PARTNERING TO STRENGTHEN TECH TALENT IN THE CAPITAL REGION

DECEMBER 2017

GREATER WASHINGTON PARTNERSHIP
FROM BALTIMORE TO RICHMOND.
FOSTERING UNITY. ADVANCING GROWTH.

VISION FOR OUR REGION

By working together—

We will leverage our unique strengths, our diversity and the power of commerce to help make the 'Capital Region' of Baltimore, Washington and Richmond the best place to work, raise a family and build a business.

- A dynamic and inventive business environment with a purpose-driven community

- A home for those seeking opportunity to fulfill their aspirations and thrive

- An economic power house that attracts the creatives, entrepreneurs, technologists and people who dream big

- A place with the transportation, housing, education, and healthcare systems designed and shaped for the 21st century

- A global magnet for talent and innovation

Establishing Baltimore, Washington and Richmond as the model for a thriving super-region.

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A NOTE ABOUT OUR METHODOLOGY

The reality is that few jobs today are not impacted by digitalization. Over just the last five years, the share of U.S. jobs and employment that require substantial digital knowledge rose rapidly, whether because of changes in the digital content of existing occupations or because of shifts in the distribution of occupations toward mid and high levels of digital activities.[iv] As applications of digital technology diffuse across industries and occupations, most workers now require some level of digital skill.

For this report and our analysis, we define "digital tech" workers as a group of workers comprising 20 occupations with high levels of digital activity. The occupational categories include software developers and programmers; computer support, database and systems; technology and engineering related; and computer and information system managers. (See end notes for a complete listing.) These jobs are highly concentrated within the high-tech services industry but are not limited to any one type of company and are spread across all industry sectors. Using this definition,

a software developer who works for a logistics company is included in our data.[v] This approach enables us to focus our comparative analysis on a set of jobs that we know are at the intersection of technology-oriented skillsets and growing employer demand.

This methodology has limitations and we know that existing data organized by occupations does not fully account for digital tech skills and competencies. Thus, our analysis understates the digital tech skills needs of our region. For example, our definition of a digital tech worker does not capture the biomedical researcher whose drug discovery efforts are increasingly driven by machine learning and advanced analytics processes to understand and visualize interaction with targets. Nor does our definition account for the retail store worker who now utilizes a tablet computer to assist customers. This highlights an important opportunity for our region, by working together, to develop deeper insights into the ways jobs are evolving and the sets of skills workers will need to fill them.

EXECUTIVE SUMMARY

"Developing and employing workers who are skilled in digital technology in its various forms is our region's largest economic opportunity"

Our region's people are its greatest asset. Ensuring that people in our region can access and acquire the skills that employers need, and that we retain those skilled workers, is an essential component of our economic competitiveness. For our region, that must start with the digital technology skills that power a broad array of our region's employers and industries, including areas of potential advantage that can fuel the Capital Region's future growth.

Today, digital technology is increasingly integrated into everything. It is remaking industries, our economy and how people work. Building on our region's strengths to grow the next generation of digital technology products and services will be essential to reorienting the Capital Region from its slow-growth trajectory to the high-growth performance we need to maintain and broaden prosperity. Developing and employing the workers who are skilled in digital technology in its various forms is our region's largest economic opportunity.

The Capital Region is already home to a deep and diverse "digital tech" workforce.[i] Our region has the third largest number of digital tech workers in the nation, and the second largest number on a per capita basis. One in every sixteen jobs in our region is in a digital tech occupation. We also boast a robust pipeline for digital tech talent, with more than 100 higher education institutions across our region, producing the largest number of digital tech-oriented degrees and certificates of any region in the U.S.

However, our region is losing share of these important digital tech jobs. Over the last five years, the number of digital tech workers in the Capital Region has increased just three percent – or 8,000 net jobs – a pace far slower than the 12 percent national growth rate.[ii] As job transformation and creation increasingly favor

digital tech occupations, there is intense competition from other regions for these desirable jobs and workers.

Today, despite a deep digital tech workforce, the gap between supply and demand for digital tech workers in our region is larger than peer regions' and the U.S. average, translating into 35,000[iii] **current unfilled digital tech jobs.** And moving forward, without action, this potential constraint on our region will only grow. A survey of the organizations comprising the Greater Washington Partnership underscores the need, showing that that these organizations alone will need to hire more than 20,000 digital tech workers – spanning all levels of skills and experience – over the next five years to fill open jobs through growth or attrition that are vital to their organizations' success. A broader evaluation of our region's employers will surely show similar demand signals.

The Capital Region has unique assets that position us to be highly competitive in digital tech. And nowhere in our region are the opportunity and challenges of creating a digital tech workforce more apparent than in the cybersecurity field. As this report spotlights, cybersecurity – a digitally-intensive field where our region can be the global leader – illustrates the unique potential for our region to become a world-class digital technology hub, developing adjacent high growth fields such as artificial intelligence, data analytics and software development.

By looking more closely at the composition of our region's cybersecurity industry, we can also learn how to deliver a digital tech workforce for the region. Key challenges that we must address include: expanding the pipeline of students interested and proficient in STEM; aligning the skills and experience that employers need with what our educational institutions and workforce training systems

provide; and improving retention of our graduates and existing employees.

To meet the demand for these skilled workers, employers must partner with academia, workforce and government leaders to adapt and expand our region's talent pipeline, from the earliest grades through college, career training and beyond. This means closer collaboration between educators and industry to tighten the feedback loop between academic and applied learning, and positioning our learning institutions and workforce systems to have the flexibility to rapidly adapt with the needs of employers and advances in technology.

Across our region there are many promising and innovative approaches that are working to address the digital tech talent needs of employers. In addition to identifying the challenges and root causes underpinning our region's current gap for cybersecurity professionals, this report is intended to highlight some examples of how the organizations comprising the Greater Washington Partnership are taking action. These models range from introducing K-12 students to possible career paths, working with higher education institutions to increase the number of people entering the workforce with in-demand credentials and certifications, to developing and recruiting a more diverse workforce. All of these signify the types of programs we can learn from and scale to meet our region's need for digital tech talent.

We are reminded by recent announcements of well-known companies looking to relocate or expand that it is a global competition for talent and that strong pipelines for talent matter – particularly digital tech talent. The Capital Region's unique attributes as the cross-roads of research and development, policy, business, media and national security, anchored by the U.S. federal government, position us to lead the nation's digital transformation and provide compelling reasons for the most talented and ambitious to be part of our desirable communities. The Greater Washington Partnership is committed to helping our region capitalize on these attributes – finding and scaling innovative ways that employers, educators and government can partner to advance the Capital Region's position as home to the best, deepest and most capable workforce in the world, starting with digital tech.

01

WHY DIGITAL TECH TALENT MATTERS TO OUR REGION

"Growing the next generation of technology products and services here in the Capital Region is essential to reorienting our economy from its slow-growth trajectory to the high-growth performance we need to maintain and broaden prosperity"

The ascendency of digital technology, particularly software, is directly driving the creation of many of the highest paying jobs and the most rapidly growing businesses in the Capital Region. Emerging applications of software in cybersecurity, precision medicine, artificial intelligence, data analytics and other fields are changing how our region's businesses work, and the products and services that they deliver to consumers, businesses and the government. The manifestation of software and its combination with information and other technologies to transform business operations – something we describe as "digital tech" – is our region's largest economic opportunity and is key to changing its growth trajectory.

For the Capital Region to achieve its growth potential going forward – over the past five years, our region's GDP grew at 0.9 percent, only half as fast as the peer regions of Boston, New York City, the San Francisco Bay Area and Los Angeles – it must have in place an ecosystem that develops, attracts and retains the necessary digital tech workforce. Today our region's employers identify significant skills and job gaps. It must also have a supporting infrastructure that allows startup and established digital tech businesses to obtain the resources necessary for growth, including access to customers, growth capital, talent, infrastructure (transport, broadband and real estate) and supportive service providers. None of these things will occur without our region acting with intentionality.

With our unique education, human capital, research and industry assets, anchored by the U.S. federal government, the Capital Region has an exceptional opportunity to be a leading creator of digital tech jobs and businesses. In fact, the confluence of the federal government as a large consumer and developer of advanced digital tech, alongside a vibrant private sector that benefits from this proximity, has already spurred the creation of a unique and highly skilled digital tech workforce.
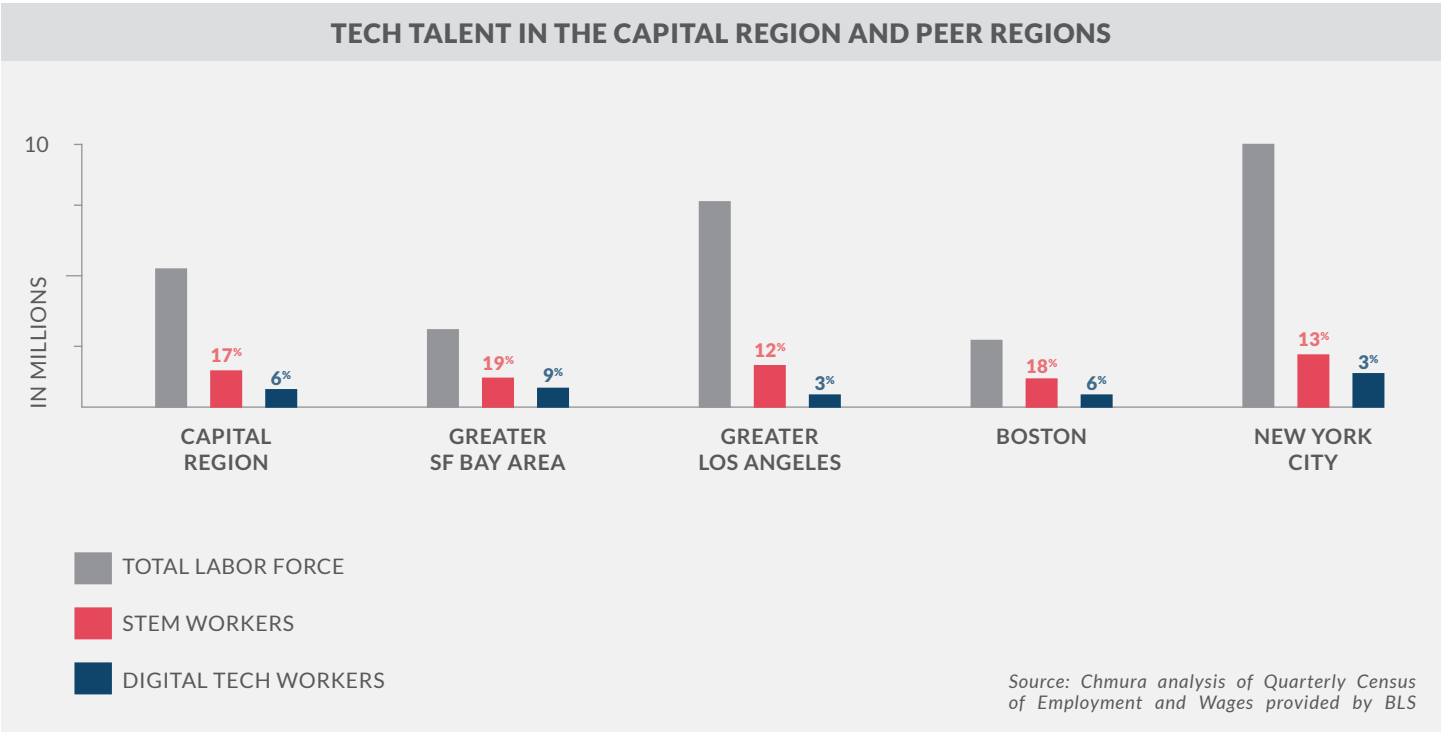
While we have many unique attributes, our region's need for digital tech workers and entrepreneurs is not unique. Many competing regions in the U.S. and worldwide have determined that their future success will also be driven by their ability to attract and retain digital tech talent and businesses. There is an intense global competition for this specialized talent. Strong demand for skills such as software development, hardware engineering and information security, coupled with a tight labor supply, is driving many employers to locate jobs in markets with the largest concentrations of high-quality talent. This supply of digital tech talent has become a critical enabler – or, in some cases, constraint – to a region's ability to grow. In today's economy and as far as we can see beyond, assuring growth requires developing, attracting and retaining a workforce that is skilled in cross-disciplinary digital fields such as computer science, cybersecurity, data science and analytics, engineering and information technology.

