearly some crossovers, there are some stand-alone jobs, such as Big Data Scientist, and Big Data Engineer that require a much more specialized skill set than the average tech position listed by the US Bureau of Labor Statistics.

In the March 2017 article in Forbes Magazine, the top 10 U.S. cities creating the most technology are:

1. San Francisco – Oakland – Layward California
   (tech industry job growth, 2006-16 90% / number of tech related jobs 2016: 220, 162
2. Charlotte – Concord – Gastonis, North Carolina
   (tech industry job growth, 2006-16 61.1% / number of tech related jobs 2016: 33,332
3. Austin – Round Rock, Texas
   (tech industry job growth, 2006-16 76.6% / number of tech related jobs 2016: 59,664)
4. San Jose – Sunnyvale – Santa Clara, California
   (tech industry job growth, 2006-16 76.6% / number of tech related jobs 2016: 176,150)
5. Indianapolis – Carmel – Anderson, Indiana
   (tech industry job growth, 2006-16 68.1% / number of tech related jobs 2016: 30,646)
6. Raleigh, North Carolina
   (tech industry job growth, 2006-16 46.9% / number of tech related jobs 2016: 39,504)
7. Nashville – Davidson – Murfreesboro – Franklin, Tennessee
   (tech industry job growth, 2006-16 16.75% / number of tech related jobs 2016: 20, 828)
8. Seattle – Tacoma – Bellevue, Washington
   (tech industry job growth, 2006-16 47.7% / number of tech related jobs 2016: 145,824)
9. Detroit – Warren – Dearborn, Michigan
   (tech industry job growth, 2006-16 26.1% / number of tech related jobs 2016: 127,033)
10. Denver – Aurora – Lakewood, Colorado
    (tech industry job growth, 2006-16 40.3% / number of tech related jobs 2016: 79,342)

The Forbes article noted that Pittsburgh (MSA area), while making rapid progress, is considered out of the top 20 list (it came in at 21), but is making strides in jobs related to tech engineering and systems design. Still an energy and industrial center, and with low housing prices, the former steel capital jumped 10 places on the list to 21st. Pittsburgh has gained tech momentum as a center for autonomous vehicles, with Uber and Ford setting up operations here to tap talent at Carnegie Mellon. Like other upstart regions, Pittsburgh has seen a rise in high-tech business services, with 2,400 new jobs in engineering and 3,900 in systems design (Kotkin & Schill, 2017).

Pennsylvania Demographics

Pennsylvania has one of the largest populations of older people in the nation, ranking sixth in number of people over 65. It also has one of the lowest in-migration rates of immigrants, particularly in the western half of the state. Combined, these trends lead to an aging and shrinking population.

PA Demographic Snapshot	
Population estimate, 2016	12,784,227
Population estimate, 2015	12,802,503
PA Population by Age Groups (2015 estimate)	
Under 5	5.6%
Under 18	21%
18-64	62%
65+	17%

PA Educational Attainment (age 25 years and over)	
Not a HS graduate	10.3%
High school graduate (includes equivalency)	35.7%
Some college, no degree	16%
Associate's degree	8.3%
Bachelor's degree	18.1%
Graduate or professional degree	11.6%
Percent high school graduate or higher	89.7%
Percent bachelor's degree or higher	29.7%

Source: US Census Bureau, 2016

Pennsylvania Labor employment

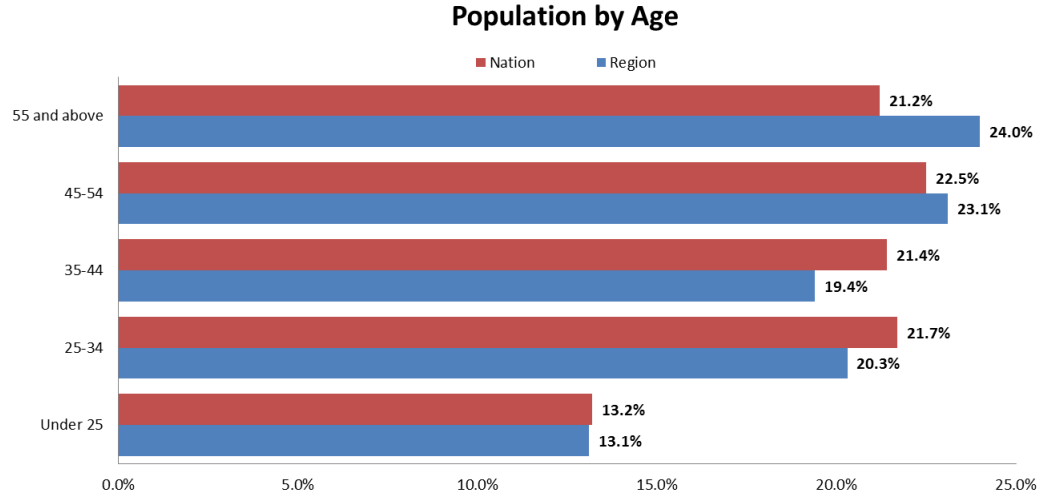
Pennsylvania has a total working age population of 6,443,000. The unemployment rate as of March 2017 was 4.8% (311,000 unemployed), slightly higher than the national average of 4.5%. Unemployment is highest among 16-19 age group (15.3%), and lowest among the group 55+ (4.1%). Unemployment is consistently more than double for black residents (11.2%) than white residents (4.8%) (Workstats, April 2017).

C. Southwestern Pennsylvania IT Trends and Developments

Southwestern Pennsylvania Demographics

The southwest Pennsylvania workforce, encompassing a 10-county area[2], is an important part of the larger economic engine for the state. According to the 2017 Southwest Planning Region Transitional Regional Plan (Southwest Planning Committee), the Southwestern Pennsylvania region is home to nearly 2,500,000 residents, which represents, about 20% of the state's population. The labor force continues to grow in the region and has, like Pennsylvania, experienced a decrease in unemployment. Mirroring the larger state and national trends, the regional workforce is aging.

