

An abstract graphic design consisting of several overlapping white-outlined squares and rectangles of various sizes, rotated at different angles. Small colored dots (purple, blue, and teal) are placed at various points along the lines and at the corners of the shapes.

2019 **TECH**
WORKFORCE
STUDY

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<Executive Summary>

The Nashville Metropolitan Statistical Area's (MSA) rapid economic growth has garnered national attention. The Nashville MSA's gross domestic product grew from \$80.1 billion in 2009 to \$134.3 billion in 2018. In this same time frame, employment increased by more than 25 percent and unemployment dropped from 9.4 percent in 2009 to 2.7 percent in 2018.

The growth of the tech sector, and the growth of technology jobs across industries, is part of the Nashville area's success story. In fact, job growth in the region grew 25 percent from 2009 to 2018 while tech job growth was 47 percent. In 2018, the Nashville MSA was estimated to have 26,195 technology workers, with an average 2,173 tech job postings per month – indicating that demand outpaces the supply of tech workers. By 2028, the region projects overall job growth of 16 percent, while tech jobs are anticipated to grow by 22 percent. The upward trend in tech workforce growth is projected to continue, demonstrating the need to address the technology worker supply gap. While this supply gap is not unique to the Nashville region or to technology jobs, the tech workforce in Nashville faces its own unique challenges and opportunities to grow and thrive.

While there is significant existing knowledge about the high demand for tech talent, this study adds to the understanding of the characteristics of the existing *supply* of tech workers in the Nashville area. Understanding the Nashville area's current supply of tech workers enables educational institutions to align course offerings to create a pipeline of talent; aids employers in recruitment of tech talent based on the strengths and gaps in the workforce and knowledge of tech workforce employee preferences; and alerts tech talent in other cities to the opportunities available in the Nashville area. Understanding the Nashville MSA's current tech talent supply will create an environment for the tech workforce to flourish.

What follows is an assessment of the demand of tech talent in the Nashville MSA drawn from traditional sources, including EMSI and CompTIA, complemented with original research conducted by the Nashville Area Chamber of Commerce's Research Center on the current supply of tech talent in the Nashville area and what is needed for the workforce of the future. The methodology for this original research included an electronic survey administered to approximately 100 stakeholders working in the Nashville MSA in the tech sector, or in tech occupations in various sectors, each with responsibility for tech staffing and management. This was followed by in-depth interviews with over 40 practitioners in leading roles related to tech across sectors and functions. The survey and interviews established a level of detailed data and information previously not available in the local market. This detail was further enhanced by review of the findings with the Greater Nashville Technology Council staff, who brought a deep understanding of tech workforce nationally and in Nashville, to help understand the findings of this original research.

WHAT THE RESEARCH REVEALED ABOUT DEMAND FOR TECH TALENT:

FINDING #1

Trends – historic and projected – provide key insights into occupational growth in the technology field. These trends can be examined in the context of education and experience requirements in order to contribute to a baseline for discussion and preparation of tech workforce.

Workforce Development Questions and Implications

What training is available locally to meet the need for future tech jobs? In a quickly-evolving field, how frequently do the demands of the market change? How can educational institutions stay ahead of the curve in preparing tech talent?

WHAT EMPLOYERS IN TECH STAFFING AND MANAGEMENT SAY ABOUT THE HIRING ENVIRONMENT:

FINDING #2

Finding the quantity of candidates necessary is challenging; finding relevant, high-quality candidates is even harder.

Workforce Development Questions and Implications

How can a candidate portray quality of skills during the application process? What are aspects of an individual's performance that constitute quality across industry areas? How can the hiring process be improved to yield the most relevant candidates?

FINDING #3

In a market where demand outstrips supply, employers of tech talent can experience a vicious cycle where staffing gaps make it difficult to retain existing employees, which exacerbates attrition, and makes the organization less attractive to potential employees.

