Inflection Point: Supply, Demand and the Future of Work in the Pittsburgh Region

A forward look at the coming transformation of work across the Pittsburgh region and its implications for employers, educators and workforce talent

Prepared by: Burning Glass Technologies and The Council for Adult and Experiential Learning with: Allegheny Conference on Community Development
AlleghenyConference.org

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INTRODUCTION

The Allegheny Conference has been sounding an alarm for some time that the Pittsburgh region is on the leading edge of a serious shortfall in our working-age population, and that we have lagged behind other regions when it comes to inward migration. As the Chair of the Conference’s Workforce Steering Committee, last year I asked a working group to dive into this issue and to examine our challenges and opportunities over the next 10 years.

Inflection Point: Supply, Demand and the Future of Work in the Pittsburgh Region is the result of this effort, and should serve as a wake-up call and catalyst for all employers, educators, civic leaders, and our current and future workforce.

The findings in this report are clear: Over the next decade, the Pittsburgh region’s workforce will be entirely transformed due to retirements, growth and occupational transitions that will require upskilling. Technology will drive change and disrupt entire sectors, and new and every employer and worker must keep pace with this change to remain competitive.

The challenge is made greater by the fact that, as a regional workforce, our numbers do not add up. With Baby Boomers now retiring, not enough skilled workers to take their place and slow inward migration, the report estimates our region could be short by more than 85,000 workers over the next 10 years if we just keep doing what we are doing today. The implications of that are substantial. We need to connect everyone to opportunity and a path to success, including the thousands who are unemployed across our region.

To be clear, we are at a critical moment for the future of our region. As employers, we need to move from being simply consumers of talent, to becoming investors in the labor marketplace. That means investing in training and bridging what has been identified as a great divide between educators and employers so that we can align our labor supply and pipeline with the market and where it is headed. It also means that we must act as a region, rather than just as individual employers, to attract the high-skilled talent we will all need to compete.

Business, education and civic leaders all have a role to play, to combine our resources and expertise on a shared path that will position us for progress and prosperity.

I urge you to read this report with that view in mind and to join us in our efforts to forge a stronger, more competitive workforce for our future.

Sincerely,
Bill Demchak
Chairman, President and Chief Executive Officer
The PNC Financial Services Group, Inc.

inflection is a change in form or pitch, and that is an apt metaphor for what we hope the impact of this report will be on community conversations about workforce and opportunity. As you will read, we face very real challenges relative to future employer demand and the trajectory of our overall demographics. However, for a region of our size we can lay claim to unequalled assets: a diverse economy, a density of world class educational institutions, a network of highly engaged corporate and civic leaders, and a long history of collaboration. These can be harnessed to meet our workforce challenges, just as we have done in the past with our environment and our economy.

This forward looking examination of both specific employer demand and the characteristics of the region’s workforce and talent pipeline presents a fresh and nuanced picture, one we believe best suited to engender a strategic and energetic community response.

 Burning Glass Technologies and the Council for Adult and Experiential Learning utilized multiple data sources for their analysis that allow them to capitalize on the strengths of each. The analysis is focused on occupations – the actual jobs – rather than industry sectors, in order to give a more complete picture, as industries comprise many different types of occupations. Publicly available state and federal labor data has been augmented by two additional data sources that provide a very specific picture of actual employer demand. Real-time market insight across the entire economy is provided by Burning Glass Technologies’ analysis of web-based job postings, offering current and detailed information about employer skill demands and nascent trends. To validate these findings, focus groups were held with more than 130 CEOs and industry leaders, including those in secondary and postsecondary education.

The findings in this analysis confirm that we are entering a period of rapid transformation spurred by innovation and technological change across every industry. Our region is not unique in experiencing these changes; but, if we embrace our history of working together to develop and implement appropriate strategies, we will create the conditions needed to ensure a prosperous future for our region.

I was pleased to chair a highly engaged Working Group who informed and framed the execution of this work at every stage. The inclusion and diversity of their perspectives, and their shared commitment to the Pittsburgh region, has enriched this work.

Sincerely,
Dmitri Shiry
Managing Partner, Deloitte, LLP
This report was made possible by generous funding by Allegheny Conference on Community Development Regional Investors as part of Opportunity 2025, and through the input and expertise of the Demand Analysis Working Group and outside analysts, as well as business, education and civic leaders.

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EXECUTIVE SUMMARY
THE PITTSBURGH REGION IS APPROACHING AN INFLECTION POINT.

Competition for jobs and talent in the global economy is putting greater pressure on communities. Increasingly, the success of regional economies is defined by their people and the quality and alignment of their workforce. The Pittsburgh region has made internationally recognized gains over the past 30 years, but it must transform itself once again to meet this competitive challenge. Decisions made, or left unmade, by community and business leaders over the next three to five years will lead in one of two directions: slow change or inaction that will erode competitiveness, or focused attention, investment, and leadership that will cement Pittsburgh’s role as an innovation hub that attracts top talent and serves as an axis for ideas and solutions with global resonance.

The nation as a whole is challenged by the unprecedented rate of job growth and the rapid change in the skill sets required for those jobs. Innovation, growth, and high-skill roles, it needs to readjust its efforts to address the skill and workforce needs of residents who are not currently on pathways to high-wage jobs.

Eduation and training providers at every level must be able to adjust, and workers will need to be able to rapidly adapt to the changing realities of workforce demand. Employers must work to establish and clearly communicate new expectations and roles. Too often, however, an information gap about emerging high-demand jobs and skills exists between employers and training providers. Without an in-depth understanding and consistent monitoring of the changing nature of the labor market, private and public sector stakeholders will be at a disadvantage when attempting to formulate the right plan to position the Pittsburgh region’s labor shed for sustainable long-term employment and successful employment outcomes.

In response to these changing conditions, the Allegheny Conference on Community Development commissioned Burning Glass Technologies and the Council for Adult and Experiential Learning (CAEL) to conduct a comprehensive analysis of the job market demand over the next decade, 2015-2025. It also serves as a call to action to the region’s employers and educators, whose collective community leadership will be required to ensure that the region has a workforce trained for the jobs and skills of the future.

QUESTIONS ADDRESSED IN THE REPORT

This study utilizes a range of data sources and analytic approaches including: traditional economic data for long-term trend analysis, job postings analysis to measure the skills and credentials in demand, and in-depth focus groups to provide robust contextualization to the quantitative indicators. This report focuses on occupations, or the jobs that people are doing, rather than industry sectors, meaning the employers. The following questions are addressed:

What are the jobs and skills in demand in the Pittsburgh region now and over the next decade?

• What occupations will be in demand across the economy and what are the associated skill sets?
• What occupations will grow fastest and need additional supply?
• Where are employers’ skill needs changing and how will training programs need to adjust?
• What are the areas where Pittsburgh’s talent base has unique capabilities worthy of promotion?

What are the strengths and risks in the Pittsburgh region’s future talent pipeline?

• Where are employers able to attract the talent they need and where are they struggling?
• Where are there robust pipelines that offer opportunity to attract new employers to the Pittsburgh region?
• Where are the risks in the pipeline due to insufficient supply, misaligned programs, or high outward migration?

What can the community of employers and training providers do to capitalize on positive findings and address the challenges identified in this report?

UNIQUE ASSETS WHICH THE PITTSBURGH REGION CAN LEVERAGE

Diverse industry mix: The diversity of Pittsburgh’s industrial sectors and its incumbent workforce represent a unique blend of strengths. A base of IT, engineering and healthcare talent and related university research allows Pittsburgh to serve as an innovation hub driving the future of science and technology. The historically strong production and construction labor force that most recently allowed the region to capitalize on shale gas production similarly provides a talent base that allows for the absorption of future fluctuations in energy and manufacturing workforce needs.

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In the Pittsburgh region 22% of workers with no college degree have a death rate that exceeds the birth rate. This demographic issue poses a substantial risk to Pittsburgh’s workforce ecosystem and economy, but it is compounded by the reality that the region has not been a stronghold for attracting enough people to replace those leaving, and has a death rate that exceeds the birth rate.

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World-class higher education institutions: The 61 local universities, community colleges, and training providers comprise a strong base of talent development, and cutting-edge research institutions provide the ability to both recruit talent and lead on innovative changes in the coming decade. This base also represents an unparalleled economic opportunity to reshape Pittsburgh’s economy. The talent associated with the universities serves as an important source of economic development and a major attraction for IT, Engineering and other advanced technology firms.

Engaged CEO network: The Allegheny Conference on Community Development represents a strong network of engaged CEOs who are personally invested in the community and are seeking to actively address the training and workforce challenges of the coming decade.

Culture of Collaboration: There is strong momentum for action on both the workforce supply and demand sides due to a longstanding culture of public-private partnership in the region. The various stakeholders have worked together for generations to overcome challenges and capture opportunities for the region. They are well-prepared to do so again.

CROSS-CUTTING TRENDS IN THE MARKET

Four themes emerged consistently throughout the analysis of dozens of data sources and over 25 hours of focus groups and interviews with 130 CEOs and HR Directors from 85 companies in the region, across all sectors, as well as K-12 and post-secondary education leaders. These four themes influence every occupational group and industry sector and are examined in more granular detail later in this report. The four key themes are:

Aligning supply and demand: Changing skill sets across virtually all occupations means that a much tighter education and industry connection must be created to align supply and demand. In addition to new focus on the K-12 and post-secondary pipeline, continual training and upskilling of people already in the workforce will be required. Technological innovations are changing daily routines for workers in almost every occupation, and will continue to do so. A culture of continuous learning must become the norm, and employers and the workforce system must develop effective and ubiquitous tools to support upskilling.

A changing 21st century workforce: Technology is changing nature of jobs means that many occupations require new, more advanced skills. Relatedly, employers are increasingly seeking credentials where no credential, or a lesser credential, would previously have sufficed, 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 upcredentialing.

Hybrid jobs, the blending of diverse skill sets into a single role: Many jobs are merging discrete skill sets into single roles that are more complex than in the past. For example, technology enablement has increased the demand for technology skills in non-technology focused jobs. Customer service is becoming an important skill in a range of occupations including those in healthcare and computer support roles for staff which may not have previously been customer facing.

Upskilling and upcredentialing: employers want demonstrated higher-level skills and certifications: The changing nature of jobs means that many occupations require new, more advanced skills. Relatedly, employers are increasingly seeking credentials where no credential, or a lesser credential, would previously have sufficed, 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 upcredentialing.

RECOMMENDATIONS FOR ACTION

This report should be viewed as an initial stake in the ground to advance a community dialogue. It is clear that the region has strong momentum and the appetite for a more systematic approach to workforce planning and partnership development between employers and training providers.

Direct strategies are suggested in all of the occupational cluster profiles that appear later in the report, and specific tactics will need to be developed for each. Program and policy changes and activities necessarily will vary among occupations as well as among different cohorts of talent. However, the high level recommendations here have emerged directly from the data and qualitative input provided by employers and educators as those with greatest potential impact to help align the region’s demand and talent supply.

THE EMPLOYER COMMUNITY MUST LEAD CHANGE AND SHIFT FROM BEING CONSUMERS OF TALENT TO BECOMING INVESTORS IN THE LABOR MARKETPLACE

Industry needs to frame and support a more effective and sustainable model to enable education and training providers to better understand changing skill demands: The need for increased alignment and coordination between training providers and industry demand is a consistent finding throughout this study. Connections between employers and their feeder training providers are uneven. Employers should lead the creation of a standing, cross-industry structure to support alignment of business needs and training demand at all levels.

A first step would be convening employers with common occupational needs. This approach will identify which industry sectors have demand for the same occupational skill set. Such a convening would also be an opportunity to identify and engage the start-up community and smaller employers who have similar talent demand. Engaging educators to work with employers to identify and build consensus on the most important skills and competencies would lead to the development and adoption of common curriculum. This type of infrastructure could also spur consistent development and dissemination of well-articulated career pathways.
Large, long-established employers and start-up and technology companies should form a partnership to attract and retain top level talent: Pittsburgh faces a talent shortfall both in the overall number of workers and in the high-skill professions that drive the innovation economy. 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 marketing 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.

Engage employers directly in a collaborative effort to retain more college graduates: As home to several of the nation’s leading colleges and universities, the Pittsburgh region should consider a concerted effort by employers and educators to promote the region and its opportunities to college students. If this were coupled with active engagement of students early in their college career around high-demand occupations, the region could decrease the level of outward migration following graduation. At the same time, however, employers must be willing to hire recent graduates knowing they will not yet have the three to five years of experience often requested.

FOCUS ON UPSKILLING TALENT IN THE REGION

Create explicit pathways to upward mobility: 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. 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.

Focus on the development of emerging, cross-cutting skills and competencies: There are a set of baseline skills and competencies which are increasingly in demand in the market and which employers across all sectors cited as gaps. These include customer service skills, leadership/management skills, and various emerging digital skills. Training providers, particularly CTE and other technical programs, are well served to balance their focus both on baseline skills and on occupationally-specific, technical skills.

Focus resources on opportunity occupations and high priority occupations: This report highlights the rapidly changing labor market, including identifying occupations that offer strong potential to earn a living wage, many of which the state does not presently recognize as a High Priority Occupation eligible for increased training funding. Career pathway initiatives can be framed around these occupations as a basis for upskilling workers who are unemployed, in declining occupations or in occupations which offer sub-living wage pay.

CAPITALIZE ON INNOVATION IN INFORMATION TECHNOLOGY, ADVANCED MANUFACTURING AND FINANCE

Build a bridge to connect larger regional employers and the start-up and innovation economy: The presence of multiple top-tier universities in a city the size of Pittsburgh, numerous corporate and federal R&D facilities in the region, and a highly engaged community of corporate leaders, is a unique combination of assets and has made the region a leader in innovation and cutting-edge technologies across a broad set of sectors.

While the number of jobs specific to this growing hub of innovation is relatively small when compared to overall regional employment in 2016, we know that demand for these innovation skills will continue to grow rapidly—in the Pittsburgh region and around the world. If the region’s future will continue to be shaped by people here, the region must focus attention and resources to skill, attract and retain the world-class talent that fuels the innovation ecosystem.

Focus on opportunities for growth in innovation technology: Particular occupation clusters which the local employer and training community might consider investing in include:

- Cybersecurity
- FinTech (shorthand for financial technology), and
- Predictive analytics, especially in the healthcare and energy sectors

In addition, special focus should be given to solidifying Pittsburgh’s role as a center of innovation for robotics, additive manufacturing and other advanced manufacturing technologies.
HOW TO USE THIS REPORT

In order to directly address the workforce needs that are most critical to the economic competitiveness of the region, we have identified the roles that are most in demand and important in the industries that provide the greatest contributions to the local economy.

To this end, we focus on five occupational clusters:
1. Information Technology
2. Business and Finance
3. Engineering, Science and Production
4. Healthcare
5. Construction

We have also selected two industry sectors to expressly analyze:
6. Energy
7. Retail and Hospitality

Energy was selected because of its rapidly changing profile in the local economy and the importance of understanding its unique workforce dynamics. Many of its occupations are also common to production industries; this industry differs from most traditional economic analyses, which focus on industry sectors in the economy. Industries employ many occupation types. For example, the Healthcare industry not only employs Physicians and Nurses, but also Financial Analysts, Custodians and Receptionists. Instead, we focus on questions such as:

- Nursing aides, orderlies and attendants
- Receptionists. Instead, we focus on questions such as:
- How many software engineers will be required, not just in IT firms but across every industry in the economy?
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By orienting this report on occupations (i.e. the jobs) as opposed to industries (i.e. the employers) we are able to focus on dynamics relating to the training pipelines and skill demands that cut across multiple employers and market sectors; moreover, this framing allows workers and training providers to understand the breadth of opportunity, and the demand for skills based on the work they are interested in doing, rather than the specific employer they may work for.

1. Growth rates signify the projected addition of new positions to the regional economy, based on industry growth and changes in the structure of the labor market.
2. Replacement rates represent positions that need to be filled due to individuals leaving the occupation, either to pursue unrelated occupations (for example, shifting from work in retail to a business role) or to leave the labor market due to retirement or moving from the region.

Not included in labor demand is churn: the movement from one job to another with the same basic responsibilities.

Labor demand is captured using a combination of traditional labor market information collected by the Bureau of Labor Statistics and analysis of job postings data, collected by Burning Glass Technologies. More detailed discussion of the growth projections methodologies are included in the Appendix.

UNDERSTANDING LABOR SUPPLY

Information on labor supply is collected from a range of government data sources which cover educational outcomes such as degree completion and K-12 performance and demographic analyses such as migration and retirements. Specific data sources used to describe labor supply include:
• Higher Education enrollment and degree completion data, National Center for Education Statistics’ Integrated Post-Secondary Database (IPEDS)
• K-12 performance data, Pennsylvania Department of Education
• Migration information, American Community Survey (ACS)
• Occupational projections, Pennsylvania Department of Labor and Industry, Bureau of Labor Statistics (BLS)
In this study we used LinkedIn’s alumni tool, a unique private data source, to track the migrations of recent graduates. Based on the sample of students with LinkedIn profiles, these data allow us to estimate how many students from local universities remain in Pittsburgh and how many leave.

HOW TO INTERPRET OCCUPATION GROUP SUMMARY CHARTS

We provide a demand and supply analysis for each occupation group based on three charts showing employment growth, demand by industry and key skill demand highlights, as depicted in this sample chart.

### Industry Demand for IT Workers

- **Other**
- **Healthcare and Social Assistance**
- **Educational Services**
- **Manufacturing**
- **Information**
- **Financial and Insurance**
- **Professional and Business Services**

**Numbers in above charts are for example only.**

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Description and Source</th>
<th>Key Question Addressed by this Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 Employment</td>
<td>Number of workers employed in these occupations in the Pittsburgh region, May 2015. Source: Model based on Occupational Employment Series, Bureau of Labor Statistics, and Burning Glass job postings data.</td>
<td>How large is this occupation group?</td>
</tr>
<tr>
<td>Annual Openings</td>
<td>Average number of projected annual openings in these occupations over the next decade. Sources: Occupational Employment Series, Bureau of Labor Statistics, PA Department of Labor and Industry and Burning Glass.</td>
<td>How many new workers are needed in these occupations each year?</td>
</tr>
<tr>
<td>% of Openings Requiring Bachelor’s Degree</td>
<td>Percentage of job postings in the last year which call for a bachelor’s degree. Jobs which require a license or other occupational training are assumptively assigned a degree level. For example, all LPNs are sub-baccalaureate and all Engineers are baccalaureate or masters-level roles. Openings for jobs such as Administrative Assistants, which can be either BA or sub-BA level roles, are assigned a degree level based on the distribution of demand in online job postings. Source: Burning Glass job postings data</td>
<td>What are the educational qualifications employers are seeking in order to address their workforce needs?</td>
</tr>
</tbody>
</table>

**Industry Demand for Workers**

- Percentage of jobs postings in each industry sector in the last year. Industry sectors are classified according to the NAICS system developed by US federal statistical agencies. Source: Burning Glass job postings data.

- In which industries is demand for this type of worker greatest?
Supply and Demand

**Data Element**

<table>
<thead>
<tr>
<th>Supply</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Supply</td>
<td>Average Annual Openings (10 years)</td>
</tr>
<tr>
<td>New Graduates (IPEDS)</td>
<td></td>
</tr>
<tr>
<td>Grad</td>
<td>BA+</td>
</tr>
<tr>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>Departures</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>500</td>
</tr>
</tbody>
</table>

**Description and Source**

**Supply and Demand**

- **Demand**: Average annual openings broken out by roles requiring a bachelor's degree or those which do not according to the approach described on the previous page. Roles specifying a graduate degree are including the bachelor's degree category because in many cases a graduate degree serves as a proxy for additional experience or expertise on top of a bachelor's degree rather than an explicitly demanded credential. Sources: PA Department of Labor and Industry and Burning Glass.

- **Supply**: The size of the local supply pipeline is determined by aggregating the total number of graduates of relevant degree programs from the 61 institutions of higher education in the Pittsburgh region and proportioning them by how many graduates remain in Pittsburgh. The number of graduates who stay in Pittsburgh is derived with school specific data from LinkedIn's Alumni Tool. For example, if 80% of LinkedIn members who graduated from a given university over the last five years still live in Pittsburgh, we include 80% of the graduates of each degree program from the university in the local supply. Sources: National Center for Education Statistics' Integrated Post-Secondary Education Data System, and LinkedIn's Alumni Tool.

**Key Question Addressed by this Indicator**

- How does the size of the pipeline of available workers graduating from local institutions align with projected annual demand?
- Additional questions which can be addressed include:
  - To what extent would attracting more graduates to remain in Pittsburgh address talent supply gaps? (Departing students are shown in the shaded cell on the supply chart.)
  - How much will education institutions need to expand enrollment in order to address supply gaps? (The data show current availability of supply against projected future growth, allowing analysis of how the pipeline must adjust to meet future workforce need.)
OCCUPATIONAL DEMAND AND TALENT SUPPLY

AGGREGATE LABOR DEMAND

The Pittsburgh region will require 34,000 new workers per year from 2015-2025. Over the next 10 years, Pittsburgh employers will need to replace 29,000 retirees annually, while adding 5,000 new positions per year. Coupled with occupational shift, the market will see 1.28 million job openings in the coming decade.

Occupational growth in Pittsburgh is projected at 4.2%: Covering the period 2015-2025, the overall workforce is projected to grow by 4.2%. The forecasted decline in the overall population of the Pittsburgh region (including slight decline 2010-2015) means the region will need to focus on retaining students trained locally, and also increase inbound migration in order meet workforce demand.

• The occupational families projected to grow most rapidly are Healthcare Support (15%), Healthcare Practitioners (12%), and Computer and Math (11%).

DEMOGRAPHIC IMPLICATIONS FOR SUPPLY AND DEMAND ALIGNMENT

Pittsburgh will have a significant need for both new talent and upskilling of existing workers as population trends leave employers short of the number of workers needed and occupations increasingly require new skills. Further, upskilling will be required to tackle persistent trends leave employers short of the number of workers needed and occupations increasingly require new skills. At the same time, the 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.

At the same time, the 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.

With little room or no room for slack in the supply pipeline, the importance of alignment increases dramatically. Every graduating job seeker must have the skills he or she needs to contribute to the local economy.

Breaking down this challenge we found:

• 4%—approximately 5,000 positions per year—represents additional hiring demand due to growth.
• 23%—approximately 296,000 positions per year—represents the hiring need for additional workers due to retirements; while
• 73%—or 930,000 positions over the ten-year period—represents the hiring and/or training and upskilling needed to replace workers leaving their occupations. This could be due to promotions to a higher-level occupation, to pursue unrelated occupations (for example, shifting from work in a retail occupation to a finance role), or from temporarily leaving the workforce, for example to care for young children. These workers will typically need training either from their employers or from an external provider in order to successfully transition from one role to another. Training for these roles falls both to employers to upskill incumbent workers and to the region’s training institutions serving adult learners.

At the same time, the 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.

With little room or no room for slack in the supply pipeline, the importance of alignment increases dramatically. Every graduating job seeker must have the skills he or she needs to contribute to the local economy.

ROLES DECLINING DUE TO AUTOMATION AND TECHNOLOGY

Automation and technology are leading to the elimination of low-skill roles. For example, traditional occupations such as Word Processors and Typists, and Grinding Machine Operators are increasingly being replaced by employees with additional or higher order skill sets who can incorporate this work into a broader occupation. What was a singular occupation is becoming a skill embedded in an occupation with a broader scope.

