

MAY 2017

# Driving Tech Talent Growth in PHL



GREATER PHILADELPHIA



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**Economy  
League**

GREATER  
PHILADELPHIA

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The Economy League is a civic catalyst that brings together cross-sector leaders and organizations to address the most challenging issues facing Greater Philadelphia. Built on our foundation of independent, high-quality analysis and practical insight, we spark new ideas, develop strategies, and galvanize action to make Greater Philadelphia globally competitive.

Learn more at [economyleague.org](http://economyleague.org)



# Message from the Economy League

**Technology is quickly changing the way we live and work.** Just two decades ago, many families did not have a computer at home. Today, most people have a computer that fits in their pocket, allowing them to communicate globally, shop for nearly any good or service, access digital entertainment, or simply hail a ride. The rapid expansion of tech into all facets of our lives is also having a transformative effect on the economy and job market. Today, tech jobs are embedded in all sectors of the economy and tech skills are increasingly vital to economic mobility for workers across industries.

In Greater Philadelphia, our ability to leverage the potential of our tech workforce as a driver of employment and economic activity will influence our region's competitiveness nationally and globally. It's hard to deny that our city and region have been experiencing something of a renaissance in recent years. A burgeoning Center City is bustling with activity and development; our profile on the global stage is expanding; and there is a growing sense of optimism about our region's potential. However, we still face several of the major challenges that have beset us for decades. Too many people in Greater Philadelphia face significant impediments to economic opportunity. Poverty remains high, labor force participation is lower than in peer metros, and many of our young people do not have the skills needed to move into family-sustaining careers. At the same time, many companies in our region struggle to find the skilled employees they need to compete and grow.

Against this backdrop, the recent blossoming of Greater Philadelphia's tech sector and the proliferation of area tech jobs in non-tech industries are major bright spots for the region. Given tech's remarkable economic and job potential, finding ways to accelerate this momentum would advance growth and expand opportunity across Greater Philadelphia. Recognizing tech's rapid growth and the potential to build on the good work already happening in the region, the Economy League of Greater Philadelphia—with support from the U.S. Economic

Development Administration, the JPMorgan Chase Foundation, the Lenfest Foundation, SEI, Ben Franklin Technology Partners, and Graduate! Philadelphia—led an in-depth research and strategy initiative to better understand our region's technology workforce and identify priority strategies to expand, deepen, and diversify that workforce.

Through this work, we have developed a better understanding of the size and key characteristics of Greater Philadelphia's tech workforce, identified gaps between employer demand and labor supply in our market, and set forth a collaborative action framework to ensure that area firms have the talent to meet future needs and residents have access to emerging opportunities. The results presented in this summary report draw upon labor market data analysis; interviews with executives from regional employers, education officials, workforce development and training experts, and other key stakeholders; and collaborative input from a diverse steering committee composed of leaders across Greater Philadelphia's tech workforce landscape.

We hope that this analysis serves not only to communicate critical tech workforce needs and opportunities to a wide range of audiences, but that we can leverage this work and the cross-sector relationships forged through this initiative into tangible actions to drive tech talent growth in Greater Philadelphia.



**JOSH SEVIN**  
*Acting Executive Director*  
Economy League of Greater Philadelphia



**CHRISTINA R. CHEPEL**  
*Partner* | *Chair*  
KPMG | Economy League of Greater Philadelphia  
Board of Directors

# Executive Summary

**Information technology has been a major driver of U.S. employment growth in recent years, both for workers with advanced education and people without a bachelor's degree.**

In Greater Philadelphia, leveraging the potential of our tech workforce will support business growth and expand opportunity—two areas where we lag peer metros. To help advance efforts to drive tech talent growth in the region, the Economy League of Greater Philadelphia conducted an in-depth market assessment and led the collaborative development of a shared framework for action to achieve the following vision and goals.

## VISION

**A deep and diverse tech talent pool in Greater Philadelphia supports business growth and fosters economic opportunity for residents**

## GOALS

1. More employers invest in upskilling their incumbent workforce to fill high-skill IT openings
2. More individuals in our region obtain IT education and training that meets rapidly evolving market needs
3. More women, people of color, and dislocated workers consider careers in IT

## KEY FINDINGS

Taking effective action to strengthen Greater Philadelphia's tech workforce requires an understanding of the current regional labor market, an analysis of recent trends, and an assessment of future needs. An in-depth market assessment yielded six key findings about our region's tech workforce.

1. **Greater Philadelphia's tech workforce is large and growing**, but is constrained by an undersupply of qualified candidates and a lack of diversity.
2. **IT employers in our region are struggling to fill high-skill job openings.**
3. With the rapid pace of change in technology, employers need high-skill workers who can **learn continuously, problem solve, and adapt to evolving business needs.**
4. **Several tech occupations provide career on-ramps for middle-skill workers**, with one-third of the region's IT workforce holding less than a bachelor's degree.
5. **Many regional residents**—from K-12 students to adults—**do not understand the wide variety of jobs, industries, and career paths in tech.**
6. **Greater Philadelphia's IT education and training ecosystem is wide-ranging**, but can better meet regional market needs.

# Driving Tech Talent Growth in PHL: An Action Framework

Driving tech talent growth in Greater Philadelphia will require sustained, collaborative focus by the wide range of firms, institutions, government agencies, foundations, and nonprofit organizations in the region. To guide this work, the Economy League and a core group of key stakeholders developed a shared action framework for leveraging our tech workforce to drive regional growth and opportunity.

### STRATEGY 1

#### Increase incumbent worker training and employer-led solutions

Increased focus on upskilling existing IT workers is a particularly promising strategy for closing our region’s high-skill labor shortage. Enhancing capacity among industry-led workforce partnerships will provide a broader platform for sharing best practices, leveraging public funding, and coordinating incumbent worker training among employers. Expanding work-based learning programs and coordinating human resources practices will also help broaden the tech talent pool.

### STRATEGY 2

#### Align and scale educational and tech training programs

Our higher education system is complemented by a growing number of specialized tech training and coding bootcamps that provide alternative entry points to a tech career. Expanding the number of bootcamp seats can help address the supply gap of qualified candidates in the near-term. Longer-term, collaboration between industry partnerships and postsecondary institutions as well as K-12 schools will help ensure that foundational and technical skills taught align with market needs and are adaptable to future trends.

### STRATEGY 3

#### Raise awareness of potential tech careers among underrepresented populations

Educating more people—particularly young women and people of color—about the breadth of career opportunities in tech will help expand and diversify the talent pipeline for IT employers in Greater Philadelphia. Targeted outreach campaigns to reach these individuals, as well as career-changers and dislocated workers, will help drive growth and expand opportunity in the region.

### STRATEGY 4

#### Improve access to data on tech talent in the region

Broad access to data and information about employer needs, career pathways, and education programs in Greater Philadelphia will help inform the actions of firms, educational institutions, and workforce providers. It will also empower jobseekers, students considering IT educational programs, and other interested stakeholders to take advantage of available opportunities.