Labor data also shows how digitally-oriented occupations are driving job creation, particularly high-paying job creation. Nationally, the share of employment in occupations with high digital content have more than tripled since 2004. Nearly two-thirds of new jobs created since 2010 have required either high- or medium-level digital skills. [vii] Across a much broader spectrum of industries and occupations, workers increasingly require foundational digital and basic skills. A competency in digital tech will become for the 21st century citizen as essential as reading and arithmetic were for his parents.
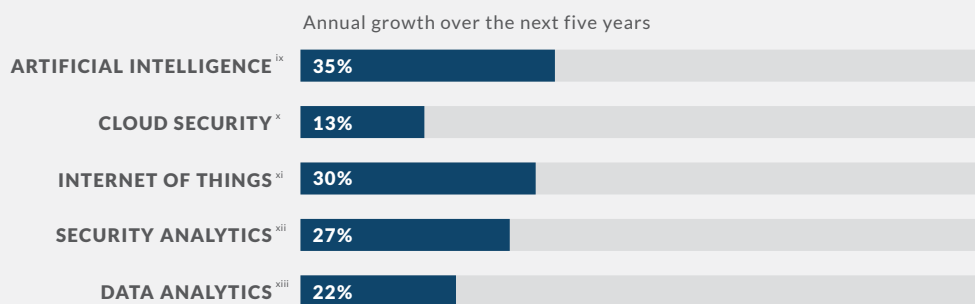
DIGITAL TECH TALENT
IN THE CAPITAL REGION

The Capital Region spanning Baltimore to Richmond, with a pool of 5.3 million people in the labor force, is home to a deep and diverse digital tech workforce. [viii] More than 330,000 digital tech workers are spread across our region's industries, adapting technologies and bringing innovation to all corners of our economy. These workers comprise the third largest population of digital tech workers of any U.S. region and are part of a larger workforce of nearly 900,000 STEM (science, technology, engineering and math) workers who power the Capital Region. In absolute terms, only New York City and Greater Los Angeles have a larger population of STEM workers, and only New York City and the San Francisco Bay Area host more digital tech workers.

TECH TALENT IN THE CAPITAL REGION AND PEER REGIONS

IN MILLIONS

Region	STEM	Digital Tech
CAPITAL REGION	17%	6%
GREATER SF BAY AREA	19%	9%
GREATER LOS ANGELES	12%	3%
BOSTON	18%	6%
NEW YORK CITY	13%	3%

■ TOTAL LABOR FORCE

■ STEM WORKERS

■ DIGITAL TECH WORKERS

Source: Chmura analysis of Quarterly Census of Employment and Wages provided by BLS

GLOBAL MARKET GROWTH PROJECTIONS IN EMERGING DIGITAL TECH

Annual growth over the next five years

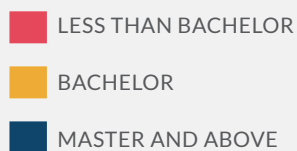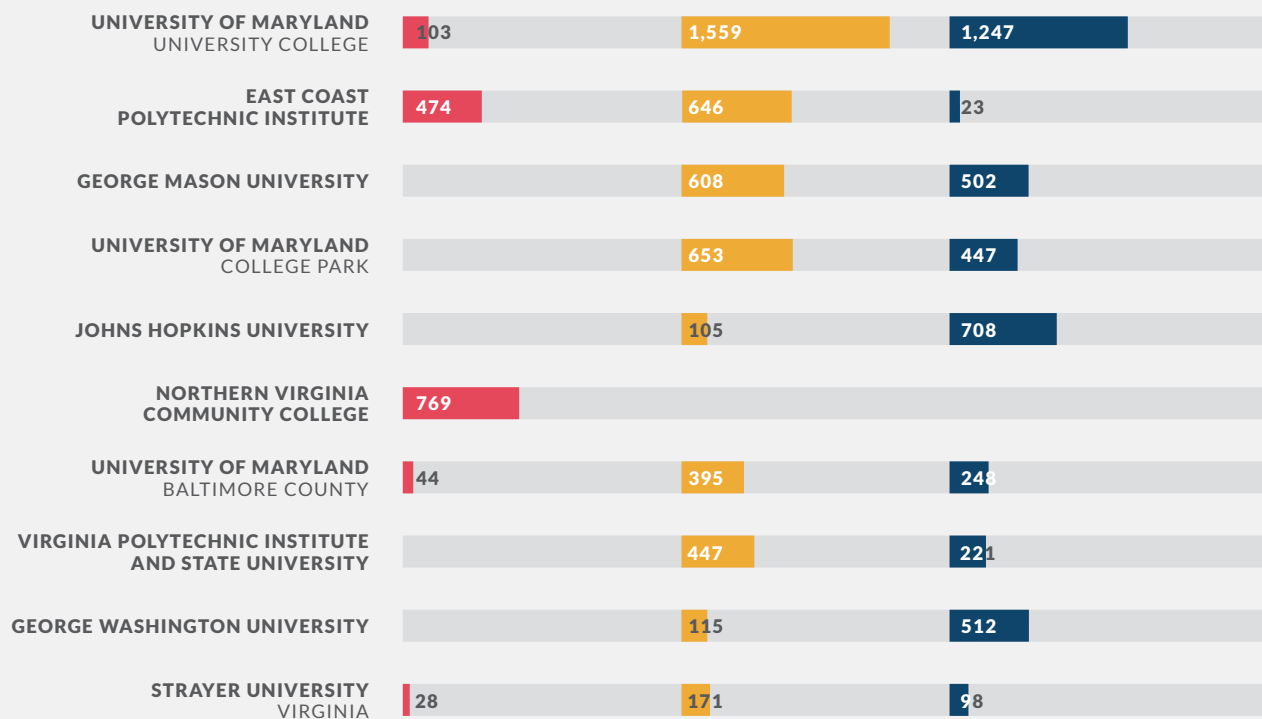|	
ARTIFICIAL INTELLIGENCE [ix]	**35%**
CLOUD SECURITY [x]	**13%**
INTERNET OF THINGS [xi]	**30%**
SECURITY ANALYTICS [xii]	**27%**
DATA ANALYTICS [xiii]	**22%**

THE CAPITAL REGION'S DIGITAL TECH TALENT PIPELINE

The foundation of the Capital Region's talent base is its strong educational institutions, systems and assets, which support a pipeline of graduates and skilled professionals that is nearly unmatched across the U.S. With more than 100 higher education institutions across our region, the Capital Region produces the largest number of digital tech-oriented degrees and certificates of any regional economy in the U.S. Of the 250,000 graduates produced each year by DC, Maryland and Virginia higher education institutions, nearly six percent earn degrees in digital tech related fields – including 7,700 bachelor's degrees, 5,200 post-graduate degrees and 4,200 certificates and two-year awards.

DIGITAL TECH-RELATED GRADUATES BY DEGREE AND REGION, 2016

	Less than Bachelor	Bachelor	Master and Above	Graduates per 10,000
CAPITAL REGION	4,275	7,732	5,280	32.0
GREATER SF BAY	973	1,977	3,074	16.6
GREATER LA AREA	2,652	4,176	3,781	13.3
NEW YORK CITY	3,168	5,149	5,248	13.8
BOSTON	646	2,568	2,532	20.8

GRADUATES PER 10,000 PEOPLE IN LABOR FORCE

🟥 LESS THAN BACHELOR

🟧 BACHELOR

🟦 MASTER AND ABOVE

Source: Greater Washington Partnership Analysis of National Center for Education Statistics data

CAPITAL REGION'S TOP 10 PRODUCERS OF DIGITAL TECH-RELATED DEGREES, 2016

Institution	Less than Bachelor	Bachelor	Master and Above
UNIVERSITY OF MARYLAND UNIVERSITY COLLEGE	103	1,559	1,247
EAST COAST POLYTECHNIC INSTITUTE	474	646	23
GEORGE MASON UNIVERSITY		608	502
UNIVERSITY OF MARYLAND COLLEGE PARK		653	447
JOHNS HOPKINS UNIVERSITY		105	708
NORTHERN VIRGINIA COMMUNITY COLLEGE	769		
UNIVERSITY OF MARYLAND BALTIMORE COUNTY	44	395	248
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY		447	221
GEORGE WASHINGTON UNIVERSITY		115	512
STRAYER UNIVERSITY VIRGINIA	28	171	98

■ LESS THAN BACHELOR

■ BACHELOR

■ MASTER AND ABOVE

Source: Greater Washington Partnership Analysis of National Center for Education Statistics data
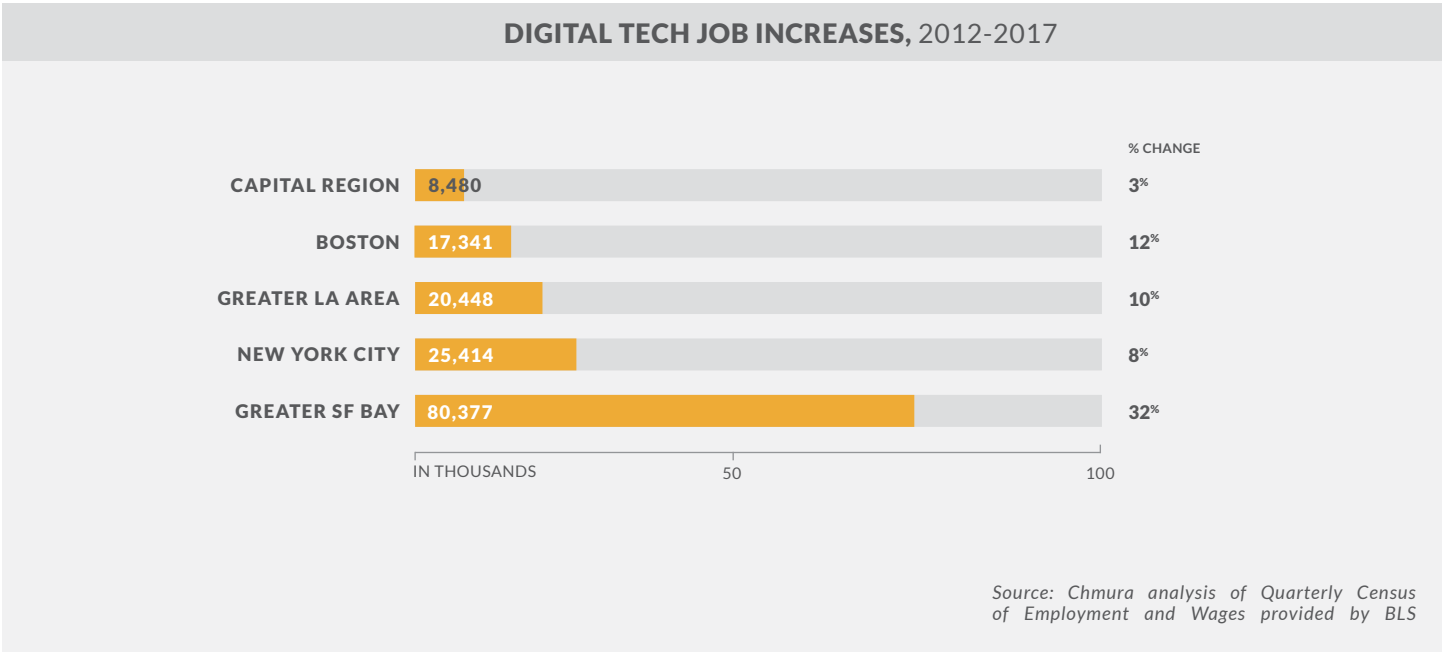
FRAMING
THE CHALLENGE

Despite these strengths, our region is losing share to other regions in digital tech employment. Over the last five years, the number of digital tech positions in our region have increased by three percent, adding approximately 8,000 jobs to the Capital Region economy, at a pace more than four times slower than the national average for growth. To put that in context, if our region had grown digital tech jobs at merely the U.S. average, the Capital Region would have added an additional 29,000 jobs over the last five years.

A similar, recent Brookings analysis looking at job creation in four digital tech industries – software publishing, data processing and hosting, computer systems design, and web publishing – found that while we remain one of the largest creators in absolute number of jobs, our region performed the worst among the 50 largest U.S. regions in terms of new job percentage growth. Our region was able to achieve valuable job growth, but it's evident that other regions are effectively competing to attract, develop and retain technology talent. To accelerate our region's growth, we must take the attributes that enable us to be a leader in digital technologies and ensure that the digital tech jobs of tomorrow are created here.