“In our utility business, we see the future combining computer and communication skills with all of the technical skills we already require. The bar gets higher all the way up the food chain.”
## Table 1: Employment Summary by Occupation Family

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Office and Administrative Support</td>
<td>204,283</td>
<td>21,084</td>
<td>21,087</td>
<td>21,094</td>
<td>0%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Food Preparation and Serving Related</td>
<td>104,112</td>
<td>16,161</td>
<td>16,167</td>
<td>16,628</td>
<td>5%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Sales and Related</td>
<td>128,943</td>
<td>17,185</td>
<td>17,186</td>
<td>17,188</td>
<td>0%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Transportation and Material Moving</td>
<td>75,503</td>
<td>8,972</td>
<td>8,974</td>
<td>8,979</td>
<td>4%</td>
<td>11.9%</td>
</tr>
<tr>
<td>Personal Care and Service</td>
<td>45,890</td>
<td>7,169</td>
<td>7,175</td>
<td>7,190</td>
<td>10%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Production</td>
<td>62,906</td>
<td>6,538</td>
<td>6,539</td>
<td>6,542</td>
<td>-1%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Construction</td>
<td>57,739</td>
<td>5,414</td>
<td>5,416</td>
<td>5,422</td>
<td>5%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Business and Financial Operations</td>
<td>64,767</td>
<td>5,344</td>
<td>5,347</td>
<td>5,356</td>
<td>5%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Building and Grounds Cleaning and Maintenance</td>
<td>41,112</td>
<td>5,249</td>
<td>5,250</td>
<td>5,252</td>
<td>4%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Healthcare Support</td>
<td>40,514</td>
<td>5,064</td>
<td>5,075</td>
<td>5,103</td>
<td>15%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Healthcare Practitioners and Technical</td>
<td>75,042</td>
<td>4,133</td>
<td>4,144</td>
<td>4,174</td>
<td>12%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Installation, Maintenance, and Repair</td>
<td>46,691</td>
<td>3,918</td>
<td>3,920</td>
<td>3,927</td>
<td>5%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Education, Training, and Library</td>
<td>50,531</td>
<td>3,842</td>
<td>3,842</td>
<td>3,844</td>
<td>2%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Management</td>
<td>51,133</td>
<td>3,591</td>
<td>3,592</td>
<td>3,596</td>
<td>4%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Community and Social Services</td>
<td>25,890</td>
<td>2,713</td>
<td>2,715</td>
<td>2,720</td>
<td>7%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Protective Service</td>
<td>22,207</td>
<td>2,165</td>
<td>2,166</td>
<td>2,166</td>
<td>3%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Computer and Mathematical</td>
<td>31,373</td>
<td>2,087</td>
<td>2,092</td>
<td>2,104</td>
<td>11%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Arts, Design, Entertainment, Sports, and Media</td>
<td>14,054</td>
<td>1,495</td>
<td>1,495</td>
<td>1,496</td>
<td>2%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>22,736</td>
<td>1,347</td>
<td>1,348</td>
<td>1,350</td>
<td>3%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Life, Physical, and Social Science</td>
<td>8,490</td>
<td>670</td>
<td>670</td>
<td>671</td>
<td>7%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Legal</td>
<td>9,962</td>
<td>557</td>
<td>558</td>
<td>559</td>
<td>7%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Farming, Fishing, and Forestry</td>
<td>1,490</td>
<td>243</td>
<td>243</td>
<td>243</td>
<td>-7%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1,185,368</td>
<td>127,393</td>
<td>127,452</td>
<td>127,604</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Employment data from Burning Glass Application of Bureau of Labor Statistics Projections Methodology; Unemployment data from Pennsylvania Department of Labor and Industry

*Bold Occupations are those areas explored in depth in “High Demand Occupational Sectors”

Red indicates negative projected growth

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## Table 2: Top-10 Sub-B.A Occupations by Growth Rate (min 500 employed)

<table>
<thead>
<tr>
<th>Projected Growth Rate</th>
<th>2015 Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Therapist Assistants</td>
<td>31%</td>
</tr>
<tr>
<td>Occupational Therapy Assistants</td>
<td>30%</td>
</tr>
<tr>
<td>Diagnostic Medical Sonographers</td>
<td>21%</td>
</tr>
<tr>
<td>Electrical Power-Line Installers &amp; Repairers</td>
<td>20%</td>
</tr>
<tr>
<td>Industrial Machinery Mechanics</td>
<td>20%</td>
</tr>
<tr>
<td>Cardiovascular Technologists &amp; Technicians</td>
<td>19%</td>
</tr>
<tr>
<td>Emergency Medical Technicians &amp; Paramedics</td>
<td>16%</td>
</tr>
<tr>
<td>Computer-Controlled Machine Tool Operators</td>
<td>16%</td>
</tr>
<tr>
<td>Medical Secretaries</td>
<td>15%</td>
</tr>
<tr>
<td>Licensed Practical &amp; Licensed Vocational Nurses</td>
<td>15%</td>
</tr>
</tbody>
</table>

Sources: Employment data from Burning Glass Application of Bureau

*Note: Minimum 500 employed, 2015. Only considers occupations that pay a living wage ($15/hr) based on median wage.
Table 3: Top-10 BA+ Occupations by Growth Rate (min 500 employed)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Projected Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech Language Pathologists</td>
<td>28%</td>
</tr>
<tr>
<td>Personal Financial Advisors</td>
<td>23%</td>
</tr>
<tr>
<td>Operations Research Analysts</td>
<td>21%</td>
</tr>
<tr>
<td>Diagnostic Medical Sonographers</td>
<td>21%</td>
</tr>
<tr>
<td>Physical Therapists</td>
<td>21%</td>
</tr>
<tr>
<td>Information Security Analysts</td>
<td>20%</td>
</tr>
<tr>
<td>Occupational Therapists</td>
<td>20%</td>
</tr>
<tr>
<td>Computer Systems Analysts</td>
<td>19%</td>
</tr>
<tr>
<td>Healthcare Social Workers</td>
<td>18%</td>
</tr>
<tr>
<td>Market Research Analysts &amp; Marketing Specialists</td>
<td>15%</td>
</tr>
</tbody>
</table>

Sources: Employment data from Burning Glass Application of Bureau of Labor Statistics Projections Methodology
Note: Minimum 500 employed, 2015. Only considers occupations that pay a living wage ($15/hr) based on median wage.

BACHELOR’S LEVEL JOBS ARE GROWING, PARTICULARLY IN STEM FIELDS

Bachelor’s degree roles are projected to grow at 4.5%, but the region faces a challenge retaining recent graduates: Bachelor’s level growth addresses emerging high value skill sets, such as cybersecurity, analysis, and healthcare. Bachelor’s degree graduates leave the region with higher frequency (33% retention rate from local universities) than sub baccalaureate graduates (79% retention rate). Pittsburgh’s retention rate of graduates is among the lowest of major cities in the country. One factor relative to low retention is that many of the most commonly awarded degrees do not align directly with regional demand. Shifting demand data and selling opportunity in the Pittsburgh region early in a college student’s career could help to retain more of the approximately 20,000 students who leave the region each year for other opportunities following graduation.

Projected growth aligns with key sectors of the regional economy: Each of the ten fastest projected growth occupations (minimum 750 projected employed in 2020) connect to key sectors of energy, information technology, and healthcare, and represent priorities for retaining talent from local universities. These roles include Information Security Analysts, Operations Research Analysts, and Physical and Occupational Therapist Assistants. See Appendix for additional occupation level details.

“...”

Cybersecurity jobs have grown quickly and represent a regional economic development opportunity: Information Security Analysts have the highest projected growth over the next decade, reflecting the growing demand for cybersecurity talent in Pittsburgh, and the potential to develop a broader pipeline and expand the cyber workforce across the economy. Just a few years ago, employers had to ‘raid the federal government’ for information security talent, but many now have high end talent in place to run their cybersecurity efforts and are now working to fill in the departmental needs at lower skill levels.

Researchers at the Federal Reserve Bank have developed a framework for Opportunity Occupations8, those paying more than median wage, with fewer than 50% of postings requiring a bachelor’s degree. These occupations, particularly when factoring in overall demand and projected growth, represent strong targets for job seekers without a bachelor’s degree to pursue.

In the Pittsburgh region, Opportunity Occupations represent 24% of local employment and 27% of projected growth. This group of roles is diverse, including Nurses, Truck Drivers, Bookkeeping Clerks, and more. Skilled trades are well represented among opportunity occupations locally, in many cases reflecting demand from the region’s diverse energy industries. Maintenance Workers, Carpenters, Construction Laborers, and Operating Engineers are all among the largest Opportunity Occupations as measured by number of employed workers. However, these roles are not projected to grow as quickly as the overall economy. Truck Drivers, also associated with the energy sector, project to be a fast-growing opportunity occupation (7% projected growth). Fast growth Opportunity Occupations in Healthcare include Registered Nurses (average salary: $62,470), LPNs ($41,490), Radiologic Technicians ($49,560), and Dental Hygienists ($56,160).
A CHANGING 21ST CENTURY WORKFORCE

Technology is changing the workforce, increasing demand for some roles, while rendering others obsolete. Many of these technology-driven trends have particular implications for Pittsburgh given its standing as a manufacturing center and hub for the finance industry. The whole world of manufacturing is being transformed by our digital age. Additive manufacturing is the future, and its leadership is up for grabs. This is the first 15 minutes.

Table 4: Opportunity Occupations

<table>
<thead>
<tr>
<th>Occupation Family</th>
<th>Employment</th>
<th>Projected Growth Rate</th>
<th>% of Opportunity Occupation Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and Extraction</td>
<td>51,693</td>
<td>6%</td>
<td>18%</td>
</tr>
<tr>
<td>Healthcare Practitioners and Technical</td>
<td>45,856</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>Office and Administrative Support</td>
<td>42,493</td>
<td>-3%</td>
<td>15%</td>
</tr>
<tr>
<td>Installation, Maintenance, and Repair</td>
<td>38,187</td>
<td>6%</td>
<td>13%</td>
</tr>
<tr>
<td>Production</td>
<td>30,608</td>
<td>2%</td>
<td>12%</td>
</tr>
<tr>
<td>Transportation and Material Moving</td>
<td>23,639</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Other</td>
<td>47,922</td>
<td>3%</td>
<td>18%</td>
</tr>
<tr>
<td>Total</td>
<td>280,398</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Bureau of Labor Statistics and Burning Glass Technologies

Connecting High Priority Occupations to the career ladder initiatives recommended in this report and already underway in the region provides an important opportunity for upskilling the existing workforce in those jobs which offer the strongest career opportunities. Using the list of Opportunity Occupations highlighted in online appendix, local employers and training providers can partner to ensure that workers are able to move from declining occupations to growing ones with robust opportunities.

“What skills are we confident will be in demand in 10 years? Learning agility, problem solving, sound decision making, trouble shooting, teamwork, technical savvy.”

High-technology occupations are at the leading edge of these changes. The workforce implications of many transformative technologies such as big data, robotics, and additive manufacturing, and healthcare innovations, such as gene therapy are only beginning to be felt. Two important implications of the evolving needs of the workforce are highlighted below, and described in greater detail in the relevant occupational sections.

- A smaller, higher skilled workforce will drive the future of manufacturing in the region: The value of manufacturing output has increased by over 10% in Pittsburgh since 2010, almost returning to pre-recession levels. However, employment has remained flat. The manufacturing workforce of the future will be smaller, but higher skilled. Roles supporting advanced manufacturing processes such as robotics or additive manufacturing are projected to grow rapidly while many lower-skill production roles are in decline.

- Manufacturing is the future, and its leadership is up for grabs. This is the first 15 minutes.

Table 5: Manufacturing Output and Manufacturing Employment in Greater Pittsburgh

<table>
<thead>
<tr>
<th>Year</th>
<th>Manufacturing Output</th>
<th>Manufacturing Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>2011</td>
<td>103.1</td>
<td>101.7</td>
</tr>
<tr>
<td>2012</td>
<td>107.8</td>
<td>102.7</td>
</tr>
<tr>
<td>2013</td>
<td>110.8</td>
<td>102.3</td>
</tr>
<tr>
<td>2014</td>
<td>112.4</td>
<td>101.4</td>
</tr>
<tr>
<td>2015</td>
<td>N/A</td>
<td>100.2</td>
</tr>
</tbody>
</table>

Sources: Output data from Bureau of Economic Analysis; Employment data from Bureau of Labor Statistics

GROWING WORKFORCE IMPACT OF THE INNOVATION ECOSYSTEM

- The region has world-class IT research, and a community of top-tier tech employers whose expansion is gaining momentum. Google, Amazon, Uber, Facebook and Duolingo, among others, have all chosen to move into or expand in Pittsburgh in recent years. These firms bring excitement to the region and establish it as a vibrant technology hub. Per capita demand for the most sophisticated and highest value IT skills, such as those in demand by the firms listed here, is currently below the national average, but growing quickly. The region must act now to retain this talent. Currently the talent is moving faster than employers.

This innovation economy, thriving in a region the size of Pittsburgh, coupled with numerous corporate and federal R&D facilities and a highly engaged community of corporate leaders is a unique combination of assets. This has made the region a leader in innovation and technology across a broad set of sectors. Its historic strengths in finance, energy, and advanced manufacturing have been joined by computer science, robotics, engineering, cognitive science, design, information systems, healthcare and life sciences, making Pittsburgh a magnet for industry partners who want to collaborate on research and recruit the best talent.

EMPLOYERS ARE BLENDING TRADITIONAL SKILL SETS TO CREATE HYBRID JOBS

Employers are increasingly combining skills sets that do not typically train together, such as LPNs with the management skills to oversee a team of Certified Nursing Assistants or Home Health Aides. As a result, employers are finding gaps between the talent they need and what is available in their own workforce or on the open market.
Digital skills begin with computer literacy and the ability to use programs such as Microsoft Office. These skills are now necessary across occupations and families, including Customer Service Representatives, Retail Supervisors, Office Clerks, and Production Clerks. More advanced digital skills, such as CRM Software, are now demanded across Sales, IT, Marketing, and Human Resources positions. These digital skills are not just for advanced roles, but many sub-baccalaureate roles as they become more complex. Executive Secretaries, HR Specialists, and Event Planners continue to use advanced digital skills in their day-to-day work.

Healthcare roles require increased digital skills overall, especially as technological and regulatory changes impact the industry. With the increase in electronic medical records and online patient portals, employers expect staff to be able to interact with computers and digital records. In Construction, Energy, and Retail, employers expect workers to take work orders in the field using tablets and smartphones. Employers in the skilled trades expect workers to be able to interact with computers and digital records and online patient portals, employers expect staff to be able to interact with computers and digital records. In Construction, Energy, and Retail, employers expect workers to be able to interact with computers and digital records. In Construction, Energy, and Retail, employers expect workers to be able to interact with computers and digital records.

DIGITAL SKILLS ARE IN DEMAND ACROSS OCCUPATIONS
Across the labor market, employers are expressing demand for technology skills. This is apparent for office work, as well as for work in the field away from standard desktop computers. Digital skills are increasingly becoming a pre-requisite for roles that offer middle class wages. In both manufacturing and financial services, several employers described their primary identification as technology companies.

"Our perfect combination? Technical proficiency and market-facing talent."

As we look 10 years out, I think any repetitive task could potentially be replaced by technology, but customer service can never be automated. Beyond Customer Service and Sales Representative positions, customer service skills are important across a broad range of occupations. They are among the top 10 skills requested for positions including Computer User Support Specialists and Computer Systems Analysts, Medical Secretaries, Mechanics, and Installation Workers. As many front-line customer service positions are replaced by computer systems, workers that previously did not have any direct interaction with customers now will, and thus have to develop or enhance service skills. Similarly, many employers seek customer service skills for internal tech support staff working with internal customers across the organization.

"Our nursing aides increasingly will need a hospitality focus as their patients are essentially their long term customers."

Representatives from the healthcare sector noted that their industry is experiencing a paradigm shift to a customer service driven model. Positions at all ends of the healthcare spectrum, from physicians to laboratory technicians to certified nursing assistants, now have increasing potential to be customer facing and the need to communicate and provide customer service will only increase. Healthcare leaders indicate that as the first point of contact for patients and family members, LPNs must have strong service skills.

In internally facing roles, teamwork, a close correlate of customer service, is increasingly important. Employers note a shift in IT processes toward agile development, requiring more teamwork and internal customer service. Construction and Manufacturing employers similarly cite teamwork, not only as a core skill set for their work, but also as a skill for which 10-12 and post-secondary graduates are not prepared. Employers would like to see more teamwork training embedded in the secondary curriculum to create a job-ready workforce. Of note, many schools in the region have added, or increased, their use of project-based learning or team building concepts in their curriculum.

HYBRIDIZATION OCCURS ACROSS INDUSTRIES AND OCCUPATIONS
Many employers are seeking workers with both domain expertise, such as business or healthcare, and robust IT and analytic skills. In other cases, employers are introducing new baseline skills into roles that had been narrower and more specific. Specific examples of hybridization include:

- Business skills for IT workers and IT skills for business workers: Financial services employers are requiring that business professionals become more tech savvy, and that IT professionals better understand the business. For example, IT roles often require knowledge of business processes and information security when working in Finance, while Business Analyst roles require knowledge of increasingly technical data tools such as SQL and SAS.
- Business and analysis skills in healthcare: As healthcare becomes increasingly focused on outcomes measurement and cost control, workers are expected to have a stronger understanding of the business implications of their care decisions, and to be savvier working with various forms of health data now available to them in real-time.

Executive Summary
How to Use This Report
Occupational Demand and Talent Supply
Recommendations for Action
High Demand Occupational Sectors
Information Technology
Business and Finance
Engineering, Science and Production
Healthcare
Construction
Profiled Industry Sectors
Energy
Retail and Hospitality
Appendices: Methodology
About Burning Glass Posting Data
Occupational Projections
Analysis of Retention of Graduates
Qualitative Methodology
About the Authors
Online Appendices
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EMPLOYERS STRUGGLE TO HIRE MIDDLE MANAGERS
An aging workforce is leading to a hollowing out of management positions. Employers are facing challenges identifying talent with leadership and management skills and filling managerial roles. This ranges across industries, and applies both to finding the skills within broad occupations, and building a pipeline to supervisory occupations, especially in the skilled trades.

In skilled trade occupations, which have the highest concentrations of older workers, employers are finding these positions particularly difficult to fill despite potential pay raises; Construction Supervisors earn an average of almost $31,000 more annually than Carpenters.2 Some employers indicate this is due to resistance from employees who would lose overtime opportunities that may amount to more than the promotion pay raise, and to having increased reporting requirements and regulations. Simultaneously, as a result of the Great Recession, employers lost many qualified individuals as promotion opportunities waned due to deferred retirements. This exacerbates the crisis for management talent as the workers now begin to retire. Some manufacturing employers have developed new mentor roles in order to create a pathway into management.

"One of our real challenges is generational. Leadership roles in construction used to be a badge of honor, but the younger workforce often seems to see the higher level of responsibility as more trouble than its worth."

In healthcare, employers indicate a need for stronger management skills as front-line clinical workers take on additional supervisory responsibilities. This includes RNs moving into Nurse Management roles or LPNs overseeing Nursing Assistants or Aides. Educators and employers both noted that management skills are not core to the licensing and certifications for these roles, which in turn makes it difficult to devote curriculum to training for these skills. Employers may need to work with accrediting bodies and educators to embed this training for new LPNs and RNs.

Some employers have begun to require talent development as a core responsibility of all managers. This progressive HR practice broadens the opportunities for line workers to learn management skills and increases the pipeline of middle management candidates.

CREDENTIAL INFLATION CAN CONSTRAIN PIPELINES AND REDUCE OPPORTUNITY
In the slack market of the recession, when labor was in more abundant supply, employers were able to increase the credential requirements for many roles, requesting a bachelor's degree where it had not been required before. For example, 44% of job postings for Executive Secretaries in the Pittsburgh region now cite a requirement for a bachelor's degree, compared to just 21% of incumbent Executive Secretaries who actually hold this degree. Upward pressure on credential requirements can have the unintended consequence of limiting employers from filling positions effectively, while at the same time leaving behind many middle skill workers who have the skills (but not the degrees) that employers are looking for.

Computer help desk roles, another area where a bachelor's degree is often requested, highlights the particular dysfunction of this phenomenon. The technical skills requested for the one-third of help desk roles that request a BA don't differ from the remaining two-thirds that only request sub-baccalaureate credentials. However the bachelor's degree jobs take employers 15% longer to fill and cost them 20% more in initial salary.

Given the pressure employers will face to find qualified workers, competency based hiring, where employers focus initial hiring screens on demonstrated skills (instead of degrees or credentials) is an important approach that will increase the pool of qualified applicants. This approach opens opportunities to job seekers who are well qualified for a job, even if they do not have a bachelor’s degree or other specific credentials an employer is seeking.

DEMOGRAPHICS AND THE TALENT PIPELINE
Pittsburgh has a large cohort of high-skill, high-wage talent working in industries with little unemployment. At the same time, 19% of its occupations, representing 39% of regional employment, have average wages of less than $15/hour. The region’s demographics, coupled with the increasingly skilled nature of high-demand occupations, will require not only upskilling of incumbent workers but also new employer and educator partnerships to ensure the region's future talent has the technical, academic and behavioral skills that will be required.

Increased demand for sales skills: Within retail banking, employers note a shift from transactional customer service to a sales approach while providing digital assistance to customers.

Broadened demand for welding skills: In 2015, welding skills were in demand 10 times more often in occupations defined as other than actual “welding” jobs. Welding skills are necessary for Maintenance Workers, Automotive Service Technicians, Bus and Truck Mechanics, as well as many Engineers and Production Workers. This impacts training both for Welders, who may have fewer opportunities as specialists, and in other roles that require welding knowledge.

UPSKILLING - EMPLOYERS WANT DEMONSTRATED SKILLS AND HIGHER-LEVEL CREDENTIALS
The changing nature of jobs has meant that many occupations require new, more advanced skills. Conversely, employers are now seeking credentials where no credential, or a lesser credential, would previously have sufficed. Employers appear to be substituting higher level credentials as an equivalent to skill mastery. This phenomenon is known as “upcredentialing” and can increase time to fill an occupation, impact starting salaries and limit upward mobility.

CHANGING SKILL DEMANDS WITHIN OCCUPATIONS
Analyst roles are calling for stronger programming and analytics skills; other roles such as Drafters are upskilling as improved AutoCAD technologies brings their skill requirements closer in line with engineering roles. The changing nature of jobs has meant that many occupations require new, more advanced skills.

The hybridization trends described here, especially the increased demand for digital skills, are another form of upskilling. Manufacturing jobs are more complex and computer operated, and Administrative Support workers require more sophisticated knowledge of the Microsoft Office suite.
THE IMPACT OF IN-AND OUT-MIGRATION PATTERNS

The Pittsburgh region demonstrated a slow increase in population from migration during and immediately after the Great Recession (2009-2013)\(^1\), including among young professionals aged 25-34, with bachelor's degrees. However, this modest increase (less than 3,000 net inbound annually) had a small effect on the regional workforce. Since the recession, as growth resumed in other metros, migration patterns have begun to reverse, with outmigration outpacing inward migration (Current Population Statistics). Incoming and outgoing migrants have similar profiles in terms of age, gender, income, and education levels. A key local challenge is a decrease in educated African American employees. Only 10% of incoming African American migrants have a bachelor's degree, compared to 14% of those that are leaving, further diminishing the diversity of the region's future leadership and workforce.