**25,000**

**new tech jobs created by employers in the Philadelphia area since 2002**

=



**25%**

**of all net job growth in Greater Philadelphia since 2002**

# The Case for Tech

## Growth and Opportunity

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**The expansion of Greater Philadelphia's tech sector and significant growth of tech jobs across industries present a unique opportunity to drive growth and prosperity in the region. Employers in the Philadelphia area have added more than 25,000 new tech jobs since 2002, equivalent to 25% of all net job growth in Greater Philadelphia during that period. There is already a significant level of activity in the region amongst a wide range of stakeholders to meet employer needs and expand career pathways, with opportunities to align and scale these efforts. The growth and opportunity dynamics in tech, however, fit within a broader national context that further illuminates the potential opening for Greater Philadelphia.**

## Information technology has been a major driver of U.S. employment growth in recent years.

Between 2002 and 2015, employment in IT occupations grew by 44% in the United States—five times faster than overall national employment growth. Even in the wake of the Great Recession, IT employment growth has outpaced overall job growth nationally, with a 12% growth rate nearly doubling the overall figure of 6% between 2012 and 2015. This post-recession growth in IT employment was the fastest of any occupational group outside of personal care and service occupations. And tech employment has a powerful ripple effect on the economy. Research shows that each new tech job can spur up to five additional jobs—a multiplier effect that is particularly high compared with other sectors.

This rapid growth has led to increasing concern about a tech labor shortage, which could limit economic growth. Recent studies suggest that over the next decade, the number of STEM (science, technology, engineering and math) job openings in the United States will outpace the number of newly-minted STEM

degree-holders by up to one million. The immediate talent shortage is a common concern among tech executives across the country. In 2016, 65% of respondents in the annual Harvey Nash KPMG CIO survey acknowledged that hiring challenges in tech are a significant obstacle to growth.

### THE TECH OPPORTUNITY



**44%**

tech job growth  
since 2002



**5X**

faster than total U.S.  
job growth since 2002



**1M**

potential unfilled  
tech openings



**12%**

tech job growth  
since 2012



**2X**

faster than total U.S.  
job growth since 2012



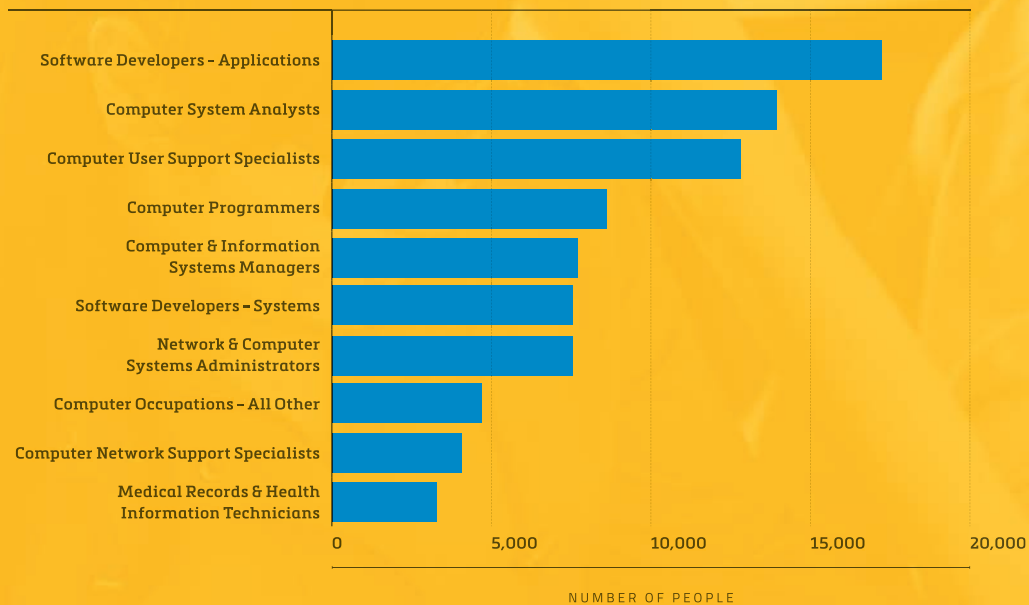
**65%**

of CIOs say tech hiring  
is a barrier to growth

## What Is a Tech Job?

A wide range of occupations across many industries create, enable, or operate technology. These occupations include jobs within tech companies—for example, a software developer at Comcast—as well as tech jobs within non-tech industries, such as computer support at a law firm. Broadly speaking, technology occupations can be grouped into five categories: information technology, installation and repair, applied technicians, engineering, and manufacturing. The analysis underlying this report focuses solely on information technology (IT) occupations—the largest and fastest growing category in our region, with 102,000 jobs and 34% growth since 2002. As a whole, IT occupations have a range of entry points across education levels, pay better than average, and present opportunities for career pathways. The definition of IT in this analysis includes 19 formal occupations, including software developers, web developers, computer support specialists, database administrators, and more.

### 10 LARGEST IT OCCUPATIONS IN PHL (2015)



Source: BLS Occupational Employment Statistics

Note: Seven remaining IT occupations with less than 3,000 employees are not shown here, including web developers, information security analysts, computer operators, operations research analysts, computer science teachers, multimedia artists and animators, and computer and information research scientists.



## Workers with advanced education are well-represented in tech—and there are significant employment opportunities for people without a bachelor’s degree.

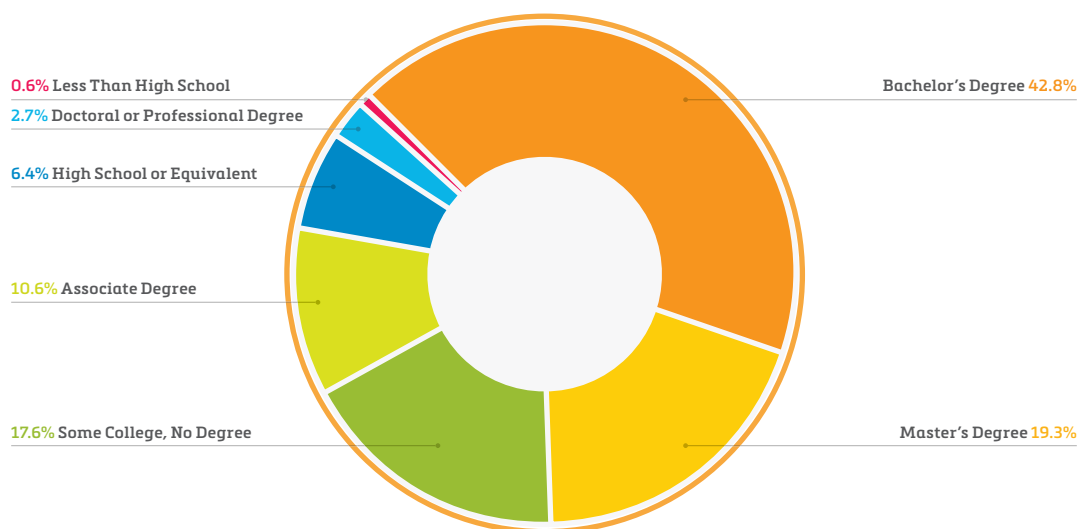
Individuals with a bachelor’s degree or an advanced degree comprise approximately 65% of the national tech workforce. This includes computer science degree-holders, who have no shortage of opportunities in tech, as well as individuals majoring in other subjects. Nearly one in twelve U.S. students who pursue a non-STEM major end up in a STEM occupation.