DIGITAL TECH JOB INCREASES, 2012-2017

		% CHANGE
CAPITAL REGION	8,480	3%
BOSTON	17,341	12%
GREATER LA AREA	20,448	10%
NEW YORK CITY	25,414	8%
GREATER SF BAY	80,377	32%

IN THOUSANDS   50   100

Source: Chmura analysis of Quarterly Census of Employment and Wages provided by BLS

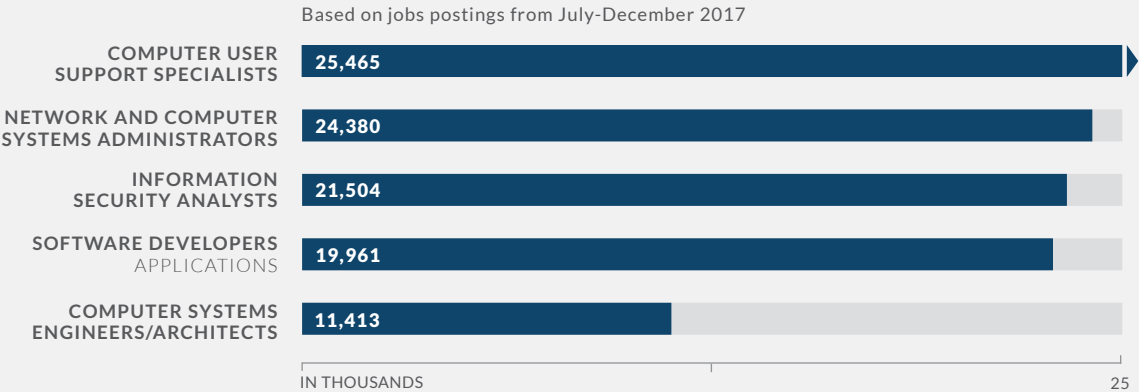# OUR REGION'S DIGITAL TECH TALENT NEEDS

Addressing the growing and evolving need for digital tech talent is imperative to realizing the vision of the Capital Region as a place for dynamism and opportunity, where people consistently choose to raise a family, work and build a business. Our analysis of job postings data and discussion with employers demonstrate an existing and growing need for digital tech workers – in terms of quantity, skillsets, skill levels and diversity – as well as a need for foundational digital skills throughout the workforce.

Despite our region's strengths in education and our number of graduates, our region has a substantial number of unfilled digital tech jobs and evidence indicates it takes employers longer to fill them than comparable regions. As an anecdotal illustration of this trend, we noted a recent study of STEM related jobs, which includes as a subset digital tech jobs, that showed our region had a median of 20 days for STEM positions to be filled.[xiv] This was much higher than other regions measured in that study.

What we know from our data gathering and review is that over the last six months, there have been more than 150,000 openings for digital tech jobs in the Capital Region, which in absolute terms is more than the peer regions of Boston, New York City and Greater Los Angeles and the San Francisco. On a per capita basis (job postings / labor force worker), the Capital Region is on par with the San Francisco Bay Area with nearly

TOP 5 DIGITAL TECH OCCUPATIONS BY JOB POSTINGS

Based on jobs postings from July-December 2017

Occupation	Job Postings
COMPUTER USER SUPPORT SPECIALISTS	25,465
NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS	24,380
INFORMATION SECURITY ANALYSTS	21,504
SOFTWARE DEVELOPERS APPLICATIONS	19,961
COMPUTER SYSTEMS ENGINEERS/ARCHITECTS	11,413

IN THOUSANDS   25

Source: Chmura Economics & Analytics

300 job postings over the last six months for every 10,000 workers. Our region had more than 1.5 times the number of postings per capita as Boston, twice the number as New York City and more three times the number as Greater Los Angeles.[xv] Each job that is unfilled is a constraint on our region's growth and potentially an opportunity lost for our region's economy if that job gets filled elsewhere.

These demand signals are supported by the articulated needs of many of the largest employers in our region. Over the next five years, through a combination of growth and attrition, the organizations comprising the Greater Washington Partnership will need to fill more than 20,000 digital tech positions in DC, Maryland and Virginia. These jobs will span the diversity of industries that power our region's economy, from aerospace and defense, finance, consumer products, entertainment, energy, healthcare and life science. Each of the industries see their own commercial activities increasingly driven by digital tech.

As our region's employers become more digital-intensive, it is generating considerable demand for hybrid talent. Discussions with employers indicate significant need for cross-disciplinary skills and experience across two dimensions: first, professionals who possess a deep knowledge in a particular domain (e.g. engineering, finance, healthcare) with strong ability in digital tech fields such as data analysis and visualization; second, professionals who can operate at the convergence of these digital technologies, where fields such as artificial intelligence and information security are increasingly interconnected. Anecdotal evidence suggests the job shortages are most acute in the occupations that integrate digital tech knowledge with other disciplines.

We must also recognize that foundational skills are essential to a vibrant and inclusive society. We hear consistently from employers about the need for soft skills – communication, critical thinking – and basic digital literacy skills such as everyday software including spreadsheets and word processing, or computer based equipment. While this report and our research concentrated on predominantly advanced skilled occupations, we are reminded that education must be broad to allow for individuals to participate meaningfully in the economy for their entire lifetime. As a recent report from Capital One and Burning Glass point out, a job seeker without familiarity with basic digital and soft skills may not even get in the door of a leading employer.[xvi]

Finally, we know that a key to success is a diverse workforce. Employers recognize the value of different backgrounds and perspectives. Nationally, women and minorities – particularly blacks and Hispanics – are underrepresented in science and engineering fields.[xvii] Digitalization is changing the skills needed to access economic opportunity while creating new race- and gender-based access challenges. From a regional growth standpoint, the Capital Region cannot achieve its full economic potential if parts of our population don't have access to opportunity and jobs.

OUR CALL TO ACTION

"In the global competition for digital tech talent, our region has a compelling value proposition"

Our region's talented workforce has powered our past success, and we must work together to ensure it is equipped to support the evolving needs of our region's employers for today and the future. While we have a strong foundation, including a deep workforce and breadth of educational institutions, this will require a concerted effort by private sector, academic and government leaders to adapt and move our region's talent pipeline – from the earliest grades through college, career training and beyond – into the next century. Employers, educators and government must partner more closely and more nimbly than ever before.

In the global competition for digital tech talent, our region has a compelling value proposition. Many of the technologies that are at the leading edge of new industries are imagined and funded by federal agencies located in the Capital Region. We produce more digital tech ready workers than any region in the United States. Our proximity to government and social enterprises provide countless opportunities to leave a mark. A region with all of the cultural and physical amenities valued by digital tech workers is readily available. A business community ready to utilize digital tech innovations in finance, healthcare, transportation, hospitality, energy, government and cybersecurity can provide revenue and investment to foster new businesses.

The totality of the Capital Region's attributes provides an unmatched opportunity to train, attract and retain world leading digital tech talent. Working together we can ensure that the Capitol Region leads our nation's digital transformation, and provides growing prosperity for our residents.

GREATER WASHINGTON PARTNERSHIP SURVEY OF HIRING NEEDS

- Today, the organizations comprising the Greater Washington Partnership employ 175,000 people in the Capital Region. More than 11% of their employees are "digital tech" workers.

- Over the next five years, as a result of growth and attrition, these organizations estimate they will need to hire more than 135,000 people in DC, MD and VA, including more than 20,000 digital tech workers.

  - These digital tech jobs will pay an average of $130,000 per year, well above the median wage of $55,000 in our region.

  - These hires will span levels of experience, including entry-, mid- and senior-level positions.

  - Beyond just "digital tech", increasingly more of these organizations' jobs – spanning occupations and industries – are requiring digital technology skills.

- These organizations rely on locally-developed talent, with 92% of all digital tech hires coming from schools or other employers in DC, MD and VA.

02

OUR REGION'S CYBERSECURITY WORKFORCE CHALLENGES

"We believe that a region that leads in cybersecurity is creating a highly-skilled digital workforce that can adapt to and lead new digital tech industries as they develop and expand"

Responding to our region's need for digital tech talent is essential to its economic future. To attempt to better understand some of the underlying challenges and solutions to this challenge, the Greater Washington Partnership decided to examine in greater detail the market for cybersecurity talent in our region.

This analysis was done for a number of reasons. First, the cybersecurity field – particularly due to the federal government and related contractors – is a disproportionate user of digital tech talent in our region. Second, cybersecurity is one of the largest economic growth opportunities for our region and the field where our region can be the global leader. Third, if we can understand the challenges and opportunities to educate and retain digital tech talent to serve this core digital tech field, we will be better able to understand the development of digital tech jobs in other industries.

THE ECONOMIC OPPORTUNITY FROM CYBERSECURITY

As digital technologies become more essential to our economy, the maintenance of data integrity and the nation's digital infrastructure becomes ever more important. This digital reliance makes cybersecurity – the protection of data and digital infrastructure – an essential discipline for the 21st century. This is true whether we are discussing the federal government or the private sector.

Digital technology enables many of our nation's industrial opportunities. As protecting data and our digital infrastructure becomes more difficult and more important as both a business problem and a national security problem, the need to avoid potential losses from cybersecurity breaches fuels the market for protection. High profile data breaches like Equifax and Yahoo remind us that companies will need to invest in the near term to protect their business. Moreover, national security concerns continue to be raised regarding the data integrity and resiliency of our national infrastructure. Interest and demand from the national security establishment will continue to be strong.

The resulting economic opportunity for the Capital Region is highly compelling. Global spending on cybersecurity products, services and solutions will exceed $1 trillion cumulatively over the next five years, driven by 12-15 percent year over year growth.[xiii] Today, cybersecurity contributes more than $14B in annual economic impact – nearly two percent of our GDP – to the Capital Region. With the global cybersecurity market projected to grow from $135B in 2017 to $202B in 2022,[xix] meeting the public and private sectors' needs for cybersecurity products and services could potentially increase our region's annual GDP growth by an additional 10-20 percent. [xx]

Cybersecurity is also an area of strength to drive the Capital Region's leadership in adjacent high growth digital technology fields – such as artificial intelligence, data science and analytics, sensors and precision medicine. All of these industries rely on data integrity, and accordingly will increase demand for cybersecurity. Moreover, as these industries grow they will in many cases fold back into cybersecurity as enablement technologies. For example, as artificial intelligence becomes more prevalent, it will require more protection, but at the same time, as it becomes more widespread, it will also become a technology used for digital protection. The emergence of artificial intelligence hacking will require the emergence of artificial intelligence fueled defense.

Many technologists anticipate that over time the line between cybersecurity and digital technologies will blur, where cybersecurity will become part of all digital industries, and many of those industries will in turn drive development of cybersecurity technologies. Accordingly, we believe that a region that leads in cybersecurity is creating a highly-skilled digital workforce that can adapt to and lead new digital tech industries as they develop and expand. By building on our existing strengths in cybersecurity, we can position our region for accelerated growth.

"Meeting the public and private sectors' needs for cybersecurity products and services could potentially increase our region's annual GDP growth by an additional 10-20 percent"
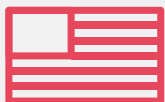
CAPITAL REGION ASSETS
900+ cybersecurity related firms in the region
A population of cyber professionals that is 3.5 times as big as the rest of the U.S. combined
Nearly all cyber-related federal government agencies and military installations in the U.S. including U.S. Cyber Command, NSA, DHS and CIA
Leading cyber-focused industry collaborative efforts, including the Financial Systems Analysis and Resilience Center and the Cyber Readiness Institute
31 Centers of Academic Excellence in Cybersecurity, more institutions than any other state or region in the country

THE NEED FOR CYBERSECURITY TALENT

Despite our region's leadership in cybersecurity, realization of its economic growth opportunity is far from guaranteed. Our analysis to date shows that other regions of the United States are competing for our talent, and in many cases attracting them. Over the last six months, there were nearly 21,000 openings for Information Security Analyst positions, representing 15 percent of all digital tech job openings in the Capital Region. [xxi]

THREE CHALLENGES CONSTRAIN OUR REGION'S CYBERSECURITY TALENT POTENTIAL

1 Despite leading the nation in cybersecurity workers and graduates, higher demand is outpacing supply

With the explosion of interconnected systems and devices, the volume and variety of cybersecurity threats have proliferated. In response, the hiring needs of government contractors and defense agencies, as well as industries including healthcare, finance, hospitality, media and internet commerce, have boomed. The tremendous growth in cybersecurity related positions have created unique needs and gaps in our region's labor market.
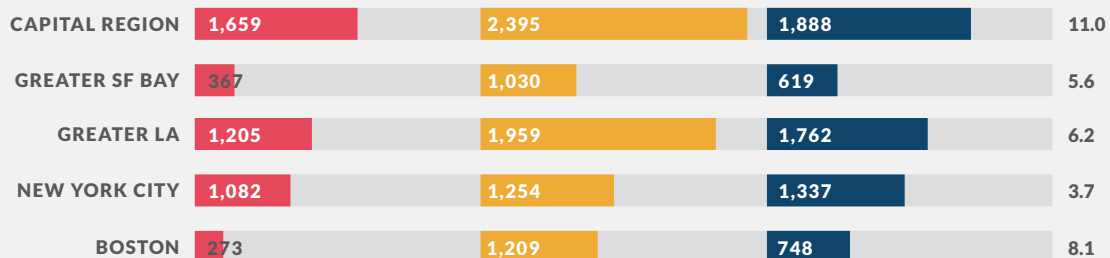
Our region leads the nation in the quantity and development of cyber talent, however disproportionally higher demand has created a larger cybersecurity jobs gap than U.S. overall. There is a national dearth of cybersecurity talent, but it is worse in our region.