Workforce Development Questions and Implications

The sector could benefit from professional development programs to upskill existing employees so they can grow, and new entry-level employees can be hired and trained. Developing a definition for employee satisfaction specifically connected to staffing gaps could be helpful for further research. How can organizations with tech functions create relationships with staffing organizations to address staffing needs?

WHAT EMPLOYERS IN TECH STAFFING AND MANAGEMENT ARE SEEKING:

FINDING #4

The most important skill set tech workers can possess is interpersonal skills – for greater success in team settings and to help tech workers understand business and organizational mission and goals.

Workforce Development Questions and Implications

Are current tech training and education providers placing adequate emphasis on interpersonal skills development? Are there opportunities to practice and hone the interpersonal skills that employers need? How can current methods for problem solving and social learning be enhanced?

FINDING #5

In hiring, experience alone is more consistently perceived as an indicator of ability than education alone.

Workforce Development Questions and Implications

Are the educational institutions training tech workers including sufficient experiential learning like internships and relevant project-based assignments? How early are young people given relevant experiential tech opportunities? How could hiring practices be improved in order to more efficiently ascertain the right candidates?

FINDING #6

While certifications hold value to organizations, further research is warranted to examine how to fully extract their value at all levels.

Workforce Development Questions and Implications

How can certifications function effectively both as a tool for learning and as a proxy for skills to potential employers? Are certifications more valuable to employers for less experienced and/or younger employees?

WHAT THE RESEARCH REVEALED ABOUT RECRUITMENT CHALLENGES AND OPPORTUNITIES:

FINDING #7

Wages in the Nashville region simply do not compete nationally and the below-average cost of living does not make up the difference. Nashville MSA tech employers indicate there is a need for increasing compensation packages.

Workforce Development Questions and Implications

Nashville MSA tech workers are paid less than their counterparts in other parts of the country, which cannot be ignored – especially in a time of low unemployment and significant demand for more tech workers.

FINDING #8

Purposefully expanding hiring practices to under-represented groups is seen as an effective recruitment solution to create a broader and more robust talent pool. Diversity levels among the tech workforce in Nashville are low. This is true at a national level as well, but to a slightly higher degree in the region.

Workforce Development Questions and Implications

How are educational institutions – including K through 12 and post-secondary – partnering to expand the talent pool to communities under-represented in the Nashville MSA tech workforce?

WHAT TECH WORKERS ARE SEEKING IN A WORKPLACE:

FINDING #9

Tech candidates are positive about many alluring quality of life factors in the Middle Tennessee region and about individual companies' organizational culture. However, they are concerned about both compensation and commute times in the region, which can diminish the attractiveness of potential Middle Tennessee employers.

Workforce Development Questions and Implications

More research is warranted on what tech candidates seek in organizational culture; what it is that they perceive as positive? How are tech employers contributing to quality of life factors in the region? Finally, tech employers should consider all options available in addressing commuting – including transit, work hours and off-site working – as this issue was a top concern for candidates.

<Introduction>

Nashville's tech community is increasingly drawing national attention, with opportunities in the tech sector and for tech workers to impact other prominent sectors including health care management, logistics, music, finance, government and education. Unprecedented levels of economic and population growth in the Nashville region, coupled with dynamic changes in the landscape of tech jobs, skills and training across sectors, are drawing tech talent to the Nashville region.

To maintain the momentum of tech growth in the Nashville region, and to provide opportunities to more Middle Tennesseans who want to pursue this work, the region needs a clear understanding of the demand for, and supply of, tech workers.

This report, created with original research conducted by the Nashville Area Chamber of Commerce's Research Center, offers new insight into the information technology workforce of the Nashville area. While much is known about the demand for tech workers in the Nashville MSA, the specifics of the supply of tech workers in the MSA - their specific skills, education and experience or their concerns about work settings and culture - are not typically captured through standard business, workforce or demographic databases. This study engaged key staff with responsibility for tech workforce in several sectors in the region to probe for insights and understanding of the region's tech workforce.