Source: Southwest Planning Region Program Year 16-17 Transitional Regional Plan / Economic Modeling Specialist



Population Trends - 1990-2015

An affiliate of the Allegheny Conference

Area	2015	2010	2000	1990	Comp. Annual % Change '10-'15	Comp. Annual % Change '00-'10	Comp. Annual % Change '90-'00
Pennsylvania	12,802,503	12,702,379	12,281,054	11,881,643	0.2%	0.3%	0.3%
10-County Region	2,565,612	2,574,959	2,656,007	2,694,079	-0.1%	-0.3%	-0.1%
Pittsburgh MSA*	2,353,045	2,356,285	2,431,087	2,468,289	0.0%	-0.3%	-0.2%
Allegheny County	1,230,459	1,223,348	1,281,666	1,336,449	0.1%	-0.5%	-0.4%
Armstrong County	67,052	68,941	72,392	73,478	-0.6%	-0.5%	-0.1%
Beaver County	168,871	170,539	181,412	186,093	-0.2%	-0.6%	-0.3%
Butler County	186,818	183,862	174,083	152,013	0.3%	0.5%	1.4%
Fayette County	133,628	136,606	148,644	145,351	-0.4%	-0.8%	0.2%
Greene County	37,519	38,686	40,672	39,550	-0.6%	-0.5%	0.3%
Indiana County	86,966	88,880	89,605	89,994	-0.4%	-0.1%	0.0%
Lawrence County	88,082	91,108	94,643	96,246	-0.7%	-0.4%	-0.2%
Washington County	208,261	207,820	202,897	204,584	0.0%	0.2%	-0.1%
Westmoreland County	357,956	365,169	369,993	370,321	-0.4%	-0.1%	0.0%
City of Pittsburgh	304,391	305,704	334,563	369,879	-0.1%	-0.9%	-1.0%

* MSA (Metropolitan Statistical Area includes these counties: Allegheny, Armstrong, Beaver, Butler, Fayette, Washington, and Westmoreland.)

Source: U.S. Census Bureau, Dicennial Census, Population Estimates
Last Updated: 07.25.2016

[2] Note: When discussing the southwestern Pennsylvania region, most data in this section uses the aggregated 10-county model consisting of Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland counties as its regional catchment area. This is commonly used by local economic development entities like the Allegheny Conference on Community Development and Pittsburgh Today's benchmarking data. In a few places, where noted, date was only available for the Pittsburgh MSA, which is comprised of seven counties: Allegheny, Armstrong, Beaver, Butler, Fayette, Washington and Westmoreland.

Southwestern Pennsylvania Educational Attainment

High school graduation rates for the Pittsburgh 7-county MSA have been increasing, but the rates of 26 area districts still fall well below the national average. The 2010-11 regional high school graduation rate was 86% and in 2013-14 it has increased to 90%. While the Pittsburgh area produces a high number of graduates of two and four year colleges, talent retention is among the lowest of major cities in the country (Florida, 2016). The Pittsburgh area has a 33% retention rate of bachelor's degree graduates, a much lower percentage than sub-baccalaureate graduates with a 79% retention rate. One factor relative to low retention is that many of the most commonly awarded degrees do not align directly with regional demand (Burning Glass, 2016).

Large disparities in educational attainment exist when viewed across regional racial and ethnic lines, with African Americans and Hispanics having much lower completion rates than white residents (Sustainable Pittsburgh, 2016). For example, The Pittsburgh Regional Quality of Life Survey reports that 18% of African Americans have a Bachelor's degree or higher degree compared to 41% of white residents (UCSUR, 2016).

SWPA Educational Attainment (18 years or older)	
Less than HS degree	6.7%
HS degree or equivalent	30.5%
Some college or Associates degree	25.9%
Bachelor's degree or higher	36.9%

Source: US Census Bureau, 2014 data

Southwestern Pennsylvania Wages

According to the Southwest Planning Committee's research, the region's jobs are concentrated in occupations that pay between $8.50 and $15 an hour. About 40% pay below $15, while 9% pay over $35 an hour. Nearly 30% of all jobs pay $15.01-$25 an hour and are in high growth industries: HealthCare, Construction, Energy, and Information Technology.

Benchmarking southwestern Pennsylvania wages against 14 other benchmark regions[3] finds that manufacturing wages are low or close to average for represented manufacturing jobs. According to BLS average annual wage data for 2016, Machinists in the region earn

[3] The 15 benchmark metro regions are: Boston, Charlotte, Cincinnati, Cleveland, Denver, Detroit, Indianapolis, Kansas City, Milwaukee, Minneapolis/ St. Paul, Philadelphia, Pittsburgh, Richmond, St. Louis, and Washington, D.C.

$40,500, the second lowest wage for this job among the benchmark areas, which spans a high of $52,800 in Seattle and a low of $40,370 in Cleveland. Industrial Production Managers in southwestern Pennsylvania fare better, earning $108,670, just below the benchmark average of $112,612 but more than the U.S. average of $107,060.

Southwestern Pennsylvania Industries

According to the Southwest Planning Committee's planning research, the core industries offering the highest rate of employment throughout the region are:

- Health Care (196,444 jobs, 16.9% of jobs)
- Retail Trade (134,275 jobs; 11.5% of jobs)
- Government (123,051 jobs, 10.6% of jobs)
- Accommodation and Food Services (101,721 jobs, 8.7% of jobs)
- Manufacturing (90,779 jobs, 7.8% of jobs)

A change with a potentially large impact on employment is taking place in clerical work and professional services occupations. Technologies like the Web, artificial intelligence, big data, and improved analytics—all made possible by the ever-increasing availability of cheap computing power and storage capacity, are automating many routine tasks. Countless traditional white-collar jobs, such as many in the post office and in customer service, have disappeared (Rotman, 2016).

Additionally, the Southwest Planning Committee's research indicates that the key industries that represent opportunity for growth and development across the region, in addition to the above, are Mining, Quarrying, Oil and Gas Extraction, and Management of Companies, all of which represent a higher concentration of industries in the region than in the nation as a whole.

High grow industries are:

- Health Care (25,757 new jobs, 16.7% increase)
- Professional Services (25,757 new jobs, 13.1% increase)
- Construction, Mining, Oil, and Natural Gas Extraction (6,387 new jobs, 36.5% increase)
- Management of Companies (5,655 new jobs, 14.3% increase)

Interestingly, Technology does not figure as stand-alone industry or growth opportunity in the above research. It is nevertheless regarded as a critical element knit throughout all industries, and is a central part of most sectors. According to the Allegheny Conference on Community Development's 2016 Pittsburgh Region Business Investment Scorecard report, The Tech sector in Pennsylvania is:

- Second most active sector for investment deals – four years and running (2013-2016)
- Where the high-wage jobs are – average annual wage for IT employees is 60% higher than the average job in the region
- $84,100 – annual average wage paid by companies in region's IT sector Pittsburgh region (4.6%) wage growth – greater than U.S. growth

Regional Technology Focus: In the 2017 State of the Industry Report in teQ, the Pittsburgh Technology Council's regional business journal, research indicates that over the past three years, all six tech industry clusters have shown positive growth, with information technology in the lead. These clusters are measured using an aggregate from 13 counties, including the three tri-county areas: Armstrong, Butler, and Indiana.

The six main tech industry clusters are:

- Information Technology: hardware establishments, software establishments, telecommunications
- Life Sciences: medical equipment, instrument and device makers, bioresearch establishments, pharmaceutical companies
- Advanced Manufacturing: automation, engineering, process controls
- Advanced Materials: chemicals, plastics, rubber
- Environmental Technology: environmental equipment, waste water management, remediation, professional services, research
- Energy Technology: coal, petroleum, natural gas, power storage, nuclear, hydroelectric

In addition to the above core clusters, additional growth factors and indicators such and university research and development, graduate students/talent, university tech transfer, and Small Business Innovation Research programs also account for a significant percentage of growth.