Today, the Capital Region is home to approximately 15 percent of all cybersecurity jobs in the U.S., three times the number of jobs of the second largest region, New York City. Within our region, the Washington DC metropolitan area has the highest density of cybersecurity jobs (four jobs per 1,000 workers) of any metro area in the country. [xxii]
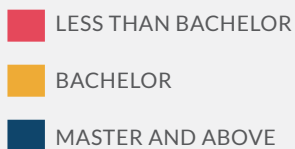
Our educational institutions are highly engaged in supporting demand by the Capital Region's employers. Our region's academic institutions have developed more than 2.5 times the number of eligible information security analyst graduates than the next largest U.S. region. These graduates come from two- and four-year institutions across our region.

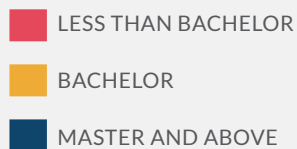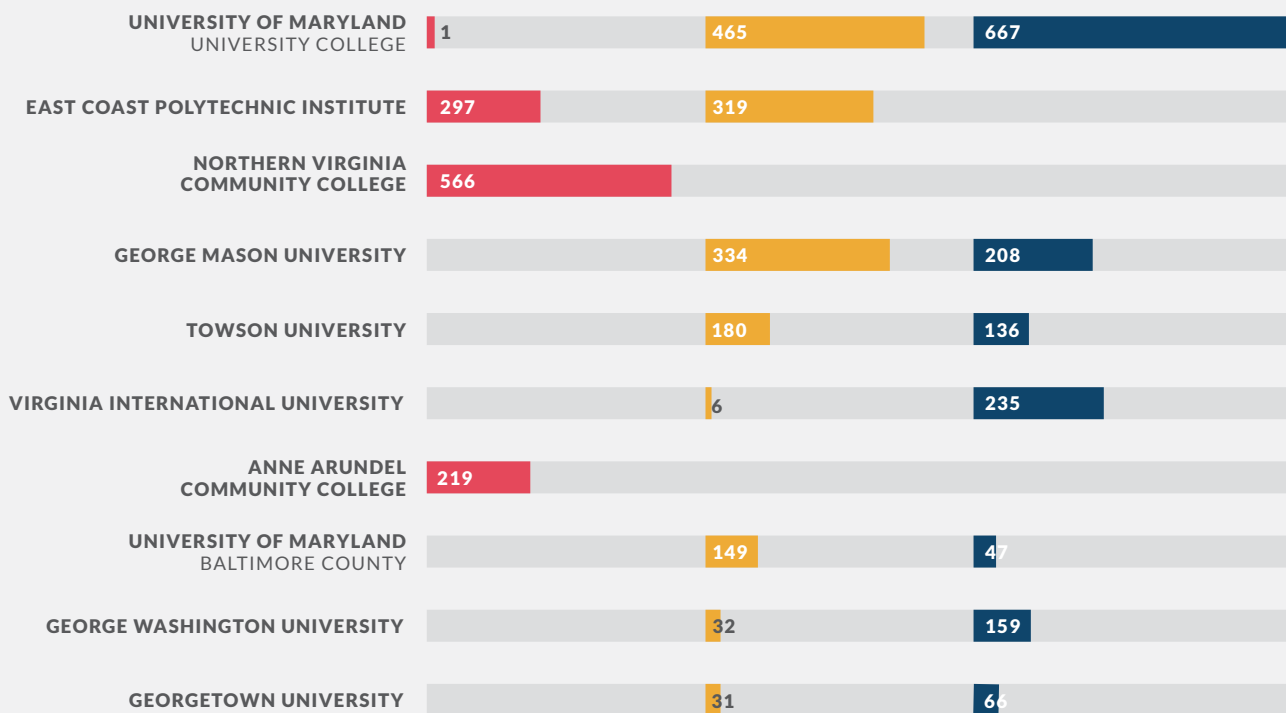## INFORMATION SECURITY ANALYST-RELATED GRADUATES BY DEGREE AND REGION, 2016

Region	Less than Bachelor	Bachelor	Master and Above	Graduates per 10,000 pop
CAPITAL REGION	1,659	2,395	1,888	11.0
GREATER SF BAY	367	1,030	619	5.6
GREATER LA	1,205	1,959	1,762	6.2
NEW YORK CITY	1,082	1,254	1,337	3.7
BOSTON	273	1,209	748	8.1

GRADUATES PER 10,000 POP

■ LESS THAN BACHELOR

■ BACHELOR

■ MASTER AND ABOVE

Source: McKinsey analysis of National Center for Education Statistics data

CAPITAL REGION'S TOP 10 PRODUCERS OF CYBER-RELATED DEGREES, 2016

University	Less Than Bachelor	Bachelor	Master and Above
UNIVERSITY OF MARYLAND UNIVERSITY COLLEGE	1	465	667
EAST COAST POLYTECHNIC INSTITUTE	297	319	
NORTHERN VIRGINIA COMMUNITY COLLEGE	566		
GEORGE MASON UNIVERSITY		334	208
TOWSON UNIVERSITY		180	136
VIRGINIA INTERNATIONAL UNIVERSITY		6	235
ANNE ARUNDEL COMMUNITY COLLEGE	219		
UNIVERSITY OF MARYLAND BALTIMORE COUNTY		149	47
GEORGE WASHINGTON UNIVERSITY		32	159
GEORGETOWN UNIVERSITY		31	66

LESS THAN BACHELOR

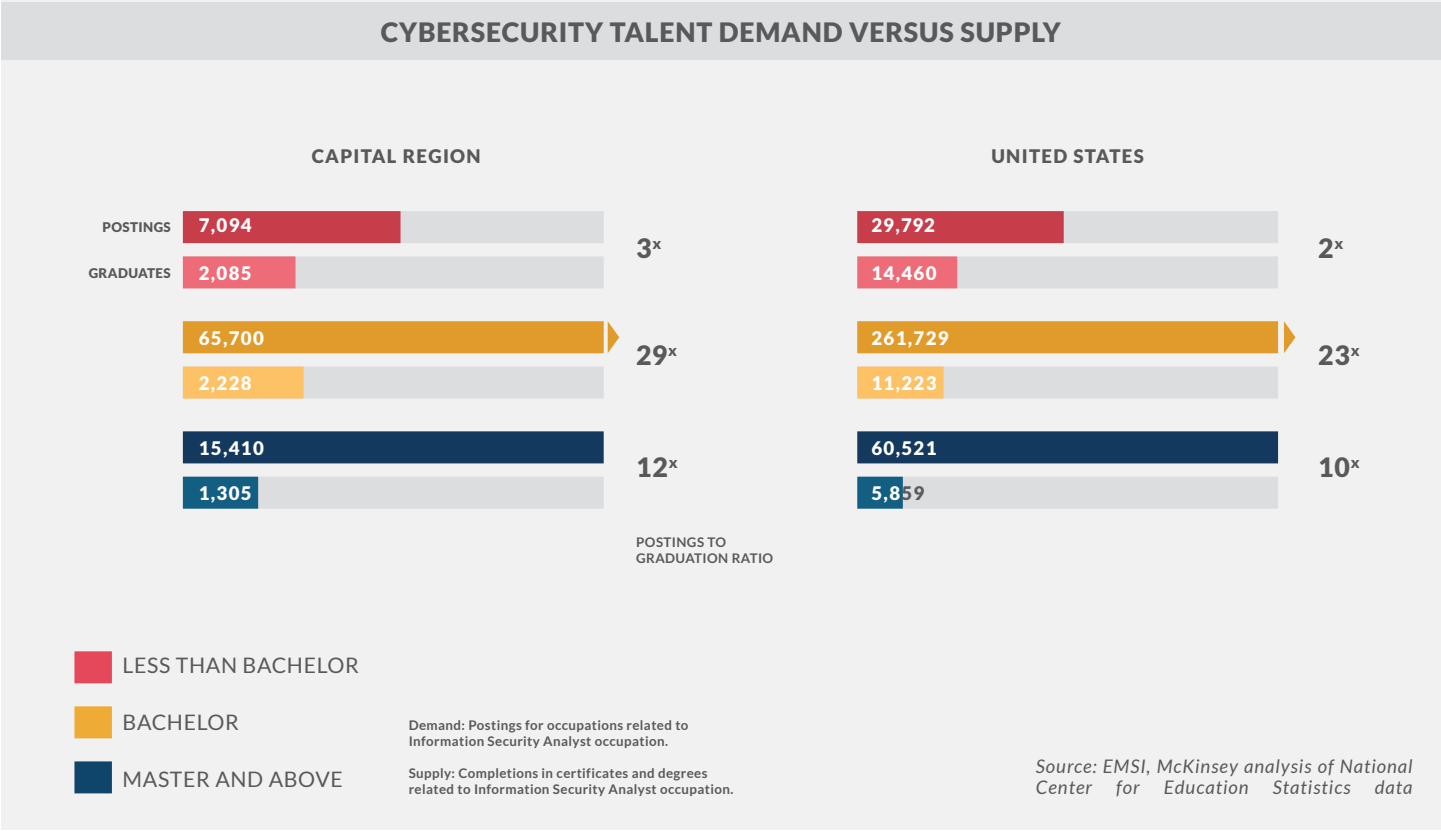BACHELOR

MASTER AND ABOVE

Reflects completions in certificates and degrees related to Information Security Analyst occupation.

Source: Greater Washington Partnership Analysis of National Center for Education Statistics data

Despite the pipeline of supply coming through our region's academic institutions, the number of unfilled positions for cybersecurity skills as well as the overall growth in demand indicates that the pipeline of cyber-enabled talent may not be sufficient nor adequately aligned to our region's specific workforce demands. Job transformation and creation will continue to heavily favor digitally oriented occupations such as cybersecurity, driving increased need for talent. This is a national problem, but one that is exacerbated in the Capital Region because of peculiarities in our region's employment of cybersecurity talent. Our region's ratio for job postings-to-graduates across all skill levels exceeds those of the rest of country.

CYBERSECURITY TALENT DEMAND VERSUS SUPPLY

CAPITAL REGION

POSTINGS	7,094	3^x
GRADUATES	2,085	
	65,700	29^x
	2,228	
	15,410	12^x
	1,305	

UNITED STATES

	29,792	2^x
	14,460	
	261,729	23^x
	11,223	
	60,521	10^x
	5,859	

POSTINGS TO GRADUATION RATIO

■ LESS THAN BACHELOR

■ BACHELOR

■ MASTER AND ABOVE

Demand: Postings for occupations related to Information Security Analyst occupation.

Supply: Completions in certificates and degrees related to Information Security Analyst occupation.