In recent years, Nashville has experienced strong demand for tech workers in various occupations and across numerous industries. With recent relocation and new jobs announcements including, most recently, the announcement that Amazon will create 5,000 jobs in its Center of Excellence in downtown Nashville, momentum is expected to accelerate. The demand for workforce is apparent and can be articulated through a variety of existing data tools and sources. Less known are the characteristics of those persons working in these occupations currently in the local labor market: the supply of tech workers.

The findings of this report are intended to serve as a resource for the region and all those engaged in development of the technology workforce, including traditional educational institutions and new training schools preparing tech talent and enhancing the skills of existing tech workers. The findings will also aid employers seeking to recruit and retain tech talent and will aid tech workers across the country considering the Nashville region by showing what opportunities are available for skilled tech workers.

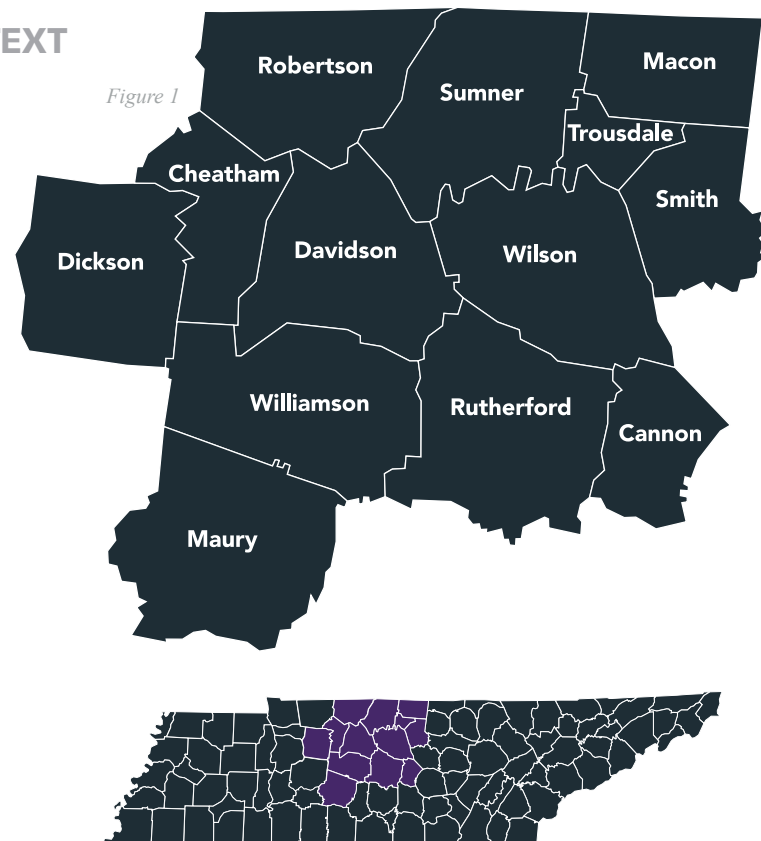
<The Study Area>

This study addresses the labor market of the Nashville Metropolitan Statistical Area (MSA). MSA's are geographic entities with a core urban area of 50,000 or more population, delineated by the U.S. Office of Management and Budget (OMB) and revised following each Decennial Census. The Nashville MSA is comprised of thirteen counties including: Cannon, Cheatham, Davidson, Dickson, Maury, Macon, Robertson, Rutherford, Smith, Sumner, Trousdale, Williamson and Wilson (see Figure 1). Among tech workers, there are substantial commuting patterns into Davidson County and Williamson County from surrounding counties. In 2018, Davidson and Williamson are host to the most tech jobs and have the most tech workers living within these counties. Throughout this study, the terms Nashville MSA, the Nashville region and Middle Tennessee will be used interchangeably.

REGIONAL TECH WORKFORCE CONTEXT

The Nashville region possesses an economy that is more diverse for its size than nearly any market in the United States. The Nashville MSA has experienced remarkable, record-breaking growth for many years, while continuing to rely on the diverse industry mix that has provided the region with great stability. See the appendix for more detail on the Nashville MSA's economic base and diversity.