Highlights from the 2017 teQ report include:

- The 9,969 technology establishments tallied in the year 2015 represent more than 13% of all companies in the 13-county region
- These firms employ 301,011 individuals and account for nearly 23.75% of the areas overall workforce
- The 22 billion annual payroll of technology and related companies, including the health services sub-cluster, represents more than 34& of the regions total wages.

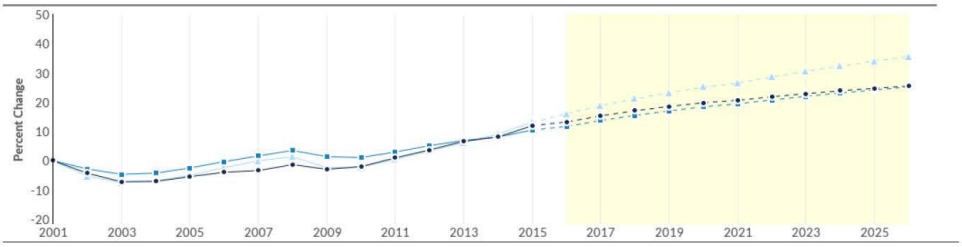
Computer and Mathematical Occupations

Pittsburgh Metro Area - 2016

Occupation Snapshot

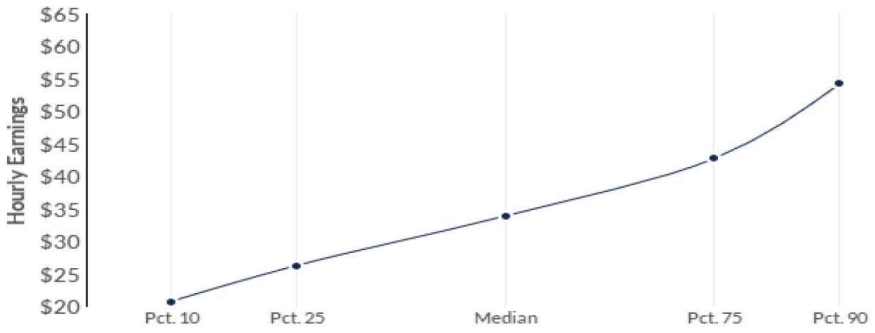
31,302	10.9%	$33.89/hr	45,419	6 : 1
Jobs	**Percent Change (2016-2026)**	**Median Hourly Earnings**	**Online Unique Postings**	**Posting Intensity**
3% below National average	Nation: 16.8%	Nation: $40.19/hr		8:1 Regional Avg

Job Growth



	Region	2016 Jobs	2026 Jobs	Change	% Change
●	Pittsburgh Metro Area	31,302	34,699	3,397	10.9%
●	Pennsylvania	151,214	169,440	18,226	12.1%
●	United States	4,176,439	4,878,048	701,609	16.8%

Percentile Earnings



PARTNER WORK

Data by EMSI, 2016

TOP TECH OCCUPATIONS IN THE PITTSBURGH REGION – 13[4] COUNTIES

As identified by Pittsburgh Technology Council and Allegheny Conference on Community Development

- Computer Systems Analysts
- Software Developers, Systems Software
- Computer User Support Specialists
- Network & Computer Systems Administrators
- Software Developers, Applications
- Computer Programmers
- Computer Network Architects
- Information Security
- Analysts Database
- Administrators Web
- Developer
- Computer Occupations, Other
- Computer Network Support Specialists
- Operations Research Analysts
- IT Manager
- Statistician Actuary

ADDITIONAL GROWING CLUSTERS IN THE PITTSBURGH REGION – 13[5] COUNTIES

As identified by Pittsburgh Technology Council and Allegheny Conference on Community Development

- Business + Finance Technologies
- Engineering Technologies
- Healthcare Technologies
- Agriculture Technologies

According to the Bureau of Labor Statistics, employment of computer and information technology occupations on a national level is projected to grow 12 percent from 2014 to 2024, faster than the average for all occupations. These occupations are expected to add about 488,500 new jobs, from about 3.9 million jobs to about 4.4 million jobs from 2014 to 2024, in part due to a greater emphasis on cloud computing, the collection and storage of big data, more everyday items becoming connected to the Internet in what is commonly referred to as the “Internet of things,” and the continued demand for mobile computing.

[1,2] The 13 counties tracked for these reports include: Allegheny, Armstrong, Beaver, Bedford, Butler, Cambria, Fayette, Greene, Indiana, Lawrence, Somerset, Washington and Westmoreland

D. Tri-County Workforce and IT Trends and Developments

Tri-County Population

The age of Pennsylvania residents skews older than in most of the country. This is particularly true for the Pittsburgh region, and the tri-county area follows that trend, with Armstrong County having the oldest population. The Pittsburgh area was hit with a confluence of events that are playing out now in demographic shifts: a very high percentage of older people who age in place versus an outmigration of the young (this has stemmed in recent years in the City of Pittsburgh but persists in many of the outlying counties). A major outmigration occurred in the 1980s and 90s, due to the collapse of the steel industry, resulting in a 'missing generation' that, had they stayed, would now have children entering the workforce. Add to that the national trend of baby boomers retiring – which one tri-county manufacturer referred to as creating a "Swiss cheese" effect among the workforce. A SHRM-AARP survey conducted on this topic found "that many U.S. organizations are largely unprepared for the brain drain and skills void that talented, retiring workers will leave."

These trends are reflected in US Census Bureau data

				Population by age category				
Area	**Total Population**	**Median Age**	**18-64 Years**	**Under 5**	**5-19**	**20-34**	**35-64**	**65+**
Armstrong	67,052	46.1	40,148	3,314	10,994	10,608	28,269	13,867
Butler	186,818	43.2	115,858	9,357	34,810	31,733	78,384	32,534
Indiana	86,966	39.1	55,829	4,262	16,230	19,543	31,654	15,217
10-county	2,565,612	42.9	1,592,530	131,634	428,057	493,525	1,032,646	479,750
PA	12,802,503	40.7	7,932,441	714,912	2326414	2516,542	5,064,841	2,179,788

Tri-County Employment

Industry in the tri-county area is currently dominated by:

1) education and health services
2) trade, transportation and utilities
3) professional and business services.

Top occupations predicted to grow between 2014 and 2024 in the three county area are: Retail Salespersons, Cashiers, Combined Food Preparation and Serving Workers, Waiters and Waitresses, and Registered Nurses (Tri-County Workforce Development Board, 2017).