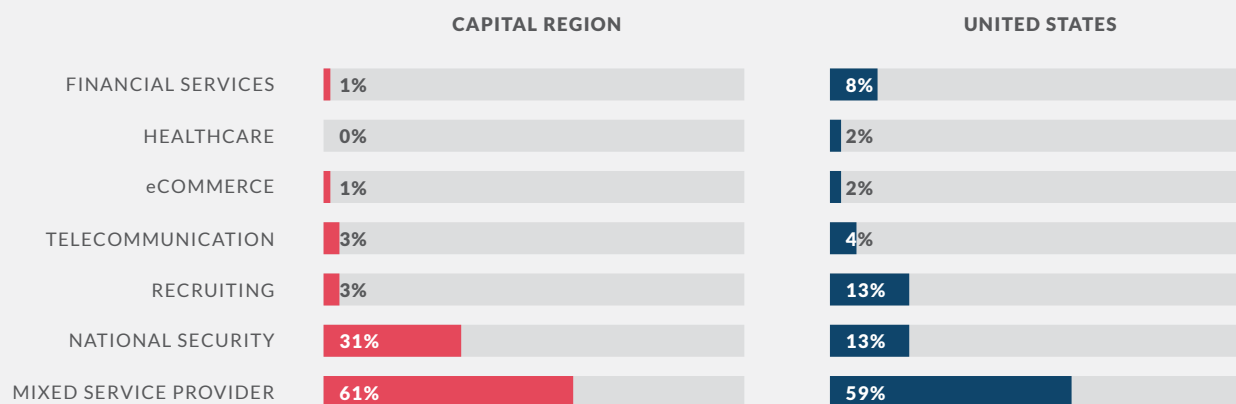*Source: EMSI, McKinsey analysis of National Center for Education Statistics data*

2 It is difficult for employers to find the skills and experience they need, and we are producing graduates who may not be prepared for the available jobs

Our region's cybersecurity workforce demand is shaped by two factors which could explain the mismatch between graduates and filled cybersecurity jobs. The first is the peculiarities of employment by the federal government or in businesses that service the federal customer. The second is the high premium our region's employers place on hiring experienced cybersecurity talent.

Undoubtedly, proximity to the federal government provides a large draw for cybersecurity talent. It allows our region to achieve a leading concentration of talent, and commercial opportunities for business owners and the digital talent they partner with. Not surprisingly given our region's concentration of federal government agencies and national security installations, these jobs tend to be over-indexed to the public sector compared to the rest of the U.S., with the national security industry including government and contractors accounting for 31 percent of job postings versus 13 percent nationally.

CYBERSECURITY JOB POSTINGS BY INDUSTRY

	CAPITAL REGION	UNITED STATES
FINANCIAL SERVICES	1%	8%
HEALTHCARE	0%	2%
eCOMMERCE	1%	2%
TELECOMMUNICATION	3%	4%
RECRUITING	3%	13%
NATIONAL SECURITY	31%	13%
MIXED SERVICE PROVIDER	61%	59%

Source: EMSI, McKinsey analysis of National Center for Education Statistics data

Our region's interdependence with the federal government creates special requirements that shape and may inhibit talent absorption. National security clearance requirements can slow or inhibit talent onboarding, and rigid educational attainment requirements inhibit talent absorption from nontraditional sources, such as certification programs at community colleges and online education. A focus on highly skilled and experienced talent for national security hiring skews talent demand away from entry level talent, or talent that would require retraining to satisfy national security requirements.

Employment patterns for cybersecurity jobs in the private sector also demonstrate a strong bias for hiring experienced workers. While some of this may be driven by private employers who serve federal customers, our conversations with private employers demonstrate a strong preference for hiring tech workers who can be productive from the first day of employment even when the federal government is not involved.

The search for highly-skilled and experienced talent causes some employers to require skill attainment that is in excess of job requirements, or seek experienced talent rather than incur onboarding and training expenses. Employers are overwhelmingly seeking candidates with a bachelor degree or higher, as well as three or more years of experience. A recent analysis of 600 cybersecurity postings in the Capital Region showed that approximately 80 percent required at least a bachelor's degree while 87 percent required more than one year of experience.[xxiii]

While more than a third of our region's graduates from accredited academic programs do not receive a bachelor's degree, a much larger proportion of job postings in cybersecurity are requiring such

CYBERSECURITY JOB POSTINGS BY REQUESTED EDUCATION AND EXPERIENCE

| EDUCATION | 16% | 61% | 23% | |
| EXPERIENCE | 17% | 48% | 20% | 15% |

DEGREE

ASSOCIATES OR LOWER

BACHELOR

MASTER AND ABOVE

YEARS REQUESTED

0-2

3-5

6-8

9+

Source: McKinsey analyses of Burning Glass and National Center for Education Statistics data

backgrounds. Given high education and experience requirements, fresh graduates often fail to meet the employer job requirements.

Moreover, even those with a bachelor degree may find it difficult to find a cybersecurity job in our region. Our employers often require a disproportionate level of additional accreditation to fill a job. For instance,

nearly 38 percent of the Capital Region's information security analyst-eligible graduates obtain degrees in cybersecurity and forensics, far outpacing the number of degrees produced by other regions. Meanwhile our region remains under-indexed in development of computer science graduates, whose skills open a broader set of opportunities across cybersecurity and digital tech.

3 Our region is a net exporter of tech talent, failing to attract and retain graduates and existing employees

Many of our region's graduates are apparently going elsewhere for jobs. Our region's higher number of degrees completed than jobs added indicates our region has been a net exporter of tech talent, producing 13,747 more degrees than tech jobs added over a recent five-year period. Our region has second highest net talent excess among peers after Boston. In comparison, San Francisco Bay Area, while producing fewer than 29,000 tech graduates, created nearly 110,000 new tech jobs, attracting talent from across the U.S. Each individual who is trained in our region but goes elsewhere for employment is an opportunity lost for our region's economic growth.

In addition to regional requirements that often create a mismatch between skill attainment and workforce opportunities, the Capital Region faces two additional challenges when our talent evaluates employment opportunities from out of our region.

TECH DEGREES COMPLETED VERSUS TECH JOBS ADDED BY REGION, 2012-2016

Legend:
- TECH JOBS ADDED
- TECH GRADUATES
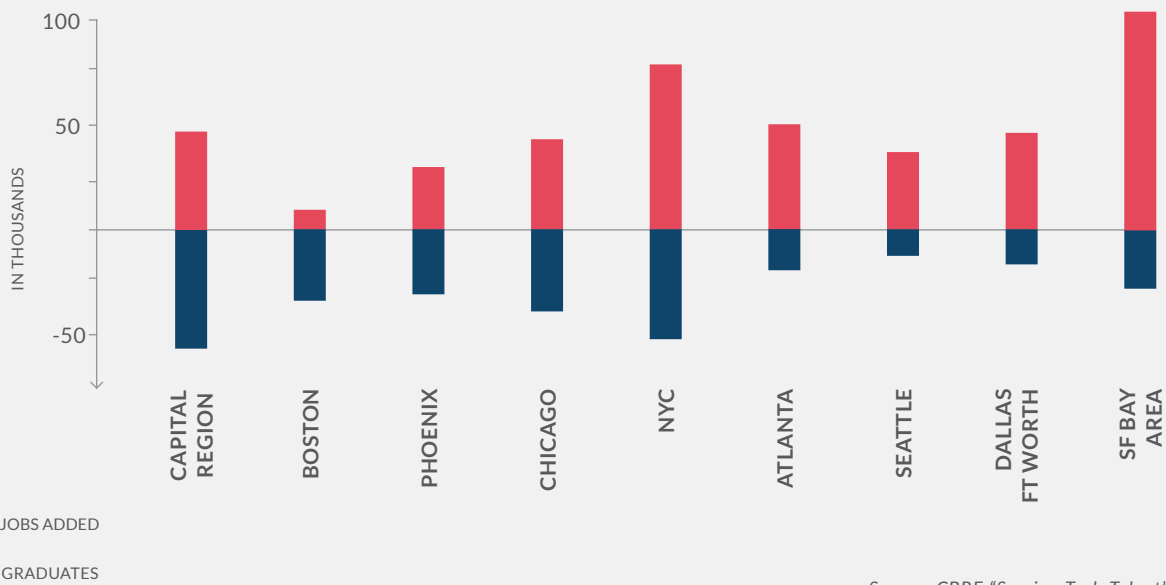
Source: CBRE "Scoring Tech Talent" Report, 2017

The first are challenges created by our region's infrastructure and housing stock. Surveys of Millennial workers consistently show that housing affordability and the quality of infrastructure are highly important for deciding where to establish a career. Many other studies of our region show that these two concerns affect the broader workforce. The many amenities and advantages of living in our region run the risk of being obscured and overcome if we do not address these challenges squarely.

With our region a high net exporter of tech talent, any talent development and upskilling efforts will need to be complemented by effective retention.

The high cost of housing and the invisible costs of inadequate infrastructure (primarily traffic and challenges with public transportation) lower the effective purchasing power of cybersecurity workers when compared to other regions.

AVERAGE CYBERSECURITY SALARY PURCHASING POWER

Source: McKinsey analysis
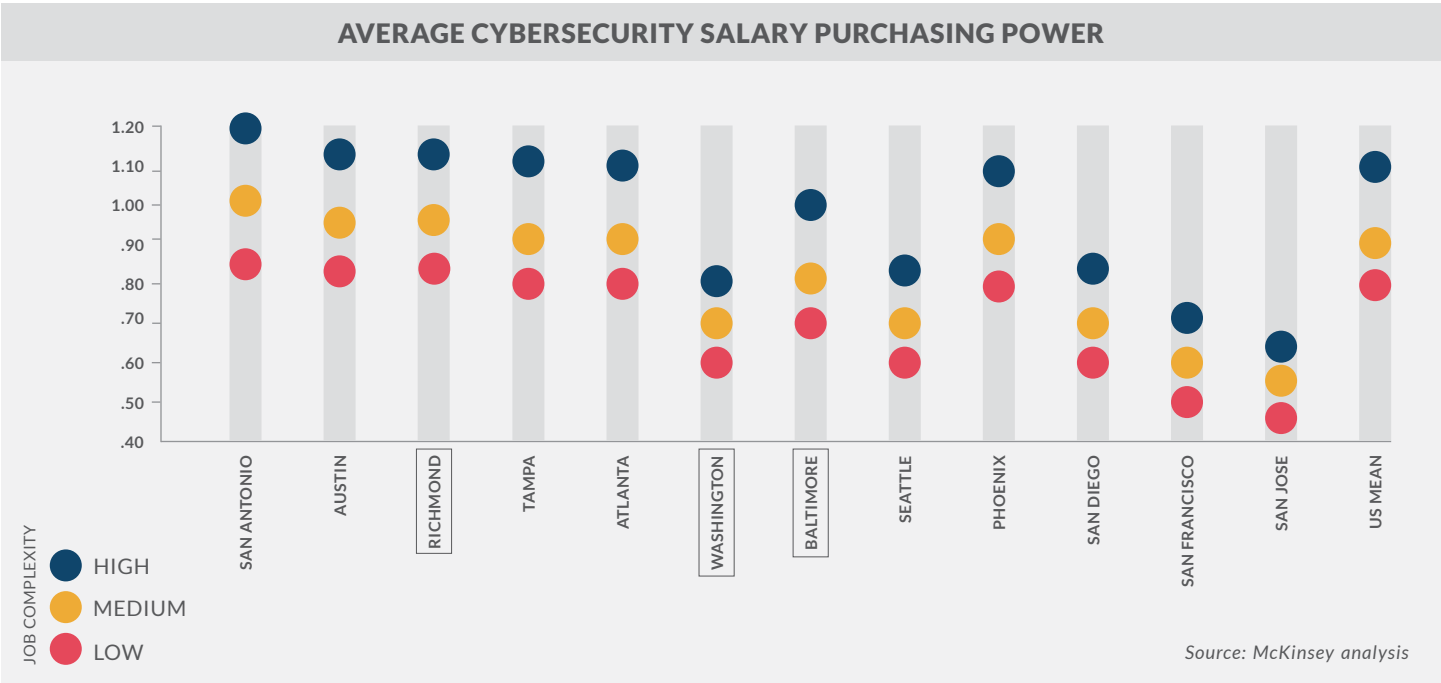
A second issue arises from the current composition of our region's cybersecurity industry. Proximity to the federal government, and its position as a large consumer of our cybersecurity talent, shapes our region's commercial activities. The federal government has historically tended to consume technology innovation through the delivery of services delivered on a time and materials basis. This service model has been extremely lucrative for the talent and business owners involved since the 1970s, and many of our region's largest cybersecurity employers' business model is based upon services. Moreover, as these companies look to diversify their revenue base away from government customers, they tend to retain this business model orientation.