While Pittsburgh's migration rates are about average among benchmark cities, any growth is countered by "natural" population decline, which is that the death rate exceeds the birth rate. No other benchmark region is experiencing "natural" population decline, which is that the death rate exceeds the birth rate. Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%).

The number of students in the K-12 system is declining: There are 336,227 students enrolled in public schools in over 500 high schools in the Pittsburgh region's 125 school districts (2014-2015). This projects to declining numbers of local graduates, from 27,359 annually from 2015-2018, to 24,779 annually from 2021-2025. Further, this figure does not account for local graduation rates (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%). Pittsburgh has one of the highest workforce shares of workers with "high school diplomas only" (88%).

### Table 6: Migration Patterns for Pittsburgh and Benchmark Cities

<table>
<thead>
<tr>
<th>Metropolitan Area</th>
<th>How much higher is inflow than outflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin-Round Rock, TX Metro Area</td>
<td>70%</td>
</tr>
<tr>
<td>Seattle-Tacoma-Bellevue, WA Metro Area</td>
<td>36%</td>
</tr>
<tr>
<td>Nashville-Davidson—Murfreesboro—Franklin, TN Metro Area</td>
<td>32%</td>
</tr>
<tr>
<td>Denver-Aurora-Lakewood, CO Metro Area</td>
<td>31%</td>
</tr>
<tr>
<td>Charlotte-Concord-Gastonia, NC-SC Metro Area</td>
<td>26%</td>
</tr>
<tr>
<td>Boston-Cambridge-Newton, MA-NH Metro Area</td>
<td>26%</td>
</tr>
<tr>
<td>Greater Pittsburgh 10-County Region</td>
<td>20%</td>
</tr>
<tr>
<td>San Jose-Sunnyvale-Santa Clara, CA Metro Area</td>
<td>19%</td>
</tr>
<tr>
<td>Minneapolis-St. Paul-Bloomington, MN-WI Metro Area</td>
<td>10%</td>
</tr>
<tr>
<td>Cincinnati, OH-KY-IN Metro Area</td>
<td>8%</td>
</tr>
<tr>
<td>Philadelphia-Camden-Wilmington, PA-NJ DE-MD Metro Area</td>
<td>2%</td>
</tr>
<tr>
<td>Indianapolis-Carmel-Anderson, IN Metro Area</td>
<td>2%</td>
</tr>
<tr>
<td>Milwaukee-Waukesha-West Allis, WI Metro Area</td>
<td>1%</td>
</tr>
<tr>
<td>St. Louis, MO-IL Metro Area</td>
<td>-5%</td>
</tr>
<tr>
<td>Cleveland-Elyria, OH Metro Area</td>
<td>-12%</td>
</tr>
</tbody>
</table>

Source: American Community Survey

### Table 7: K-12 Enrollment by Grade Level

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Total Enrolled, 2015</th>
<th>Annual # of Potential Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total in PreK-12, 10-county</td>
<td>336,227</td>
<td>27,359</td>
</tr>
<tr>
<td>Projected Potential Graduates 2015-2018</td>
<td>109,434</td>
<td>25,872</td>
</tr>
<tr>
<td>Projected Potential Graduates 2019-2020</td>
<td>51,744</td>
<td>24,779</td>
</tr>
<tr>
<td>Projected Potential Graduates 2021-2025</td>
<td>123,896</td>
<td>24,779</td>
</tr>
</tbody>
</table>

Source: Pennsylvania Department of Education\(^1\)

The Pittsburgh region has an 88% graduation rate: Local graduation rates range from 77% (Beaver County) to 94% (Butler County).\(^{11}\)
Table 8: Graduation Rate by County

<table>
<thead>
<tr>
<th>County</th>
<th>Graduation Rate, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>90%</td>
</tr>
<tr>
<td>Armstrong</td>
<td>91%</td>
</tr>
<tr>
<td>Beaver</td>
<td>77%</td>
</tr>
<tr>
<td>Butler</td>
<td>94%</td>
</tr>
<tr>
<td>Fayette</td>
<td>79%</td>
</tr>
<tr>
<td>Greene</td>
<td>80%</td>
</tr>
<tr>
<td>Indiana</td>
<td>92%</td>
</tr>
<tr>
<td>Lawrence</td>
<td>92%</td>
</tr>
<tr>
<td>Washington</td>
<td>90%</td>
</tr>
<tr>
<td>Westmoreland</td>
<td>92%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>88%</strong></td>
</tr>
</tbody>
</table>

Source: County Health Rankings

There are great disparities between school districts:
In addition to broad variations in the graduation rates within the 10 county southwestern Pennsylvania region, the state rankings of public schools show inconsistent opportunities for students. Thirty-four of the 10 county southwestern Pennsylvania region school districts are in the top 25% of the state, while 32 are among the lowest performing districts. The talent pipeline from regional schools is imbalanced.

"What gets measured gets reported, and that’s why test scores get so much public attention. It would be great if businesses called attention to successful career awareness programs and if those schools got public recognition for them."

School districts also have varying levels of ability and capacity to implement effective career awareness and workforce standards that are mandated by the state. The goal is to have K-12 students become knowledgeable about career opportunities and be able to develop a personalized pathway that can guide their education choices. Clearer accountability associated with the standards is needed, as are opportunities to share best practices and scale programs that have strong industry engagement.

"Many kids simply don’t see what success a good job, a positive community environment, etc. look like or genuinely understand how to get there. We need to focus on providing kids with both a good education and skill development in the classroom as well as really substantive, creative opportunities that help drive and motivate kids as well as their families."

Career and Technical Education (CTE) providers face strong challenges with respect to funding levels and student recruitment. The system is operating below its potential, attracting too few students, and is often hampered by complex funding models that discourage broader participation and stronger overall investment in the system. Funding specifically for CTE has remained flat, and the current funding model, where schools must provide funding along with students, provides disincentives to regional high schools who may otherwise send students to workforce specific programs or retain them in the existing academically focused program.

The Career and Technical Centers (CTCs) lag behind traditional high schools in academic performance measures, and many of the programs offered are not well-aligned to the local labor market or well connected to local employers. This report identifies significant opportunities for CTCs to fill existing gaps for training for high-demand occupations as well as upskilling students and workers in technical fields.

CTE providers indicate dual challenges around funding and student recruitment. They also face recruitment and enrollment challenges which stem in part from outdated perceptions of many careers as well as persistent stigma associated with blue-collar occupations more generally.

Half-day, non-comprehensive CTCs struggle to connect academic skills: The CTCs embedded within larger schools indicate a challenge motivating students toward pure academic skills, such as mathematics, despite the high demand for these skills in skilled trade occupations. Several regional CTC directors noted a disconnect between academic learning and career-focused learning.

CTE enrollment is focused on skilled trades: 38% of CTE enrollment is in programs training students for skilled trades, particularly Installation, Production, or Construction. These providers indicate strong industry partnerships, including development of internships.

Several of the largest individual CTE programs are for careers with low salaries and limited opportunities for direct career advancement: The largest single program for enrollment is Cosmetology, at 12%. In the health fields, employers indicate a lack of alignment with the program offerings.

<table>
<thead>
<tr>
<th>Program</th>
<th>Enrollment (2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosmetology General</td>
<td>1,215</td>
</tr>
<tr>
<td>Health/Medical Assisting Services, Other</td>
<td>910</td>
</tr>
<tr>
<td>Institutional Food Worker</td>
<td>883</td>
</tr>
<tr>
<td>Automotive Mechanics Technology/Technician</td>
<td>813</td>
</tr>
<tr>
<td>Autobody/ Collision and Repair Technology</td>
<td>599</td>
</tr>
<tr>
<td>Welding Technology/Welder</td>
<td>541</td>
</tr>
<tr>
<td>Commercial and Advertising Art</td>
<td>411</td>
</tr>
<tr>
<td>HVAC Maintenance Technology</td>
<td>404</td>
</tr>
<tr>
<td>Homeland Security, Law Enforcement</td>
<td>389</td>
</tr>
<tr>
<td>Machine Tool Technology</td>
<td>358</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,379</strong></td>
</tr>
</tbody>
</table>

Source: Analysis of Program Enrollment data from Pennsylvania Bureau of Career and Technical Education. Note: Total reflects full CTE enrollment. Full data can be found in the appendix.
POST-SECONDARY EDUCATION AND TALENT RETENTION

Pittsburgh demonstrated a slow increase in population from migration (2009-2013)16, including among young professionals aged 25-34, with a bachelor's degree: The overall increase is modest, at net migration of positive 12,524 over three years. Incoming and outgoing migrants have similar profiles in terms of age, gender, income, and education levels. The key local challenge is a decrease in educated African American employees. Only 10% of incoming African American immigrants have a bachelor's degree, compared to 14% of those that are leaving, exacerbating existing issues with creating a diverse workforce.

"Diversity is a challenge for recruitment and for retention across just about every industry. Affinity groups at larger companies can help, but that doesn't solve for welcoming and integrating into the broader community, and it doesn't help for the smaller and mid-size companies."

LABOR SUPPLY AND UNEMPLOYMENT

Skilled trades such as production and construction have large numbers of long-term unemployed workers. High unemployment numbers in occupations that have clear current and future demand suggests a skills gap that calls for assessment, retraining or upskilling.

Unemployment in the Pittsburgh region is 5.2%: The local unemployment rate ranges from 4.7% in Allegheny County to 7.2% in Fayette County, as of February 2016. This rate is slightly above the national rate (4.9% in February, 2016).

"What we see in the workforce system is that six out of ten jobs are low wage. This factors into the employers' ability to fill a job and people's willingness to work in that field. We also see a trend of fewer middle class jobs. We need strategies that will put people to work in family-sustaining jobs."

Unemployment, including long-term unemployment, is high in the skilled trades: Construction (16%) and Production (11%) have double-digit unemployment rates, providing potential workers back into the labor market. These also have high levels of long-term unemployed (9% in Construction, and 7% Production). Decreasing unemployment in these areas will be crucial to filling the future demand for related roles, but will require focused training based on the increasing skill expectations of employers. Should one or more ethane crackers be built in the region, engaging this talent will be a critical factor in meeting demand. See Table 10: Unemployment by County for details.

LABOR SUPPLY AND WORKFORCE DIVERSITY

Employers across industries express difficulty identifying and recruiting a diverse workforce. A diverse workforce is a critical business need, even more so for employers in sectors such as in Healthcare and Hospitality, where workers must provide customer service to a diverse set of clients and be able to interact and respond to cultural differences. Healthcare employers describe diversity of the workforce as a "service delivery imperative."

However, in professional occupations, Pittsburgh sees a brain drain of workers of color; 14% of departing African Americans have a bachelor's degree, compared to only 10% of those entering the region. Women are similarly underrepresented in many occupation groups.
"Our patients represent the diversity of our community, not just in terms of color, but also different generations, cultures, veterans, etc. In order to deliver the best care, our workforce needs to match that diversity.”

Only 8% of local workers are African American. While this is proportional to the local population, the demographics are particularly stark in several economically critical occupations: African Americans make up 5% of Healthcare Practitioners, 4% of Healthcare Support workers, 4% of Engineering workers, and 1% of local IT workers.

Lack of diversity, especially in professional occupations, makes recruiting external talent significantly harder for local employers. Some firms offer affinity or internal groups to help build a support network for new recruits but the broader lack of community diversity poses challenges to retaining new workers, especially those with spouses and families.

Additionally, employers state that millennials increasingly indicate a preference for diversity when making choices about where they want to live and work.

Large employers, such as hospitals, which hire across a range of occupations, typically have higher levels of diversity among lower skilled or lower paying roles. This provides an opportunity for those employers to develop articulated career pathways into higher skill, higher wage occupations that are less diverse.

### Table 11: Workforce Demographics by Occupation Group

<table>
<thead>
<tr>
<th>Occupation</th>
<th>% African American</th>
<th>% Latino</th>
<th>% Asian/Other</th>
<th>% Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business and Financial Operations</td>
<td>4.8%</td>
<td>1.3%</td>
<td>4.1%</td>
<td>47.3%</td>
</tr>
<tr>
<td>Computer and Mathematical</td>
<td>1.2%</td>
<td>2.1%</td>
<td>11.5%</td>
<td>20.1%</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>4.1%</td>
<td>1.9%</td>
<td>2.6%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Life, Physical, and Social Science</td>
<td>9.3%</td>
<td>3.1%</td>
<td>19.3%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Healthcare Practitioners and Technical</td>
<td>4.6%</td>
<td>0.5%</td>
<td>1.4%</td>
<td>83.1%</td>
</tr>
<tr>
<td>Healthcare Support</td>
<td>3.6%</td>
<td>7.1%</td>
<td>1.8%</td>
<td>97.3%</td>
</tr>
<tr>
<td>Food Preparation and Serving Related</td>
<td>14.2%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>70.0%</td>
</tr>
<tr>
<td>Office and Administrative Support</td>
<td>8.3%</td>
<td>1.5%</td>
<td>1.1%</td>
<td>72.1%</td>
</tr>
<tr>
<td>Construction and Extraction</td>
<td>3.5%</td>
<td>1.5%</td>
<td>0.4%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Installation, Maintenance, and Repair</td>
<td>3.5%</td>
<td>2.0%</td>
<td>0.9%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Production</td>
<td>6.5%</td>
<td>1.9%</td>
<td>3.3%</td>
<td>20.8%</td>
</tr>
<tr>
<td>Transportation and Material Moving</td>
<td>9.0%</td>
<td>2.5%</td>
<td>4.9%</td>
<td>19.5%</td>
</tr>
<tr>
<td><strong>Total Workforce</strong></td>
<td>7.9%</td>
<td>1.5%</td>
<td>2.0%</td>
<td>50.8%</td>
</tr>
</tbody>
</table>

Source: American Community Survey
This report was undertaken as a broad analysis of workforce trends in the Pittsburgh region and should be viewed as an initial stake in the ground to advance concrete action to effectively align talent supply and demand. It is clear that the region has strong momentum and the appetite for a more systematic approach to workforce planning and partnership development between employers and training providers.

The recommendations below are a call to collective action. Discrete strategies are suggested in all of the occupational cluster profiles that appear later in the report, and specific tactics will need to be developed for each. Program and policy changes and activities will necessarily vary among occupations as well as among different cohorts of talent. However, the high level recommendations below have emerged directly from the data and analysis provided by employers and educators as those with greatest potential impact to help align the region’s demand and talent supply.

THE EMPLOYER COMMUNITY MUST LEAD CHANGE AND SHIFT FROM BEING CONSUMERS OF TALENT TO BECOMING INVESTORS IN THE LABOR MARKETPLACE

Industry needs to frame and support a more effective and sustainable model to enable education and training providers to better understand changing skill demands. The need for increased alignment and coordination between training providers and industry demand is a consistent finding throughout this study. Connections between employers and their feeder training providers are uneven. There is strong desire to strengthen ties in support of the local job market and economic development; however, successful partnerships are uneven and not sufficiently scaled. Employers should lead the creation of a standing, cross-industry structure to support alignment of business needs and training demand at all levels.

A first step would be convening employers with common occupational needs, as this approach will identify which industry sectors have demand for the same occupational skillset. Such a convening would also be an opportunity to identify and engage the start-up community and smaller employers who have similar talent demand. Engaging educators to work with employers to identify and build consensus on the most important skills and competencies would lead to the development and adoption of common curriculum. This type of infrastructure could also spur consistent development and dissemination of well-articulated career pathways.

“We have four community colleges in our region and they are critical to our manufacturing pipeline. But they all seem to be offering training in a vacuum. I’d like to see them work together, maybe even sharing high-level instructors that they can’t afford to hire on a part-time basis.”

Large, long-established employers and start-up and technology companies should form a partnership to attract and retain top level talent. Pittsburgh faces a talent shortfall both in the overall number of workers and in the high skill professions that drive the innovation economy. 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 identify 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.

“FOCUS ON UPSKILLING TALENT IN THE REGION

Create explicit pathways to upward mobility: 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. 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. 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.

FOCUS ON THE DEVELOPMENT OF EMERGING, CROSS-CUTTING SKILLS AND COMPETENCIES: There are a set of baseline skills and competencies which are increasingly in demand in the market and which employers across all sectors cited as gaps. These include customer service skills, leadership/management skills, and various emerging digital skills. Training providers, particularly CTE and other technical programs, are well served to balance their focus to developing technical skills.

“We have a lot of IT talent from local colleges and universities, and also work to attract top-level talent here. We end up too often having to create our own marketing material for this. We need to have a one-stop shop to find information and to help sell the City to talent.”

Engage employers directly in a collaborative effort to retain more college graduates: As home to several of the nation’s leading colleges and universities, a concerted effort by employers and educators is needed to promote the region and its opportunities. Recent focus groups conducted by the Allegheny Conference with nearly 100 students from five area colleges and universities revealed a low level of awareness of the region and its employment opportunities and quality of life. When students were presented with the Pittsburgh region opportunity “story” they showed strong positive response and interest.

Recent STEM graduates and high skill workers coming to Pittsburgh are a major part of the region’s attractiveness to technology employers. Engaging employers in selling the Pittsburgh region, specifically for entry-level college graduates, is needed. If this were coupled with active engagement of students early in their college career around high demand occupations, the region could decrease the level of outward migration following graduation. At the same time, however, employers must be willing to hire recent graduates knowing they will not yet have the three to five years of experience typically required.

“We need to have a one-stop shop to find information and to help sell the City to talent.”

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Recent STEM graduates and high skill workers coming to Pittsburgh are a major part of the region’s attractiveness to technology employers. Engaging employers in selling the Pittsburgh region, specifically for entry-level college graduates, is needed. If this were coupled with active engagement of students early in their college career around high demand occupations, the region could decrease the level of outward migration following graduation. At the same time, however, employers must be willing to hire recent graduates knowing they will not yet have the three to five years of experience typically required.

“FOCUS ON UPSKILLING TALENT IN THE REGION

Create explicit pathways to upward mobility: 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. 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. 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.

FOCUS ON THE DEVELOPMENT OF EMERGING, CROSS-CUTTING SKILLS AND COMPETENCIES: There are a set of baseline skills and competencies which are increasingly in demand in the market and which employers across all sectors cited as gaps. These include customer service skills, leadership/management skills, and various emerging digital skills. Training providers, particularly CTE and other technical programs, are well served to balance their focus to developing technical skills.

“We have a lot of IT talent from local colleges and universities, and also work to attract top-level talent here. We end up too often having to create our own marketing material for this. We need to have a one-stop shop to find information and to help sell the City to talent.”

Engage employers directly in a collaborative effort to retain more college graduates: As home to several of the nation’s leading colleges and universities, a concerted effort by employers and educators is needed to promote the region and its opportunities. Recent focus groups conducted by the Allegheny Conference with nearly 100 students from five area colleges and universities revealed a low level of awareness of the region and its employment opportunities and quality of life. When students were presented with the Pittsburgh region opportunity “story” they showed strong positive response and interest.

Recent STEM graduates and high skill workers coming to Pittsburgh are a major part of the region’s attractiveness to technology employers. Engaging employers in selling the Pittsburgh region, specifically for entry-level college graduates, is needed. If this were coupled with active engagement of students early in their college career around high demand occupations, the region could decrease the level of outward migration following graduation. At the same time, however, employers must be willing to hire recent graduates knowing they will not yet have the three to five years of experience typically required.
The Pennsylvania Department of Education’s Career Education and Work Standard provides a structure through which businesses and K-12 can partner to address employability skills. Engaging students early in meaningful activities around career exploration needs to be scaled in order to create an effective means to engage businesses directly for the long term.

Focus resources on opportunity occupations and high priority occupations: This report highlights the rapidly changing labor market, including identifying occupations that offer strong potential to earn a living wage, many of which the state does not presently recognize as a High Priority Occupation eligible for increased training funding. Immediate consideration should be made toward petitioning for high priority recognition in order to properly allocate resources. These primarily support the energy and skilled trades, such as Control & Valve Installers, and Surveying and Mapping Technicians. Additional opportunities are with Health Technologists.

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.

**CAPitalize on Innovation in Information Technology, Advanced Manufacturing and Finance**

Build a bridge to connect larger regional employers and the start-up and innovation economy: The presence of multiple top-tier universities in a city the size of Pittsburgh, numerous corporate and federal R&D facilities in the region, and a highly engaged community of corporate leaders, is a unique combination of assets and has made the region a leader in innovation and cutting-edge technologies across a broad set of sectors. Its historic strengths in finance, energy and advanced manufacturing have been enriched by new strengths in computer science, robotics, engineering, cognitive science, design, information systems, healthcare and life sciences, making the Pittsburgh region a magnet for industry partners who want to collaborate on research and recruit the best talent.

The critical question is how best to leverage all this expertise—technological, medical, financial—to maximum impact? While the number of jobs specific to this growing hub of innovation is relatively small when compared to overall regional employment in 2016, we know that demand for these innovation skills will continue to grow rapidly—in the Pittsburgh region and around the world. If the region’s future will continue to be shaped by people here, the region must focus attention and resources to skill, attract and retain the world class talent that fuels the innovation ecosystem.

**Focus on opportunities for growth in innovation technology:** Particular occupation clusters which the local employer and training community might consider investing in include:

- Cybersecurity
- FinTech (shorthand for financial technology), and
- Predictive analytics, especially in the healthcare and energy sectors

In addition, special focus should be given to solidifying Pittsburgh’s role as a center of innovation for robotics, additive manufacturing and other advanced manufacturing technologies.
High Demand Occupational Sectors
Information Technology | Business and Finance | Engineering, Science and Production | Healthcare | Construction
Pittsburgh’s IT sector serves as a key driver of growth in the region and represents an unparalleled economic development opportunity to reshape Pittsburgh’s economy. Currently, there is a dual market for IT with the majority of jobs (70%) centered in financial, business and professional services, and a smaller, but growing number, in the startup and broader technology community that are significant in their cutting-edge nature and ability to shape our economy, and to drive industry innovation here and worldwide.

“The duality in IT demand becomes less pronounced as industries across sectors increasingly require skill domains such as machine learning and analysis. The overall employment curve will emphasize these growing skills.”

The software sector in Pittsburgh is gaining momentum with “landing party companies” such as Google, Facebook, Amazon, and Uber choosing to locate significant parts of their operations in the city. The recent decisions of these firms to expand their offices in the region speaks to available talent from research institutions generally, and Carnegie Mellon in particular. The shape of Pittsburgh’s future IT workforce depends in large part on the region’s ability to leverage this momentum to create a mutually reinforcing ecosystem for high-end IT skills, and cementing Pittsburgh’s standing as a tech hub.

While the excitement about the potential of a transformative IT sector is palpable, it is relatively nascent. In the larger Business and Finance IT workforce, employer demand is being shaped by skill hybridization, upskilling and upcredentialing, with employers seeking employees who can interpret and understand the business implications of technology across a whole range of occupations.

### Table 12: Information Technology Occupation Family Summary

<table>
<thead>
<tr>
<th>2015 Employment</th>
<th>Annual Openings 2015-2025</th>
<th>% of Openings Requiring Bachelor’s Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>31,372</td>
<td>2,103</td>
<td>89%</td>
</tr>
</tbody>
</table>

**Figure 1: Industry Demand for IT Workers**

**Alignment of Workforce Supply and Demand**

Supply of IT talent does not meet demand: Supply and demand in IT is mismatched. IT jobs will grow extremely rapidly over the next decade (11%) – 2.6x faster than the market overall. But graduates from local universities are leaving at high rates, creating a supply shortage of workers. However, better retention of the IT graduates from local universities, as well as increased talent attraction efforts would help to close this gap. A barrier to attracting and retaining talent in the area may be the lower-than-average salaries for IT occupations in the Pittsburgh region compared to the nation ($34/hour v. $41/hour).