But tech jobs are not reserved solely for workers with advanced education. More than one-third of tech workers hold less than a bachelor’s degree. The tech workforce includes a broad range of middle-skill jobs—those that require some education or training beyond high school, but less than a bachelor’s degree—including computer user and network support specialists, web developers, health information technicians, and others. These jobs are often filled by workers with an associate degree, CompTIA

certification, experience in coding bootcamps or other training programs, or some combination of these credentials and experience.

Not only do middle-skill tech jobs provide entry points into a growing field that pays family-sustaining wages, they are on-ramps to long-term career pathways. Entry-level employees in middle-skill jobs can develop and hone IT skills and business knowledge that, with continued training, can help to address firms’ needs higher up the organizational chart.

### EDUCATIONAL ATTAINMENT OF THE U.S. TECH WORKFORCE (2015)



Source: U.S. Census Bureau, American Community Survey 5-Year Estimates

In Greater Philadelphia, leveraging the potential of our tech workforce will support business growth and expand opportunity—two areas where we lag peer metros.

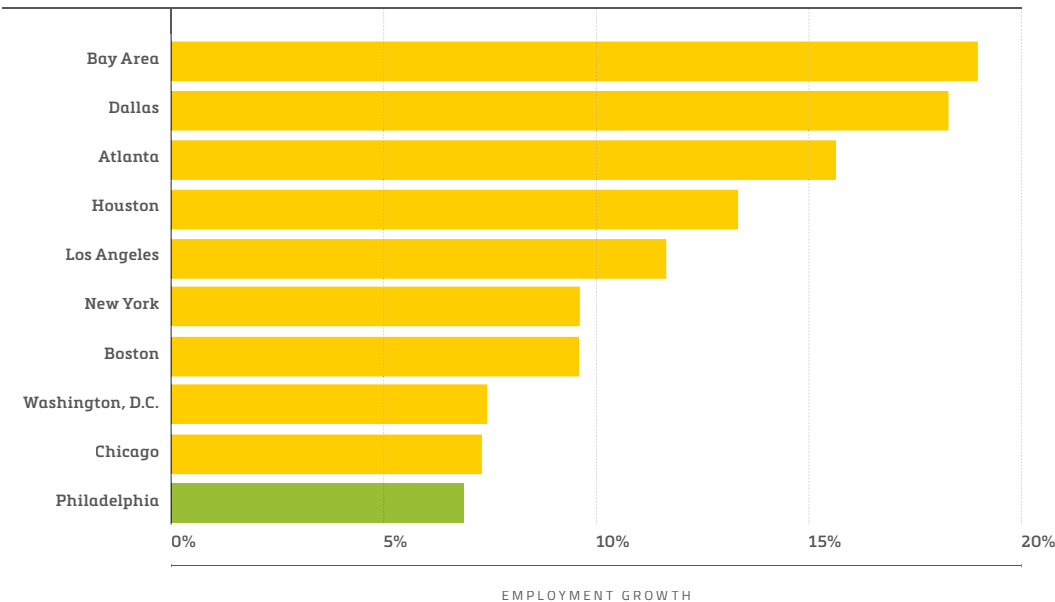
Projections indicate that over the next ten years, Greater Philadelphia could see 26,000–44,000 job openings in IT, between new jobs and replacement openings as workers retire.<sup>1</sup> This represents a major opportunity for our region, a historically slow-growth economy with too few family-sustaining employment opportunities for residents.

Between 2011 and 2016, total employment in Greater Philadelphia increased by 7%—the slowest pace among the ten largest U.S. metro areas. Our region lags fast-growth western and southern metros—with the Bay Area expanding by 18% and Dallas by 17% during that period—and also east coast metros like Boston and New York, where the job base grew by nearly 10%. The region’s labor force participation rate of 78.1% is below average among those same ten metro areas, as 800,000 of the 3.8 million working-age adults in Greater Philadelphia are neither working nor actively

looking for work. At the same time, 26% of individuals in the city of Philadelphia live in poverty.

These statistics, of course, do not tell nearly the whole story of our region. They do underscore the need to take full advantage of bright spots in our economy that can drive growth and expand opportunity. Tech’s potential to support both of these critical priorities in Greater Philadelphia is clear—but we need a shared understanding of the dynamics of the tech workforce and a framework to guide our actions going forward.

**OVERALL EMPLOYMENT GROWTH BY METRO AREA (2011–2016)**



Source: BLS Quarterly Census of Employment and Wages

<sup>1</sup>Projections are derived from BLS national employment projections, Pennsylvania Department of Labor and Industry projections, and application of recent historical growth rates for IT employment in Greater Philadelphia. For more information, see the full technical report at [economyleague.org/techworkforce](http://economyleague.org/techworkforce).



# Understanding PHL's Tech Workforce

## A Regional Bright Spot Facing Constraints

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**Taking effective action to strengthen Greater Philadelphia's tech workforce requires an understanding of the current regional labor market, analysis of recent trends, and an assessment of future needs. With this in mind, in 2016 the Economy League conducted a detailed market assessment of Greater Philadelphia's tech workforce.**

**This market assessment defines and sizes the region's tech workforce; examines employment growth trends; analyzes labor supply and demand dynamics; reviews education and training infrastructure; and highlights the strengths, weaknesses, and opportunities in Greater Philadelphia's tech workforce. The results draw on extensive labor market data analysis and interviews with more than 30 individuals across the region's tech workforce landscape. The assessment also incorporates detailed input from a steering committee of leaders representing regional employers, colleges and universities, workforce development intermediaries, government, youth education programs, and other civic organizations.**

The complete technical report can be found at  
[economyleague.org/techworkforce](http://economyleague.org/techworkforce).

# Key Findings

1

**Greater Philadelphia's tech workforce is large and growing, but is constrained by an undersupply of qualified candidates and a lack of diversity.**



Today, 102,000 people in Greater Philadelphia work in IT occupations. While this accounts for just 4% of the regional workforce, 25,000 new tech jobs have been created in the region since the early 2000s—equivalent to 25% of all net job growth during that span. Much of this growth has occurred in just the past few years, with more than 8,900 new tech jobs created between 2012 and 2015. Outside of business operations and healthcare support occupations, no other occupational segment in our economy has grown more quickly than tech. And with a mean annual wage of \$89,000, the average tech job in Greater Philadelphia pays \$37,000 more than the average salary in the region.