CYBERSECURITY JOB POSTINGS BY FUNCTION
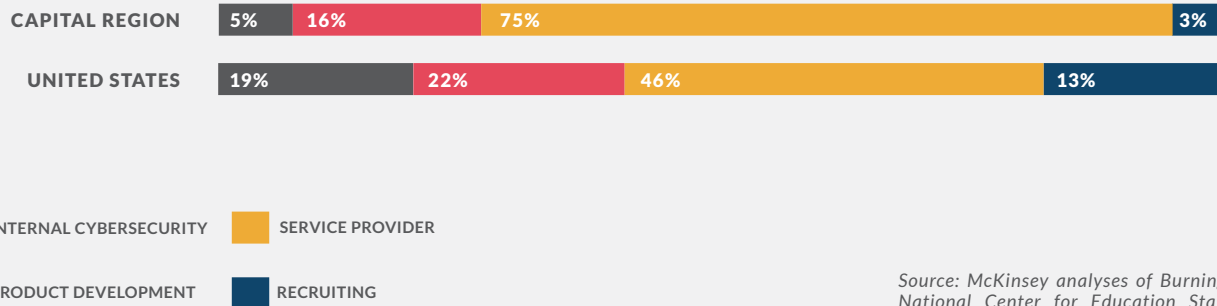
CAPITAL REGION	5%	16%	75%	3%
UNITED STATES	19%	22%	46%	13%

- ■ INTERNAL CYBERSECURITY
- ■ PRODUCT DEVELOPMENT
- ■ SERVICE PROVIDER
- ■ RECRUITING

Source: McKinsey analyses of Burning Glass and National Center for Education Statistics data

Although service models that rely on human labor can be highly lucrative, they are very difficult to scale, because human talent is expensive and often hard to find. Product businesses can often scale and grow more rapidly in comparison, because once a consumer benefit can be delivered through a product, the labor component of a business' value chain decreases. This difference often results in higher margins and rapid growth. Participants in service and product businesses alike agree that the structure of such businesses, the management and organization skills required and the talent required often differs substantially between these two approaches. Moreover, the conversion from one approach to the other is extremely difficult to achieve.
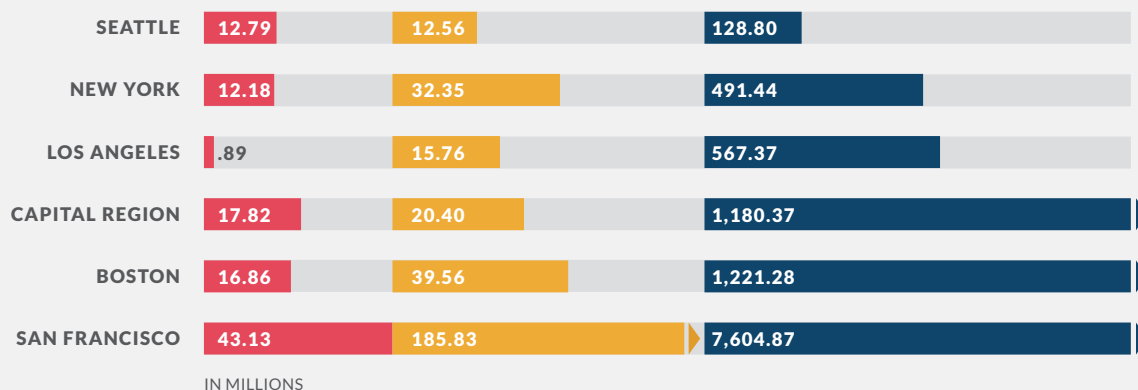
As a middle ground, many of our region's cybersecurity businesses seek a blended model and offer services and products together as a solution. Solution-based businesses offer some of the margin improvements available from a product-based business, without a complete organizational change away from a service-based structure.

The Capital Region cybersecurity industry is currently highly skewed towards service and solution-based businesses. A recent study of the close to 900 cybersecurity companies in our region showed that only five percent were product-based businesses.[xxv] The under emphasis on cybersecurity related product businesses creates a significant competitive threat to our region. For entrepreneurial individuals, the attractiveness of stock ownership in a product-based business is highly compelling. The margins achievable from a product-based technology business can lead to extraordinary growth in business value and wealth creation opportunities for the talent and investors who build such companies. For service-based companies with a reliance on government customers, various initiatives and purchasing rules limit the price paid, thereby constraining margins and limiting compensation and growth opportunities for cyber talent.

Other regions of the U.S. have broader ecosystems to create and grow cybersecurity product businesses. Venture capital tends to cluster where there are the most immediate opportunities for successful product-based business creation. Deployment patterns show that the Capital Region suffers in this comparison. Venture capital is a lagging indicator of a region's ability to grow innovative product-based startups. Capital pools where there is a proven record of growing companies in a region. The lack of venture capital invested in product-based cybersecurity startups is an indication that we are falling behind other competing regions.

TOTAL CAPITAL INVESTED IN CYBERSECURITY COMPANIES, 2010-2016

	Angel Investments	Seed Funding	Venture Capital
SEATTLE	12.79	12.56	128.80
NEW YORK	12.18	32.35	491.44
LOS ANGELES	.89	15.76	567.37
CAPITAL REGION	17.82	20.40	1,180.37
BOSTON	16.86	39.56	1,221.28
SAN FRANCISCO	43.13	185.83	7,604.87

IN MILLIONS

- ANGEL INVESTMENTS
- SEED FUNDING
- VENTURE CAPITAL

Source: McKinsey analysis of PitchBook and Kaufman Index

For individuals who wish to benefit from product-based innovation, the draw of other regions is strong. While recent activity suggests positive momentum for our region – even the federal government is signaling that it would like to obtain more product-based innovation – the Capital Region lags behind other regions in cybersecurity start-up investment. Despite the Capital Region having the largest cybersecurity footprint, San Francisco cybersecurity venture capital out-invests the Capital Region by 6.5 times. When compared to the size of the talent pool, this difference is further compounded. The Capital Region also ranks in the bottom half of the country in terms of rate of startup density.

Anecdotally, many of the Greater Washington Partnership's member companies often hear that cybersecurity talent views our region as less desirable for those that want to work for entrepreneurial businesses. While, we do not believe that this viewpoint is necessarily supported by the high level of business activity in our region around cybersecurity, the perception of many graduates may be that while the Capital Region is well known for its public sector cyber opportunities it is less suited for those who would like to pursue high growth product startups.

03

FIVE STRATEGIES TO ADDRESS THE CYBERSECURITY TALENT GAP

"The value proposition of our region is irrefutable;
the Capital Region is leading the nation's
digital transformation"

The challenges that we have described above cannot be overcome without a concerted and regional approach. We believe that employers, educators and government must work together to close the cybersecurity talent gap and accelerate the development, attraction and retention of digital tech talent more broadly.

The Greater Washington Partnership's analysis and discussions with regional stakeholders leads us to recommend five strategies to address both the growth and absorption of the region's digital tech talent population. While we believe that near-term focus should be on cybersecurity – we earlier identified our unique strengths in cybersecurity and the spillover effects that cybersecurity can have in growing adjacent digital tech fields – these strategies are broadly applicable to the talent digital tech pipeline. The strategies will require new forms and levels of partnership across our region, and the Greater Washington Partnership is committed to working collaboratively to help advance them. As we hone these strategies and define our own priorities, we look forward to the community's continued input.

1 Scale best practices to grow the pipeline of STEM talent in high school and subsequent enrollment in postsecondary education

As more of our region's economy becomes oriented to and dependent on digital technologies, it is critical we have a robust pipeline of interested and proficient students who will continue their education and go on to fill the cybersecurity and other digital tech jobs. This education continuance is important because 65 percent of all jobs – spanning the entire economy – will require postsecondary education or training by 2020.[xxv] Additionally, employers indicate they value graduates raised in the region because they are more likely to stay here or eventually return because of family ties and other connections.

One practice our region can scale and strengthen is career and technical education (CTE) programs that allow students to earn college credits or gain an industry certification while still in high school. These programs provide early technology education on-ramps and promote persistence in STEM-related postsecondary study. High school and middle CTE

DIAGNOSTIC FINDINGS—CYBERSECURITY TALENT GAP

ROOT ISSUES

INSPIRE & DEVELOP

1 Not enough school graduates interested and proficient in STEM to bridge demand gap

2 Difficult for employers to find skills they need within existing talent pool

A Experience required for entry level jobs limits opportunities for fresh graduates

B Imperfect information prevents effective assessment of job candidates and job needs

ATTRACT & RETAIN

3 Region is a net exporter of tech talent, failing to attract and retain graduates and existing employees

A Region's value proposition fails to attract/retain talent in a competitive market

B Small start-up footprint and service-oriented innovation ecosystem limits diversity of jobs and their attractiveness to cybersecurity talent

SOLUTION STRATEGIES

1 Scale best practices to increase STEM talent pool out of high school and enrollment into postsecondary education

2 Clarify employer demand signals to motivate educators and job seekers

3 Support experiential learning programs to allow graduates to obtain practical skills prior to joining the workforce

4 Define and communicate a unified regional message that conveys our digital tech leadership

5 Develop focused approach to create cyber product ecosystem in Capital Region by supporting startups and talent

programs, such as those in Henrico County Public Schools, are helping students gain academic, technical, and work readiness skills in technology fields. We can also look to programs such as the cyber science program at Baltimore's Loyola Blakefield college preparatory school, which is providing students with industry-caliber skills in cyber science, along with opportunities to apply those skills in the classroom.

Employers, educators and policymakers each play critical roles in the development of effective career and technical education programs. Where implemented with the close partnership and support of industry, these programs can align to employers' needs and enable employers to identify and hire talented workers more precisely.

An important element of successful pathway programs is making the process of exploring, entering and finishing college easier for students. Enhanced counseling in high school CTE programs, along with more widespread adoption of public-facing tools such

as the Virginia Community College System's Education Wizard, are helping reduce students' confusion about colleges and careers. Further down the pipeline, "compacts" such as the one being pioneered between Northern Virginia Community College and George Mason University are creating a more seamless and cost-effective transition experience between two-year and four-year institutions, ensuring fewer course credits get lost along the path to a bachelor's degree.

It is important that best practice information be distributed to the field, so that funders, program leaders and policymakers make the best decisions and ensure investments are driving change. Programs across our region should be encouraged and incentivized to undertake rigorous evaluation to identify effective interventions and to determine metrics for success for these programs. Examining curricula, methods, participant demographics and readiness levels, and the models for engagement with employers will identify components parts that form a foundation for success.

2 Clarify employer demand signals to motivate educators and job seekers

Educating and training job seekers to meet employers' needs is especially difficult in the rapidly changing technology world. The needs of an employer, or the field in general, can adjust even in the time it takes for a student to complete a program. Today, we see technologies such as cybersecurity and artificial intelligence quickly converging, in the process redefining the combinations of skills and exposure that workers will need. Our education institutions and training providers must keep an eye on trends and have a clear view into

industry changes to ensure that programs are filling a real demand and evolving to meet the requirements of our region's federal and commercial employers.

To support better alignment, our region's employers must engage in collaborative demand planning to forecast and communicate open positions and emerging skill needs. These demand signals will motivate educators and job seekers, in addition to the policymakers whose decisions shape and fund many of our region's programs.

Initiatives such as the Northern Virginia Technology Council's new Tech Talent Employer Collaborative, which brings together employers, education institutions and training providers to better align curriculum to workforce needs, are promising and can potentially be expanded to greater reaches of the Capital Region. With this greater information, digital tech education and training programs across the region will be empowered to respond to the market's talent requirements.

Similarly, on the supply side, it is essential to have tools to measure and evaluate the progress of our region's graduates. In our work to date we have not found a comprehensive data source that collects on a regional basis the graduation rates, job placement and skills matching of graduates to employment in cybersecurity or digital tech more broadly. We recommend that our region come together to collect and publish such data to measure digital tech talent creation and employment. By providing a common frame of reference, our region's educational programs could tailor their offerings to employer requirements, and employers could look more closely at how to match up requirements with skill attainment rather than solely degree attainment.

3 Create experiential learning programs to allow graduates to obtain practical skill development prior to joining the workforce

The private sector, educators and government must be bold with investment in market-driven programs that link learning with work and bridge the divide we see today with employer's demands for experienced hires. New pathways such as apprenticeships, innovative internship and externship partnerships between education institutions and employers, and new training models that expand beyond the classroom to applied learning could help to improve the skills that students carry into the professional world. Additionally, such programs can improve regional retention by increasing exposure to the diverse and, in many cases, cutting-edge career opportunities available through employers in our region.

To support the expansion of employer-driven experiential learning programs in our region, a network of experts, industry practitioners, educators and employers should come together regularly to identify areas of opportunity and form a community of practice that can catalyze and scale effective models. Our discussions with stakeholders to date indicate that, currently, the vast majority of programs operate independently and do not share information or collaborate with others.