“"When we hire for IT positions, we are really looking for those who are clearly ‘learning agile.’ Too many get de-selected in our hiring process because of a lack of a specific degree, but technical aptitude trumps all.”

The current workforce and future pipeline lack diversity: Diversity is a large local challenge; only 1% of the local IT workforce is African American compared to 7% nationally. At the college level, African American students are 50% less likely to be enrolled in Computer Science and other STEM majors than all other students. At the high school level, only 37 African American students in the entire state took the AP Computer Science exam.

**Figure 2: Supply and Demand of IT Workers**

**Changing 21st Century Workforce**

Pittsburgh has dual IT job markets: Pittsburgh’s demand for IT workers is currently concentrated in Professional Services and Finance, with the responsibilities of these roles generally focused around providing enterprise systems support and application integration. IT jobs in the Financial Services sector represent strong career opportunities for workers, but they do not typically serve as beacons for talent attraction.
What has begun as a dual IT market can evolve to higher skill levels overall as new domains gain market importance: The region’s greatest opportunities for growth and for talent attraction lie in the software industry ecosystem inhabited by start-ups and high-profile consumer tech firms. To the extent that these firms continue to locate in Pittsburgh, the city will become an even stronger magnet for top tier engineers looking to work on cutting-edge solutions. A strong presence of recognizable technology firms can help to cultivate a robust network and culture of software developers and aid in talent attraction and recruitment efforts for employers across all industries.

Cybersecurity demand is strong and growing: Cybersecurity postings have grown rapidly in Pittsburgh, at three times the rate of IT jobs overall since 2010. There were 2,625 job postings for cybersecurity professionals in the region in 2015.19 Information Security Analysts are projected to grow at 20% over the next ten years, one of the top IT occupations, and among the top 5% of all occupations. Local cybersecurity demand is concentrated in Professional Services and Finance and Insurance. The demand in Financial Services is twice the national average, with the largest employers being BNY Mellon and The PNC Financial Services Group, Inc. Although the cybersecurity marketplace is not as well established beyond these two industries, the healthcare, retail, and utilities industries cited this as a fast-emerging need as recent data breaches in all three of these sectors have prompted regulatory and investor demands for failsafe information security and grid safety.

### DATA TABLES

#### Table 13: Information Technology Occupation Summary Table

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Systems Analysts</td>
<td>6,252</td>
<td>$70,760</td>
<td>19%</td>
<td>462</td>
<td>91%</td>
<td>1.24</td>
</tr>
<tr>
<td>Computer User Support Specialists</td>
<td>5,352</td>
<td>$44,100</td>
<td>11%</td>
<td>378</td>
<td>44%</td>
<td>1.33</td>
</tr>
<tr>
<td>Network &amp; Computer Systems Administrators</td>
<td>4,330</td>
<td>$69,410</td>
<td>7%</td>
<td>261</td>
<td>75%</td>
<td>1.06</td>
</tr>
<tr>
<td>Software Developers, Applications</td>
<td>4,086</td>
<td>$84,740</td>
<td>12%</td>
<td>270</td>
<td>90%</td>
<td>0.99</td>
</tr>
<tr>
<td>Software Developers, Systems Software</td>
<td>2,493</td>
<td>$75,660</td>
<td>12%</td>
<td>166</td>
<td>83%</td>
<td>0.53</td>
</tr>
<tr>
<td>Computer Programmers</td>
<td>2,421</td>
<td>$69,080</td>
<td>5%</td>
<td>135</td>
<td>83%</td>
<td>1.32</td>
</tr>
<tr>
<td>Database Administrators</td>
<td>1,229</td>
<td>$74,400</td>
<td>11%</td>
<td>78</td>
<td>78%</td>
<td>1.09</td>
</tr>
<tr>
<td>Computer Occupations, Other</td>
<td>1,210</td>
<td>$73,260</td>
<td>3%</td>
<td>73</td>
<td>87%</td>
<td>0.59</td>
</tr>
<tr>
<td>Computer Network Support Specialists</td>
<td>1,171</td>
<td>$58,150</td>
<td>9%</td>
<td>81</td>
<td>61%</td>
<td>0.75</td>
</tr>
<tr>
<td>Operations Research Analysts</td>
<td>681</td>
<td>$65,620</td>
<td>21%</td>
<td>55</td>
<td>87%</td>
<td>0.88</td>
</tr>
<tr>
<td>Computer Network Architects</td>
<td>675</td>
<td>$93,870</td>
<td>3%</td>
<td>34</td>
<td>75%</td>
<td>0.67</td>
</tr>
<tr>
<td>Information Security Analysts</td>
<td>625</td>
<td>$55,780</td>
<td>20%</td>
<td>46</td>
<td>91%</td>
<td>0.67</td>
</tr>
<tr>
<td>Statisticians</td>
<td>353</td>
<td>$52,220</td>
<td>15%</td>
<td>25</td>
<td>94%</td>
<td>1.65</td>
</tr>
<tr>
<td>Actuaries</td>
<td>282</td>
<td>$98,360</td>
<td>15%</td>
<td>21</td>
<td>100%</td>
<td>1.31</td>
</tr>
<tr>
<td>Web Developers</td>
<td>212</td>
<td>$53,810</td>
<td>23%</td>
<td>18</td>
<td>86%</td>
<td>0.67</td>
</tr>
<tr>
<td>Grand Total</td>
<td>31,372</td>
<td>$67,790</td>
<td>11%</td>
<td>2,103</td>
<td>89%</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Sources: Employment: Bureau of Labor Statistics and Burning Glass model
Median Salary: BLS Occupational Employment Statistics
% Requesting BA: Burning Glass job postings data
Location Quotient: BLS Occupational Employment Statistics
Leading technology companies are coming to Pittsburgh to hire researchers and engineers with specific advanced skill sets. For example, in just the last six months, Uber announced the expansion of its autonomous vehicle research facility, Facebook announced that it will be opening an Oculus virtual reality research center, and Amazon acquired Safaba for the firm’s machine translation expertise. However, the top-tier IT skills that are most attractive to software engineers have relatively low advertised demand in Pittsburgh, reflecting the potential for continued growth for employers who can tap into a robust supply of talented programmers and researchers graduating from local universities.

The roles with highest demand in the region, those in Professional Services and Finance, are being affected by trends in skill hybridization, upskilling and upcredentialing. For example, many employers noted a shift in software development processes. Where development used to follow a waterfall method, which follows a sequential, linear process, firms increasingly use agile development, which uses more frequent iterations and is cross-functional. This method requires greater team work, where they are not needed.

INFORMATION TECHNOLOGY SKILLS AND CREDENTIALS

Demand for front-end development, cloud computing and big data skills, is coming. The fastest growing skills in the nation over recent years are displayed in Table 14: Fastest Growing IT Skills in Terms of National Online Demand.

“Data science is a new field, but it will be crucial across all industries. We all have more data, but key is having the talent that can clearly articulate the story the data is telling us.”

Table 14: Fastest Growing IT Skills in Terms of National Online Demand

<table>
<thead>
<tr>
<th>Skill</th>
<th>Online Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>AngularJS</td>
<td>Programming and Development Skills</td>
</tr>
<tr>
<td>CoffeeScript</td>
<td></td>
</tr>
<tr>
<td>Node.js</td>
<td></td>
</tr>
<tr>
<td>Backbone.js</td>
<td></td>
</tr>
<tr>
<td>Jenkins</td>
<td></td>
</tr>
<tr>
<td>Pandas for Python</td>
<td></td>
</tr>
<tr>
<td>Big Data Skills</td>
<td></td>
</tr>
<tr>
<td>Data Science</td>
<td></td>
</tr>
<tr>
<td>Big Data</td>
<td></td>
</tr>
<tr>
<td>Sqoop</td>
<td></td>
</tr>
<tr>
<td>Apache Pig</td>
<td></td>
</tr>
<tr>
<td>Tableau</td>
<td></td>
</tr>
<tr>
<td>Cloud Computing</td>
<td></td>
</tr>
<tr>
<td>New Relic</td>
<td></td>
</tr>
<tr>
<td>CEPH</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Internet of Things</td>
<td></td>
</tr>
</tbody>
</table>

Source: Burning Glass Technologies

Bold skills are those with more than 500 job postings in the Pittsburgh region, indicating local demand.

Upcredentialing is impacting sub-baccalaureate positions: Computer User Support Specialists are a common sub-baccalaureate entry point into the IT workforce. 56% of postings for this role call for less than a bachelor’s degree. When employers request a bachelor’s degree for this role, they typically look for the same set of technical skills, but take 12% longer to fill the roles, suggesting employers are asking for credentials even where they are not needed.

DATA TABLES

The next table displays top skills in demand for the occupation family. Skill demand is based on an analysis of job postings data. While employers do not name every skill required for an occupation, the postings reflect those skills that employers are looking for in candidates, both specialized (technical, occupation-specific) and baseline (cross-cutting, or soft skills). Baseline skills represent 25% of all skill demand in IT occupations. The high relative demand for baseline skills reflects the importance of these capabilities to employers in the hiring process.
**Regional Training Strategies to Develop Future Workforce**

**Continue to invest in Pittsburgh’s areas of strength:** Pittsburgh has strengths in cutting edge fields such as robotics and machine learning, stemming from strong local research institutions. As these domains move from primarily research capabilities to the mainstream and become drivers of growth in the region, it will be important to continue to invest and promote Pittsburgh’s existing talent and innovation in these areas. Employers point to the strength of local universities in high-level technology roles, e.g. cybersecurity, data analytics, computer science and high-end software development, as a major opportunity for the region moving forward. But, we caution that employers in the region may need to proactively hire in front of demand or risk losing the high-end talent to other markets. Talent is currently moving faster than employers.

**Build a pipeline to scale emerging technology companies:**

Startup and later stage technology companies have a limited but skilled pipeline of technical talent available in the region. However, as these companies begin to scale, they often must fill key sales, marketing, and C-level roles with experienced managers who continue to live in other cities. While this situation is not unique to Pittsburgh, the region should consider building and attracting a stronger management pipeline for these companies or face potential “flight risks.”

**Innovate and compete with FinTech firms:**

Given its strength in both IT and Financial Services, Pittsburgh may consider pursuing FinTech, a hybrid of the two. Local financial services firms note the rapidly changing industry, and banks increasingly view themselves as software companies, and in direct competition with many of these emerging FinTech firms, given the online nature of most financial transactions and the broad array of consumer choice. The local strengths in these areas allow innovation to occur locally as FinTech grows in importance, particularly in the early warning services and customer protection fields.

**Incorporate business training with IT programs:**

Understanding of business functions is critical to IT professionals. For example, understanding of both business processes and advanced IT skills are critical for Computer Systems Analysts, BI Analysts, and Computer Systems Engineers as they use technology to support a company’s operational functions.

**Help students and educators identify value-add credentials that feed into clear career pathways:** When asked about IT certifications, employers indicated that there would be winners and losers in the certification world, but the certification model is generally a “loser.” The sense among most employers is that the high volume of certifications has watered down their value and many employers have come to view them as merely resume fillers. This is reflected in certification demand: the 50 most commonly demanded certifications account for two-thirds of all employer demand for certifications.

<table>
<thead>
<tr>
<th>Table 15: Demand for Information Technology Skills in the Pittsburgh Region</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specialized Skills</strong></td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>1. Technical Support</td>
</tr>
<tr>
<td>2. Software Engineering</td>
</tr>
<tr>
<td>3. Web Site Development</td>
</tr>
<tr>
<td>4. Business Process</td>
</tr>
<tr>
<td>5. Systems Analysis</td>
</tr>
<tr>
<td>7. Software Development</td>
</tr>
<tr>
<td>8. System and Network Configuration</td>
</tr>
<tr>
<td>9. Data Management</td>
</tr>
</tbody>
</table>

Source: Burning Glass Technologies

**Information Technology Recommendations**

Given the two distinct IT markets within Pittsburgh, initiatives in IT should aim to grow the future high-end workforce, while sustaining the region’s longstanding strength in employment of enterprise IT staff.

**Regional Training Strategies to Develop Future Workforce**

**Continue to Invest in Pittsburgh’s Areas of Strength:** Pittsburgh has strengths in cutting edge fields such as robotics and machine learning, stemming from strong local research institutions. As these domains move from primarily research capabilities to the mainstream and become drivers of growth in the region, it will be important to continue to invest and promote Pittsburgh’s existing talent and innovation in these areas. Employers point to the strength of local universities in high-level technology roles, e.g. cybersecurity, data analytics, computer science and high-end software development, as a major opportunity for the region moving forward. But, we caution that employers in the region may need to proactively hire in front of demand or risk losing the high-end talent to other markets. Talent is currently moving faster than employers.

**Build a Pipeline to Scale Emerging Technology Companies:** Startup and later stage technology companies have a limited but skilled pipeline of technical talent available in the region. However, as these companies begin to scale, they often must fill key sales, marketing, and C-level roles with experienced managers who continue to live in other cities. While this situation is not unique to Pittsburgh, the region should consider building and attracting a stronger management pipeline for these companies or face potential “flight risks.”

**Innovate and Compete with FinTech Firms:** Given its strength in both IT and Financial Services, Pittsburgh may consider pursuing FinTech, a hybrid of the two. Local financial services firms note the rapidly changing industry, and banks increasingly view themselves as software companies, and in direct competition with many of these emerging FinTech firms, given the online nature of most financial transactions and the broad array of consumer choice. The local strengths in these areas allow innovation to occur locally as FinTech grows in importance, particularly in the early warning services and customer protection fields.

**Develop and Highlight Supply of Fast Growing Skills:** The supply of high-end IT skills from local universities and the innovation sector provides opportunities to advertise the presence of this talent in the region. By establishing an identity as a strong market for these skills, the region can expand the strength of its workforce and more successfully retain computer science graduates from local colleges and universities, which will in turn help to attract more brand-name IT companies. This will require collaborative efforts between industry and educators that must be adequately structured and funded.

**Incorporate Business Training with IT Programs:** Understanding of business functions is critical to IT professionals. For example, understanding of both business processes and advanced IT skills are critical for Computer Systems Analysts, BI Analysts, and Computer Systems Engineers as they use technology to support a company’s operational functions.

**Help Students and Educators Identify Value-Add Credentials that Feed into Clear Career Pathways:** When asked about IT certifications, employers indicated that there would be winners and losers in the certification world, but the certification model is generally a “loser.” The sense among most employers is that the high volume of certifications has watered down their value and many employers have come to view them as merely resume fillers. This is reflected in certification demand: the 50 most commonly demanded certifications account for two-thirds of all employer demand for certifications. Development of robust career pathways will support the identification of skills and certifications that lead to advancement.
**Figure 3: Example of IT Career Pathway**

**IT Support and Administration Pathway**

- **Computer Repair Technicians**
  - Certification In-Demand
  - CompTIA A+ Technician
  - CompTIA Network+
  - Cisco Certified Network Associate (CCNA)
  - VMWare Certified Associate
  - Certification In-Demand
  - IT Infrastructure Library (ITIL)
  - Project Management Professional Certification (PMP)
  - CompTIA Project+
  - CompTIA Server+
  - $17

- **Helpdesk/Computer Support**
  - Management skills such as supervision and mentoring of helpdesk staff.
  - CompTIA A+ Technician
  - CompTIA Network+
  - Cisco Certified Network Associate (CCNA)
  - VMWare Certified Associate
  - Certification In-Demand
  - IT Infrastructure Library (ITIL)
  - Project Management Professional Certification (PMP)
  - CompTIA Project+
  - CompTIA Server+
  - $21

- **Advanced Helpdesk**
  - Advanced computer network skills such as network storage and disaster recovery planning.
  - Advanced network support and security skills.
  - CompTIA A+ Technician
  - CompTIA Network+
  - Cisco Certified Network Associate (CCNA)
  - VMWare Certified Associate
  - Certification In-Demand
  - IT Infrastructure Library (ITIL)
  - Project Management Professional Certification (PMP)
  - CompTIA Project+
  - CompTIA Server+
  - $33

- **Helpdesk Managers**
  - Look for improvements in the efficiency of networks through network modeling and analysis.
  - A bachelor’s degree is typically needed to advance to this role.
  - CompTIA A+ Technician
  - CompTIA Network+
  - Cisco Certified Network Associate (CCNA)
  - VMWare Certified Associate
  - Certification In-Demand
  - IT Infrastructure Library (ITIL)
  - Project Management Professional Certification (PMP)
  - CompTIA Project+
  - CompTIA Server+
  - $45

- **Network Support**
  - Core Skills
  - IT Support and Administration
  - Management skills such as supervision and mentoring of helpdesk staff.
  - Advanced computer network skills such as network storage and disaster recovery planning.
  - Advanced network support and security skills.

- **Network Administrators**
  - Advanced computer network skills such as network storage and disaster recovery planning.
  - Advanced network support and security skills.
  - A bachelor’s degree is typically needed to advance to this role.

Source: Burning Glass Technologies
Prepare for expansion in Cybersecurity hiring demand in Manufacturing and Retail: Compared to the nation and key comparison cities, Pittsburgh has a lower percentage of cybersecurity job postings. Compared to the nation and key comparison cities, Pittsburgh has a lower percentage of cybersecurity job postings in the Manufacturing sector (5% vs 11% nationally). This suggests that there is likely to be an expansion of need for cybersecurity workers in manufacturing in Pittsburgh. For example, as autonomous vehicles gain traction, and the “Internet of Things” becomes ubiquitous, expertise is likely to be needed to ensure the security of Internet-connected electronics. Similarly, retailers cite cybersecurity hiring as “blazing hot” as they work to secure their customer data.

**ECONOMIC DEVELOPMENT AND EMPLOYER RECOMMENDATIONS**

Increase and emphasize competency- and skill-based hiring to fill immediate gaps: The Pittsburgh region’s two- and four-year institutions are not retaining enough students to keep up with demand. As a result, the market relies on strong inbound migration for IT roles. Additionally, only 12% of the demand for IT talent is advertised at the sub-baccalaureate level, while 35% of graduates who remain in Pittsburgh are at this level.

Table 16: Cybersecurity Postings

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>% of Cyber Postings Local</th>
<th>% of Cyber Postings National</th>
<th>2010-2015 Average Annual Local Postings Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Services</td>
<td>43%</td>
<td>43%</td>
<td>23%</td>
</tr>
<tr>
<td>Finance and Insurance</td>
<td>26%</td>
<td>13%</td>
<td>45%</td>
</tr>
<tr>
<td>Healthcare</td>
<td>5%</td>
<td>6%</td>
<td>28%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>5%</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>Information</td>
<td>5%</td>
<td>7%</td>
<td>23%</td>
</tr>
<tr>
<td>Retail</td>
<td>2%</td>
<td>2%</td>
<td>29%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
<td>18%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Burning Glass Technologies

In cybersecurity, employers are seeking workers with credentials requiring at least five years experience, meaning that shortages in this area are going to take some years to overcome. In the short run, gaps can be addressed through competency-based (as opposed to credential-based) hiring, and through employer/training provider partnerships. This ensures that graduates from sub-BA programs have the skills to qualify for jobs which might typically require a more advanced degree. Employers indicate a willingness to move toward competency-based hiring, including hiring based on “portfolios over degrees.” An emerging source of talent throughout the nation is from IT boot camps, which can help to upskill the existing workforce in a rapid manner.
Hiring for Business and Financial Services talent is being shaped by the changing nature of the industry. This includes the shift of transactional banking to online and mobile channels, and the rise of powerful techniques and technologies that allow customer behaviors and other trends to be mined for rich insights into new ways of doing business. This changing landscape means that workers with strong customer service skills will be vital for building lasting customer relationships at a time when most customer interactions with banks are becoming more impersonal. Additionally, workers with strong technical and analytical skills who are able to deliver the analytical insights or agile services that customers and employers expect are also in high demand.

These trends are affecting Business and Finance roles, and Administration roles, in different ways. At the high-skill end, technology and the rise of big data has driven strong growth in demand for Analysts of all varieties; skill end, technology and the rise of big data has driven strong growth in demand for Analysts of all varieties; conversely administrative roles are declining as many of their functions are being absorbed by other occupations or replaced by automation.

Table 17: Business and Finance Occupation Family Summary

<table>
<thead>
<tr>
<th>Family Summary</th>
<th>Business and Finance</th>
<th>Office and Administrative Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 Employment</td>
<td>64,767</td>
<td>204,283</td>
</tr>
<tr>
<td>Annual Openings</td>
<td>5,355</td>
<td>21,836</td>
</tr>
<tr>
<td>% of Openings Requiring Bachelor's Degree</td>
<td>89%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Figure 4: Supply and Demand of Business and Finance Workers

Aligning Workforce Supply and Demand

Demand for Business and Finance talent is outstripping local supply. Growth of Business and Finance occupations (5%) is slightly above the regional average (4.2%), and cannot currently be met by the local pipeline. The gap is especially prevalent at the bachelor’s and graduate level, where there are 4,000 annual openings being met by only 3,000 new graduates.

Conversations with employers illuminated challenges attracting and retaining local talent. They indicate an attempt to build a stronger hook, through employee perks and other activities, to increase regional retention.

“...we try to take our interns around town and create a sense of community within each class to increase our chances of convincing them to stay after graduation. We've also found that involving them in community service projects helps interns develop an affinity for the city."

Slow growth and changing credential requirements of Administrative roles reduce opportunities for workers. While demand for high-end bachelor’s level occupations is strong, demand for Administration occupations is projected to be flat over the next 10 years (0% growth), and two of the top 10 occupations, Tellers (-21%) and Shipping and Receiving Clerks (-2%) are projected to decline. Many of these roles are responsibilities are being absorbed by other occupations or by automation.

Despite slow growth, administrative roles have high replacement rates due to turnover, with over 21,000 open positions per year. Only 62% of these openings pay a living wage ($15/hour), and many of these roles have increasing credential requirements, such as Executive Secretaries, where 44% of job postings require a bachelor’s degree, compared to 21% of incumbents. Employers imposing credentials where they are not needed constrains their pool of applicants, raises costs, and limits the diversity of their hiring pool.