- Covering the 12-month period of April 2016 to Mar 2017, Armstrong County's labor force of 33,000 had a higher unemployment rate (6.25%) than the state (4.8%).

- Butler County's labor force of 98,100 has a slightly lower unemployment rate (4.6%) than the state (4.8%).

- Indiana County's labor force of 39,600 has a higher unemployment rate (6.1%) than the state (4.8%).

In the aggregate, the number of people age 55 - 69 is increasing in the tri-county region while the number of people under the age of 54 is decreasing. Over the past five years the regional population has expanded due to significant growth in Butler County, while population rates in Armstrong and Indiana counties have declined slightly.

Tri-County Educational Attainment

In the tri-county region, educational attainment is lowest in Armstrong County and highest in Butler County. The percentage of residents 25 or older that earned a bachelor's degree or higher is greatest in Butler (32.3%) and educational attainment is most diversified in Indiana.

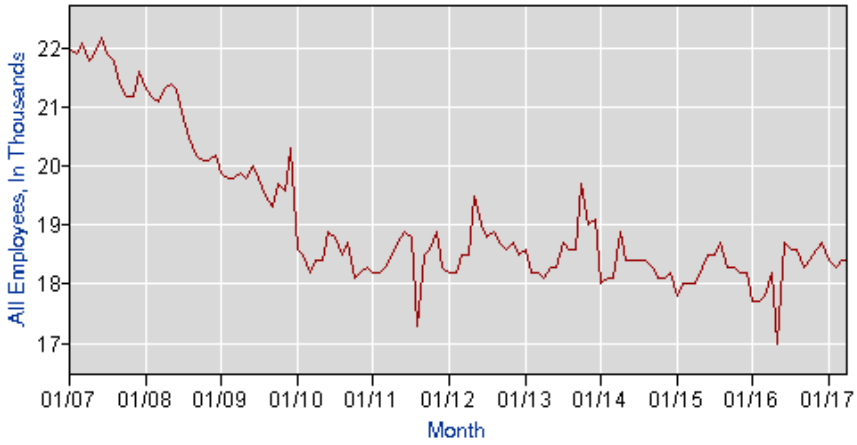
Tri-County Educational Attainment (25 years and older, 2015)			
	Armstrong	*Butler*	*Indiana*
Less than HS degree	11.1%	6.9%	11.5%
HS degree or equivalent	49.4%	34.9%	43.9%
Some college	15.6%	16.5%	14.0%
Associates degree	8.9%	9.4%	8.0%
Bachelor's degree	10.5%	21.1%	13.5%
Graduate or professional degree	4.4%	11.2%	9.1%

Source: US Census, American Fact Finder, 2017

Tri-County IT / Technology

According to the Tri-County Workforce Development Board's research, there are 219 information technology and communication services employers within the local area. There are 3,006 employees within the information technology and communication services industry which counts as 2.26% of our local employment. The industry is showing growth in the region with 222 additional jobs being shown between 2007 and 2008, but has since declined according to the 2017 US Bureau of Labor Statistics report (US Bureau of Labor Statistics) 2017.

Pittsburgh Pennsylvania: Information Sector – All Employees, In Thousands
(US Bureau of Labor Statistics 2017)



Data in the Tri-County region regarding IT / Technology industry and workforce trends, employment / employer numbers, and wage information in the Tri-County area for the purpose of this report, was somewhat limited. Informal verbal feedback from Tri-County IT companies indicate that the local industry struggles with several challenges that include difficulty in finding qualified workers who can truly accomplish job-related tasks. Additionally, potential workers often don't have accurate, relevant knowledge or an understanding of what level of education, training, and skills are required for jobs in the technology sector as there is a disconnect in communication.

In addition, there are small clusters of IT/Technology employers in each of the three counties. For example, Butler County is home to one of the region's fastest growing technology companies, US Ariel Video, Inc. Although they currently employ only 4 individuals, they are expected to grow over the next year and add people to their team. Drone technology is of interest to many construction firms as the drones map the landscape and provide civil engineers with the resources they need for various projects. However, the larger takeaway from the research indicates that the Tri-County region is generally not keeping up to date with the evolving needs of employers. And talent from the region is being extracted and brought to the cities - Pittsburgh or Cleveland or elsewhere. Many of the regional skill training providers realize there is a challenge and need to better align with the needs of the regional technology industry.

The Pittsburgh region reflects a disparity of economic opportunity. There is a concentration of high-wage, high skill occupations with relatively low unemployment such as in Information Technology (IT) and Engineering. However, there are also 32,000 long-term unemployed residents, most commonly in occupations such as Production or Administrative Support with slower than average growth prospects. While the region must continue to expand innovation and growth of high-skill roles, it needs to redouble its efforts to address the skill and workforce needs of residents who are not currently on pathways to high-wage jobs (Burning Glass 2015).

Armstrong County Snapshot

According to the May 2017 PA Department of Labor and Industry statistics, Armstrong County has a 6.2% unemployment rate, with approximately 2,000 individuals identifying as unemployed. The median household income is $44,942, compared to PA average of roughly $53,599. There has been a decline of on-line job postings since 2015, about - 26.3%, more than twice that of the larger statewide decline of -10.8%.

The County's top employers include: Armstrong County Memorial Hospital Armstrong School District Armstrong County Wal-Mart Associates Inc. Moreover, according to a recent Tribune Review article, Armstrong County is falling behind in job creation, skilled IT/Tech workers/talent, IT and tech education and training. With one of the highest rates of unemployment in the state, a recent snapshot of jobs indicated that Armstrong County had roughly 340 postings (Thomas). Additional information in the article included:

- Tomorrow's workers will need to be technology-minded, customer service-oriented and agile with the potential for leadership growth. There will be a leadership gap as the study anticipates a short supply of managers after baby boomers retire.
- Information technology expertise is needed across the board in all fields.
- Information technology cuts across a lot of jobs at Armstrong County's largest employer, Armstrong County Memorial Hospital, according to John Lewis, CEO and president. The hospital has about 1,100 full-time and part-time employees. "Attracting IT workers is one thing, but retaining them is another," he said of the highly marketable skill.

There are currently a few tech-related businesses basing their operations in Armstrong County. One firm, Electro-Optics Center (EOC) stands out as an economic driver for the region. In a 2014 article, the Pittsburgh technology Council praised the EOPC for its cutting-edge research and ability to attract national attention.

Armstrong County in southwestern Pennsylvania is home to the Pennsylvania State University's Electro-Optics Center (EOC), the focal point for many of the nation's cutting-edge research initiatives, including products for the U.S. Departments of Defense (DoD) and Human Services (DHS) and U.S. industry. The Center assists the government with coordinating, providing knowledge of various smaller entities and helping to focus efforts towards developing systems of DoD and DHS interest. As such, it has become a formidable national and international resource (Pittsburgh Technology Council 2014).