Developing a network for employers and educators to collaborate on curriculum, streamline job placement, or even create a standard for accreditation of work-based learning could help address many of the common challenges these programs face. A clear network would also allow other employers to tap into the system and more coherently and efficiently create their work-based opportunities.

4 Define and communicate a unified regional message that conveys our digital tech leadership

While the attributes of our region as a leader in cybersecurity are extremely positive, we often fail to provide a positive and engaging public message for how appealing our region can be. Our region is quite literally one of the few in the world where technology, policy and opportunities collide to birth new industries. Substantially all of the technologies that are shaping our nation's economic future were fostered or are being advanced in our region. More narrowly, our region's cybersecurity industry produces and engages the strongest and deepest talent pool in the nation. On another level, our region provides a welcoming and opportunity-rich environment for women technologists.

We must collectively convey in our discussions the Capital Region's primary position as a digital technology hub. Our region is leading the 21st century and our industrial transformation. It's essential that our region coalesces around this reality as we describe it to ourselves and to those we wish to attract. The value proposition of our region is irrefutable. It's time to come up with a uniform way to describe it. The Capital Region is leading the nation's digital transformation. Let's describe it that way.

5 Develop a focused approach to create a cybersecurity product ecosystem in the Capital Region by supporting product startups and talent

To create more product-based companies, which we believe will help our region retain more of the best and brightest digital tech talent, our region must engage in a range of concerted activities to promote their development. Best practices for regional economic development show that innovation-based startup formation is most likely to succeed through coordination of research institutions, entrepreneurs, workforce, customers and supportive government policies. Siloed programs that attempt to achieve such integration rarely achieve sufficient density to scale nor make meaningful differences to economic development.

We believe that the broader ecosystem should coalesce its comprehensive regional activity around a multi-pronged approach that includes: establishing training programs to accelerate already established product-based cybersecurity businesses while allowing existing service-based cybersecurity businesses to receive help converting their business model; establishing a joint network of commercial and federal customers that comes together with startup business to provide exposure to new ideas and enhance the revenue opportunities for nascent businesses; utilizing social media, events and other activities to facilitate a higher level of awareness of commercial opportunities from large regional employers; and, in the absence of venture capital, better utilizing government funding and incentives to catalyze private capital formation to finance the development of product-oriented businesses.

04

HIGHLIGHTING BEST PRACTICES OF SELECT EMPLOYERS

"We believe that employers, educators and government must work together to close the cybersecurity talent gap and accelerate the development, attraction and retention of digital tech talent more broadly"

Many Capital Region employers are taking action to address the skills gap challenge, supporting a broad range of training efforts in our region. The profiles below spotlight some of the ways that a select set of leading employers are working with academia, primary and postsecondary education, workforce intermediaries and other community stakeholders to increase the pipeline of skilled and diverse workers to join their organizations, as well as to upgrade and transform the skills of their current employees, to meet the need for digital tech skills. These efforts exemplify the goal of providing lifelong learning and opportunity, from the earliest grades through the span of an individual's career.

CAPITAL REGION EMPLOYERS

CAPITAL ONE

EXELON

JOHNS HOPKINS UNIVERSITY

MEDIMMUNE

MONUMENTAL
SPORTS & ENTERTAINMENT

RALLY HEALTH

T. ROWE PRICE

CAPITAL ONE
CAPITAL ONE CODERS

In partnership with public schools and youth-serving nonprofits, Capital One Coders helps middle school students develop a greater interest in STEM (science, technology, engineering and mathematics) during a critical period in their development. Through the 10-week classroom program, currently operating in 10 cities across Capital One's U.S. footprint, including McLean, Virginia and Richmond, Virginia, Capital One associate volunteers teach students about problem solving, teamwork, the basic principles of software development and coding in a fun and engaging environment. Additionally, the curriculum is adapted to one and three-week camps and one-day hack fests.

THE NEED

As technology hurtles us toward a more productive and prosperous future, the sheer pace of change threatens to leave many behind. Capital One Coders is committed to exposing middle school students to technology. Through Coders, Capital One is filling a critical gap in our nation's schools by teaching students what they need to succeed in the digital age. These students are learning valuable skills that can put them on path for an in-demand and rewarding career in technology.

THE SOLUTION

Students learn how to develop apps for mobile Android devices, while growing computational thinking skills like algorithms, abstraction, decomposition, pattern recognition, and generalization, instead of focusing on a specific programming language or syntax. Capital One associates serve as mentors/teachers, guiding students and supporting their application development project, in preparation for the program culmination expo where students demo their apps to family and friends.

"Through Capital One Coders we are filling a critical gap in our nation's public and private schools by teaching students skills for the 21st century. These students are learning valuable skills that can put them on paths for a high demand and rewarding career in technology"

Rob Alexander
Chief Information Officer
Capital One

PARTNERSHIPS

The program partners with local schools and other youth-serving nonprofits to host the program. Capital One provides the curriculum, volunteers, hardware and other resources. Partners are responsible for sourcing students to participate

RESULTS

Since the program's creation in April 2014, Capital One Coders has partnered with over 20 schools and nonprofit organizations in the Capital Region, impacting 3,000 students. By the end of 2017, Capital One will have engaged 900 associates from our offices in the Capital Region in over 25,000 hours in pro bono volunteerism for the Capital One Coders program.

CAPITAL ONE
CAPITAL ONE DEVELOPER ACADEMY

Capital One Developer Academy (CODA) is a training initiative created by Capital One that identifies top students with a passion for technology across a variety of non-Computer Science majors to take part in the training experience that will put them on the path to becoming software engineers

THE NEED

As Capital One leverages technology to bring simplicity and humanity to banking, the firm recognizes it must attract, develop, and retain top tech talent. Finding diverse perspectives to contribute to Capital One's tech products is key for the future of the organization.

THE SOLUTION

CODA is a six-month, immersive training experience that puts associates on the path to becoming software engineers. CODA associates are immersed in all the critical building blocks of Capital One technology, including agile, AWS, DevOps, and more, as they learn full stack development, utilizing JavaScript as the foundational programming language. The curriculum includes hands-on learning experiences focused on both technical and soft skills training. It is a mix of learning and practical application, including a mini-internship where associates code and develop solutions to a real, Capital One business problem. Mentorship is a critical component of the program. The associates are supported by development advisors, technical advisors, program managers, and buddies. Upon graduation, CODA associates join Capital One's Technology Development Program (TDP) to apply their skills in a rotational program, infusing Capital One with top engineers and future leaders.

"As Capital One transforms into a technology company, we need top talent; we've recruited thousands of engineers and there is an insatiable demand for great technology talent as the rate of change across industries continues to accelerate. We created a program that specifically looks to non-traditional candidates and give them the skills to work in tech, and grow within the company. We see the power of bringing together diverse perspectives to create impactful products and services for our customers"

Devin Lipawsky
Vice President, Technology
Capital One

PARTNERSHIPS

Capital One partners with leading technology training organizations to develop co-created, best-in-class content for associates. This gives associates access to the best industry innovations combined with internal know-how. For CODA, Capital One has a cutting-edge physical environment for learning, as well as intuitive, seamless online experiences. Key learning partners include General Assembly, Udacity, Slack, Github, and Pathgather.

RESULTS

The inaugural cohort of 60 associates will graduate in December 2017, and assume engineering roles. The second cohort (~30 associates) starts in February 2018, and the third (~ 45 associates) will launch in July 2018.

EXELON

Exelon hires a significant number of graduates in STEM fields. To build and nurture that pipeline, the company also supports a comprehensive package of STEM-focused programming through partnerships with local school systems, governments, nonprofits and private organizations. These programs focus on building skills and creating opportunities in technical and craft fields.

THE NEED

Globalization, U.S. competitiveness and ongoing innovation will require talented professionals with STEM (science, technology, engineering and math) skills. Educators recognize the need, but many lack access to the resources to fully engage and prepare students for this fast-changing field.

THE SOLUTION

In the greater Washington D.C. area, two programs – Energizing Student Potential (ESP) and the recently launched Infrastructure Academy – will provide STEM education and ensure that residents can compete for positions in the critical areas that drive the regional economy, including energy.

ESP focuses on students in grades 5-8, a critical age for STEM engagement. ESP is designed to empower librarians and teachers to help students explore. The hands-on program focuses on the science of energy, transportation, energy efficiency and conservation. Students also are exposed to careers in energy through classroom visits from Pepco and Exelon employees, and field trips to company facilities and other destinations. ESP was piloted at 18 District of Columbia schools in 2017 and will expand to 36 schools in 2018.

"Exelon is committed to building a brighter, more sustainable future and creating opportunities for people where we live and work. When we joined forces with Pepco, we committed more than $5 million for job creation and training, in addition to funding for education and other community development programs. These efforts will enable people to develop the skills to work in fields that will remain critical to supporting the Washington metropolitan area"

Chris Crane
President and CEO
Exelon Corporation

PARTNERSHIPS

The Infrastructure Academy, supported through funds targeted for workforce development from the Exelon-PHI merger, is a partnership with the District of Columbia, the University of the District of Columbia, and other business stakeholders. The facility will focus on occupational skills training related to the infrastructure industry, including the utility, energy efficiency, transportation and logistics sectors. Exelon has proven success in this arena in nearby Baltimore with BGE's Smart Energy Workforce Development Program, a joint effort with local workforce development agencies and vocational schools to increase access for residents of the local community to BGE's technical positions.

RESULTS

A recent BGE intern, now a substation maintenance technician, reports: *"Before BGE, I worked at retail shops. Now I'm working on transformers and breakers. This is an opportunity for me to have a better life. This is more than a job, it's a career."*

JOHNS HOPKINS UNIVERSITY

Johns Hopkins is partnering to support the P-TECH school at Baltimore's Paul Laurence Dunbar high school an innovative grade 9 to 14 public school that creates clear pathways from high school to college and career for young people from all academic backgrounds. P-TECH students are not pre-screened for admission. In six years or less, they graduate with a high school diploma and a no-cost, two-year associate degree in a growth industry field. Each P-TECH school works with a corporate partner(s) and a local community college to ensure an up-to-date curriculum that is academically rigorous and economically relevant. Hallmarks of the program include one-on-one mentoring, workplace visits and skills instruction, paid summer internships and first-in-line consideration for job openings with a school's partnering company.

THE NEED

P-TECH matters because current CTE programs must be synced with the present and future demands of industry. In the U.S. alone, there are 28 million "middle-skill jobs" – jobs that require an associate degree or similar technical training, but not a four-year degree – with 14 million additional jobs coming online by 2018. The fastest growing and highest paying sectors of the job market are those requiring proficiency in STEM (Science, Technology, Engineering, Mathematics) fields, but fewer than one-third of U.S. students are adequately prepared in STEM.

THE SOLUTION

P-TECH is designed to help break the cycle of poverty and address skills gaps in our nation's labor force by preparing urban, suburban and rural young people from all backgrounds for academic achievement and skilled, middle-class employment.

"The P-TECH model offers transformational opportunities for Baltimore's youth and a chance to prepare our city's workforce for the jobs and careers of the future"

Ron Daniels
President,
The Johns Hopkins University

PARTNERSHIPS

RESULTS

P-TECH at Dunbar is a collaborative Healthcare partnership among the Baltimore City Public Schools, Baltimore City Community Colleges, State of Maryland, Johns Hopkins University and Medicine, University of Maryland Baltimore and Kaiser Permanente. P-TECH programs map their academic and workplace skills curricula directly to 21st century Healthcare industry labor market demands.

Graduates from P-TECH at Dunbar will earn their high school diploma and an industry-recognized, two-year postsecondary degree in a Healthcare field. These students will also benefit from career experience and mentorship in the workplace and will be first in line for skilled jobs upon graduation through partnerships with private sector participants.

MEDIMMUNE

Over the years and across its many locations, MedImmune has partnered with various schools and universities to build passion for science. MedImmune recognizes the important role of companies to develop future scientists, engage with surrounding communities and expose talent to future STEM careers. In 2016, MedImmune created a partnership with Johns Hopkins University to help students who would otherwise not have insight or access, to broaden their exposure to the STEM community and biotech industry. In 2017, MedImmune expanded the program to high school students through summer rotations for rising juniors and seniors.