As a field, technology has been present for many decades, but has expanded rapidly in the nation and the world since the 1990s. Nashville's tech job growth is notably faster than the national average for growth in this field. Technology has become ubiquitous as a feature of nearly every industry, firm and location in the country and, in Nashville, the tech workforce is deployed across healthcare management, manufacturing, music, logistics, finance, government, education and many other industry sectors. CompTIA, widely regarded as the world's leading information technology association, draws the distinction between core tech industry employment and tech occupation employment in other industries. Nationally and in the Nashville region, tech occupations exist in both tech-dominated firms and across many industry sectors.



<Tech Workforce Supply and Demand Context >

US technology companies employed approximately 6.1 million people in 2017 – a two percent increase from 2016, a rate of growth which is estimated to continue in 2018, according to CompTIA. CompTIA reports that while 44 percent of technology professionals work in the technology industry, the majority of technology professionals work in other sectors such as healthcare, which is the largest employer segment in the Nashville market. Generally, there is high demand for talent for medium and large firms and this demand is projected to continue to increase.

At the local level, the Nashville MSA continues to experience rising demand for technology workers. Job growth is projected 24 percent by 2028, continuing to exceed national levels that will increase by 16 percent.

PROJECTED TECH JOB GROWTH, 2018-2028

Figure 2



Based on national estimates, an area the size of the Nashville MSA would be expected to have 30,461 technology workers. In 2018, there were 26,195 tech workers in the area, signifying a regional job concentration or “location quotient” of 0.86 - a level 14 percent lower than the national job concentration. While the number of technology professionals in the Nashville region is still below the value required currently, growth in demand for tech talent is accelerating at a rate far faster than the nation’s.

Intense competition for tech talent is present in Nashville and across the nation, with a national average of 2,309 tech job postings per month (for areas comparable in size to Nashville) and an average of 2,173 in the Nashville region.

DEMAND FOR TECH WORKERS - JOB POSTINGS/MONTH

Figure 3



SUPPLY FOR TECH WORKERS - JOBS

Figure 4



The supply of tech workers has historically been and will continue to remain lower than the national average for areas similar in size to Nashville. In fact, the gap between expected and actual employment is anticipated to remain roughly the same over the next five years. This means the current tight labor market will continue to tighten even more, making it far more difficult to find candidates with the skills and experience needed to fill open positions.

There are, however, interesting caveats to this workforce marketplace. Research with area stakeholders reveals that many firms maintain standing job postings in order to sustain a pipeline of candidates (i.e., postings are not a one-to-one proxy for current openings). Additionally, some large firms based in this or other regions in the country may be posting for positions across their facilities well beyond the local market, and firms may be reliant on human resources posting activity that in some ways may not fully resemble the needs of the organization at any given point in time. Other issues add to the complexity of hiring tech workers as well, such as the greater or lesser likelihood that certain tech occupations and roles will be posted through traditional means.

Research for this study, corroborated by other reports, highlights the imprecision inherent in attempting to “read the local labor market” simply by scanning demand as viewed through job postings. For these reasons, understanding the dynamics of the existing workforce in a set of occupations requires obtaining original inputs and appropriately modelling them to the area’s universe of tech occupations. That motivation guided the design of this study, which sought to move past what are suggested gaps in demand and supply simply informed by the demand side of the equation. Incorporating a deeper understanding of the existing supply can yield results for the local market in terms of pivots, shifts, training and refocus of firms, educators and others to respond not merely to what appears as demand for workers, but what the base of supply of workers truly looks like.