UPMC recently announced that it will raise entry level wages to a minimum of $15 over the next three years. This development has the potential to reshape the market for many administrative roles, particularly if other major employers follow suit, as UPMC is among the top-3 hirers for these roles. Increased wages will make these careers more attractive to job seekers, and could increase retention.
**DATA TABLES**

**Table 18: Business and Finance Occupational Summary Table**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accountants &amp; Auditors</td>
<td>14,232</td>
<td>$62,560</td>
<td>7%</td>
<td>1,206</td>
<td>99%</td>
<td>1.23</td>
</tr>
<tr>
<td>Market Research Analysts &amp; Marketing Specialists</td>
<td>5,654</td>
<td>$60,230</td>
<td>15%</td>
<td>544</td>
<td>80%</td>
<td>1.20</td>
</tr>
<tr>
<td>Management Analysts</td>
<td>4,542</td>
<td>$73,220</td>
<td>7%</td>
<td>371</td>
<td>96%</td>
<td>0.76</td>
</tr>
<tr>
<td>Business Operations Specialists, Other</td>
<td>4,441</td>
<td>$69,490</td>
<td>2%</td>
<td>354</td>
<td>84%</td>
<td>0.46</td>
</tr>
<tr>
<td>Financial Analysts</td>
<td>3,584</td>
<td>$68,200</td>
<td>6%</td>
<td>288</td>
<td>100%</td>
<td>1.21</td>
</tr>
<tr>
<td>Purchasing Agents</td>
<td>3,119</td>
<td>$58,460</td>
<td>-1%</td>
<td>247</td>
<td>76%</td>
<td>1.24</td>
</tr>
<tr>
<td>Training &amp; Development Specialists</td>
<td>2,823</td>
<td>$54,270</td>
<td>5%</td>
<td>222</td>
<td>66%</td>
<td>1.14</td>
</tr>
<tr>
<td>Loan Officers</td>
<td>2,577</td>
<td>$51,880</td>
<td>1%</td>
<td>197</td>
<td>51%</td>
<td>1.31</td>
</tr>
<tr>
<td>Claims Adjusters, Examiners &amp; Investigators</td>
<td>2,420</td>
<td>$59,210</td>
<td>3%</td>
<td>194</td>
<td>62%</td>
<td>1.06</td>
</tr>
<tr>
<td>Cost Estimators</td>
<td>2,354</td>
<td>$61,850</td>
<td>5%</td>
<td>188</td>
<td>64%</td>
<td>1.24</td>
</tr>
<tr>
<td>Personal Financial Advisors</td>
<td>2,217</td>
<td>$84,440</td>
<td>23%</td>
<td>216</td>
<td>50%</td>
<td>1.02</td>
</tr>
<tr>
<td>Compliance Officers</td>
<td>2,042</td>
<td>$63,350</td>
<td>2%</td>
<td>144</td>
<td>89%</td>
<td>1.17</td>
</tr>
<tr>
<td>Wholesale &amp; Retail Buyers</td>
<td>1,313</td>
<td>$52,080</td>
<td>5%</td>
<td>117</td>
<td>92%</td>
<td>0.85</td>
</tr>
<tr>
<td>Financial Specialists, Other</td>
<td>1,088</td>
<td>$72,750</td>
<td>4%</td>
<td>86</td>
<td>98%</td>
<td>0.93</td>
</tr>
<tr>
<td>Grand Total</td>
<td>64,767</td>
<td>$61,070</td>
<td>5%</td>
<td>5,359</td>
<td>89%</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Sources:
- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- % Requested BA: Burning Glass job postings data
- Location Quotient: BLS Occupational Employment Statistics

Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendix.
Table 19: Administration and Office Support Occupational Summary Table

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Clerks, General</td>
<td>29,817</td>
<td>$28,100</td>
<td>0%</td>
<td>3,197</td>
<td>19%</td>
<td>1.13</td>
</tr>
<tr>
<td>Customer Service Representatives</td>
<td>26,530</td>
<td>$30,900</td>
<td>5%</td>
<td>2,973</td>
<td>18%</td>
<td>1.19</td>
</tr>
<tr>
<td>Secretaries</td>
<td>24,717</td>
<td>$31,820</td>
<td>2%</td>
<td>2,420</td>
<td>23%</td>
<td>1.24</td>
</tr>
<tr>
<td>Stock Clerks &amp; Order Fillers</td>
<td>16,577</td>
<td>$21,500</td>
<td>6%</td>
<td>1,916</td>
<td>7%</td>
<td>0.91</td>
</tr>
<tr>
<td>Bookkeeping, Accounting &amp; Auditing Clerks</td>
<td>16,442</td>
<td>$34,900</td>
<td>-5%</td>
<td>1,577</td>
<td>38%</td>
<td>1.02</td>
</tr>
<tr>
<td>Supervisors - Office &amp; Administrative Support Workers</td>
<td>12,555</td>
<td>$52,230</td>
<td>4%</td>
<td>1,107</td>
<td>64%</td>
<td>0.95</td>
</tr>
<tr>
<td>Receptionists &amp; Information Clerks</td>
<td>9,340</td>
<td>$25,670</td>
<td>4%</td>
<td>1,139</td>
<td>2%</td>
<td>0.88</td>
</tr>
<tr>
<td>Billing &amp; Posting Clerks</td>
<td>5,871</td>
<td>$32,710</td>
<td>8%</td>
<td>604</td>
<td>13%</td>
<td>1.26</td>
</tr>
<tr>
<td>Shipping, Receiving &amp; Traffic Clerks</td>
<td>4,758</td>
<td>$30,740</td>
<td>-2%</td>
<td>424</td>
<td>6%</td>
<td>0.76</td>
</tr>
<tr>
<td>Tellers</td>
<td>4,494</td>
<td>$23,640</td>
<td>-21%</td>
<td>546</td>
<td>6%</td>
<td>0.98</td>
</tr>
<tr>
<td>Medical Secretaries</td>
<td>4,369</td>
<td>$30,290</td>
<td>15%</td>
<td>488</td>
<td>14%</td>
<td>0.93</td>
</tr>
<tr>
<td>Bill &amp; Account Collectors</td>
<td>2,958</td>
<td>$34,680</td>
<td>-2%</td>
<td>295</td>
<td>25%</td>
<td>0.85</td>
</tr>
<tr>
<td>Production, Planning &amp; Expediting Clerks</td>
<td>2,730</td>
<td>$48,670</td>
<td>3%</td>
<td>242</td>
<td>44%</td>
<td>0.96</td>
</tr>
<tr>
<td>Insurance Claims &amp; Policy Processing Clerks</td>
<td>2,500</td>
<td>$34,070</td>
<td>3%</td>
<td>241</td>
<td>42%</td>
<td>1.16</td>
</tr>
<tr>
<td>Data Entry Keyers</td>
<td>2,327</td>
<td>$27,600</td>
<td>-4%</td>
<td>231</td>
<td>7%</td>
<td>0.99</td>
</tr>
<tr>
<td>Grand Total</td>
<td>204,283</td>
<td>$31,640</td>
<td>0%</td>
<td>21,094</td>
<td>1%</td>
<td>1.04</td>
</tr>
</tbody>
</table>

Sources:
- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- Projected Annual Openings: Burning Glass job postings data
- Location Quotient: BLS Occupational Employment Statistics

Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendices.

BUSINESS AND FINANCE SKILLS AND CREDENTIALS

Among the most important trends in the job market today is that of “hybrid skills” where skill sets are entering in jobs where they did not previously exist. This trend is particularly noteworthy among business, financial, and associate support roles, as employers are asking these employees to become even more versatile. For office and administrative roles, employers are looking for a combination of strong technical skills and strong employability skills. Neither category is sufficient to get a job on its own. Along with this increased skill requirement, employers are requiring more bachelor’s degrees than in the past.

HYBRID JOBS: BLENDING DIVERSE SKILLS SETS INTO A SINGLE ROLE

Skill requirements are changing for Administrative Support:

Many administrative support roles have gradually upskilled over the last several years; for example, increasing demand for writing and computer skills across roles. With regard to technical skills, a high degree of proficiency in Microsoft Office is becoming the table stakes for competitive candidates. These skills are requested more often than traditional administrative support skills such as scheduling. In many cases, employers are also looking for candidates with experience on enterprise software systems such as SAP or PeopleSoft.

Baseline employability skills are particularly critical: Employers also demand a high level of proficiency in baseline employability skills such as communication, customer service, and organization. Half of the skills requested in these roles are “baseline” skills (e.g. cross-cutting non-technical skills), compared to a third of skills in the market overall. This occupation has a higher demand for baseline skills than any other occupation family.
Customer service skills are in high demand across the industry: Customer service occupations and skills are increasingly important, and demand in the region is especially concentrated as employers base their financial and customer service operations in the Pittsburgh region. Customer Service Representatives are highly concentrated in Pittsburgh (LQ=1.19), and are projected to have nearly 3,000 annual openings over the next decade, more than any other occupation paying a living wage ($15/hour). Many of these customer service jobs have higher skills requirements than in the past.

"People who used to just take your money are now being asked to have a deeper understanding of the bank's products and services, they are asked to be sales people. We are also adding digital specialist roles within each bank given that many of our customers need help accessing and using online banking technology."

UPSKILLING: EMPLOYERS REQUEST HIGHER-LEVEL SKILLS AND CREDENTIALS

Business and Finance roles require stronger analytics skills and greater technical savvy:

The fast growing analyst roles require a complex set of skills, combining business expertise with use of tools such as SQL to analyze big data sets. Employers expect a continued growth of these skill sets, including moving more toward predictive analytics. Market research analysts have higher demand for analysis skills, such as Google Analytics and SAS, and database skills, such as SQL, when working within Finance firms. This pattern is consistent across occupations in the Finance industry.

Table 20: Commonly Requested Baseline Skills

<table>
<thead>
<tr>
<th>Commonly Requested Baseline Skills</th>
<th>All Jobs</th>
<th>Office and Administrative Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>47%</td>
<td>53%</td>
</tr>
<tr>
<td>Customer Service</td>
<td>34%</td>
<td>66%</td>
</tr>
<tr>
<td>Organizational Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detail Oriented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem Solving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-Tasking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 21: Baseline Skills Gaps

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 23: Skill Demand for Administrative Support Workers

<table>
<thead>
<tr>
<th>Specialized Skills</th>
<th>Baseline Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data Entry</td>
<td>Communication Skills</td>
</tr>
<tr>
<td>2. Administrative Support</td>
<td>Customer Service</td>
</tr>
<tr>
<td>3. Accounting</td>
<td>Organizational Skills</td>
</tr>
<tr>
<td>4. Scheduling</td>
<td>Microsoft Excel</td>
</tr>
<tr>
<td>5. Accounts Payable and Receivable</td>
<td>Writing</td>
</tr>
<tr>
<td>6. Spreadsheets</td>
<td>Detail-Oriented</td>
</tr>
<tr>
<td>7. Cash Handling</td>
<td>Microsoft Office</td>
</tr>
<tr>
<td>8. Appointment Setting</td>
<td>Computer Skills</td>
</tr>
<tr>
<td>9. Mathematics</td>
<td>Problem Solving</td>
</tr>
<tr>
<td>10. Product Sale and Delivery</td>
<td>Multi-Tasking</td>
</tr>
</tbody>
</table>

Source: Burning Glass Technologies

BUSINESS AND FINANCE RECOMMENDATIONS

REGIONAL TRAINING STRATEGIES TO DEVELOP FUTURE WORKFORCE

Expand university partnerships to develop analytical skills: Employers project analytical skills to be core, baseline skills within the industry moving forward. Some employers suggested that regional schools should be more proactive in reaching out to industry, and some are bypassing the career centers and forming individual relationships with professors to try to attract the best students.

"The region produces great candidates, I just wish there were more of them."

Focus on training pathways to Customer Service Representatives and other administrative roles: Customer Service Representatives and other administrative roles are an important entry into the middle class. There is a core set of skills such as customer service, writing, and problem solving which are key to these roles and are also taking on growing importance across the market. These skills can be addressed with progressive levels of sophistication and increased focus on workforce development in K-12, higher education, and other workforce training providers. Creating career ladders that focus on these skills and guide job seekers into Customer Service Representative and other administrative roles can help to support an expanded pool of workers for administrative roles and open up a broad range of professional jobs for workers.

ECONOMIC DEVELOPMENT AND EMPLOYER RECOMMENDATIONS

Leverage regional IT strengths to grow finance operations: Pittsburgh’s cybersecurity workforce is already heavily focused in the Finance industry, led by large national companies headquartered locally. The local community should work to leverage this strength to build a more robust pipeline into IT in Finance and Professional Services to retain top talent graduating from local institutions.

In addition to the Information Security Analysts already present in Pittsburgh, the region should proactively begin to build the broader cybersecurity infrastructure. Pittsburgh has lower demand cybersecurity trained Software Application Developers and Network Administrators than the national average. A more robust training infrastructure will encourage IT professionals to move into cybersecurity locally.
Pittsburgh is a national leader in advanced manufacturing technologies such as additive manufacturing, and while the region is well positioned to take advantage of the benefits, there are also important workforce implications in these trends. The manufacturing workforce of the future will have fewer, but higher skilled jobs. While manufacturing output in the region has risen to be close to pre-recession levels, the total number of people employed in engineering and production roles has not moved above 2010 levels.

Engineering, science, and production occupations employ 118,000 workers, or roughly 10% of the total workforce. Because of their criticality to the manufacturing industry, they have deep importance to the local economy.

Looking at projected occupational growth, engineering and production roles will grow more slowly than average, but strong need and opportunities exist for the roles most closely linked to advanced manufacturing, such as machinists, industrial maintenance technicians, and mechanical engineers.

Table 24: Engineering, Science, and Production Occupation Families Summary

<table>
<thead>
<tr>
<th>Family</th>
<th>2015 Employment</th>
<th>Annual Openings 2015-2025</th>
<th>% of Openings requiring Bachelor’s Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture &amp; Engineering</td>
<td>22,736</td>
<td>1,350</td>
<td>76%</td>
</tr>
<tr>
<td>Production and Maintenance</td>
<td>86,802</td>
<td>8,499</td>
<td>7%</td>
</tr>
<tr>
<td>Life and Physical Science</td>
<td>8,490</td>
<td>671</td>
<td>89%</td>
</tr>
</tbody>
</table>

Figure 7: Industry Demand for Engineering Workers

Figure 8: Supply and Demand of Engineering Workers

ALIGNMENT OF WORKFORCE SUPPLY AND DEMAND

Engineering Workforce: While the volume of graduating engineers at the bachelor’s and master’s level appears to align with the local demand overall, employers commonly report struggling to fill positions. Engineering roles take 20% longer to fill in Pittsburgh than nationally. Additionally, local employers indicate that they have national recruitment strategies for engineers and research scientists, in part because of an inability to find qualified graduates locally. This suggests potential misalignment between local programs and local need.

At the same time, employers may be able to adjust their processes to cultivate and attract local talent. Employers may not have the necessary internships in place to train and recruit students or may be asking for too much experience (75% of advertised posts request three or more years of experience). Further study of the alignment between local engineering programs, local workforce needs and the potential risk of misalignment is warranted.

Production and Maintenance Workforce: Demand for production work is shifting towards the roles that support advanced manufacturing and away from many of the lower-level roles that have traditionally been important sources of employment in the region. As a result, there are high levels of unemployment in the production workforce. More than 6,000 production workers and engineering technicians—the equivalent of one year of demand—are long-term unemployed. While overall growth of production workers is projected to slightly decline (-1% over the next 10 years), an aging workforce means employers will need to fill nearly 7,000 roles per year due to replacement. Looking more narrowly at welders, machinists, and other roles which typically utilize post-secondary programs, there are over 1,000 projected annual openings, against only 472 completions in the last year.
"Unions do an excellent job of training, and the training is free, but certain fields are not attracting enough candidates. The need for highly skilled mechanics is large and will remain so, but while we had more than 1,000 interested in becoming an operating engineer, we had only 75 applicants seeking a career as a mechanic."

As the job market has evolved, it does not appear that the training ecosystem for production roles has kept pace, as Career and Technology Centers (CTCs) are not projected to fill gaps in the Production workforce. Skilled production roles will grow fastest among the production occupations, but total enrollment in CTC programs is under 1,000 for Machine Tool Technology, Precision Metal Work, and Welding programs. At the community college level, employers would like to see educational alignment strengthened.

"It seems like all of the community colleges are fragmented causing them to have similar, overlapping programs. They appear to be in competition rather than collaboration with one another."

**CHANGING 21ST CENTURY WORKFORCE**

Advanced manufacturing leads to smaller quantity, but higher skilled employees: The value of manufacturing output has increased by over 10% in Pittsburgh since 2010, almost returning to pre-recession levels, while employment has remained flat. The increased ratio of the value of manufacturing output to the number of people employed is a national trend that will likely continue. Increases in automation, the scaling of additive manufacturing, and the development of new more efficient production techniques will continue to transform the manufacturing workforce.

**Figure 9: Manufacturing Output and Manufacturing Employment in Greater Pittsburgh**

**Greater Pittsburgh Production vs Production Jobs**

Index, 2010 = 100

<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>96</td>
</tr>
<tr>
<td>2011</td>
<td>100</td>
</tr>
<tr>
<td>2012</td>
<td>104</td>
</tr>
<tr>
<td>2013</td>
<td>108</td>
</tr>
<tr>
<td>2014</td>
<td>112</td>
</tr>
<tr>
<td>2015</td>
<td>116</td>
</tr>
</tbody>
</table>

CHANGING 21ST CENTURY WORKFORCE

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**Greater Pittsburgh Production vs Production Jobs**

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<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>96</td>
</tr>
<tr>
<td>2011</td>
<td>100</td>
</tr>
<tr>
<td>2012</td>
<td>104</td>
</tr>
<tr>
<td>2013</td>
<td>108</td>
</tr>
<tr>
<td>2014</td>
<td>112</td>
</tr>
<tr>
<td>2015</td>
<td>116</td>
</tr>
</tbody>
</table>

**Sources:**
### Table 26: Engineering Occupations Summary Table

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineers</td>
<td>3,847</td>
<td>$76,410</td>
<td>9%</td>
<td>247</td>
<td>98%</td>
<td>1.52</td>
</tr>
<tr>
<td>Industrial Engineers</td>
<td>3,112</td>
<td>$81,880</td>
<td>2%</td>
<td>176</td>
<td>98%</td>
<td>1.13</td>
</tr>
<tr>
<td>Mechanical Engineers</td>
<td>2,548</td>
<td>$84,190</td>
<td>10%</td>
<td>163</td>
<td>99%</td>
<td>1.11</td>
</tr>
<tr>
<td>Electrical Engineers</td>
<td>2,045</td>
<td>$85,980</td>
<td>2%</td>
<td>110</td>
<td>98%</td>
<td>1.20</td>
</tr>
<tr>
<td>Electrical &amp; Electronic Engineering Technicians</td>
<td>1,268</td>
<td>$52,560</td>
<td>-9%</td>
<td>74</td>
<td>14%</td>
<td>1.01</td>
</tr>
<tr>
<td>Architectural &amp; Civil Drafters</td>
<td>1,261</td>
<td>$50,280</td>
<td>-15%</td>
<td>71</td>
<td>28%</td>
<td>1.59</td>
</tr>
<tr>
<td>Mechanical Drafters</td>
<td>1,205</td>
<td>$48,750</td>
<td>0%</td>
<td>68</td>
<td>13%</td>
<td>1.74</td>
</tr>
<tr>
<td>Electronics Engineers</td>
<td>1,065</td>
<td>$74,770</td>
<td>-3%</td>
<td>55</td>
<td>90%</td>
<td>0.51</td>
</tr>
<tr>
<td>Architects</td>
<td>807</td>
<td>$78,020</td>
<td>4%</td>
<td>47</td>
<td>99%</td>
<td>0.52</td>
</tr>
<tr>
<td>Environmental Engineers</td>
<td>625</td>
<td>$82,940</td>
<td>7%</td>
<td>37</td>
<td>100%</td>
<td>1.89</td>
</tr>
<tr>
<td>Civil Engineering Technicians</td>
<td>586</td>
<td>$48,530</td>
<td>2%</td>
<td>36</td>
<td>45%</td>
<td>1.28</td>
</tr>
<tr>
<td>Electrical &amp; Electronic Technicians</td>
<td>534</td>
<td>$58,410</td>
<td>2%</td>
<td>31</td>
<td>2%</td>
<td>1.21</td>
</tr>
<tr>
<td>Engineers, Other</td>
<td>407</td>
<td>$96,610</td>
<td>11%</td>
<td>26</td>
<td>91%</td>
<td>0.63</td>
</tr>
<tr>
<td>Industrial Engineering Technicians</td>
<td>388</td>
<td>$49,360</td>
<td>4%</td>
<td>24</td>
<td>7%</td>
<td>0.66</td>
</tr>
<tr>
<td>Mechanical Engineering Technicians</td>
<td>363</td>
<td>$49,100</td>
<td>3%</td>
<td>22</td>
<td>22%</td>
<td>0.96</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>22,736</strong></td>
<td><strong>$69,990</strong></td>
<td><strong>3%</strong></td>
<td><strong>1,350</strong></td>
<td><strong>76%</strong></td>
<td><strong>1.10</strong></td>
</tr>
</tbody>
</table>

**Sources:**
- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- % Requesting BA: Burning Glass job postings data
- Location Quotient: BLS Occupational Employment Statistics

Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendices.
### Table 27: Production and Maintenance Occupations Summary Table

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance &amp; Repair Workers, General</td>
<td>15,378</td>
<td>$37,800</td>
<td>3%</td>
<td>1,227</td>
</tr>
<tr>
<td>Team Assemblers</td>
<td>7,430</td>
<td>$29,020</td>
<td>-1%</td>
<td>790</td>
</tr>
<tr>
<td>Supervisors - Production &amp; Operating Workers</td>
<td>5,503</td>
<td>$58,620</td>
<td>0%</td>
<td>485</td>
</tr>
<tr>
<td>Machinists</td>
<td>4,567</td>
<td>$37,270</td>
<td>11%</td>
<td>483</td>
</tr>
<tr>
<td>Inspectors, Testers, Sorters, Samplers &amp; Weighers</td>
<td>4,469</td>
<td>$39,680</td>
<td>0%</td>
<td>446</td>
</tr>
<tr>
<td>Welders, Cutters, Solders &amp; Brazers</td>
<td>3,691</td>
<td>$38,840</td>
<td>3%</td>
<td>368</td>
</tr>
<tr>
<td>Industrial Machinery Mechanics</td>
<td>3,677</td>
<td>$46,920</td>
<td>20%</td>
<td>342</td>
</tr>
<tr>
<td>Helpers - Production Workers</td>
<td>3,466</td>
<td>$29,180</td>
<td>-4%</td>
<td>452</td>
</tr>
<tr>
<td>Supervisors - Mechanics, Installers &amp; Repairers</td>
<td>3,355</td>
<td>$64,320</td>
<td>2%</td>
<td>251</td>
</tr>
<tr>
<td>Electrical &amp; Electronic Equipment Assemblers</td>
<td>2,294</td>
<td>$31,340</td>
<td>-3%</td>
<td>249</td>
</tr>
<tr>
<td>Packaging &amp; Filing Machine Operators</td>
<td>2,049</td>
<td>$37,140</td>
<td>6%</td>
<td>299</td>
</tr>
<tr>
<td>Cutting, Punching &amp; Press Machine Operators</td>
<td>1,921</td>
<td>$36,020</td>
<td>-15%</td>
<td>192</td>
</tr>
<tr>
<td>Computer-Controlled Machine Tool Operators</td>
<td>1,499</td>
<td>$37,830</td>
<td>2%</td>
<td>242</td>
</tr>
<tr>
<td>Grinding, Lapping, Polishing &amp; Buffing Machine Tool Operators</td>
<td>1,258</td>
<td>$35,860</td>
<td>1%</td>
<td>178</td>
</tr>
<tr>
<td>Printing Press Operators</td>
<td>1,229</td>
<td>$31,760</td>
<td>16%</td>
<td>163</td>
</tr>
<tr>
<td>Water &amp; Wastewater Treatment Plant &amp; System Operators</td>
<td>1,222</td>
<td>$46,290</td>
<td>2%</td>
<td>101</td>
</tr>
<tr>
<td>Tool &amp; Die Makers</td>
<td>581</td>
<td>$44,250</td>
<td>2%</td>
<td>90</td>
</tr>
<tr>
<td>Computer Numerically Controlled Machine Tool Programmers</td>
<td>248</td>
<td>$46,590</td>
<td>0%</td>
<td>54</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>86,802</strong></td>
<td><strong>$38,777</strong></td>
<td><strong>1%</strong></td>
<td><strong>8,499</strong></td>
</tr>
</tbody>
</table>

**Sources:**
- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- Location Quotient: BLS Occupational Employment Statistics
- Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendix.