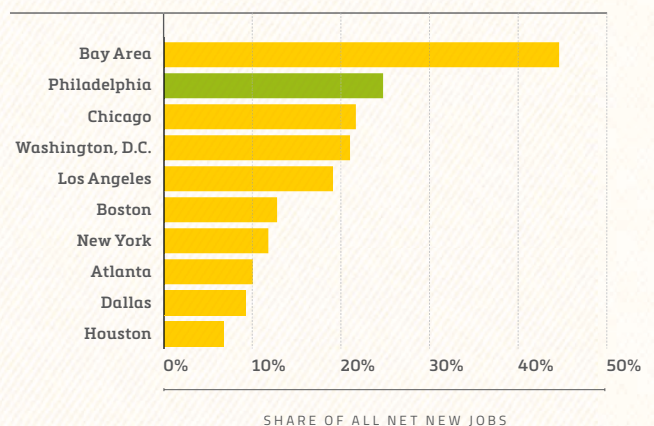
Tech will continue to be a major engine of job growth in our economy. Projections anticipate 2,600–4,400 tech job openings every year for the next ten years, including net new positions and replacement openings as workers retire. Greater Philadelphia's colleges and universities, though, awarded just under 2,600 IT-related degrees and credentials in 2015. If all these individuals remained in the region after graduation, the number of newly-trained employees entering the workforce each year would barely meet the low end of IT employment growth projections over the next decade.

However, a sizeable share of local graduates leaves the region after graduation, with Campus Philly estimating that about 64% of students who graduate from area institutions remain in the region after school. If the percentage of IT graduates staying in our region were to match that rate, we would need at least another 900–2,700 new workers annually to meet projected openings. Some of this gap can be filled by recruiting from out of the region, but with many metros facing a similar talent crunch, competition for tech workers is

particularly fierce and drives up costs for firms. With the competition and cost of out-of-region recruiting, there's an even greater imperative to focus locally for our tech workforce needs.

A pronounced lack of gender and racial diversity in the tech workforce is also a major contributor to the gap between labor supply and demand. In Greater Philadelphia, women comprise 49% of the regional workforce, but hold only 26% of tech jobs. African Americans comprise 10% of the region's tech workforce versus 18% of the overall workforce, and Hispanics hold 4% of tech jobs compared with 8% of all jobs in the region. Greater Philadelphia's tech workforce is slightly more inclusive than the U.S. tech workforce, but underrepresentation of women and people of color remains a significant barrier for individual opportunity and business growth in the region.

**NEW TECH JOBS AS SHARE OF ALL NET NEW JOBS (2002–2015)**



Source: BLS Occupational Employment Statistics  
Note: Metro-level data

## 2

### IT employers in our region are struggling to fill high-skill job openings.



Greater Philadelphia firms large and small, in tech and non-tech industries, report an acute need for more workers with specialized expertise and experience. Software developers are among the most sought after tech professionals; the number of software application developer positions in the region increased by 6,800 between 2012 and 2015. But these formal occupations do not capture the full diversity of jobs within software development and the specific needs of regional employers. Area firms report a particular need for more back-end developers (responsible for the data and infrastructure behind what end users see) with foundational knowledge of Java and .NET. This contrasts with front-end developers (responsible for the part of websites or applications that users interact with), who are generally easier for regional employers to find. Full-stack developers, who have command of both ends, are highly sought after by cutting-edge startups but fill a narrower slice of the overall need in the region.

There is much more to IT than software development, and other hard-to-fill occupations in Greater Philadelphia span the IT workforce spectrum. DevOps engineers, who bridge the gap between software development and systems operations, are in particular

demand. People in these roles typically have specialized knowledge in at least one area but are able to quickly learn and understand other skills and tools. Quality assurance (QA) analysts—broadly responsible for assessing potential vulnerabilities and understanding how processes interact, as opposed to software testers who can be quickly trained for a discrete task—are similarly difficult to find. There is also a talent crunch for cybersecurity professionals, with the high stakes often creating hard requirements for years of experience and advanced education.

With the rapid growth in “big data,” firms in our region report difficulty in hiring data scientists to interpret this new information. Demand is also high for individuals with specialized knowledge around the Internet of Things, an ecosystem in which sensors embedded in physical objects are connected through networks allowing machine-to-machine communication and data collection. Cloud computing, or the ability to store and access data on remote servers rather than on an individual’s computer or on a company’s campus, is a related field requiring specialized knowledge and experience that regional employers are having difficulty finding.



**TRACEY  
WELTON-ROSSMAN**  
*Chief Marketing Officer*  
Chariot Solutions

“Chariot is always on the lookout for qualified software developers, and we often have more job openings than we’re able to fill. Access to a broader pool of high-skill workers would enable us to better serve our clients and grow more quickly as a firm.”

### 3



With the rapid pace of change in technology, employers need high-skill workers who can **learn continuously, problem solve, and adapt to evolving business needs.**

While many tech jobs require a foundation of technical skills, area IT employers of all sizes and types consistently cite the need for more people with a range of soft skills to successfully navigate the rapidly evolving tech landscape.

For software developers, the constant churn of new programming languages in the market drives a persistent need for continuous learning. The most in-demand languages often change over just a few years and require developers to be able to quickly refresh skill sets. According to the Institute of Electrical and Electronic Engineers, while foundational languages such as Java and Python continue to be important, new languages like Scala saw a fourfold increase in the number of job listings from 2014 to 2016.

The need to learn quickly and problem solve is critical in positions across the tech workforce. In Accenture's Technology Vision 2016 survey of 3,000 IT and business executives worldwide, "deep expertise for the specialized task at hand" was cited as only the fifth-most important skill needed from tech workers. Being able to learn quickly, shift gears, and multitask

were all ranked as more important skills needed to succeed. Greater Philadelphia firms value these skills particularly for IT workers who show a capacity to understand business operations and can connect technology development with business needs. In many cases, workers who demonstrate a combination of business and technical skill sets find their way into higher-level positions.

IT employers often focus on candidates with a bachelor's degree as a strategy to find individuals with these skills. This approach, however, can have a limiting effect, as it screens out a broad segment of viable candidates. While many IT jobs can be done effectively without a bachelor's degree, IT employers often find themselves at a loss for other effective ways to assess a candidate's soft skills. At some firms in our region, misalignment between human resources professionals and IT hiring managers can unintentionally screen out qualified candidates. Misunderstandings can result in up-credentialing on job postings, with more education requirements than needed or a laundry list of technical skills that an IT manager would not necessarily expect one person to know.