<Methodology>

The research conducted for this study focuses on generating a new understanding of the characteristics of the existing supply of tech workforce in the Nashville area. Previous studies on demand include 2018 research by Middle Tennessee State University (MTSU), which created a profile across the Nashville MSA and the Clarksville MSA. The Nashville Area Chamber of Commerce Research Center's work relies on a subset of the occupational categories used in the MTSU profile and focuses on the Nashville MSA, which has a larger and denser ecosystem of tech jobs. The Research Center's work serves as a complement to the research by MTSU, with a narrower geographic and occupational focus.

After conducting a data and literature review of existing patterns and trends in the overall technology workforce, the Research Center conducted survey research that collected new information on the Nashville tech workforce. An electronic survey was administered to approximately 100 stakeholders working in the Nashville MSA in the tech sector or in tech occupations in various sectors; each stakeholder had responsibility for tech staffing and/or management. Participating organizations and individuals reflected a cross-section of occupation types and encompassed all major areas of tech activity within those industries. Survey completion time was estimated at 60 to 90 minutes each, for a comprehensive inventory of over 60 distinct questions in major and sub-categories. Surveys were administered between January and November 2018.


In-depth interviews were conducted with over 40 practitioners in leading roles related to tech across sectors and functions. Follow-up interviews with respondents averaged between 30 to 45 minutes in length and addressed a variety of qualitative topics building on survey responses. Interviews were both in-person and by phone. Interviews were conducted between March and October 2018.

Total employment of firms involved in the research numbered between 18,000 to 24,000 in the area, with sizable tech contingents in each company. The survey and interviews established a level of detailed data and information previously not available in the local market. The research design, methodology and implementation were adapted from numerous models that address similar issues relating to the tech workforce in other regions and nationally. The review and understanding of the findings were aided significantly by the leadership of the Greater Nashville Technology Council, who brought their broad, deep and on-the-ground understanding of the tech sector and tech jobs across industry sectors to bear in interpreting the findings. More detail on the methodology of this report is found in an appendix to the report.

<Study Findings>

The Nashville area's technology workforce, represented across an array of sectors and thousands of firms, is an increasingly dominant factor in the region's economy. The region's transformation into a leading metropolitan center for the Southeast and the nation compels policymakers, educational partners, and firms to boldly address the ways that Middle Tennessee can grow, train and attract tech workers to meet the needs of the tech sector and all sectors reliant on tech workers.

Findings from this research are presented through nine key themes, each of which poses questions and opportunities for how the region can strengthen and expand its tech talent training and pipeline.

 **FINDING #1**
Trends – historic and projected – provide key insights into growth of select occupations in the technology field. These trends can be examined in the context of education and experience requirements in order to contribute to a baseline for discussion and preparation of tech workforce.

EMSI data projections indicate which tech-related occupations will grow or decline in the Nashville MSA (*figure 5*). The survey conducted for this research adds dimension to the occupational projections by asking survey respondents to consider the needs – in both experience and education – for workers to be prepared for the tech jobs of the future (*figures 6-8*).

Almost all of the occupations shown in *figure 5* are expected to experience an increase in the Nashville area between now and 2028, with some growing at substantial rates. There is a notable decline projected for the occupational category “computer programmer.” It is worth noting, however, that there have been nuanced shifts in occupation classifications over time. The category of “computer programmer” has evolved as the field has grown and is oftentimes interchangeable with more specific designations such as different variations of “software developer.” Therefore, it would be faulty to conclude that this line of work is projected to decline as this difference may be explained by the evolving specificities of the tech sector and shifts in titles designated by hiring managers. When computer programmers’ job outlook is combined with that of software developers, these jobs are expected to increase 62 percent between 2008-2028.



Cybersecurity continues to grow in importance to organizations.

Cybersecurity is a growing concern and this is reflected in increased occupational and educational offerings.

According to the *Pricewaterhouse Coopers 2018 Global State of Information Security Survey*, **40 percent** of organizations using automation or robotics believe that cyberattacks are the most serious threat to their business.

High turnover exacerbates this concern.

The survey conducted for this report shows that employers believe finding and training employees with security expertise is expected to remain a challenge.