Despite significant early investments including millions in federally earmarked dollars, the center currently employs approximately 37 individuals in highly specialized fields that require advanced degrees and sophisticated training.

The economic force the EOC set out to be for Armstrong county residents has unfortunately not delivered on its promise of using technology as a stimulus for growth and investment. Although a significant effort was made in terms of accessible training and educational partnerships for the community, there are a limited number of jobs at EOC that require far more advanced training than the providers could provide.

More recently a $15 million dollar investment in Involta, a national provider for IT and data storage, created a new facility in Northpointe in South Buffalo township, and currently employs 15 individuals. With UPMC slated to be a major tenant in the facility, Involta could be the pivot that Armstrong County needs to gain the needed momentum for tech-related growth.

Butler County Snapshot

The largest population of the Tri-County region Butler County accounts for about 7.5% of the population of the region, with roughly 186,000 people currently residing there according to the 2017 Tri-County Workforce Development Board Labor and Employment Report. It is also the county employing the most people, with familiar industry leaders such as Westinghouse Electric Company and Alcoa, in addition to more regional large employers such as Butler Health System, and Concordia.

Core occupations in Butler county consist largely of industries that are linked closely by common product markets, labor pools, similar technologies, supplier chains, and other similar economic ties:

- Advanced materials and diversified manufacturing
- Agriculture and food production
- Building and construction
- Business and financial services
- Education
- Information and communication
- Life sciences
- Logistics and transportation
- Lumber, wood, and paper

Indiana County Snapshot

Roughly 86,364 individuals reside throughout Indiana County, making it the second most populous county in the tri-county region. The four core sectors of employment consist of Energy, Manufacturing, Healthcare, and Agriculture. According to the Indiana County website, agriculture plays an important role in the landscape, culture, and economy of the county. Much of the County has prime agricultural land that supports productive farming, which is one important component of the County's economic vitality. The establishment of small farms has been increasing throughout the County in recent years (Indiana County Center for Economic Operations).

Manufacturing, once abundant in the county, accounts for only about 10% of employment. Healthcare, as it is across the region and nationally, is on the rise and is the largest employer, accounting for roughly 14% of the jobs in Indiana County. Education is particularly strong in Indiana County as it boasts a number of post-secondary institutions, including Indiana University of Pennsylvania, Westmoreland Community College, Cambria-Rowe Business College, and the Indiana County Technology Center. There are also seven school districts, and several faith-based options for K-12 education needs.

While information/tech oriented businesses have begun to appear, technology remains a slow-growth industry. Occupations requiring tech related skills have been increasing somewhat, but are also slow to develop.

E. Key Findings and Challenges for Tri-County Information Technology

In March-April 2017 C4IOE / TCWIB requested that members of the IT/Technology Industry Partnership respond to a survey regarding workforce training needs, hiring trends, and industry trends. Five responses were received, though some respondents did not answer all questions. Although the number of IT/Technology survey respondents was not statistically significant to draw quantitative conclusions for the tri-county region, the results did provide some qualitative information, and served to shed light on how local developments relate to national and regional trends.

While there are several ways to individuals to attain and build the necessary skills for their chosen career pathway, many IT / Technology related careers throughout most industries are built on similar core foundations, and basic educational levels. However, basic skills are not enough for many IT / Tech job candidates today.

More and more, employers are wanting job candidates in the IT / Technology sector to have certificates or degrees in various specialties. In a 2014 report, Burning Glass Technologies suggested that: "A staggering number of employers now require a bachelor's degree for a wide range of jobs, but the shift has been dramatic for some of the occupations historically dominated by workers without a college degree…" (Burning Glass Technologies 2014). For many in the Tri-County Region, this is a particularly daunting trend because the average educational attainment is a High School diploma or its equivalent for individuals in all three counties (roughly 42% of the total population). As the necessity for a diploma or even a BA has increased, not having them has become a de-facto filter when it comes to recruitment for many companies and businesses across all sectors.

One trend that seems to somewhat address this is phenomenon, at least in the IT / Technology sector, is that many tech-related businesses have their own 'in-house' training program for individuals who at least 'make it in the front door'.

In several instances a traditional 'career pathway' for many traditional IT / Technology careers has shifted to more of a 'career pool.' Which means, "get in the door, learn a bit, swim in the pool, and see where you might go." This seems to be a trend in many of the larger career / professional IT areas such as Information Technology Support/Services, Network Systems, and Programming & Software. Individual learning styles are being honored and supported, and someone with no conventional degree but who has excellent skills from hands on learning or being mentored, can wind up in a supportive workplace. This is great news for the individual who may not know exactly the direction his/her career should take.

Respondents to surveys across all Tri-County Industry Partnership sectors reported the following industry trends: fluctuations in the energy industry, especially coal and gas; the expanding medical market; uncertain political climate/ government changes; price competition; automation; outsourcing/off-shoring; and the difficulty of keeping up with market changes and developments.

Respondents also identified workforce specific concerns from employers including: aging workforce, lack of job readiness skills among new / potential hires; youth pipeline too small; and employee retention. Also mentioned were a lack of personal drive and passing drug tests. Educators / resource partners chose the same top three challenges.

Lack of workplace skills: In the area of workforce challenges, a number of employers noted the difficulty in finding entry-level workers with necessary workplace skills, such as reliability, punctuality, ability to work well with others, a good worth ethic and general

professionalism. They also cited needing people who had basic math, computer (i.e. Microsoft Office and basic internet) and communication skills, as well as the ability to pass a pre-employment drug test. All of these challenges mirror those noted in state and national reports and surveys.

Workforce training programs / providers (from Employer view): Overall satisfaction with current workforce training programs was mixed. Some respondents cited a need for more affordable and time flexible programs. Employers mentioned the need for education providers to listen to what employers need. As an aside, there may be a disconnect here for a variety of reasons. One reason cited is that the community college system in Pennsylvania is struggling as a whole – competing for a dwindling number of students (due to population), and thus dealing with financial concerns. So some institutions may be focused on programs that bring in students, rather than programs that suit employers.

Barriers to training: According to employers, the top barriers to employee training are: training classes are too far away, training / class times are inconvenient, not enough funding to cover employees who need training, programs are too time consuming for employees to attend because they can't be absent from shift/work responsibilities as much as needed to attend training.

Courses Needed: The following courses will be needed by some local employers in the next 12 months: Advanced MS Word, Exchange Server, A+Certification, Active Directory, Cisco, and Security.

Training concerns from Training Providers / Resource Partners: One provider / resource partner cited a lack of involvement from the technology sector in the Tri-County region. Compared to other business sectors, the IT employers (it was felt), do not participate as much. (As another aside, this report recommends expanding the "participation invite" to IT employees across ALL industry sectors, not just the IT industry / companies). As mentioned previously in this report, because IT is a support occupational group, not to mention the core of how business "gets done" these days, it crosses all industry sectors. Participation may be much higher if IT employees across industries, are invited to contribute to industry partnership and other business group activities in the Tri-County region.