**BOB MOULE**  
CEO  
Cloudamize

"I don't necessarily need employees who have a four-year degree and know every programming language. I need motivated people who can adapt and learn quickly, collaborate with coworkers and clients to solve problems, and are willing to go the extra mile to get results."

# 4



## Several tech occupations provide career on-ramps for middle-skill workers, with one-third of the region’s IT workforce holding less than a bachelor’s degree.

The pinch for high-skill openings in our region should not obscure the fact that the IT workforce includes people with varying levels of formal education. Today, an estimated 35,000 IT workers in Greater Philadelphia—35% of the tech workforce—hold less than a bachelor’s degree.

Computer support specialist, particularly for help desk support, is the most common middle-skill gateway job highlighted by local firms. Associate degree programs providing background in software, hardware, networking, and diagnostics help prepare candidates for these positions, and certifications offered by CompTIA, Microsoft, Cisco, and others provide foundational skills. While technical skills are important, the primary focus of these positions is customer service, for which communication, interpersonal, and problem-solving skills are of the utmost importance. Software testing and web development can also provide a gateway into the IT workforce. Software testers typically need a basic foundation in C# programming, test planning, and effective writing and communication to share findings of software bugs. Web developers can often enter the field with an associate degree or some postsecondary training in HTML, CSS and Javascript, along with strong communication skills to translate client needs into a well-designed and maintained site.

The share of new IT jobs available to those with less than a bachelor’s degree, however, is on the decline. Between 2002 and 2015, an estimated 19% of net new IT jobs created in Greater Philadelphia were in occupations requiring less than a bachelor’s degree. That figure has shrunk in recent years, with

only 15% of net new IT jobs created between 2012 and 2015 requiring less than a bachelor’s degree. Up-credentialing is partly responsible for this trend, but the most significant threat to middle-skill IT jobs is automation. Any task that can be “boxed”—where the task is extremely clear and can be discretely assigned with no additional questions—can eventually be automated. That process is already underway. Many tasks assigned to software testers that only a few years ago required human analysis are now automated, and the remaining human elements are increasingly being delegated to existing positions higher up the organizational chart. And the number of web developers shrank by one-fifth nationally over the past few years as new software enabled users with relatively basic web needs to build their own sites at less cost.





# 5

## Many regional residents—from K-12 students to adults—do not understand the wide variety of jobs, industries, and career paths in tech.



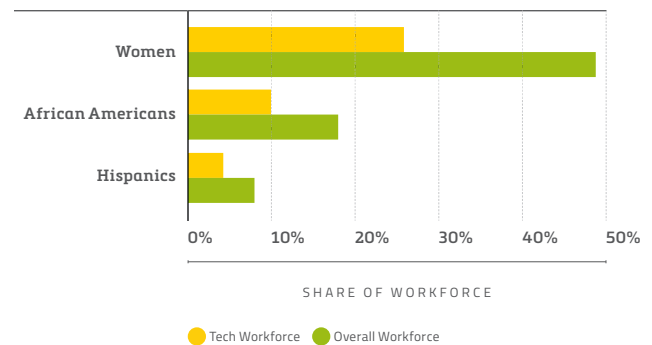
The spread of technology into everyday life is generating a diversity of employment opportunities that extend far beyond common perceptions of tech jobs. While images of the entrepreneur building a high-growth startup or the professional hacker furiously writing code have become predominant notions of what a tech career entails, the reality is that most IT jobs are in non-tech industries. In major sectors like finance, healthcare, and education, IT is an increasingly critical part of operations and production. And tech career pathways in the corporate world often provide greater stability than the startup environment, which can appeal to many workers.

General awareness of such opportunities is limited, however, due in large part to the rapid pace of technological change and the lack of integration of basic tech education into school curricula. These challenges are particularly acute for young people of color and women, who are significantly underrepresented in the tech workforce both in Greater Philadelphia and nationally. Limited awareness of available opportunities in tech can make it difficult for women and people of color, young and old, to imagine themselves in a tech career.

Few programs or initiatives in our region adequately frame the range of experiences and skill sets involved with different IT occupations. Communicating the

variety of skill sets used across IT careers—from artistic and creative talent applied in user-experience (UX) and user-interface (UI) work, to problem solving and attention to detail associated with quality assurance, to the people skills required for help desk positions—is critical to retaining the interest of young people and allowing them to see a path that interests them. The lack of understanding of career opportunities in tech extends to many parents and guardians, who play a significant role in shaping a child’s career interests but often have little idea of the broad and quickly evolving range of opportunities that tech has to offer.

DIVERSITY IN THE GREATER PHILADELPHIA WORKFORCE



Source: U.S. Census Bureau, American Community Survey 5-Year Estimates



**STACY HOLLAND**  
Executive Director  
Lenfest Foundation

“In order to thrive, our region must begin thinking about a long-term talent development strategy. Exposing young people to the variety of careers in tech can help build a talent pipeline into careers that can ensure economic mobility.”

# 6



## Greater Philadelphia's IT education and training ecosystem is wide-ranging, but can better meet regional market needs.

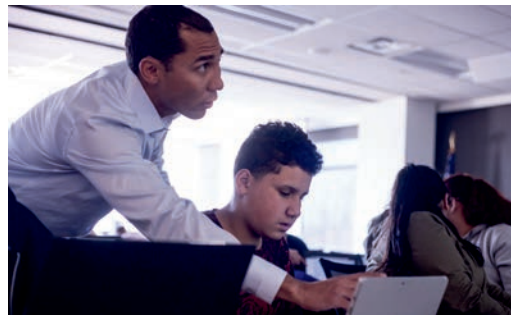
Educational institutions across our region have also faced challenges in adapting to rapidly changing IT market needs. With technological evolution outpacing educators' capacity to update curricula, many students are left learning out-of-date techniques and approaches. Funding constraints are a driving factor behind the slow realignment of IT curricula to meet market needs, and challenges in finding qualified instructors also play a role.

IT employers largely view our higher education institutions as major assets in talent development and attraction, though universities have struggled at times to balance employers' technical skill demands with their broader academic missions. Increased adoption of the CS+X curriculum model has helped expand the number of students in tech while preserving the breadth of a liberal arts education. The CS+X model, which combines computer science with another discipline through a double major, minor, or interdisciplinary work, meets employer demand for candidates with writing, critical thinking, and problem-solving skills alongside a foundation of technical skills.

Area community colleges offer a range of IT opportunities through associate degrees, certificates, and non-credit training. They serve an important role for both students coming out of high school and those who are changing careers or upskilling. Community colleges are working to make it easier for students to fulfill IT degree requirements through discrete certifications they earn over time. However, salary constraints and structural labor issues inhibit the ability of many community colleges to hire qualified faculty with up-to-date skills.