The example of an apparent declining need for computer programmers is illustrative of the constant evolution of tech occupations and roles and, consequently, of the training and qualifications needed to fill the jobs of the future. The differences between occupational types and ongoing shifts that will persist call for caution for both students and educators regarding future needs and requirements. Likewise, area employers must assess trend and projection data in light of their firm and industry's particular experiences and needs in order to maximize the effectiveness of hiring and retention efforts. In tech, many skills, and hence occupations, can quickly become outdated, redundant or evolve into other specialties – a pattern that is likely to continue. The charts that follow show the projected growth or decline of specific tech occupations (figure 5).

JOB GROWTH, 2008-2028

Figure 5

OCCUPATION	2008 JOBS	2018 JOBS	2028 JOBS	2008-2028 CHANGE	2008-2028 % CHANGE	ANNUAL OPENINGS
DATABASE ADMINISTRATORS	618	733	888	270	44	63
SOFTWARE DEVELOPERS, SYSTEMS SOFTWARE	1922	2409	2927	1005	52	217
SOFTWARE DEVELOPERS, APPLICATIONS	1620	3073	4489	2869	177	342
COMPUTER PROGRAMMERS	2080	1535	1575	-505	-24	118
NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS	1651	2177	2575	924	56	181
COMPUTER SYSTEMS ANALYSTS	2808	3893	4596	1788	64	336
INFORMATION SECURITY ANALYSTS	259	625	875	616	238	70
WEB DEVELOPERS	425	760	941	516	121	78
COMPUTER NETWORK ARCHITECTS	582	996	1160	578	99	91
COMPUTER AND INFORMATION RESEARCH SCIENTISTS	53	42	61	8	15	5
COMPUTER USER SUPPORT SPECIALISTS	2401	3883	4714	2313	96	397
COMPUTER NETWORK SUPPORT SPECIALISTS	1058	1771	2006	948	90	172

Source: EMSI

The following figures (figures 6 - 8) show what respondents deem as necessary qualifications for a candidate to be hired into a specific role.

The left pie chart represents the minimum level of education that a candidate would need for the corresponding position (for a person with no experience). On the right, the pie chart portrays the level of experience required for a given position (for a person with no relevant degree or certification). Thus, the percentages indicate the number of respondents who expected a given candidate to have the respective education or experience level. Please note no corresponding relationship exists between education requirements and experience requirements.