Note: A more complete summary of findings is available on the TCWIB website.

II. Addressing the Needs and Challenges of Information Technology in the Tri-County Area

A. Opportunities to Strengthen IT in the Tri-County Region

Following are observations and opportunities for tri-county stakeholders to consider for strengthening the area's Information Technology workforce. They were derived from a combination of one-on-one interviews with area employers and training professionals, and lessons learned from other geographic areas.

New technologies: Another area employer spoke of a need to get out in front of some of the new technologies, rather than waiting and reacting to them. "We need new solutions, new thought patterns. How can new technologies be useful in (various industries)? What opportunities will they create?" He cited 3D printing, the Internet of Things and Virtual Reality as examples of new technologies.

Scarcity mentality: There is a limited pool of talent in the tri-county area and some employers and trainers spoke about this causing a scarcity mentality around labor issues. Some employers are fearful of losing employees to the competition or to job opportunities in neighboring counties. In reaction, they make choices in the short term that may hurt them in the medium and long term, such as not sending employees to group training programs because they fear such visibility will enable workers to be poached. One area employer noted that employees leaving for other jobs is a two way street: the employer must look at what they can do to retain employees and ask, what could they have done better to foster loyalty and engagement of that employee in their current position?

Education and training: The skills gap in information technology will persist and local employers as well as employers mentioned in national reports believe it will get worse in the next few years. This suggests new ways for addressing the skills shortage are needed. Going to school and completing studies before getting a job, is being challenged, especially for industries like information technology where the skills need to evolve along with the technology requirements central to the industry. Continuous education models are being explored – with shorter college courses, online learning and targeted upskilling.

Team effort: Some survey respondents noted they have seen a need for more communication between educators and employers – the lack of communication does not serve the industry well. "As employers, we need to stop thinking this is just an educational problem; it's a whole industry problem and we need to be developing strategies alongside our educators to ensure that we are showing up at job fairs and schools with the right message." Another area employer felt, "We have done a disservice to young people, especially in the inner cities, by not giving them an understanding of the options they have."

Hard and soft: While the demand for technical skills like STEM will remain high – employers highly emphasize the need for students and workers to develop soft skills. As one tri-county employer noted: "There's a saying that goes, you can get a job with your hard skills, and you can lose it with your soft skills."

Supply and demand of skills: Area employers emphasized what has been described in national reports, that colleges and training centers need to better align their teaching approaches to rapidly changing workforce needs. Ways of doing this were suggested:

- offer training in packages that are smaller, faster, and more relevant to immediate needs in the labor market;
- rather than a two-year degree, students may take a six- or nine-month course, then use that skill in the workplace and at a later date they may upskill with another such course;
- better connect students to career opportunities by inviting them to the workplace for plant tours and mentoring opportunities; and
- workforce data should be more widely shared to help align the supply and demand of skills.

Diversified education and credentialing ecosystem: Educators and industry partners see a new education and training ecosystem emerging in which some job preparation functions are performed by formal educational institutions in fairly traditional classroom settings, some elements are offered online, some are created by for-profit firms, some are free, some exploit augmented and virtual reality elements and gaming sensibilities, and a much real-time learning takes place in formats that job seekers pursue on their own. Some say alternative credentialing mechanisms will arise to assess and vouch for the skills people acquire along the way.

B. Developing High-demand Skills and Career Pathways:

Based on our research, C4IOE identified six (6) key information technology occupational clusters in demand or projected to be in demand in the tri-county area or region. Following are the clusters and sample occupations for each. Almost all of these professions are on the Pennsylvania hi-priority occupation (HPO) list.

Top clusters currently in the tri-county area:

- ***General Information Technology Support / Services:***
    - Computer User Support Specialist, Computer Programmer, Network & Computer System Administrator, Database Administrator, Computer Security Specialist, Computer Systems Analyst, IT Manager
- ***Interactive Media & Web***:
    - Web Developer, Interactive Media 3-D, Designer
- ***Network Systems***:
    - Computer Network Support Specialist, Computer Network Architect, Operations Research Analyst
- ***Programming Software***:
    - Software Developer/Engineer, Computer Programmer, Software Quality Assurance Engineer
- ***Information Security & Business Continuity***:
    - Information Security Analyst, Certified Information Security Professional, Computer Forensics Analyst, Systems / Business Continuity Manager
- ***General IT User Support:***:
    - Computer Repair Technician, IT Service Professional, IT Maintenance Tech

The Information Technology profession offers a wide variety of career paths and entry

points to those paths, across many industries. Career progressions can branch across occupation clusters into multiple job opportunities, due to the cross-applicability of IT skills to various roles, and into various industries. In additional, more jobs are emerging at the intersection of technology and various industries, where instead of simply a support function, IT / Technology plays a major role in the business, e.g. computerized robots distributing medications in hospitals, ERP (enterprise resource planning) systems, companies that set up e-stores for customers who can sell merchandise to THEIR customers, etc.

Different employers will also expect varying levels of preparation for the same or similar jobs. Expectations also differ for years of experience needed for a position, often reflecting the difference in hiring someone at the early stages of their skills versus someone who is credentialed / certified in that skill set, and this is reflected in the career pathways model.

In the General Information Technology Cluster, most occupations except for Computer User Support Specialist generally require at least an associate degree, with most employers asking for a bachelor's degree. In the IT / Tech field, because of rapidly changing technology, employers and employees value the continuing training and certifications that develop when changes or new systems or software are developed. Generally the difference for the employer in hiring someone with associate's versus bachelor's degree is whether the candidate is bringing years of experience or not, plus does the candidate have up to date training / certifications in the latest IT / Tech related topics such as: a variety of CompTIA certifications, Cisco Network certification, Microsoft certification, SANS, PMI, Certified Database Administrator, etc.

In the General IT User Support Cluster, CompTIA certifications, Cisco certified Network Associate, and the wide range of software training for programs supporting users. In the Interactive Media & Web Cluster, generally at least a 4-year degree is needed, except for a Web Developer. And certificates in these areas and others are also needed: Adobe Creative Suite, Vector illustration, 3D modeling, Javascript, FLASH, SQL, etc.

In the Network Systems Cluster, some of the same certifications as needed in the General IT Cluster are helpful in the occupations in this cluster as well – CompTIA certifications, Cisco certification, etc. For Support Specialist – Entry level, a Bachelor's degree is not required generally, though some employers may want candidates to have one. Generally a Bachelor's degree and 1-2 years' experience is needed. For the Programming & Software Cluster, Perl, Python, PHP, Java, are going to be helpful in addition to CompTIA certifications. For developer roles, especially senior roles, generally 5-7 years of experience is what employers want.