THE NEED

To build a diverse talent pipeline, it is important to encourage and instill a love for science in students. While STEM is an area of focus in some education systems, there remains a strong need for access to and opportunities in science across broader populations of students, from kindergarten through Ph.D. training. Students may have a baseline understanding of science, but also need exposure to and hands-on experience with how science can be applied to a career.

THE SOLUTION

MedImmune built two programs to support students at various points along their education path. MedImmune created a summer rotation program for high school students. The one-day and three-week programs allow students full exposure to biotech research and development by following the path from discovery to manufacturing. The students follow a rotation plan beginning in early stages of research to understand the discovery process and then follow the path a molecule takes, through to manufacturing, with a view of science applications and the backgrounds of scientists in the function. This design is intended to both pique interest in scientific application and technology, and provide exposure to a broad range of science backgrounds and education paths.

MedImmune also partnered with Johns Hopkins to create the Johns Hopkins-MedImmune Scholars Program to provide hands-on experience to graduate students. In this program, in addition to the standard Johns Hopkins curriculum, students are introduced to the process and challenges of drug discovery and development through coursework co-taught with scientists from MedImmune. Additionally, students may complete a year-long internship at MedImmune to develop on-the-job training for non-laboratory careers. This unique approach offers graduate students hands-on experience in the biomedical field, preparing them for careers in the biopharma industry, while obtaining a traditional Ph.D. from a world-class university.

"Creating new avenues for the exchange of innovative ideas and groundbreaking research among scientists, engineers and clinicians is a critical part of drug discovery and development, and a key component of our culture at MedImmune. This program will help plant the seeds of collaboration in order to bring science and innovation to life"

Bahija Jallal
President, MedImmune and EVP,
AstraZeneca

PARTNERSHIPS

The key partners to deliver these rotation programs were the FDA (Federal Drug Administration) and the Montgomery County school district via RISE (a program designed by the county to partner rising junior and senior high school students with local employers for exposure to various careers), and Johns Hopkins University. These organizations source and schedule students for the various opportunities.

RESULTS

The objectives of these programs are qualitative, focused on providing exposure and insights into the industry. In addition to student impact, there is value to MedImmune employees via mentoring and sharing expertise. One notable moment from the 2017 high school rotations in partnership with RISE was the declaration of one student that she intended to start a STEM program at her school once the school year began. For the graduate students, MedImmune is proud to continue the work with Johns Hopkins and is already enrolling the second cohort of students, with incoming requests from other universities to establish similar programs.

MONUMENTAL SPORTS & ENTERTAINMENT

The Washington Capitals (Caps Care) have teamed up with EverFi and the National Hockey League to present the Future Goals Program, an online teaching tool that demonstrates important skills to help prepare students grades 5 through 7 for success in life with a focus on STEM career paths.

Hockey Scholar™ covers the following topics:

- Engineering behind equipment
- Calculating ice surface area and volume
- Circumference, area of circles, radius & diameter
- States of matter & phase changes
- Examination of mass, velocity and kinetic energy
- Manipulating variables to run experiments
- Data analysis and drawing conclusions

THE NEED

The program encourages students to be excited about science, technology, engineering and mathematics—as some students may lack enthusiasm for these subjects in the classroom. It can also be difficult for youth to comprehend the possibility for a STEM career in the realm of sports.

THE SOLUTION

This online digital course was developed in accordance with state and provincial math and science standards. By using the fast-paced, exciting game of hockey as a learning vehicle, the program helps students understand the real-world applications of science and math principles.

"If the Greater Washington Region is to enhance its national leadership and competitive position, then we must motivate and encourage students into the STEM fields. In collaboration with the National Hockey League and EverFi, the Washington Capitals are thrilled to have the opportunity to guide students in the direction of STEM careers through the game of hockey"

Ted Leonsis
CEO, Owner and Founder
Monumental Sports & Entertainment

PARTNERSHIPS

The Washington Capitals have partnered with the National Hockey League and EverFi, a leading critical skills education platform, for this initiative.

RESULTS

As of November 2017, a total 81 schools and 3,561 students in the District of Columbia, Maryland and Virginia have participated in the program.

RALLY HEALTH

Rally Health has adopted the Technology Development Program (TDP), which is a program launched in 2009 by Optum, a UnitedHealth Group Company (like Rally Health). The program – which operates in thirteen states and three countries, and accounts for 1,032 hires – is expanding to the District of Columbia.

THE NEED

TDP addresses three critical needs for Rally Health: (1) access to early-in-career technologists; (2) continued expansion of the company's technological footprint from Silicon Valley to Washington D.C.; and (3) the opportunity to improve the gender diversity of Rally Health's technologists. Progress with gender diversity in the tech sector is dependent on innovative programs like TDP as the representation of women in technical college programs is much higher than their representation in industry.

THE SOLUTION

TDP has two components: (1) a 10-week internship program that incorporates ideas such as shark tank, buddy program, tech talks, volunteer events, networking, and senior leadership exposure, with planned conversions from Intern to full time employee at the end; and (2) a one-year development program with two rotations covering areas such as development/engineering, systems and business analysis, data analytics and data science, DevOps/infrastructure, security and product management, and a final placement at the end. In the Rally Health instance of TDP, it will also incorporate content that improves the likelihood of longer-term success and career growth for women technologists such as one-to-many mentoring and dedicated technical development.

"Capitalizing on the great work launched and nurtured by Optum and enriching it with a D.C. instance and a focus on the acquisition and advancement of women technologists is a critical priority for Rally Health in 2018"

Grant Verstandig
Founder and CEO
Rally Health

PARTNERSHIPS

In other states, the most important partnerships for this program have been academic institutions such as the Universities of Minnesota, Wisconsin, Virginia, Notre Dame, Massachusetts and Illinois, as well as RPI and Iowa State.   With the program's expansion to Washington D.C., there are opportunities to forge relationships with Capital Region schools, including schools that prioritize the success of traditionally underrepresented students.

RESULTS

80% of the Rally Health TDP Intern participants will be aspiring women technologists. 80% of the national program's Intern participants receive offers to join the one-year development program.

T. ROWE PRICE

Out of the challenges of the unrest in 2015, a local West Baltimore pastor reached out to the then-CEO of T. Rowe Price, James Kennedy, to see if there were ways for school principals and T. Rowe Price associates to work together. The T. Rowe Price Foundation created a program for T. Rowe Price associates and West Baltimore principals to receive technical assistance around common management issues.

THE NEED

For West Baltimore school principals, there is often a challenge in receiving all the professional development they need to excel in their roles. For T. Rowe Price associates, finding avenues that allow them to both work on their management styles, and being able to do this while connecting with the community and understanding the issues of our local schools in their home community is extremely valuable. Both sides gain from this unique experience.

THE SOLUTION

T. Rowe Price developed an ongoing symposium that has the following goals:

- Use problems of practice to analyze complex leadership dilemmas, gaining new perspectives to identify leadership actions
- Identify common themes in the practices and attributes of effective leaders across sectors when managing change
- Identify the differences between Technical and Adaptive Change and how they are connected to Growth and Fixed Mindsets
- Describe the change process and how to get individuals on board with change

PARTNERSHIPS

The Foundation partnered with New Leaders for New Schools and with T. Rowe Price's internal Enterprise Learning unit to help both develop the curriculum and facilitate the sessions of West Baltimore principals and T. Rowe Price management associates. New Leaders for New Schools specializes in providing high-quality leadership training to principals that prepare them to elevate instruction across their schools, accelerate student learning, and build a brighter future for their communities. Enterprise Learning works to help associates in advancing their learning toward more organizational effectiveness.

RESULTS

The goal was for all participants to be introduced to action planning and develop a plan on change management steps they would make in the following year. In addition, the participants learned to use each other as support as they carried out their work.

ACKNOWLEDGEMENTS

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ABOUT

The Greater Washington Partnership is a first-of-its-kind civic alliance of CEOs in the region, drawing from the leading employers and entrepreneurs committed to making the Capital Region – from Baltimore to Richmond – the best place to work, raise a family and build a business.

END NOTES

i   For this report and our analysis, we define "digital tech" workers as a group of workers comprising 20 technology-oriented occupations, as listed below. The location quotient (LQ) is a measure of the relative size of an industry or occupation group in a region compared to the average size in the nation. Employment numbers are as of 2017Q3.

DIGITAL TECH OCCUPATIONS, CAPITAL REGION

Occupation	Number of Workers	Location Quotient	Occupation	Number of Workers	Location Quotient
COMPUTER AND INFORMATION SYSTEMS MANAGERS	22,504	1.73	COMPUTER NETWORK ARCHITECTS	12,112	2.04
COMPUTER PROGRAMMERS	15,756	1.51	COMPUTER USER SUPPORT SPECIALISTS	29,339	1.32
SOFTWARE DEVELOPERS APPLICATIONS	46,567	1.54	COMPUTER NETWORK SUPPORT SPECIALISTS	12,222	1.76
SOFTWARE DEVELOPERS SYSTEMS SOFTWARE	34,305	2.16	COMPUTER OCCUPATIONS ALL OTHER	36,532	3.71
WEB DEVELOPERS	8,716	1.48	COMPUTER HARDWARE ENGINEERS	4,473	1.71
COMPUTER AND INFORMATION RESEARCH SCIENTISTS	3,639	3.54	ELECTRICAL ENGINEERS	8,096	1.20
COMPUTER SYSTEMS ANALYSTS	36,603	1.74	ELECTRONICS ENGINEERS EXCEPT COMPUTER	7,326	1.53
INFORMATION SECURITY ANALYSTS	11,577	3.17	ELECTRICAL AND ELECTRONICS DRAFTERS	828	0.81
DATABASE ADMINISTRATORS	7,409	1.75	ELECTRICAL AND ELECTRONIC ENGINEERING TECHNICIANS	6,028	1.26
NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS	27,170	1.97	ELECTRO-MECHANICAL TECHNICIANS	389	0.75

NUMBER OF WORKERS — LOCATION QUOTIENT

Source: JobsEQ

ii   Chmura analysis of Quarterly Census of Employment and Wages provided by Bureau of Labor Statistics
iii   Chmura Economics & Analytics. Data reflect online job postings, active ads only as of 12/3/2017.
iv   Muro, Mark, et al. "Digitalization and the American workforce." Brookings Institution, 17 Nov. 2017
v   We acknowledge and thank the authors of CBRE's "Scoring Tech Talent" report, whose methodology guided this report.
vi   U.S. Department of Commerce, Bureau of Economic Analysis.
vii   Muro, Mark, et al. "Digitalization and the American workforce." Brookings Institution, 17 Nov. 2017
viii All occupation data are presented in terms of at-place employment and are derived from the most recent four quarters of industry employment (from the Bureau of Labor Statistics, updated quarterly) and the industry/occupation matrix available for our region. Total Employment is the sum of four data sets: covered employment (which comprises federal, state, local, and private sector employees covered by unemployment insurance programs in the United States), self-employment, non-covered railroad employment, and non-covered religious organizations employment. Represents civilian labor force only.
ix   Artificial Intelligence-Global Market Outlook (2016-2022), Orbis Research
x   Cloud Security Market to See 13.9% Growth Through 2022.", BCC Research, 31 Oct. 2017
xi   "Internet of Things Technology Market by Node Component (Processor, Sensor, Connectivity IC, Memory Device, and Logic Device), Network Infrastructure, Software Solution, Platform, Service, End-use Application, and Geography - Global Forecast to 2022." Markets & Markets, Nov. 2017.
xii   McKinsey analysis
xiii "Global Big Data Analytics Market Research and Forecast 2017-2022." Orion Market Research
xiv   "Benchmarking Greater Washington," Brookings Institution, 2015.
xv   Chmura Economics & Analytics. Data reflect online job postings for the 180-day period ending 12/3/2017.
xvi   "The Digital Edge: Middle-Skill Workers and Careers." Capital One and Burning Glass, 2017.
xvii National Science Foundation, National Center for Science and Engineering Statistics. 2017. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017. Special Report NSF 17-310. Arlington, VA
xviii "Cybersecurity Market Report." Cybersecurity Ventures, 2 Dec. 2014
xix   "Global cyber security market forecast 2016-2021 | Statistic." Statista, 2017
xx   McKinsey and Greater Washington Partnership analysis
xxi   McKinsey analysis
xxii Cybersecurity Supply/Demand Heat Map. Cyberseek, 2017
xxiii McKinsey analysis
xxiv Tandem NSI cyber census
xxv   "Recovery: Job Growth and Education Requirements through 2020," Georgetown University, Center on Education and the Workforce, 2013