Tech training opportunities in Greater Philadelphia beyond the formal education system have spread in recent years. Work-based learning experiences like internships, co-ops, and apprenticeships are used by some employers to address immediate needs and to help develop their own talent pool. A growing number of independent training programs and coding bootcamps fill gaps in formal education and serve a range of populations. Some have developed productive relationships with employers to create direct hiring pipelines. Still, most of these programs are relatively small; combined, they do not reach sufficient scale to fully address the supply/demand gap in our region.

At the K-12 level, schools have struggled to meaningfully integrate tech into curricula. Many schools are introducing tech tools to help students learn traditional subjects by investing in computers, iPads, and educational software. These tools can help students learn, but do not prepare them to join the tech workforce. Students in many schools are lacking a foundational introduction to IT at a young age, as well as more specialized coursework in computer science and other IT disciplines throughout middle school and high school.





# Driving Tech Talent Growth in PHL

## An Action Framework

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**Grounded in the market assessment findings, the Economy League and the tech workforce steering committee developed a detailed action framework to achieve the shared vision of a deep and diverse tech talent pool in Greater Philadelphia that supports business growth and fosters economic opportunity for residents.**

**The priority strategies detailed in this framework flow from the opportunities and challenges identified in the market assessment: a limited talent pool for high-skill tech job openings; a large number of middle-skill incumbent tech workers; the need for tech workers with foundational technical skills that can also learn continuously and quickly adapt; a lack of awareness of tech career opportunities, particularly among women, people of color and dislocated workers; and a wide-ranging education and training system that can better meet market needs.**

**VISION**

**A deep and diverse tech talent pool in Greater Philadelphia supports business growth and fosters economic opportunity for residents**

**GOALS**

1. More employers invest in upskilling their incumbent workforce to fill high-skill IT openings
2. More individuals in our region obtain IT education and training that meets rapidly evolving market needs
3. More women, people of color, and dislocated workers consider careers in IT

**WHO IS INVOLVED**

Realizing this vision and goals will require action by a wide range of stakeholders in Greater Philadelphia, each with a unique role to play in driving tech talent growth.



## STRATEGY 1

# Increase Incumbent Worker Training and Employer-Led Solutions

**Leveraging employers' incumbent IT workforce is a particularly promising strategy for addressing the high-skill labor shortage in our region.** Most on-the-job training and upskilling is powered by direct financial investment from employers, but employers alone cannot fully address the high-skill labor shortage. To get to sufficient scale, upskilling programs within individual firms must be combined with efforts to build greater capacity among industry-led workforce partnerships to advocate for specific training programs, leverage public funding for training, provide a venue for sharing best practices, and potentially serve as a vehicle for joint incumbent worker training. There are also opportunities to expand work-based learning programs and coordinate human resources practices to broaden the tech talent pool.

## PRIORITY TACTICS

### Large Employers Collaborate and Boost Investment for Incumbent Worker Training

In many respects, incumbent workers are well-positioned to meet firms' high-skill needs. Middle-skill employees in help desk, network administration, or database administration positions already know the business, have a baseline of foundational IT skills, and have various non-technical skills forged by years of work experience. Large employers often have a significant cohort of such workers, along with the resources and scale to provide targeted training. With additional training, firms can tap these incumbent workers to fill junior-level positions in software development, web development, or cybersecurity. And with employers reporting few challenges filling those existing middle-skill positions, internal movement up the organizational chart will not necessarily result in a downstream hiring crunch. Incumbent worker training would allow firms to fill high-skill positions while opening up on-ramp IT opportunities for middle-skill workers. Many firms understandably worry that employees will leave after receiving training, but this can be mitigated through explicit agreements for workers to stay at the firm for a specified period of time. There is no one-size-fits-all solution, but even non-financial changes—such as flexible scheduling to allow for workers to take courses, or co-locating training programs at an office—can be useful in upskilling a workforce.

### Small and Midsize Employers Develop and Expand Paid Internship, Co-Op and Apprenticeship Programs

For small and midsize employers, further participation in work-based learning programs can expand the pipeline of future employees. This low-cost strategy is a good fit for firms of this size, as they often have limited resources for upskilling investment and typically have smaller, more informal full-time job recruitment programs than larger companies. Many firms already have regular rotations of interns or co-op students, and use those students as a primary pool for hiring needs. There is opportunity to cast a broader net in recruiting students for these work-based programs. Expanding the potential pool of students beyond those pursuing bachelor's degrees—in partnership with community colleges, training programs or bootcamps—would allow firms to not only bolster their chances of filling talent needs but also boost diversity.

Incumbent worker training would allow firms to fill high-skill positions while opening up on-ramp IT opportunities for middle-skill workers.

## CASE STUDY

### AT&T Retrains its Existing Workforce to Reposition Itself

As AT&T works to transition from a legacy telecom giant to a modern tech and media company, it is making an unprecedented investment in retraining its existing workforce to fill new roles that will require competencies in software development, cloud computing, data science, and more. In an interview with the Harvard Business Review, an AT&T senior executive made the case for the company's strategy: "You can go out to the street and hire for the skills, but we all know that the supply of technical talent is limited, and everybody is going after it. Or you can do your best to step up and reskill your existing workforce to fill the gap." Half of all AT&T employees—140,000 workers—are going through re-training, with the firm spending \$280 million annually on training programs, nanocredentials, and tuition reimbursement. Although the scale is massive, that sum works out to about \$2,000 per worker, per year. The program is not just a financial investment, but a full wraparound service, with tools to identify skill gaps, map out future career pathways for existing workers, and connect to flexible training options via online learning partnerships with Udacity and Georgia Tech. If AT&T succeeds, it will be a model for legacy tech companies to compete against modern tech companies.

### Industry Partnerships Connect More Firms to Best Practices and Training Opportunities

While most employer-led programs will be determined by individual firms, there is ample opportunity for firms to collaborate more closely around shared needs and solutions. Industry partnerships—formal partnerships in the Commonwealth of Pennsylvania that bring together multiple employers in a specific industry or cluster—provide opportunities for firms to share success stories, learn about effective training opportunities, and connect to public funding for upskilling. Increasing the number of employers participating in these partnerships could reduce the practice of firms poaching workers from each other and provide a larger public policy platform. While some firms in our region take advantage of existing partnerships, broader representation in these partnerships would amplify benefits to members and boost advocacy power.

### HR Leadership Groups Engage Members Around Hiring Practices to Meet IT Workforce Needs

Firms can often face self-imposed barriers in finding qualified candidates when their job postings ask for more skills than truly needed and when they use bachelor's degrees as a blunt proxy for non-technical skills. Competency-based hiring, which provides

alternative means for candidates to demonstrate that they have particular competencies—such as problem-solving, communications, or technical skills—rather than focusing solely on credentials, can be an effective way to identify more qualified workers. With IT employers reporting challenges in finding candidates with the requisite non-technical skills, embracing competency-based hiring practices could expand the candidate pool for employers and simultaneously open up opportunities for diverse candidates.