In the Information Security Cluster, the CompTIA Security & Network certifications will be helpful. Also, in this field, there are several professional certifications, including for example, CISSP (Certified Information Systems Security Professional), and EnCase Certified Examiner (EnCE).

III. Recommendations

Following are five key recommendations for the Tri-County WIB and its constituents highlighting opportunities to advance, compete, strengthen, and thrive in their work. These recommendations are based on the research data, and qualitative input provided by local and regional employers, educators and service providers

1. **Focus on the High Priority IT and Technology, and Technology – Related Occupations and their growth.**

2. **Form extended partnerships and alliances with the top employers** Priority IT and Technology, and Technology –Related Fields **in the Tri-County Region.**

3. **Dissolve information barriers: equitable access to Internet / technology, information about the jobs that are in demand, and the training programs available.**

4. **Develop training that reflects the needs of the region – and the jobs that are in demand in the IT/Technology, and Technology-Related Fields.**

5. **Focus on Upskilling talent to address the IT/Technology demands.**

1) Focus on the High Priority Occupations and their growth

In the 2015 Inflection Report (Pittsburgh MSA), research suggests industry and the workforce should focus resources on opportunity occupations and high priority occupations (HPO). HPO's potential offer individuals the opportunity to earn a living wage, however some of those occupations are not recognized by the state as HPO's eligible for additional training dollars.

The report further suggests that petitioning for high priority recognition in order to properly allocate resources, should be a priority for industry. Career pathway initiatives can be framed around the High Priority Occupations as a basis for upskilling workers who are unemployed, in declining occupations or in occupations which offer sub-living wage pay (Burning Glass 2015).

2016 High Priority Tech Occupations for Tri-County Workforce Development Area:

- Computer Systems Analysts
- Software Developers, Systems Software
- Computer User Support Specialists
- Network & Computer Systems Administrators
- Software Developers, Applications
- Computer Network Support Specialists
- Computer Programmers

"Tri-County Occupations by Predicted Growth, 2014-2024 by Estimated Annual Openings" from the 2017 Tri-County Workforce Development Board / Labor and Employment Report:

- Retail Salespersons – 7,431 openings
- Cashiers – 6,284 openings
- Combines Food Preparation & Serving Workers – 5,983 openings
- Waiters & Waitresses – 5,208 openings
- Registered Nurses – 4,886 openings
- Laborers & Freight, Stock & Material Movers - 4,257 openings
- Customer Service Representatives – 3,302 openings
- Office Clerks, General – 3,071 openings
- Home Health Aides – 2,824 openings
- Stock Clerks & Order Fillers – 2,722 openings

2) Form extended partnerships and alliances with the top employers in the Tri- County Region for the purpose of attracting and retaining talent

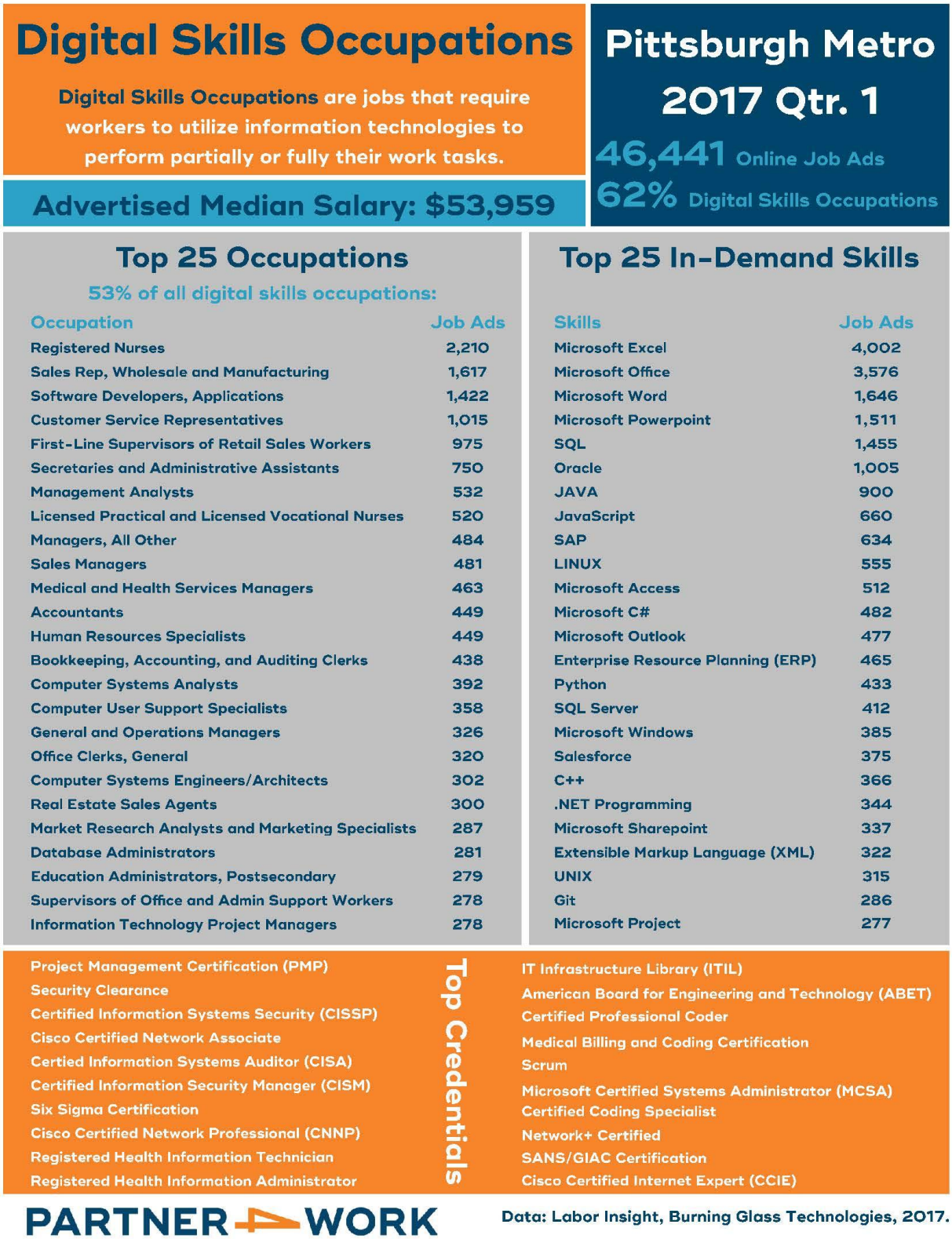
Top 10 Employers by Employment on Q3 of 2016 by County

Source: PA Dept. of L&I, Center for Workforce Information and Analysis (CWIA), May 2017)