LEVEL OF EXPERIENCE OR EDUCATION ALONE THAT IS SUFFICIENT BY ROLE

Figure 6



Source: The Research Center, Nashville Area Chamber of Commerce

LEVEL OF EXPERIENCE OR EDUCATION ALONE THAT IS SUFFICIENT BY ROLE

Figure 7



Source: The Research Center, Nashville Area Chamber of Commerce

LEVEL OF EXPERIENCE OR EDUCATION ALONE THAT IS SUFFICIENT BY ROLE

Figure 8

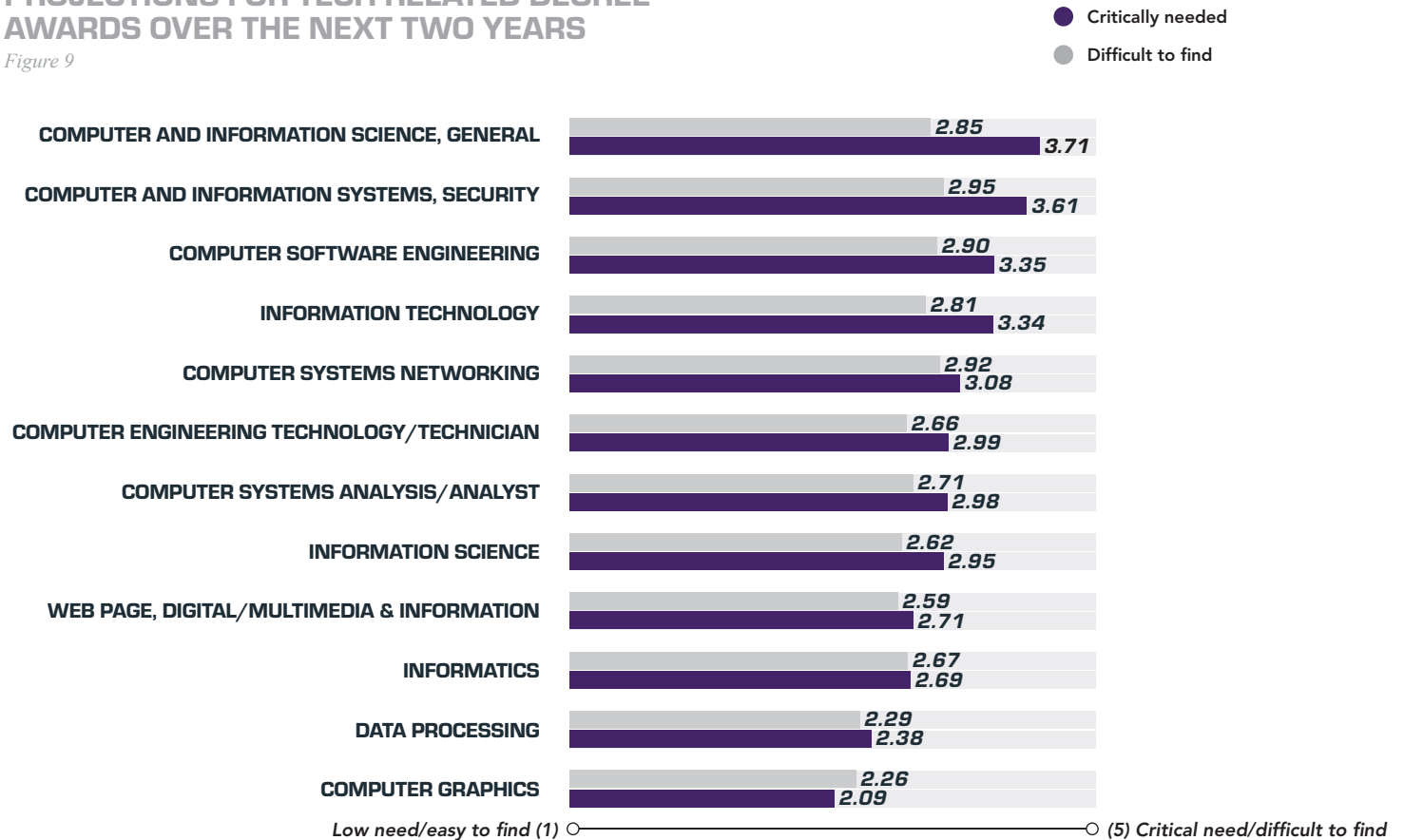


Source: The Research Center, Nashville Area Chamber of Commerce

Figure 9 includes survey respondents understanding of the need for various tech-related degrees and difficulty of finding candidates with those degrees over the next two years. A response of five indicates greater need and greater difficulty of finding candidates with the specific degree or skill.

PROJECTIONS FOR TECH-RELATED DEGREE AWARDS OVER THE NEXT TWO YEARS

Figure 9



Source: The Research Center, Nashville Area Chamber of Commerce, Scale=1-5

Workforce Development Questions and Implications

What training is available locally to meet the need for future tech jobs?

In a quickly-evolving field, how frequently do the demands of the market change?

How can educational institutions stay ahead of the curve in preparing tech talent?



FINDING #2

Finding the quantity of candidates necessary is challenging; finding relevant, high-quality candidates is even harder.

Across approximately one hundred named skills, firms with tech workers in the Nashville area report that it is often difficult to find the quantity of candidates required. But of those who report difficulty with the desired quantity of candidates, nearly all (96.9 percent) indicate that it is more difficult to find the *quality* of candidates necessary to meet demand.