### Key Findings: Skills and Credentials

#### Upskilling: Employers Request Higher-Level Skills and Credentials

Changing skill requirements leave middle-skill workers at risk of being left behind. In order to help the workforce adapt, advanced manufacturing training programs should be reoriented to help upskill the 6,000 unemployed production workers and engineering technicians. Stronger and better articulated career ladders are necessary to help job seekers move into the roles which represent the future of the manufacturing industry.

Drafting and technician roles, both declining relative to the overall market, are becoming more specialized. This has created a more challenging market for sub-baccalaureate engineering roles. Drafters represent almost 25% of the unemployed workers from the Engineering family; however, these roles are declining by 15% over the next 10 years, compared to 4.2% for the economy overall. Fewer drafters are needed because software has made the process more efficient and a new generation of engineering workers is well versed in using design software directly. The positions that remain have become more sophisticated and are asking for greater levels of specialization and expertise, becoming more similar to engineers.

### Executive Summary

#### How to Use This Report

- Occupational Demand and Talent Supply
- Recommendations for Action
- High Demand Occupational Sectors
- Information Technology
- Business and Finance
- Engineering, Science and Production
- Healthcare
- Construction
- Profiled Industry Sectors
- Energy
- Retail and Hospitality

### Appendices: Methodology

- About Burning Glass Posting Data
- Occupational Projections
- Analysis of Retention of Graduates
- Qualitative Methodology
- About the Authors
- Online Appendices

### End Notes

- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- Location Quotient: BLS Occupational Employment Statistics
- Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendix.
Figure 10: Growth of Engineering Occupations
Projected 10-Year Growth for Engineering Roles

<table>
<thead>
<tr>
<th>Role</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineers</td>
<td>5%</td>
</tr>
<tr>
<td>Engineering Technicians</td>
<td>3%</td>
</tr>
<tr>
<td>Drafters</td>
<td>6%</td>
</tr>
<tr>
<td>All Jobs</td>
<td>4%</td>
</tr>
</tbody>
</table>

Source: Burning Glass Application of Bureau of Labor Statistics

Opportunities for the region to build on its advanced manufacturing strengths: Pittsburgh has important assets that position it well to succeed in the 21st century manufacturing economy. Its status as a research hub, particularly in fields such as robotics, make it a center for innovation and job creation for firms in the region. In April 2016, General Electric opened a $39 million additive manufacturing plant in Findlay Township. Similarly, the area has attracted firms focusing on autonomous vehicles (such as Uber) which are eager to locate in Pittsburgh’s leading engineering research facilities. As additive manufacturing industries flourish in the region, Pittsburgh can promote the development of these industries by cultivating a talent base that has the skills which these emerging fields will draw from. The table above shows the top job titles, occupations and skills related to autonomous vehicles.

**DATA TABLES**
The tables below displays top skills in demand for the occupation family. Skill demand is based on an analysis of job postings data. While employers do not name every skill required for an occupation, the postings reflect those skills that employers are looking for in candidates, both specialized (technical, occupation-specific) and baseline (cross-cutting, or soft skills). Baseline skills represent 29% of skill demand in Engineering occupations, and 32% of demand for Production. The high relative demand for baseline skills reflects the importance of these capabilities to employers in the hiring process.

Table 28: Top Jobs and Skills Related to Autonomous Vehicles

<table>
<thead>
<tr>
<th>Top Titles, Autonomous Vehicle Roles</th>
<th>Top Occupations</th>
<th>Top Skills</th>
<th>Concentration in Pittsburgh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Learning Engineer</td>
<td>Software Developer, Applications</td>
<td>LINUX</td>
<td>Average</td>
</tr>
<tr>
<td>Systems Engineer</td>
<td>Electrical Engineer</td>
<td>Robotics</td>
<td>High</td>
</tr>
<tr>
<td>Software Development Engineer</td>
<td>Computer Systems Engineer</td>
<td>C++</td>
<td>Average</td>
</tr>
<tr>
<td>UAV/LIM Designer</td>
<td>Computer and Information Research Scientists</td>
<td>Simulation</td>
<td>Average</td>
</tr>
<tr>
<td>Risk Analyst</td>
<td>Mechanical Engineer</td>
<td>MATLAB</td>
<td>Average</td>
</tr>
<tr>
<td>Analytic Data Scientist</td>
<td>Geospatial Information Scientists and Technologists</td>
<td>Electrical Engineering</td>
<td>Very High</td>
</tr>
<tr>
<td>Java Software Developer</td>
<td>Business Intelligence Analysts</td>
<td>Python</td>
<td>Low</td>
</tr>
<tr>
<td>Mechanical Engineer</td>
<td>Software QA Engineers and Testers</td>
<td>Prototyping</td>
<td>Very High</td>
</tr>
<tr>
<td>Transportation Engineer</td>
<td>Risk Management Specialists</td>
<td>Systems Engineering</td>
<td>Average</td>
</tr>
</tbody>
</table>

Source: Burning Glass Job postings

Table 29: Skill Demand for Engineering Workers

<table>
<thead>
<tr>
<th>Specialized Skills</th>
<th>Baseline Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. AutoCAD</td>
<td>Communication Skills</td>
</tr>
<tr>
<td>2. Electrical Engineering</td>
<td>Project Management</td>
</tr>
<tr>
<td>3. Mechanical Engineering</td>
<td>Writing</td>
</tr>
<tr>
<td>4. Computer Aided Drafting/Design (CAD)</td>
<td>Organizational Skills</td>
</tr>
<tr>
<td>5. Civil Engineering</td>
<td>Planning</td>
</tr>
<tr>
<td>6. Repair</td>
<td>Microsoft Office</td>
</tr>
<tr>
<td>7. Inspection</td>
<td>Microsoft Excel</td>
</tr>
<tr>
<td>8. Manufacturing Processes</td>
<td>Troubleshooting</td>
</tr>
<tr>
<td>10. Engineer in Training</td>
<td>Quality Assurance and Control</td>
</tr>
</tbody>
</table>

Source: Burning Glass Job postings
Encourage development of high-skill internships with local universities to shift hiring from national to local: Many of the advanced manufacturing jobs in the Pittsburgh region are in research and development, requiring highly-skilled engineers and scientists. Local institutions, especially Carnegie Mellon and the University of Pittsburgh, have the potential to feed students into this work via internships and retain local talent. At present, employers are using national recruiting to fill positions in Pittsburgh, with the Biological and Physical Scientist occupations among the highest net importers of talent.

Create explicit pathways to upward mobility in Engineering and Production roles: As the manufacturing workforce changes and many production roles decline due to automation, the employers and training institutions may need to rethink traditional pathways into these roles. The large number of unemployed production workers and engineering technicians will likely need additional training to move into the advanced manufacturing jobs which are driving growth. Creating well-defined, well-articulated and commonly agreed upon career ladders can help address the scale of this challenge by bringing workers, training providers and industry together around a common language with shared expectations. The diagram below provides an example of the kind of career ladders that regional stakeholders can develop and rally around.

Similarly, the identification, by employers, of common cross-cutting skills which make workers more resilient to economic and technical changes in the market, will help to smooth transitions for workers and create a larger pool of available talent for employers.

Broaden CTE pathways to bring more students into Production and Engineering: Employers, training providers, and the full range of community stakeholders must work to address the stigma associated with production and manufacturing jobs. Students and their parents push against pathways into production work which is often perceived as “dirty” and volatile given the layoffs that have occurred in recent years. The heavy emphasis on attending 4-year colleges draws students away from traditionally constructed CTE programs. One promising approach is to broaden the scope of the CTE programs so that they prepare students for the full range of jobs in a professional pathway, not just those which do not require a BA. This means creating engineering and production programs which provide a broad range of competencies from the occupational area such as strong math skills, specialized software skills, and introductions to robotics. From these, students can be equally well prepared to continue toward a Bachelor’s in Engineering or move into a production or technician role with shorter term post-secondary training requirements.

“The schools need to do more than just have industry advisory boards; they need to build real partnerships with industry. Retired HR professionals might be willing to go into the schools to share what employers are looking for.”

**ECONOMIC DEVELOPMENT AND EMPLOYER RECOMMENDATIONS**

Focus on and Build from Strengths as an Advanced Manufacturing Cluster: Pittsburgh is viewed as a leader in advanced manufacturing with recent investments from Uber in autonomous vehicles, GE in additive manufacturing and others confirming this trend. The region should double down on investments in cutting-edge research in order to reinforce the advanced manufacturing cluster in the region. In particular, this means employers and universities should work together to explicitly reinforce, develop, and promote a workforce with the engineering research, computer science research, and advanced production skills that power research and manufacturing innovation.
Figure 11: Example Career Ladder: Advanced Manufacturing

**Advanced Manufacturing Pathway**

- **Certification In-Demand**
  - American Welding Society Certification
  - Knowledge of metallurgy and various welding techniques
  - Ability to prepare machinery for operation using numerical computer programming techniques and CAD software
  - Use of hand tools, interpreting blueprints and basic machine operation
  - Operate specialized machine tools to perform precision operations
  - Fabricate, inspect and modify machinery parts
  - Coordinate and assess the operations of the manufacturing team
  - Manage manufacturing floor for efficient operation

- **Demand**
  - Low
  - Medium
  - High

- **Subject Intensive**
  - Math
  - Writing
  - People Skills
  - Skilled Labor
  - Science
  - Computer Skills

- **Core Skills**
  - Skilled and Technical Sciences

- **Skills**
  - People Skills
  - Science
  - Computer Skills

- **Machine Operators**
  - $16
  - Use of hand tools, interpreting blueprints and basic machine operation
  - Responsible for cleaning and maintaining manufacturing floor

- **Welders**
  - $19
  - Knowledge of metallurgy and various welding techniques

- **Machinists**
  - $18
  - Operate specialized machine tools to perform precision operations
  - Fabricate, inspect and modify machinery parts

- **CNC Programmers**
  - $22
  - Ability to prepare machinery for operation using numerical computer programming techniques and CAD software

- **Manufacturing Supervisors**
  - $28
  - Coordinate and assess the operations of the manufacturing team
  - Manage manufacturing floor for efficient operation

- **Executive Summary**
  - How to Use This Report
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    - Qualitative Methodology
    - About the Authors
    - Online Appendices
  - End Notes
Industry demand for healthcare talent is being shaped by an aging population. Employers face the dual challenge of replacing older workers in the workforce as well as increasing workers as the population ages. Healthcare occupations are projected to grow nearly twice as fast as the job market overall over the next ten years.

Table 31: Healthcare Occupation Family Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Healthcare Practitioners</th>
<th>Healthcare Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 Employment</td>
<td>75,043</td>
<td>40,514</td>
</tr>
<tr>
<td>Annual Openings 2015-2025</td>
<td>4,174</td>
<td>5,103</td>
</tr>
<tr>
<td>% of Openings Requiring Bachelor’s Degree</td>
<td>53%</td>
<td>—*</td>
</tr>
</tbody>
</table>

*Not typically relevant.

But shortages are projected at the sub-baccalaureate level. Occupations at risk of being undersupplied include Licensed Practical Nurses, Medical Records Technicians, Dental Hygienists, and Respiratory Therapists, which all have fewer annual degree completions than projected openings. The rapid expansion of healthcare roles and the volume of hiring needed will put pressure on employers to have well-articulated pipelines and hiring systems in place. Three of the four fastest projected growth (minimum 500 employed) healthcare occupations directly correspond to an aging population: Physical and Occupational Therapist Assistants and Home Health Aides. Many employers noted the reduction in high school level training, suggesting the need for healthcare CTE programs to return.

Education and training providers are not ready for the scope and scale of changes within the industry.

UPMC recently announced that it will raise entry level wages to a minimum of $15 over the next three years. This development has the potential to reshape the market for many lower skill healthcare roles, particularly if other major employers follow suit. Increased wages will make careers more attractive to job seekers, and could increase retention.

Supply and demand dynamics for specific healthcare roles: In the aggregate, local healthcare graduates meet the expected future annual demand at the Practitioner level. This leads to a below average time to hire locally compared to national averages.

“Education and training providers are not ready for the scope and scale of changes within the industry.”

The workforce does not represent the diversity of the population: Employers express difficulty finding a diverse workforce for practitioner and support roles. Employers seek workers that can support both cultural differences in the community and understand health disparities across the population and create a more welcoming provider environment.

CHANGING 21ST CENTURY WORKFORCE

Employer demand and training programs are not aligned for many positions: Several critical practitioner roles – LPNs, Technologists, etc. – require direct training and licensure. However, employers are not finding the talent needed from traditional programs and must seek new pipelines. For example, one employer indicates adapting its need for Medical Technologist positions by hiring unlicensed science degree holders. The employer then trains employees and works toward obtaining licensure. More broadly, employers do not believe training programs are prepared to adjust to the speed and scope of industry changes.

Advanced technologies are changing healthcare delivery: New technologies are radically transforming healthcare. In some cases, the workforce implications are clear: the rise of electronic health records has created a new class of clinical analyst jobs and nurses with IT and data analysis skills. In others, the technologies are only now being developed. CMU’s Quality of Life Technology Center provides an opportunity for Pittsburgh to be on the front lines of innovation around the technologies needed to support an aging population.

“Healthcare is traditionally behind in technology changes. In the future, networking, development and automation technology skills will shift from technical to core skills for most key positions.”

HEALTHCARE
### Table 32: Healthcare Practitioners Occupation Summary

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>Completions, 2014</th>
<th>Completions: Openings Ratio</th>
<th>Typical Degree Level</th>
<th>Location Quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered Nurses</td>
<td>29,579</td>
<td>$61,220</td>
<td>13%</td>
<td>1,705</td>
<td>2,244</td>
<td>1.0</td>
<td>37% BA</td>
<td>1.35</td>
</tr>
<tr>
<td>Licensed Practical &amp; Licensed Vocational Nurses</td>
<td>5,632</td>
<td>$42,140</td>
<td>15%</td>
<td>362</td>
<td>312</td>
<td>0.7</td>
<td>HS</td>
<td>1.00</td>
</tr>
<tr>
<td>Physicians &amp; Surgeons, Other</td>
<td>4,365</td>
<td>**</td>
<td>9%</td>
<td>165</td>
<td>150</td>
<td>0.5</td>
<td>Doctorate</td>
<td>1.60</td>
</tr>
<tr>
<td>Pharmacy Technicians</td>
<td>3,122</td>
<td>$28,700</td>
<td>5%</td>
<td>189</td>
<td>62</td>
<td>N/A*</td>
<td>HS</td>
<td>0.90</td>
</tr>
<tr>
<td>Emergency Medical Technicians &amp; Paramedics</td>
<td>3,072</td>
<td>$31,160</td>
<td>16%</td>
<td>193</td>
<td>0</td>
<td>N/A*</td>
<td>HS</td>
<td>1.30</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>2,677</td>
<td>$107,140</td>
<td>2%</td>
<td>106</td>
<td>299</td>
<td>2.0</td>
<td>Doctorate</td>
<td>1.06</td>
</tr>
<tr>
<td>Physical Therapists</td>
<td>2,451</td>
<td>$80,050</td>
<td>21%</td>
<td>147</td>
<td>197</td>
<td>1.0</td>
<td>Graduate</td>
<td>1.46</td>
</tr>
<tr>
<td>Radiologic Technologists</td>
<td>2,375</td>
<td>$48,430</td>
<td>6%</td>
<td>119</td>
<td>189</td>
<td>1.4</td>
<td>24% BA</td>
<td>1.50</td>
</tr>
<tr>
<td>Medical &amp; Clinical Laboratory Technologists</td>
<td>1,953</td>
<td>$53,280</td>
<td>4%</td>
<td>94</td>
<td>5</td>
<td>N/A*</td>
<td>83% BA</td>
<td>1.31</td>
</tr>
<tr>
<td>Dental Hygienists</td>
<td>1,889</td>
<td>$55,800</td>
<td>9%</td>
<td>101</td>
<td>51</td>
<td>0.4</td>
<td>31% BA</td>
<td>1.46</td>
</tr>
<tr>
<td>Medical &amp; Clinical Laboratory Technicians</td>
<td>1,866</td>
<td>$35,980</td>
<td>3%</td>
<td>89</td>
<td>25</td>
<td>0.2</td>
<td>24% BA</td>
<td>1.39</td>
</tr>
<tr>
<td>Occupational Therapists</td>
<td>1,573</td>
<td>$67,720</td>
<td>20%</td>
<td>87</td>
<td>179</td>
<td>1.5</td>
<td>Graduate</td>
<td>1.67</td>
</tr>
<tr>
<td>Medical Records &amp; Health Information Technicians</td>
<td>1,534</td>
<td>$36,680</td>
<td>11%</td>
<td>95</td>
<td>86</td>
<td>0.8</td>
<td>31%</td>
<td>0.91</td>
</tr>
<tr>
<td>Respiratory Therapists</td>
<td>1,335</td>
<td>$51,770</td>
<td>10%</td>
<td>67</td>
<td>66</td>
<td>0.8</td>
<td>30%</td>
<td>1.35</td>
</tr>
<tr>
<td>Physician Assistants</td>
<td>1,056</td>
<td>$84,460</td>
<td>11%</td>
<td>58</td>
<td>242</td>
<td>3.7</td>
<td>Graduate</td>
<td>1.29</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>75,042</strong></td>
<td><strong>$57,470</strong></td>
<td><strong>12%</strong></td>
<td><strong>3,578</strong></td>
<td><strong>4,174</strong></td>
<td><strong>53%</strong></td>
<td><strong>1.21</strong></td>
<td></td>
</tr>
</tbody>
</table>

* Roles with near-zero completions-openings ratios are listed as N/A. Pharmacy Technicians are N/A as the positions typically require on-the-job experience.

** Physicians and Surgeons salary data not available from the BLS.

Sources:
- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- Location Quotient: BLS Occupational Employment Statistics

Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendix.
HEALTHCARE SKILLS AND CREDENTIALS

Management skills are required, especially to support home health staff: increased management skills are in demand across occupations, particularly in nursing and related roles. Cost pressures are pushing additional responsibility, including management, into new roles. Additionally, as home healthcare becomes a larger portion of the care delivered by healthcare organizations, employees across occupations are required to have relevant skills to support this population. Nurses and other practitioners must be able to perform home health assignments and oversee the support level home health staff in the field. Employers face a challenge with the supervision of remote staff in healthcare, which is a new skill set that will continue to grow.

Customer service skills are increasingly important across clinical care occupations: employers seek customer service skills across nursing roles, registrars, phlebotomists, and more, due to the importance of building relationships with patients and the increased importance of quality of care metrics. Finding and training workers with these skills has been a challenge for employers. Entry level clinical positions need these skills as employers view patients as long-term customers.

"Healthcare is moving to a new customer-focused model, but we still need the clinical and technical expertise."

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing Assistants</td>
<td>13,579</td>
<td>$27,380</td>
<td>7%</td>
<td>1,609</td>
<td>1.14</td>
</tr>
<tr>
<td>Home Health Aides</td>
<td>12,242</td>
<td>$21,030</td>
<td>25%</td>
<td>1,671</td>
<td>1.22</td>
</tr>
<tr>
<td>Medical Assistants</td>
<td>5,661</td>
<td>$27,750</td>
<td>15%</td>
<td>733</td>
<td>1.10</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>2,001</td>
<td>$32,050</td>
<td>6%</td>
<td>234</td>
<td>0.83</td>
</tr>
<tr>
<td>Medical Transcriptionists</td>
<td>1,238</td>
<td>$34,820</td>
<td>9%</td>
<td>118</td>
<td>1.83</td>
</tr>
<tr>
<td>Phlebotomists</td>
<td>1,094</td>
<td>$28,160</td>
<td>11%</td>
<td>125</td>
<td>1.03</td>
</tr>
<tr>
<td>Orderlies</td>
<td>900</td>
<td>$24,580</td>
<td>5%</td>
<td>105</td>
<td>2.09</td>
</tr>
<tr>
<td>Physical Therapist Assistants</td>
<td>863</td>
<td>$47,920</td>
<td>31%</td>
<td>117</td>
<td>1.33</td>
</tr>
<tr>
<td>Occupational Therapy Assistants</td>
<td>705</td>
<td>$47,670</td>
<td>30%</td>
<td>99</td>
<td>2.71</td>
</tr>
<tr>
<td>Pharmacy Aides</td>
<td>471</td>
<td>$26,840</td>
<td>0%</td>
<td>59</td>
<td>1.16</td>
</tr>
<tr>
<td>Medical Equipment Preparers</td>
<td>412</td>
<td>$28,710</td>
<td>8%</td>
<td>53</td>
<td>1.16</td>
</tr>
<tr>
<td>Physical Therapist Aides</td>
<td>389</td>
<td>$31,610</td>
<td>40%</td>
<td>57</td>
<td>1.64</td>
</tr>
<tr>
<td>Healthcare Support Workers, Other</td>
<td>285</td>
<td>$37,140</td>
<td>3%</td>
<td>35</td>
<td>0.69</td>
</tr>
<tr>
<td>Massage Therapists</td>
<td>215</td>
<td>$29,550</td>
<td>17%</td>
<td>26</td>
<td>0.44</td>
</tr>
<tr>
<td>Veterinary Assistants &amp; Laboratory Animal Caretakers</td>
<td>210</td>
<td>$22,880</td>
<td>0%</td>
<td>29</td>
<td>0.84</td>
</tr>
<tr>
<td>Grand Total</td>
<td>40,514</td>
<td>$26,920</td>
<td>15%</td>
<td>5,103</td>
<td>1.13</td>
</tr>
</tbody>
</table>

Sources:
Employment: Bureau of Labor Statistics and Burning Glass model
Median Salary: BLS Occupational Employment Statistics
% Requesting BA: Burning Glass job postings data
Location Quotient: BLS Occupational Employment Statistics
Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendix.
UPSKILLING: EMPLOYERS REQUEST HIGHER-LEVEL SKILLS AND CREDENTIALS

Employers desire specialist roles and clinical experience from new entrants: Many healthcare employers noted an increased demand for specialized nurses (e.g., trauma, geriatrics, etc.) however training for these roles is typically on the job, meaning that new entrants to the field are not immediately qualified for these roles. Employers express a desire for new entrants to the market to have more robust clinical experience than is commonly available through training programs.

Business and analysis skills in healthcare: As healthcare becomes more outcome focused, healthcare workers are expected to have a stronger understanding of the business implications of their care decisions and to be savvier at working with various forms of health data.

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<tbody>
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The demands put on healthcare workers are changing and the importance of non-clinical skills for clinical workers has grown. For example, the top 10 skills required for LPNs include traditional healthcare (patient care, medication administration), customer service skills (patient/family education and instruction), and core leadership (treatment planning). Employers and training providers should work together to develop creative approaches to address non-clinical skill training that is targeted to structured certification requirements.