ARMSTRONG	BUTLER	INDIANA
Armstrong County Memorial Hospital	Federal Government	PA State System of Higher Education
Armstrong School District	Westinghouse Electric Co LLC	Indiana Regional Medical Center
Armstrong County	Butler Healthcare Providers	State Government
Wal-Mart Associates Inc.	AK Steel Corporation	Diamond Drugs Inc.
Allegheny Ludlum LLC	Wal-Mart Associates Inc.	Wal-Mart Associates Inc.
State Government	Butler Area School District	S&T Bank
Rosebud Mining Company	Seneca Valley School District	Indiana County
Federal Government	PA State System of Higher Education	Genon Energy Services LLC
Apollo-Ridge School District	Kawneer Commercial Windows LLC	Indiana Area School District
Cook Inc.	Butler County Court House	First Commonwealth Bank

Businesses, schools, and training programs could collaborate and form a partnership to attract and retain top level talent. According to the Inflection Report's suggested recommendations for the region, a coordinated, sustained and well-funded marketing effort to promote inbound migration and talent retention is needed. There are many organizations promoting the region but a coordinated effort is required to amass sufficient

resources to have a visible impact. If employer demand for talent in critical emerging occupations is not clear and compelling, existing talent may leave the region (Burning Glass 2015).



3) **Dissolve information barriers: provide equitable access to internet/technology, information about the jobs that are in demand, and the training programs available**

Too often existing pathways are unclear, either because of lack of information available to workers about the jobs and skills in demand, or lack of awareness or limited options for training that is aligned with employer skill needs (Burning Glass 2015).

Earlier this year, policy analysts at the National Telecommunications and Information Administration suggested that one way to close the (employment) gap might be to give rural people digital literacy training so they can see how the Internet would be useful to them. That's a nice idea, but making broadband access more affordable is likely to have a much bigger impact. Regardless of where people live, families that don't make much money are far less likely to use the Internet. And compared with what's available in other countries, service plans for midrange broadband in the U.S. are pretty expensive: about $52.50 per month on average. (Orcutt 2016).

People without broadband are not necessarily entirely offline... some of them rely on smartphones. But because of small screens and data caps, phones are not an adequate substitute for home broadband. Its absence in some communities is a growing problem at a time when the jobs of the future will be increasingly digital: the Bureau of Labor Statistics projects that 500,000 information technology jobs will be created in the next few years. Already, one in 20 American adults is deriving some income from online "gig" employment (not including ride- or home-sharing services), according to joint studies by Microsoft Research and the Pew Research Center. Such opportunities are only expected to grow—for people who have broadband access. (Talbot 2016).

4) **Develop training that reflects the needs of the region – and the jobs that are in demand.**

The region's students and parents might have to adjust their vision of training beyond just the working-class standard of a four-year college degree, according to Allegheny Conference researchers. Technical training is part of the equation for some of the good- paying jobs of the future.

Allegheny Conference officials and other regional leaders will continue to work on the issue, offering a "digital hub" later this year or early next year that will provide an online portal for students, parents and other to explore career paths, needed skills, required education and other helpful information. (Thomas)

Explore non-traditional education and training approaches: For example:

- Focus on developing cross cutting skills
- Develop cross-industry certifications
- Differentiate training offerings so more students / workers can access them – shorter courses, online, time given at work for training, etc.
- Improve communications: proactively identify industry needs today and tomorrow and communicate them to educators

- Advocate for soft skills to be taught in K-12 and arrange interactions with real employers so students can practice them in a real world setting
- Enable higher education to become something that happens in workplaces as well as schools.

5) Focus on Upskilling talent

In the Allegheny Conference's 2015 Inflection Point report, researchers note that as the market places an increasing premium on workers with higher skills, the development and clear articulation of career pathways is critical to ensuring employers have an adequate talent supply and that workers have opportunities to advance.

Employers can create explicit pathways that lead to advancement within their firms, within industries and across industries. Alignment and clear expectations between employers and training providers can accelerate workers' advancement into higher value roles.

Create an environment where more area workers have an opportunity to connect to and prepare for manufacturing opportunities**.** Identify groups that have the potential to increase their skills – such as some among the 7,000 chronically unemployed manufacturing workers in the region; or non-traditional groups that can be tapped for trained – such as women, disadvantaged youth, minorities, new immigrants, rural youth who don't usually learn about opportunities in advanced manufacturing or technology. Work with training providers to determine ways of tailoring courses for upskilling.

Upskilling and up credentialing: employers want demonstrated higher-level skills and credentials: The changing nature of jobs means that many occupations require new, more advanced skills. Employers increasingly are seeking credentials now where previously no credential, or a lesser credential, would have sufficed. This is constraining opportunities for upward mobility, increasing time to fill jobs and impacting starting salaries. Building closer industry and educator connections to focus on a comprehensive understanding of skill requirements and related assessment can help to alleviate up credentialing (Burning Glass 2015).

IV. Appendices

Appendix 1: Report Methodology

This report addresses key research questions around demographics of the region, industry trends and occupational trends on a national, state, regional, and local level, career pathways, training needs, and skill standards (including credentialing) for key occupations. Additionally, the report describes the IT/Technology related Career Pathways / Skill standards model that was developed as part of this process, and provides recommendations related to career paths, workforce development and training for this industry in the local TCWIB region.

Research for this report consists of a mix of primary and secondary source material. Secondary sources include national, state, regional and local and research reports, print news articles and on-air news segments, and data sets from government agencies and economic development entities. Primary sources include a mix of one-on-one interviews and an online survey developed by C4IOE and administered in April 2017. The survey was sent to employers, education providers and job-related service providers in the tri-county region that are part of the IT/Technology Industry Partnership. There were 5 respondents to the survey, though some did not answered all questions. The survey results are available on the TCWIB website: www.tricountywib.org The reports and the Career Pathways / Skill Standards models are also available on this website.

Appendix 2: About C4IOE / About TCWIB

About C4IOE

C4IOE is a management consulting firm, founded in 1998, which provides services to businesses, individuals, government and nonprofit organizations. Our services include: human resources strategies/processes, social entrepreneurship/ventures, performance improvement, training and curriculum design, change management, organization development, process redesign, non-profit planning and management, strategic planning, operational planning, technical writing, and other organizational initiatives and practices, for the purposes of improving performance of, and creating positive change in individuals and organizations.

About Tri-County Workforce Investment Board (TCWIB)

The mission of the Tri-County Workforce Investment Board, Inc. is to provide responsive and innovative leadership that meets the current and future needs of employers and job seekers. The vision of the Tri-County Workforce Investment Board, Inc. is that the local area will be a destination of choice for employers and job seekers, where existing businesses experience growth and where new businesses are eager to locate because of the excellent job opportunities, economic vitality, quality of life and the presence of a skilled workforce. The Tri-County Workforce Investment Board, Inc. is comprised of 29 volunteer members from Armstrong, Butler, and Indiana counties. Members are community leaders with policy and decision making experience.

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