### Key Performance Indicators

- > Number of workers receiving upskilling investments
- > Number of firms making incumbent workforce investments
- > Number of students participating in work-based learning programs
- > Conversion rate of interns into full-time employees
- > Membership growth in industry partnerships

## STRATEGY 2

# Align and Scale Educational and Tech Training Programs

**IT employers point to Greater Philadelphia's institutions of higher education as major assets in talent development and attracting young people to the region.** Our higher education system is complemented by a growing number of specialized tech training and coding bootcamps that provide alternative entry points to a tech career. All of these elements are critical to developing Greater Philadelphia's tech talent. In the near-term, training solutions and bootcamps can help to address the undersupply of qualified candidates. Longer-term, postsecondary institutions as well as K-12 schools can collaborate with industry partnerships to ensure that foundational and technical skills taught align with market needs and are adaptable to future trends.

## PRIORITY TACTICS

### **Trainers and Funders Expand the Number of Training and Bootcamp Seats for Software Development and Hardware Solutions**

Greater Philadelphia has a growing number of accelerated training programs for software development, hardware skills, and networking solutions. The most promising programs pair technical skills training with a focus on soft skills and an internship to bring students up to a level that enables them to get to work immediately. Because these programs operate at such a small scale, however, their impact is limited. They would benefit from building a stronger network with each other to share resources for curriculum development and volunteer training. Closer collaboration would also help create economies of scale with employer relationships—both to learn about real-time employer needs and develop direct job pipelines.

### **Higher Education Leaders Coordinate Curricula to Bridge Gaps Between Employer Needs and Postsecondary Programs**

Further commitment to frequent and structured communications between academic institutions and IT employers in our region would strengthen relationships and allow academic institutions to keep up with changing market trends. Today, conversations are typically held between individual schools and employers, but opportunities exist to build economies of scale by sharing information more broadly, potentially through industry partnerships. Including community colleges and other postsecondary institutions in these conversations would expand opportunities for creating a more diverse tech workforce. This two-way relationship could also build partnerships enabling senior company employees to teach at colleges to ensure that students have access to the most up-to-date information available.

The most promising programs pair technical skills training with a focus on soft skills and an internship to bring students up to a level that enables them to get to work immediately.



## CASE STUDY

### A Local Gold-Standard Training Program

Zip Code Wilmington, Delaware's first coding school, is both a 12-week software development training school and a 26-week apprenticeship program that gives its participants real-world experience to prepare for a full-time position. Zip Code is strengthened by partnerships with Wilmington corporations that have high demand for software developers, such as JPMorgan Chase and Capital One, which guide curriculum development and hire graduates in apprenticeships and full-time positions. The program has a 93% placement rate within three months of graduation. Zip Code's curriculum sets it apart from other coding schools since it focuses on teaching Java, a foundational programming language that continues to be in high demand. Employers who participate in the apprenticeship program cover \$9,000 of the total \$12,000 bootcamp fee, significantly reducing the cost for students. In 2016, Zip Code Wilmington was selected as one of 10 programs nationwide to participate in the U.S. Department of Education Educational Quality through Innovative Partnerships (EQUIP) program. Through EQUIP, Zip Code students are eligible to receive Pell Grants and a full semester of college credits toward an associate or bachelor's degree in applied technology at Wilmington University.

#### Key Performance Indicators

- > Number of students graduating with a credential in computer science or an IT field
- > Number of students placed by bootcamps
- > Number of schools including tech curriculum



#### State and Local Governments Prioritize and Fund Inclusion of Tech Learning in K-12 Curricula

A sustainable long-term tech talent pipeline will require meaningful integration of computer science and technology learning into K-12 curricula. This is also key to creating a tech workforce that reflects the overall diversity of the region. The broader challenges faced by a number of area public school systems have made progress on this front difficult, as tech must fit in alongside critical investments and reforms needed to raise proficiency in other subjects. However, learning tech skills is a critical element of 21<sup>st</sup>-century job readiness that can reinforce other subjects and spark excitement in students. Tech education isn't just about learning how to code—it helps develop critical thinking, problem solving, and communication skills that cut across disciplines. To build tech into everyday curricula, local schools would have to recruit new teachers and continuously retrain them to stay current with rapidly changing technology. Progress on adoption of tech into K-12 curricula will require a broad coalition of partners to make the case about the need for this change, how it would be funded, and how it would be sustained.



### STRATEGY 3

## Raise Awareness of Potential Tech Careers Among Underrepresented Populations

**Even with the growing number of programs focused on exposing young people to tech careers via classroom visits, shadowing opportunities at firms, hackathons, internships, and more, there remains a knowledge gap among young people about the nature and extent of IT jobs in our regional economy.** Additional efforts are needed to raise awareness of the breadth of career opportunities in tech—particularly for young women and people of color, who are significantly underrepresented in the region’s tech workforce. Beyond reaching young people and the adults in their lives, increasing awareness of IT job opportunities among adult workers in other industries who are either looking to change careers or who have been laid off will help expand the long-term pipeline of IT workers.

### PRIORITY TACTICS

#### **Nonprofit Leaders and Corporate Partners Develop a Comprehensive Outreach Campaign**

A comprehensive outreach campaign sharing a set of key messages with three targeted groups—students, adult figures who influence youth, and dislocated workers—would help expand and diversify the number of residents in Greater Philadelphia considering IT careers. For each of these groups, targeted infographics or short videos highlighting the diversity of careers and people in tech could be impactful tools if paired with the right distribution channels. A nonprofit could lead this effort with one or more corporate partners providing financial and technical assistance, particularly around design and videography.

For students, exposure to tech career skills and pathways needs to start early and targeted efforts to deepen their understanding of specific pathways should follow as they get older. Students should be able to imagine different tech careers and should be aware of resources and programs within and outside of school to support this career exploration.

For parents and educators, guiding students toward tech can be daunting given the proliferation of tech career pathways. More employer and tech leader

engagement with parents and teachers at PTA meetings or other community-based gatherings would help build awareness among this group and highlight the vast opportunity in this sector for their children.

Beyond these groups, many career-changers and dislocated workers may assume that a tech career is out of the picture without realizing that many tech workers come from a non-computer science background. These workers should be able to easily access programs and other training resources that can aid in this transition, and be aware of examples of successful career-changers in the region.

For students, exposure to tech career skills and pathways needs to start early and targeted efforts to deepen their understanding of specific pathways should follow as they get older.

## Myth-Busting: What Does a Tech Career Really Look Like?

### **There are a wide variety of tech careers—it's not just coding.**

Artistic and creative talent can translate to a job in user-experience (UX) or user-interface (UI) work; problem-solving and attention to detail can translate to a job in quality assurance; people skills can translate to a job in computer support. Communicating the variety of skill sets used across IT careers is critical to keeping young people with varied interests from tuning out early.