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However, the outward migration of educated workers of color is hampering the effort to create a representative employee base. Only 5% of Healthcare Practitioners, and 4% of Healthcare Support workers locally are African American, compared to just over 8% of the population as a whole. Developing a regional training strategy for bringing a diverse workforce to healthcare can help address this critical need. This can include training diverse workers in non-clinical roles to shift to clinical positions.

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CONSTRUCTION

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Almost 58,000 workers are employed in construction in the Pittsburgh region. But slow growth and cyclical behavior provide challenges for the local market outside of roles with specific apprenticeships. The majority of supervisors are in the Baby Boomer generation, and the quantity of talent coming from CTE providers is not high enough, especially with the potential for spikes from large ethane cracker projects.

While the occupation group is not projected to expand based on traditional econometric models, there are two proposed ethane cracker projects (by Shell Chemical Appalachia LLC and PTT Global Chemical) that will potentially place stress on the 10-county southwestern Pennsylvania region’s construction workforce. For example, the construction phase of the project proposed by Shell Chemical Appalachia LLC is projected to directly employ 1,900 to 2,300 workers in the region, and indirectly support up to an additional 1,300 workers.21

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Table 35: Construction Occupation Family Summary

<table>
<thead>
<tr>
<th></th>
<th>2015 Employment</th>
<th>Annual Openings 2015-2025</th>
<th>% of Openings Requiring Bachelor’s Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Managers and Estimators</td>
<td>972</td>
<td>9,922</td>
<td>6%</td>
</tr>
<tr>
<td>Inspectors (Construction)</td>
<td>972</td>
<td>9,922</td>
<td>6%</td>
</tr>
<tr>
<td>Electricians</td>
<td>1,649</td>
<td>18,529</td>
<td>1%</td>
</tr>
<tr>
<td>Laborers</td>
<td>7,105</td>
<td>84,222</td>
<td>1%</td>
</tr>
<tr>
<td>Brick masons</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Carpenters</td>
<td>2,000</td>
<td>23,647</td>
<td>1%</td>
</tr>
<tr>
<td>Plumbers</td>
<td>1,364</td>
<td>15,832</td>
<td>1%</td>
</tr>
<tr>
<td>Mechanics</td>
<td>1,800</td>
<td>20,907</td>
<td>1%</td>
</tr>
<tr>
<td>Machinists</td>
<td>954</td>
<td>11,000</td>
<td>1%</td>
</tr>
<tr>
<td>Painter</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Painters</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Inspectors (Paving)</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Inspectors (Surfacing)</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Inspectors (Surface)</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Inspectors (Tamping)</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
<tr>
<td>Inspectors (Equipment)</td>
<td>1,200</td>
<td>13,910</td>
<td>1%</td>
</tr>
</tbody>
</table>

 ALIGNMENT OF WORKFORCE SUPPLY AND DEMAND

Few occupations will grow faster than the overall workforce, but there is the potential for large demand spikes: Brick masons (11%), Laborers (9%), and Paving, Surfacing & Tamping Equipment Operators (8%) are among the few occupations projected to grow faster than 4.2%, the overall market rate for the next decade. Construction and Building Inspectors, projected to grow at 6%, is one of the few construction roles where employers regularly request a Bachelor’s degree.

The demand for occupations will vary over time, with the potential for casualties that can create waves, but never a tsunami; these crackers would represent a tsunami.3 While the occupation group is not projected to expand based on traditional econometric models, there are two proposed ethane cracker projects (by Shell Chemical Appalachia LLC and PTT Global Chemical) that will potentially place stress on the 10-county southwestern Pennsylvania region’s construction workforce. For example, the construction phase of the project proposed by Shell Chemical Appalachia LLC is projected to directly employ 1,900 to 2,300 workers in the region, and indirectly support up to an additional 1,300 workers.

This is despite the Construction and Extraction occupation family having over 9,000 long-term unemployed workers (Source: American Community Survey), who alone could fill more than one year of demand. The largest segment of long-term unemployed are laborers, indicating a need to upskill those working into more specialized roles and/or to provide training which allows them to seek employment across a range of industries such as energy or production.

Career and Technical Education and Apprenticeship programs provide a strong pipeline: The largest set of CTE enrollment is in skilled trades (38%), and the employers and trade unions have strong partnerships with them. While graduates are often prepared, the raw numbers are not sufficient to fill the more than 5,000 annual openings. The Builders Guild of Western Pennsylvania, Inc., representing unions and contractors, provides tours and is working to support education administrators in better understanding the opportunities in order to recruit into the apprenticeship programs. The trade unions noted a misperception that apprenticeships were only for recent high school graduates, but the average age of an apprentice is 27. Unions note the career payback is of value for candidates into their 40s. As is the case in production and other skilled trade jobs, students and parents resist these opportunities in K-12 education due to a stigma regarding the roles.

CONSTRUCTION SKILLS AND CREDENTIALS

HIBRID JOBS: BLENDING DIVERSE SKILL SETS INTO A SINGLE ROLE

Employers require math skills that candidates commonly struggle with when graduating from high school. Employers are looking for algebra and geometry skills, but struggle to find candidates with sufficient abilities; apprenticeships require aptitude tests.

"Math skills are a big issue across many businesses. We've been successful in focusing math training to what will actually be required on the job. The math you need as an operator is different than the math for carpentry. Narrowing the breadth of math training has created something very achievable for students."

Roles, especially supervisory roles, are tech enabled: Employers emphasize that many jobs, especially supervisory roles are now tech enabled. For example, work orders and blueprints are now being delivered through iPads. Similarly, as construction equipment becomes more complicated, the need for a technologyiterate workforce also grows. Mechanics were noted as an occupation that was particularly affected by this change. Employers seek workers able to be trained on equipment technology, including for repair and maintenance.

“These positions use laptops more than they use wrenches.”

UPSKILLING: EMPLOYERS REQUEST HIGHER-LEVEL SKILLS AND CREDENTIALS

Adding supervisory-level skills is a hard sell to the construction workforce: Several construction roles include clear ladders from apprenticeship through journeyman, foreman, and superintendent. However, employers find that many employees are “not interested” in promotions. This resistance is due to paperwork and non-trade tasks, as well as loss of overtime pay. Carpentry apprenticeship programs have begun working to move the top 3rd year (of 4) apprentices to earn management training.

“Math skills are a big issue across many businesses. We’ve been successful in focusing math training to what will actually be required on the job. The math you need as an operator is different than the math for carpentry. Narrowing the breadth of math training has created something very achievable for students.”

Almost 58,000 workers are employed in construction in the Pittsburgh region. But slow growth and cyclical behavior provide challenges for the local market outside of roles with specific apprenticeships. The majority of supervisors are in the Baby Boomer generation, and the quantity of talent coming from CTE providers is not high enough, especially with the potential for spikes from large ethane cracker projects.
### DATA TABLES

#### Table 36: Construction Occupation Summary

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpenters</td>
<td>12,209</td>
<td>$44,840</td>
<td>4%</td>
<td>1,095</td>
<td>—*</td>
<td>1.68</td>
</tr>
<tr>
<td>Construction Laborers</td>
<td>11,196</td>
<td>$36,610</td>
<td>9%</td>
<td>1,171</td>
<td>2%</td>
<td>1.25</td>
</tr>
<tr>
<td>Operating Engineers &amp; Other Construction Equipment Operators</td>
<td>5,958</td>
<td>$46,750</td>
<td>6%</td>
<td>557</td>
<td>—*</td>
<td>1.58</td>
</tr>
<tr>
<td>Plumbers, Pipefitters &amp; Steamfitters</td>
<td>5,628</td>
<td>$58,910</td>
<td>5%</td>
<td>525</td>
<td>—*</td>
<td>1.17</td>
</tr>
<tr>
<td>Supervisors - Construction Trades &amp; Extraction Workers</td>
<td>5,687</td>
<td>$65,300</td>
<td>5%</td>
<td>489</td>
<td>43%</td>
<td>0.98</td>
</tr>
<tr>
<td>Electricians</td>
<td>5,583</td>
<td>$49,700</td>
<td>5%</td>
<td>505</td>
<td>—*</td>
<td>0.98</td>
</tr>
<tr>
<td>Painters, Construction &amp; Maintenance</td>
<td>1,891</td>
<td>$37,330</td>
<td>5%</td>
<td>180</td>
<td>—*</td>
<td>0.87</td>
</tr>
<tr>
<td>Construction &amp; Building Inspectors</td>
<td>1,522</td>
<td>$51,070</td>
<td>6%</td>
<td>149</td>
<td>24%</td>
<td>1.93</td>
</tr>
<tr>
<td>Cement Masons &amp; Concrete Finishers</td>
<td>1,452</td>
<td>$51,880</td>
<td>6%</td>
<td>131</td>
<td>—*</td>
<td>0.94</td>
</tr>
<tr>
<td>Brickmasons &amp; Blockmasons</td>
<td>936</td>
<td>$50,270</td>
<td>11%</td>
<td>91</td>
<td>—*</td>
<td>1.56</td>
</tr>
<tr>
<td>Paving, Surfacing &amp; Tamping Equipment Operators</td>
<td>799</td>
<td>$53,420</td>
<td>8%</td>
<td>78</td>
<td>—*</td>
<td>1.26</td>
</tr>
<tr>
<td>Sheet Metal Workers</td>
<td>783</td>
<td>$62,210</td>
<td>3%</td>
<td>73</td>
<td>—*</td>
<td>0.77</td>
</tr>
<tr>
<td>Roofers</td>
<td>649</td>
<td>$37,180</td>
<td>1%</td>
<td>60</td>
<td>—*</td>
<td>1.01</td>
</tr>
<tr>
<td>Rotary Drill Operators, Oil &amp; Gas</td>
<td>536</td>
<td>$43,880</td>
<td>7%</td>
<td>54</td>
<td>—*</td>
<td>1.96</td>
</tr>
<tr>
<td>Mine Cutting &amp; Channeling Machine Operators</td>
<td>529</td>
<td>**</td>
<td>-26%</td>
<td>46</td>
<td>—*</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>57,739</strong></td>
<td><strong>$45,350</strong></td>
<td><strong>5%</strong></td>
<td><strong>5,422</strong></td>
<td>N/A</td>
<td>1.17</td>
</tr>
</tbody>
</table>

*This occupation does not typically call for a Bachelor's degree.

** Mix Cutting salary data not available from the BLS.

Sources:
- Employment: Bureau of Labor Statistics and Burning Glass model
- Median Salary: BLS Occupational Employment Statistics
- % Requested BA: Burning Glass job postings data
- Location Quotient: BLS Occupational Employment Statistics

Table reflects top occupations within the family. Grand totals represent the full occupation family, which can be found in the Appendix.

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### CONSTRUCTION RECOMMENDATIONS

#### REGIONAL TRAINING STRATEGIES TO DEVELOP FUTURE WORKFORCE

Convene local leaders to develop a regional pipeline and strategies for incentivizing managerial roles:

Construction Manager positions are more difficult to fill (9% longer) locally than across the country. Industry leaders should develop a joint strategy for creating a pipeline into these roles. Similarly maintaining active communication between employers and training providers is critical to building the supply needed to handle rapid increases in demand such as would occur if the ethane cracker projects move forward.

Work with cohort of unemployed workers and non-traditional pipeline to identify candidates for upskilling:

Promote career ladders for laborers to help provide advancement into more technically specific roles with lower unemployment. Electricians are one of the largest segments of unemployed workers locally; electrician positions are also 10% more difficult to fill than national averages. This indicates a direct opportunity to solve a local employment need while addressing unemployment through targeted training. Employers also point to a need to look outside traditional candidate pools and point to veterans as a population that could potentially be tapped.

In addition, workers with backgrounds in construction, production and energy roles share many similar skills. Cross training allows workers to flex between industries as demand fluctuates based on local economic needs. Creating training structures that support and encourage this flexing can help to create a workforce that is more resilient.
Profiled Industry Sectors

Energy | Retail and Hospitality
In this report, Energy is investigated as an industry, covering a range of occupations from Engineers and Construction Workers to Truck Drivers and other transportation workers. Energy Sector jobs in Greater Pittsburgh Report, produced in 2012 by Development Dimensions International for the Allegheny Conference on Community Development identified the “Targeted Jobs” for the industry. These are jobs for which employers projected high-volume hiring and difficulty finding qualified applicants. The outcome included the identification of 14 priority occupations in energy that connectively employ 54,000 workers in the Pittsburgh region. Many of these represent strong opportunities for sub-baccalaureate candidates, but are difficult for workers to commit to due to the cyclicality of the sector which grew by more than a third from 2010 to 2014, then contracted by 18% in just over one year. Employers are struggling to fill high-priority energy occupations economy-wide: The priority occupations (Table 37: Energy Occupational Summary Table) for energy continue to be pain points for employers. Employers will need to fill more than 5,000 openings annually, and are already finding difficulty filling these roles compared to national averages. For example:

• Machine Tool Operators take 40% longer to fill locally than nationally, and Welders and Machinists take more than 15% longer.
• Engineering Technicians, crucial to designing electrical power systems, are specifically cited by employers as a difficult role to fill with qualified candidates. This challenge extends beyond energy, with Electrical Engineering Technicians (14%) and Mechanical Technicians (13%) showing a higher time to fill than national averages for the region as a whole.

Locally, perception of industry careers among younger workers is that they undesirable, and the career ladders within the industry are not well articulated, hampering talent attraction. National recruitment efforts for corporate and engineering roles has been difficult. "Public perception of the energy sector makes it hard for qualified candidates to feel comfortable with job stability."

Energy companies have passed the initial wave of retiring workers, and utilities are taking proactive measures to handle retirements: Local energy employers faced a retirement wave in recent years, and do not envision another wave approaching soon. Utility companies are proactively managing transitions, including offering early retirements, and are beginning to see a balancing of the workforce.

Proposed projects could lead to rapid expansion in demand for energy workforce: The two proposed ethane cracker projects in Beaver County, PA and Belmont County, OH, have the potential to shake up the energy workforce of the 10-county southwestern Pennsylvania region. These projects are estimated to add significant construction positions; the proposal by Shell Chemical Appalachia LLC is projected to employ 1,900-2,300 direct workers during the construction phase. These projects would also spur significant downstream activity, such as new manufacturing locations.
Alternatively, the data in Table 38: Energy Occupation Summary references occupations critical to the energy industry nationally. These data provide a set of additional roles for local focus in the energy workforce, and demonstrate areas where there is high concentration locally.

The energy industry has a broad demand for computer, HR, and engineering talent. Many of these positions show high levels or employment and concentration in the Pittsburgh region, providing opportunity for energy companies to recruit locally from other industries. In some cases, these are higher-skill roles than the previously identified list of fourteen occupations, and should be considered priorities to ensure the full energy industry thrives.

DATA TABLES

Table 37: Energy Occupation Summary – Priority Occupations

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy &amp; Tractor-Trailer Truck Drivers</td>
<td>16,135</td>
<td>$40,900</td>
<td>100%</td>
<td>5,241</td>
<td>13%</td>
<td>0.89</td>
</tr>
<tr>
<td>Supervisors - Construction Trades &amp; Extraction Workers</td>
<td>5,687</td>
<td>$65,300</td>
<td>100%</td>
<td>1,466</td>
<td>43%</td>
<td>0.98</td>
</tr>
<tr>
<td>Supervisors - Production &amp; Operating Workers</td>
<td>5,503</td>
<td>$58,620</td>
<td>100%</td>
<td>1,454</td>
<td>44%</td>
<td>0.95</td>
</tr>
<tr>
<td>Machinists</td>
<td>4,567</td>
<td>$37,270</td>
<td>100%</td>
<td>1,444</td>
<td>—*</td>
<td>1.23</td>
</tr>
<tr>
<td>Inspectors, Testers, Sorters, Samplers &amp; Weighers</td>
<td>4,469</td>
<td>$35,680</td>
<td>100%</td>
<td>1,339</td>
<td>33%</td>
<td>0.71</td>
</tr>
<tr>
<td>Welders, Cutters, Solderers &amp; Brazers</td>
<td>3,691</td>
<td>$38,840</td>
<td>100%</td>
<td>1,165</td>
<td>—*</td>
<td>1.13</td>
</tr>
<tr>
<td>Industrial Machinery Mechanics</td>
<td>3,677</td>
<td>$46,920</td>
<td>100%</td>
<td>1,012</td>
<td>—*</td>
<td>1.1</td>
</tr>
<tr>
<td>Sales Managers</td>
<td>2,569</td>
<td>$120,010</td>
<td>0%</td>
<td>555</td>
<td>81%</td>
<td>0.67</td>
</tr>
<tr>
<td>Mechanical Engineers</td>
<td>2,548</td>
<td>$84,190</td>
<td>0%</td>
<td>486</td>
<td>99%</td>
<td>1.11</td>
</tr>
<tr>
<td>Electrical Engineers</td>
<td>2,045</td>
<td>$85,980</td>
<td>0%</td>
<td>330</td>
<td>98%</td>
<td>1.2</td>
</tr>
<tr>
<td>Computer-Controlled Machine Tool Operators</td>
<td>1,499</td>
<td>$37,830</td>
<td>100%</td>
<td>485</td>
<td>—*</td>
<td>1.29</td>
</tr>
<tr>
<td>Helpers—Installation, Maintenance &amp; Repair Workers</td>
<td>981</td>
<td>$26,710</td>
<td>0%</td>
<td>329</td>
<td>—*</td>
<td>0.67</td>
</tr>
<tr>
<td>Property, Real Estate &amp; Community Association Managers</td>
<td>880</td>
<td>$63,140</td>
<td>0%</td>
<td>208</td>
<td>65%</td>
<td>0.55</td>
</tr>
<tr>
<td>Petroleum Engineers</td>
<td>228</td>
<td>$112,890</td>
<td>0%</td>
<td>48</td>
<td>100%</td>
<td>1.61</td>
</tr>
<tr>
<td>Grand Total</td>
<td>54,479</td>
<td>$67,790</td>
<td>6%</td>
<td>15,502</td>
<td>89%</td>
<td>1</td>
</tr>
</tbody>
</table>

*This occupation does not typically call for a bachelor’s degree

Sources:
- Employment: Bureau of Labor Statistics
- Median Salary: BLS Occupational Employment Statistics
- % Requested BA: Burning Glass job postings data
- Location Quotient: BLS Occupational Employment Statistics
Table 38: Energy Occupation Summary - Nationally Critical Occupations

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment 2015</th>
<th>Median Salary</th>
<th>Projected Growth Rate</th>
<th>Projected Annual Openings, 2015-2025</th>
<th>% Requested BA</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Systems Analysts</td>
<td>6,252</td>
<td>$70,760</td>
<td>19%</td>
<td>462</td>
<td>91%</td>
<td>1.24</td>
</tr>
<tr>
<td>Plumbers, Pipefitters &amp; Steamfitters</td>
<td>5,928</td>
<td>$58,910</td>
<td>5%</td>
<td>525</td>
<td>0%</td>
<td>1.17</td>
</tr>
<tr>
<td>Computer User Support Specialists</td>
<td>5,352</td>
<td>$44,100</td>
<td>11%</td>
<td>378</td>
<td>44%</td>
<td>1.33</td>
</tr>
<tr>
<td>Civil Engineers</td>
<td>3,847</td>
<td>$76,410</td>
<td>9%</td>
<td>247</td>
<td>98%</td>
<td>1.52</td>
</tr>
<tr>
<td>Managers, Other</td>
<td>3,374</td>
<td>$101,230</td>
<td>2%</td>
<td>232</td>
<td>91%</td>
<td>0.46</td>
</tr>
<tr>
<td>Supervisors - Mechanics, Installers &amp; Repairers</td>
<td>3,355</td>
<td>$64,320</td>
<td>2%</td>
<td>251</td>
<td>52%</td>
<td>0.87</td>
</tr>
<tr>
<td>Industrial Engineers</td>
<td>3,112</td>
<td>$81,880</td>
<td>2%</td>
<td>176</td>
<td>98%</td>
<td>1.13</td>
</tr>
<tr>
<td>Training &amp; Development Specialists</td>
<td>2,823</td>
<td>$54,270</td>
<td>5%</td>
<td>222</td>
<td>66%</td>
<td>1.14</td>
</tr>
<tr>
<td>Compliance Officers</td>
<td>2,042</td>
<td>$63,350</td>
<td>2%</td>
<td>144</td>
<td>89%</td>
<td>1.17</td>
</tr>
<tr>
<td>Industrial Production Managers</td>
<td>1,613</td>
<td>$93,710</td>
<td>1%</td>
<td>99</td>
<td>89%</td>
<td>1.01</td>
</tr>
<tr>
<td>Database Administrators</td>
<td>1,229</td>
<td>$74,400</td>
<td>11%</td>
<td>78</td>
<td>78%</td>
<td>1.09</td>
</tr>
<tr>
<td>Computer Occupations, Other</td>
<td>1,210</td>
<td>$73,260</td>
<td>3%</td>
<td>73</td>
<td>87%</td>
<td>0.59</td>
</tr>
<tr>
<td>Financial Specialists, Other</td>
<td>1,088</td>
<td>$72,750</td>
<td>4%</td>
<td>86</td>
<td>98%</td>
<td>0.93</td>
</tr>
<tr>
<td>Supervisors - Helpers, Laborers &amp; Material Movers</td>
<td>958</td>
<td>$50,210</td>
<td>2%</td>
<td>97</td>
<td>14%</td>
<td>0.63</td>
</tr>
<tr>
<td>Chemists</td>
<td>935</td>
<td>$63,700</td>
<td>4%</td>
<td>71</td>
<td>99%</td>
<td>1.7</td>
</tr>
<tr>
<td>Grand Total</td>
<td>43,118</td>
<td>$67,233</td>
<td>6%</td>
<td>3,141</td>
<td>65%</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Note: Data represents the occupation across Pittsburgh, not focused on the energy industry.
Sources:
Employment: Bureau of Labor Statistics
Median Salary: BLS Occupational Employment Statistics
% Requesting BA: Burning Glass job postings data
Location Quotient: BLS Occupational Employment Statistics

Energy roles are hybrid, with an increasing demand for technical skills across roles. Employers provide significant training internally, with an emphasis on hiring for personality fit and willingness to work in sometimes difficult and remote locations.

Skills are highly transferrable to and from construction and manufacturing: The energy sector hires construction, production, and engineering workers that are in demand in other sectors, such as Advanced Manufacturing and broader construction. Employers view the required skills as highly transferrable, offering opportunities for cross-training to build a robust pipeline of talent that can weather industry waves.

Employers have developed internal training programs: Employers describe a hiring and training pipeline that is based around personality traits and attitude, followed by strong employer-specific training. This practice may lead to workers with industry-specific skills that are less transferrable, decreasing the ability to weather economic cycles.

Develop partnerships with local universities to retain engineering talent: The engineering roles in the energy industry are in demand across the Pittsburgh region, and are difficult to fill. The industry should aim to enhance local partnerships with the universities to build internships and ensure to highlight the importance of the industry.
Encourage and expand competency-based hiring:
Echoing the recommendations from the 2012 Energy Occupational Analysis Report, these roles represent strong opportunity for sub-BA candidates. More than 80% of the projected openings in these target occupations require less than a bachelor’s degree, and all but one are difficult for employers to fill. Employers across the industry have developed training programs at the entry-level and supervisory levels, and these programs are beginning to adapt to technology needs. CTE programs and community colleges must effectively articulate and teach the competencies required for these occupations, and employers should develop apprenticeship opportunities to bring young workers into the field.