### **Tech jobs are in many types of firms and industries, not just start-ups.**

While the idea of someday working at a tech startup captures the imagination of many young people, most tech jobs in our region and nation are in non-tech industries. And though these positions may not be at high-profile startups, they also require workers to use technology creatively to solve compelling challenges and problems, and can offer corporate career pathways with stability and other benefits that are attractive to many workers.

### **Tech jobs are open to people of all backgrounds.**

The tech workforce has a reputation for its lack of diversity, but tech is a growing opportunity area for people of all backgrounds. A number of existing programs in Philadelphia are already focused on increasing the number of women and underrepresented minorities in tech, and scaling these programs as well as increasing awareness of IT careers as a whole can draw more diverse populations to tech jobs.

### **Key Performance Indicators**

- > Number of women and people of color in the tech workforce
- > Number of women and people of color pursuing tech education and training
- > Number of dislocated workers pursuing tech training
- > Number of students majoring in IT at local colleges

### **Employers and Youth Programs Expand Career Exposure with Increased Attention to Follow-Up**

Dozens of tech career exposure efforts by intermediaries and individual firms in our region provide important opportunities for young people to learn about what careers in tech look like. Emphasizing hands-on experience in these programs is essential, as young students can easily tune out during talks or presentations. Furthermore, creating more direct follow-up opportunities for students would amplify the benefits of one-off programs. Immediately following a more traditional career exposure experience, students could be directed to one of the many ongoing extracurricular tech education programs in our region. While traditional career exposure approaches and training are needed, opportunities exist to think more creatively about how to best to connect young people with the tech community. To this end, hackathons have grown in popularity, and extracurricular youth tech programs in our region have also looked at creative ideas like a competitive coding league.



#### STRATEGY 4

## Improve Access to Data on Tech Talent in the Region

### Key Performance Indicators

- > Web traffic on career pathways and training program sites
- > Number of employers responding to regional survey about tech talent needs

**Broad access to data and information about employer needs, career pathways, and education programs in our region helps inform the actions of employers, educational institutions, and workforce providers.** It also empowers jobseekers, students considering

IT educational programs, and other interested stakeholders to take advantage of available opportunities. Data on employer needs, skill gaps, and opportunities presented in this report is only a snapshot of current conditions and past trends. The needs of IT employers, the landscape of education and training programs, and awareness of tech career opportunities are all different today than what they were five or ten years ago, and the pace of change is likely to accelerate. Ongoing data collection around all aspects of the tech talent pipeline will be critical in ensuring that the actions being taken by regional stakeholders to drive growth and expand opportunity in IT are grounded in current facts and trends.

#### PRIORITY TACTICS

### Nonprofit and Public Sector Leaders Create and Maintain Shared Information for Students and Jobseekers

Individual organizations in the region, from youth development non-profits to academic institutions, provide a variety of information about the career pathways and certification needs for IT occupations. Streamlining this content and combining it with information about area education and training programs would make it easier for prospective students to understand available opportunities and which skills and certifications lead to advancement. Any organization leading this effort, however, would require investment from corporate or philanthropic partners to create and maintain these shared resources.

### Industry Partnerships Implement Regular Data Collection and Analytics on Tech Talent Trends and Needs

Gaps in existing available data on the tech workforce create blind spots for employers, educators, and workforce professionals. For example, reliable estimates of job postings and the education level or skills required by industry sector would better inform where to focus education and training efforts. Conducting a comprehensive survey of tech firms and IT departments to understand their changing tech needs, training efforts, views on relevant certifications and skills needed, and hiring projections could provide a region-wide basis for specific training needs. Consistent analysis of this data would also yield information on how tech talent responds to industry trends, and vice versa. Due to the rapid changes in the technology market, regularly updating needs assessments will be important.





# Moving the Framework Forward

**Driving tech talent growth in the region is a long-term proposition that will require sustained, collaborative focus by the wide range of firms, institutions, government agencies, foundations, and nonprofit organizations involved in this work.** While transformation will take time, actions we take today to advance the strategies and tactics presented in this report will help put Greater Philadelphia on a path to better leveraging our tech workforce for growth and opportunity for all residents in the region.

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## Early Implementation Efforts

### Convening IT Employers and Expanding Data Collection

The Innovative Technology Action Group (ITAG) is an industry partnership and a regional leader around Technology/IT employer engagement and workforce development. ITAG is an initiative of the Chester County Economic Development Council and is funded in part by the private sector and the Chester County Workforce Development Board. ITAG brings together a diverse set of business, education, training, and public sector leaders from Southeastern PA to learn from one another and collaborate around shared workforce needs and solutions. Going forward, ITAG has committed to expanding its bi-monthly regional meetings to include the Driving Tech Talent Growth in PHL steering committee members. This will help to build new relationships among major IT employers in Greater Philadelphia and provide a natural ongoing home for collaborative efforts to advance the action framework highlighted in this report.

ITAG will also expand its annual Technology/IT employer needs assessment survey to reach more firms and collect additional critical information on employer needs including training, hiring, and more. The Economy League

will assist ITAG with design and distribution of the expanded survey and will help identify additional partners to extend the survey's reach. Leveraging ITAG's existing annual survey to reach a broader audience of employers will help regional leaders maintain up-to-date and detailed information about changing labor market needs and dynamics on an ongoing basis, allowing for more targeted interventions by employers, educators, funders, and others going forward.

### Engaging HR Leaders

Recognizing the role of HR decision-making in addressing current and future tech workforce challenges, the Philadelphia Regional Chapter of the Society for Human Resource Management (Philly SHRM) has committed to engaging its member base around IT workforce hiring and training best practices. Part of the world's largest HR professional society, Philly SHRM provides professional development and networking opportunities for more than 1,400 area human resource practitioners representing more than 500 of Greater Philadelphia's leading employers. Philly SHRM will be conducting focus groups in 2017 to help shape their approach to deepening member engagement around IT hiring issues.





# Steering Committee

**The Driving Tech Talent Growth in PHL analysis and action framework was guided by a steering committee comprised of leaders from IT employers, higher education, workforce development organizations, government, philanthropy, and other regional nonprofits. The committee met throughout the fall of 2016 and winter of 2017.**

**Tom Ahart**, Director of College Success Services,  
Graduate! Philadelphia

**Jason Bannon**, Director, Marketing and Communications,  
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**Saul Behar**, VP and General Counsel, University City  
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**Dean Miller**, President & CEO, PACT

**Sylvester Mobley**, Executive Director, Coded by Kids

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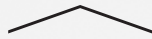
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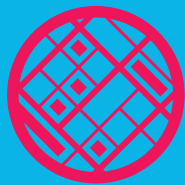
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The Economy League's **World Class Greater Philadelphia** agenda focuses on **improving education and talent development outcomes in our region, boosting business growth, and making our infrastructure more effective and reliable.** The World Class agenda was developed with input from more than 1,700 regional business, nonprofit, government, labor, and community leaders from across Greater Philadelphia.



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