Develop an internal management pipeline through communication and management training:
Communication and supervisory skills are the top two baseline skills for first-line supervisors of both construction and production workers; these are not the top skill requirements for any other predominantly sub-baccalaureate role. Employers should develop internal training to move employees into these roles.

**REGионаl training strategies**

**Develop technology-enabled skills that protect against cyclicality:** Pittsburgh’s diverse energy opportunities, from wind to nuclear to natural gas, provide a unique opportunity for workforce training that cuts across segments and is responsive to cyclicality in the energy markets. Core skills, such as understanding of inspection, basic computer skills, and understanding of environmental health and regulations, are critical for workers across energy sectors.

**Refocus career and technical education on high growth, hard-to-fill roles:** Machine Tool Operators, Welders, and Machinists are three of the most difficult roles for local employers to fill. Local CTE and post-secondary providers can train students to enter these careers. Post-secondary credentials are not filling the gaps, with fewer than 500 completers of welding and machinist programs in the region in 2014. There are approximately 1,000 students enrolled in Welding, Machining, or Power Installer CTC programs today, which is well short of the necessary demand. Due to broad need for machinist positions across energy and advanced manufacturing, this training is lower-risk for job seekers.

**Expand industry and career awareness at the K-12 level:** With the changing shape of local energy production, direct and sustained efforts must be made toward enhancing the career awareness of young audiences. The potential for career advancement and innovation can work well for a young audience and build a future pipeline into the industry if elements of the industry work together to grow interest. This career awareness should be developed across manufacturing and energy sectors, introducing students to the opportunities in manufacturing, life sciences, production, and construction, and requiring various levels of education.

**Leverage dual expertise in energy and engineering to expand renewable energy:** The Pittsburgh region’s educational strength provides an opportunity to continue to build the local energy sector and expand the workforce. In addition to Carnegie Mellon’s Scott Institute for Energy Innovation, the region has a base of renewable energy work with companies such as EverPower Wind Holdings and the recent growth of SolarCity. Many of the electrical, installation, and pipeline skills already present in the market will allow innovative power generation companies to grow locally, including in declining occupations.
Retail and Hospitality

Retail and Hospitality Services industries employ over 18% of the Pittsburgh region’s workforce, spanning roles in retail stores, corporate headquarters, hotels, and food service establishments. These industries have large numbers of entry-level positions, and they also have comparatively fewer opportunities for career advancement. In addition to the large entry-level workforce, these industries employ a high-skill workforce, especially in corporate headquarters, with business and IT work in growing demand.

Alignment of Workforce Supply and Demand

Entry-level roles are filled by young workers and exhibit high turnover: Food service and hospitality roles are filled by young workers and often have high turnover, as they do not typically offer the wages or upward opportunities to make them desirable career track roles. 43% of hotel clerks are younger than 25. However, these jobs act as an important entry point to the workforce for young people. The ability to fill entry-level retail and hospitality positions is directly correlated to access to public transportation and dense areas of worker supply. Employers cite growing suburban locations as particularly difficult to staff.

Finding qualified candidates for many culinary and hospitality occupations is increasingly challenging as high quality training programs have either disappeared or are unable to produce sufficient volume. The many new restaurants and hotels that have opened in Pittsburgh recently also constrain supply, and employers noted significantly higher numbers of entry-level workers.

The five largest occupations, Retail Salespersons, Cashiers, Combined Food Preparation and Serving Workers, Waiters and Waitresses, and Custodians will all experience more than 100% turnover of staff over the next decade. This pattern of churn leads to constant internal training by employers, who seek opportunities to train more systematically rather than “just-in-time” training models. As front-line roles take on more complex skill requirements, a rapid training model becomes more difficult to execute.

Upward mobility is limited; higher-level roles are outsourced: Nationally, half of all workers in the industry (47%) are in front-line sales roles. This is also true in restaurants, where 42% of the market is in fast-food work. The size of these roles relative to managers and corporate opportunities, leaves limited room to advance within the industry, especially as managers cite limited time to train new workers.

Exacerbating this issue, employers indicate a number of positions being outsourced or filled by independent contractors (1099 employees). Outsourced roles include data analytics and high level customer service. The tendency for these to be higher-level roles further constrains development and promotion opportunities for entry level workers.

Our grocery stores are rapidly diversifying and offer more prepared foods and even in-store dining. We now find ourselves in competition with restaurants for workers for the first time.”

The Retail industry is changing as lines of competition overlap: Retail in Pittsburgh is changing; e-commerce is creating national competition and an increased demand for delivery of products quickly and efficiently. Inventory systems have been made more precise through the use of scanning and tracking systems. Additionally, many traditional retailers are finding a need to diversify their inventory with lower margins, modeled after the growth of big box stores, which combine grocery, clothing stores, gas stations, and more under a single brand. As a result, employers require higher level skills for their staff, requiring them to have hybrid traditional retail and e-commerce/technology skills, while store managers are expected to have higher levels of logistics and supply chain management skills as they take on additional inventory and shipping responsibilities.

IT roles in Retail and Hospitality are small but growing and important: As firms collect more customer data, adopt more sophisticated point of sales systems, and expand their e-commerce operations, they are hiring greater numbers of IT workers. For those that have not yet done so, local employers expect to ramp up their cybersecurity workforce in the near future. Those with local headquarters are hiring more technical staff, taking advantage of the existing pipeline from local universities. Increased digital services within retail offer broad opportunity to expedite the growth of IT roles within Pittsburgh.

“Amazon is putting huge pressure on many of us and it is really impacting margins. People value convenience more than price.”

Regulatory issues and potential policy changes are creating uncertainty: Healthcare changes, possible new regulations relating both to minimum wage and earnings from tips, as well as food safety regulations are creating uncertainty, and constraining employers’ abilities to manage future workforce demand.

“Depending on what happens with minimum wage, we may have fewer people in our restaurants and will need to look at how technology can replace people, such as getting and paying your bill on your phone.”

Retailers are investing heavily in software development as websites and mobile platforms are increasingly important. Rapidly changing customer expectations, from free shipping to one-day delivery to online ordering and curbside pickup also increase the pressure for companies to effectively differentiate themselves, thus increasing the need for internal branding and marketing expertise.
RETAIL AND ACCOMMODATION SKILL FINDINGS
Retail occupations require a set of skills beyond simply sales and customer service. Top skills in demand include mathematics, collaboration, and leadership. These roles require a set of teamwork skills and basic mathematics skills that are crucial to success.

Hospitality occupations – in hotels and food services – demand a combined set of management, mathematics, and communication skills similar to retail. These roles also carry some understanding of legal requirements, such as with food safety and inspection requirements legally mandated for restaurants and lodging establishments.

UPSKILLING: EMPLOYERS REQUEST HIGHER-LEVEL SKILLS AND CREDENTIALS
Management positions are difficult to fill: Developing a pipeline into management was highlighted as a key challenge in employer focus groups. One industry leader indicated that exit surveys of employees indicated managerial issues as a primary factor for departure, causing the employer to revamp their manager training program. Within retail, problem solving and overcoming adversity were cited as common skill requirements for managers, while lack of math skills was commonly cited as an issue, especially for internal pipelines. Management skills in retail provide opportunities to build ladders into higher paying occupations in the region. The sales and management skills that are in high demand for retail managers provide cross-training opportunities in other industries.

HYBRID JOBS: BLENDING DIVERSE SKILL SETS INTO A SINGLE ROLE
Customer Service Representatives need digital skills: Increased savvy among consumers requires customer service representatives in retail having stronger IT skills, as brick and mortar retail becomes a digitally enabled experience. Retail employees are required to support both in-person and online shopping.

“Our biggest challenge is in adapting traditional retail roles to ones that also have significant technology skills. In the end, we still need people who will know the customer.”

Retail has an increasing need for data analytics and cybersecurity: While data analytics have grown in retail headquarters, employers indicate outsourcing these across the country or to 1099 (contract) employees. Employers project increased hiring for cybersecurity talent in Pittsburgh, especially in light of recent high-profile cyber-attacks at national retailers. Pittsburgh’s cyber talent, which is heavily concentrated in Professional Services and Finance firms, can begin to expand into retail.

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Sources: Burning Glass Technologies
Table 40: Hospitality Skills and Occupations

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<td>Product Sale and Delivery</td>
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<td>Dining Room and Cafeteria Attendants and Bartender Helpers</td>
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Sources: Burning Glass Technologies

RETAIL AND ACCOMMODATION RECOMMENDATIONS

ECONOMIC DEVELOPMENT AND EMPLOYER RECOMMENDATIONS

Bet on data analytics locally and expand partnerships with universities for software talent: Retail growth, especially in competing with online retailers, will increasingly require strong supply chain management and data analytics to ensure rapid delivery to clients. This requires highly technical data analysts and data scientists that employers have been outsourcing to 1099 contractors. As with data analytics, software development will be increasingly important to competition in retail. Strong websites and mobile applications are critical. In both these areas, employers should expand existing, or develop new, partnerships with local schools to create a strong pipeline and encourage students to work in the area.

REGIONAL TRAINING STRATEGIES TO DEVELOP FUTURE WORKFORCE

Create cross-industry partnerships to create career ladders and pipelines for staff: Partnerships across firms that hire retail, hospitality, sales and customer service workers can be developed to attract and retain well-qualified workers in the retail ecosystem. Providing strong training to retail workers can be a benefit to retailers in that it helps them to create a stronger pool of managers and to workers who can use the training to advance, whether in retail-specific occupations or into related roles in consumer banking or general customer service.

Cybersecurity is also an area where the workforce would benefit from cooperation. Cybersecurity demand is strong in both the short- and long-term. Industry leaders from retail to manufacturing should collaborate with local universities to develop a robust training ecosystem for cyber workers at all levels. Through collaboration with training providers, each industry can include the unique features necessary for success.
Appendices: Methodology
This study draws from a range of data sources and analytic approaches including traditional economic data, job postings analysis and in-depth focus groups. The types of data used are described in detail in the How to Use This Report section. Below, we provide additional detail on the sources and methodology for the data included in this report.

### ABOUT BURNING GLASS JOB POSTING DATA

To supplement traditional sources of labor market data with more comprehensive and up-to-date information on employer demand for jobs and skills, Burning Glass has mined its comprehensive database of over 100 million unique online job postings dating back to 2007. Burning Glass’ spidering technology extracts information from close to 40,000 online job boards, newspapers, and employer sites on a daily basis and de-duplicates postings for the same job, whether it is posted multiple times on the same site or across multiple sites. All Burning Glass postings data in this report reflect all job postings for the same job, whether it is posted multiple times on the same site or across multiple sites. All Burning Glass postings data in this report reflect all job postings collected in the U.S. during the 2015 calendar year, localized to the 10-county southwestern Pennsylvania region where appropriate.

In this report, job postings data is used primarily to measure the skills and credentials that are in demand by employer. These data are uniquely able to assess the specific skills that employers request in real-time and segmented by location, industry and other factors not possible using traditional, static skill profiles.

### OCCUPATIONAL PROJECTIONS

The occupations projected included in this report are based on those developed by the Bureau of Labor Statistics and the Pennsylvania Department of Labor and Industry. For this project we have implemented the technical approach developed by the Bureau of Labor Statistics for the 2016-2026 projections which improves substantially upon the methods currently used.31 This improved method results in significantly higher numbers of projected occupational openings than the current methodology.

In particular, the old BLS method assumes that workers enter a field at a young age, work in their field until they are about 65, and then retire. The new framework allows for the reality that many workers will work in multiple occupations over the course of their careers.

The new methodology breaks occupational demand into three parts: openings due to occupational growth, openings due to workers retiring (or otherwise permanently exiting the workforce), and openings created by workers moving to different roles, but staying in the workforce. This third category is not captured in the current BLS models and accounts for the difference between the data included here and the lower projections numbers that are currently provided by state and federal statistical agencies. Beginning with the 2016-2026 projections, this method will become the standard way of tracking openings.

All projections included in this report represent the aggregate of the 10-county region of the study. 2015 employment estimates are based on OES employment data and state and national projections.

### ANALYSIS OF RETENTION OF GRADUATES

LinkedIn’s Alumni Tool is used to estimate the number of graduates from local institutions who remain in Pittsburgh, following graduation. Replicating methodology developed at the Brookings Institution, we estimate the total number of graduates remaining in the region by degree area and level. Based on the sample of graduates with LinkedIn profiles, we measure the proportion of recent graduates (over the last five years) who list Pittsburgh as their current location. We apply those proportions across the number of degree completions by major and degree level at each school to estimate the number of graduates who remain in Pittsburgh. (Completions data are sourced from IPEDS.) Finally, we sum the completions and the estimated proportion of students who have stayed across all local institutions. Limitations of this approach include the following: it is assumed that the proportion of students with LinkedIn profiles is a representative sample with respect to geography. Because we are not able to segment the LinkedIn data by major, it assume that students from a given institution are equally likely to stay in the region or leave regardless of their specific major.

### QUALITATIVE METHODOLOGY

To validate and deepen the quantitative labor market supply/demand analysis, the Council for Adult and Experiential Learning (CAEL) conducted a series of facilitated conversations with representatives from industry, education and workforce development. This process drew upon CAEL’s deep experience working with firms and community leaders to address skills shortages and training needs.

Eight focus groups were held at the offices of the Allegheny Conference between March 1st-3rd with another dozen follow-up interviews during the months of March and April. In total over 125 CEOs, HR directors and other representatives from 85 employers, as well as leaders in education and training, participated in the process.

Scope & Process - Each conversation was approximately 2½ hours in length and averaged 15 participants. CAEL conducted the conversations within the context of three distinct time horizons of workforce demand:

- Short Term – Past 6 Months & Next 6 Months
- Medium Term – 3-5 Years Out
- Long Term – 5-10 Years Out

- Long Term – 5-10 Years Out
Community Colleges, traditional four-year colleges and including, K-12 and Career and Technical Education, the spectrum of education and training providers For the supply side focus group, participants represented 10-county Pittsburgh region. Special consideration was given to regional diversity in terms of location and size of the organizations.

Focus group invitations were facilitated through the Allegheny Conference membership team who reached out to 150 employers and industry consortia in the 10-county Pittsburgh region. Special consideration was given to regional diversity in terms of location and size of the organizations.

For the supply side focus group, participants represented the spectrum of education and training providers including, K-12 and Career and Technical Education, Community Colleges, traditional four-year colleges and universities, workforce investment boards and education associations.

The following is a list of businesses and institutions that provided direct feedback throughout the process:

- A.W. Beattie Career Center
- Allegheny Health Network
- Allegheny Intermediate Unit
- ATI
- American Eagle Outfitters
- Aquatech International Corporation
- ASQ, Inc.
- Big Burrito Restaurant Group
- Boyden
- Builders Guild of Western Pennsylvania
- Carmeneuse Lime and Stone
- Carnegie Mellon University
- Carnegie Mellon University CERT
- Catalyst Connection
- Chatham University
- Chevron
- Columbia Gas of Pennsylvania, Inc.
- Comcast
- Community College of Allegheny County
- CONSOL Energy, Inc.
- Constructors Association of Western Pennsylvania
- Convergys
- Covestro LLC
- Duquesne Light Company
- East Pittsburgh Hospitality Group
- Elliot Group
- Elwood Group, Inc.
- EQT Corporation
- EverPower Wind Holdings, Inc.
- Expedit
- FCG Solutions, Inc.
- Federated Investors, Inc.
- FirstEnergy Corp.
- Forbes Road Career & Technology Center
- Gateway Health Plan
- Giant Eagle
- Google
- Healthcare Council of Western Pennsylvania
- Hefren-Tillotson, Inc.
- Herbert, Rowland, Grubic
- Highmark Health
- Independence Excavating, Inc.
- Indiana University of Pennsylvania
- Innovation Works
- Jendoco Construction & Real Estate
- Joseph Wynn
- KPMG
- Lenape Technical School
- MARC USA
- Mascaro Construction Co.
- Mercer
- Michael Baker International
- Parkway West Career and Technology Center
- Pennsylvania State University
- Peoples Natural Gas
- PITT OHIO
- Pittsburgh Council on Higher Education
- Pittsburgh Technical Institute
- Pittsburgh Technology Council
- Plus Consulting, LLC
- Point Park University
- PPG
- Presbyterian Senior Care
- Quest Diagnostics Incorporated
- Range Resources
- Robert Morris University
- Rosedale Technical College
- S&T Bank
- Slippery Rock University
- Staffmark
- Summa Technologies
- The Hite Company
- The PMC Financial Services Group, Inc.
- Three Rivers Workforce Investment Board
- Uber
- UPMC
- UPMC Enterprises
- West Penn Power
- Westinghouse
- Westmoreland County Community College
- Winchester Thurston School
- Wyndham Grand Pittsburgh

Topics Covered - Each industry focus group followed the same basic structure. However, the unique needs of each industry shaped much of the conversation. The focus groups were asked to provide feedback on:

- Whether the volume of job postings accurately represents demand
- Industry trends which affect workforce demand (e.g. increased automation, process improvements, internet of things, etc.)
- Levels of in-house training and continual upskilling of existing workforce
- The degree to which employers are satisfied with the workforce supply system, and where there may be concerns about the quantity and quality of job seekers coming from area education and training providers
- Skills and competencies that will be most valued in the workforce of the future

During the supply side (education and training providers) the following topics were covered:

- Validation of the quantitative supply and demand data - does the data reflect what they hear from employers?
- Insights on levels of industry engagement and partnership with training providers
- Best practices from industry partnerships
- Areas where training and credentialing may not be addressing employer needs
- Barriers that appropriately skilled/credentialed job seekers face in applying for positions within each cluster of interest

During the supply side (education and training providers) the following topics were covered:
Incorporation of Findings - The findings from each focus group were incorporated seamlessly into the overall analysis. Qualitative data gathered through the focus group process helped shape each industry’s findings, and analysis, but perhaps more importantly, helped identify some of the cross-industry findings. This blended approach should be considered a core strength of this report, contextualizing nearly every finding with industry testing and feedback.

ABOUT THE AUTHORS

ABOUT BURNING GLASS

Burning Glass Technologies delivers job market analytics that empower employers, workers, and educators to make data-driven decisions. Burning Glass is reshaping how the job market works, with data that identify the skill gaps that keep job seekers and employers apart and tools that enable both sides to bridge that gap and connect more easily. The company’s artificial intelligence technology analyzes hundreds of millions of job postings and real-life career transitions to provide insights into labor market patterns. This real-time strategic intelligence offers crucial insights, such as which jobs are most in demand, market patterns. This real-time strategic intelligence offers insights into labor market trends, and in creating a job market that works for everyone.

ABOUT CAEL

CAEL is a national non-profit leader in the field of workforce and economic development, providing consulting, research, tools, and strategies needed to create effective talent development solutions. In the last five years alone, CAEL has supported various workforce skill needs and sector specific initiatives in more than 150 communities in 43 states. CAEL brings significant experience working with workforce and economic development practitioners, on the ground ability to facilitate employer engagement, analysis of labor market and target sector information, and a national perspective on best practices to align talent development with regional economic clusters. In addition to workforce and economic development, CAEL has built a national reputation as the thought leader in the field of adult education, putting meaningful learning, credentials and work within reach for all.

ONLINE APPENDICES:

1) Appendix 1: Occupational Data
   a. Individual Occupation Data, all occupations including employment, projected growth rate, replacement rate, projected annual openings, time-to-fill, location quotient, median salary
   b. Occupation Family Data, all occupations including Employment, Projected Growth Rate, Projected Annual Openings
   c. Opportunity Occupations Data, including employment, projected growth rate, replacement rate, projected annual openings, time-to-fill, location quotient, median salary

2) Appendix 2: High Demand Occupational Sector Data, including expansion of all occupation data tables within the report
   a. Occupation Family Data, by occupational sector, including employment, projected growth rate, replacement rate, projected annual openings, time-to-fill, location quotient, median salary
   b. Sectoral Data for energy, including employment, projected growth rate, replacement rate, projected annual openings, time-to-fill, location quotient, median salary

3) Appendix 3: Industry Data
   a. Occupation Family Data by Industry Group
   b. Manufacturing Output v Employment Data
   c. Bureau of Economic Analysis Data

4) Appendix 4: Education Data
   a. K-12 Enrollment, 10-county region
   b. IPEDS Completions, 10-county region
   c. High School Graduation Rates, 10-county region
   d. CTC Enrollment, 2014

5) Appendix 5: Demographics and Unemployment
   a. Unemployment rates
      i. By County
      ii. By Occupation Family
   b. Employment by Age Group
   c. Occupation Family racial demographics
   d. Occupation Family gender demographics

6) Appendix 6: Migration Data
   a. Total migration estimates, Allegheny and benchmark cities
   b. Destinations of migrants from Allegheny
   c. Origins of inflow of migrants
1 These data were produced through Burning Glass's application of the improved projections methodology which the Bureau of Labor Statistics will use beginning with the 2016-2026 projections. The differences between this methodology and the model currently used are discussed in the methodology section of the appendix.

2 American Community Survey.

3 In this study, the Pittsburgh region (or 10-county southwestern Pennsylvania region) is classified as a 10-county region including: Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington, and Westmoreland counties.

4 These data were produced through Burning Glass's application of the improved projections methodology which the Bureau of Labor Statistics will use beginning with the 2016-2026 projections. Difference between this methodology and the model currently used are discussed in the methodology section of the appendix.

5 U.S. Census Bureau Population Estimates.

6 The benchmark cities are: Austin, TX; Boston, MA; Charlotte, NC; Cincinnati, OH; Denver, CO; Indianapolis, IN; Milwaukee, WI; Minneapolis, MN; Nashville, TN; Philadelphia, PA; San Jose, CA; Seattle, WA; and St. Louis, MO. Pittsburgh has the highest percent of the workforce above 55 at 22%, followed by St. Louis with 20%. All other cities are 17% or under. Data are from the American Community Survey.

7 http://www.citylab.com/work/2016/03/which-metros-are-best-at-keeping-their-college-graduates/473604/


9 OES Average Salary Carpenters: $44,840; Construction Supervisor: $65,300

10 Migration numbers based on the Current Population Survey, and demographics based on the American Community Survey.

11 American Community Survey.


14 Graduation Rate accessed from www.countyhealthrankings.org


16 http://www.citylab.com/work/2016/03/which-metros-are-best-at-keeping-their-college-graduates/473604/

17 Migration numbers based on the Current Population Survey, and demographics based on the American Community Survey across age groups.


19 Cybersecurity jobs defined as those that have a cybersecurity-related title, require a cybersecurity certification, or request cybersecurity-specific skills. Cybersecurity-related titles used to define the roles analyzed in this report include ‘network security’, ‘information security’, ‘information assurance’, and ‘penetration testers’. Cybersecurity skills include information assurance, crytography, computer forensics, malware analysis, 800-53 and AirSight.

20 Location quotients (LQ) are a measure of occupation concentration within a region. National average demand equals 1.0 while an LQ of 1.2 indicates 20% higher demand than the national average (or 1.2 times the national concentration).


22 http://venturebeat.com/2016/01/18/facebook-is-opening-an-oculus-research-office-in-pittsburgh/


24 Certification data on Burning Glass Technologies job posting data.


26 Shell and PTT have not yet made final investment decisions nor committed to construction timelines for these projects.


30 http://www.tinyurl.com/zyp568

31 Technical details and a helpful set of FAQs about the Bureau of Labor Statistics’ new methodology are described here: http://www.bls.gov/emp/leap_separations.htm
Inflection Point | Supply, Demand and the Future of Work in the Pittsburgh Region