The following figures illustrate two different aspects of a “skills gap,” or an area where there is a discrepancy between organizational need for a skill and the degree to which a candidate appears to be able to meet that need. *Figures 10 and 11* show that the general skills gap is attributed more to quality (acceptable, perceived standards of performance) than quantity (sufficient number of applicants) across both technology and soft skills. In the appendix, it is shown that this pattern holds when participants were asked about more specific skill areas including software development, network architecture, development operations, tooling, design, mobility, storage, computer tooling and other technologies.

This is not unique to the tech sector, as hiring departments often receive a high volume of applications, some of which do not meet the basic qualifications of the job posting. As technology work is a unique field where, as evidenced by participants’ interview responses, ability is valued most highly compared to specific levels of either education or experience, this dynamic is worth further study in order to better streamline the process for both hiring departments and potential candidates.



Tech in Small Business

Small business is an important foundation of any economy.

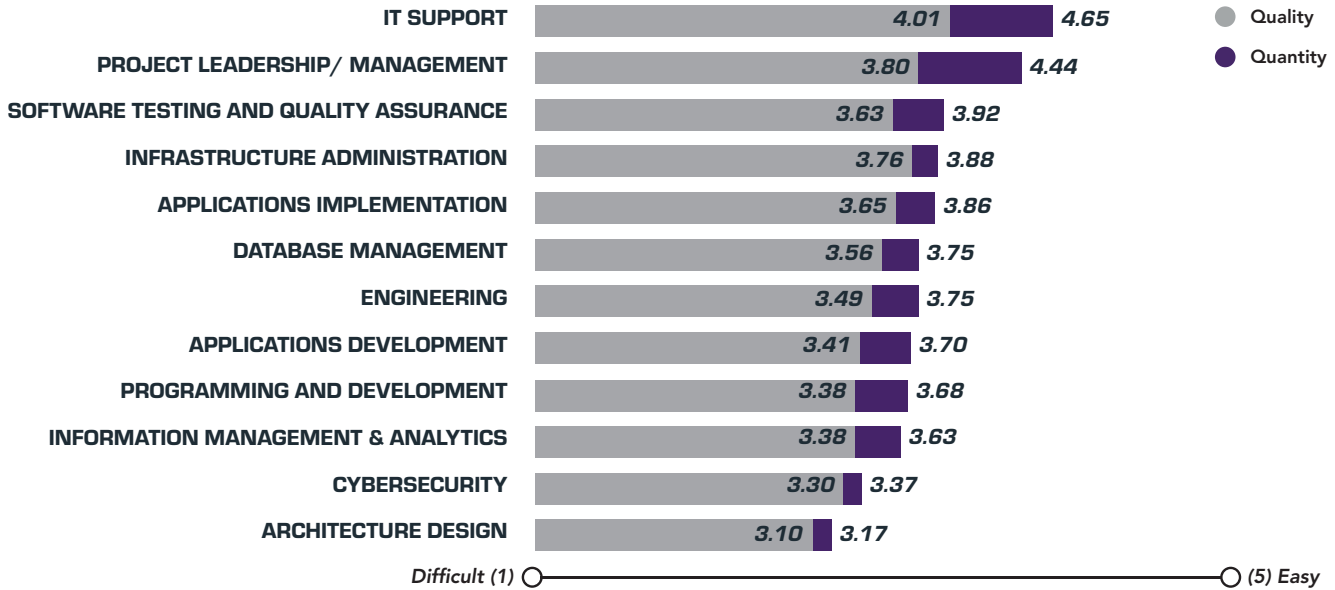
Traditionally, tech workers have been needed in small business, but this has recently been shifting because of advances in cloud computing, off-the-shelf management tools and increasing technical skill and self-sufficiency of the general workforce.

This trend is expected to increase, meaning that tech will be largely concentrated in mid-size or larger firms in the future.

Gig-workers are also becoming more common and can be defined as part-time technology help or technology professionals doing temporary contract work.

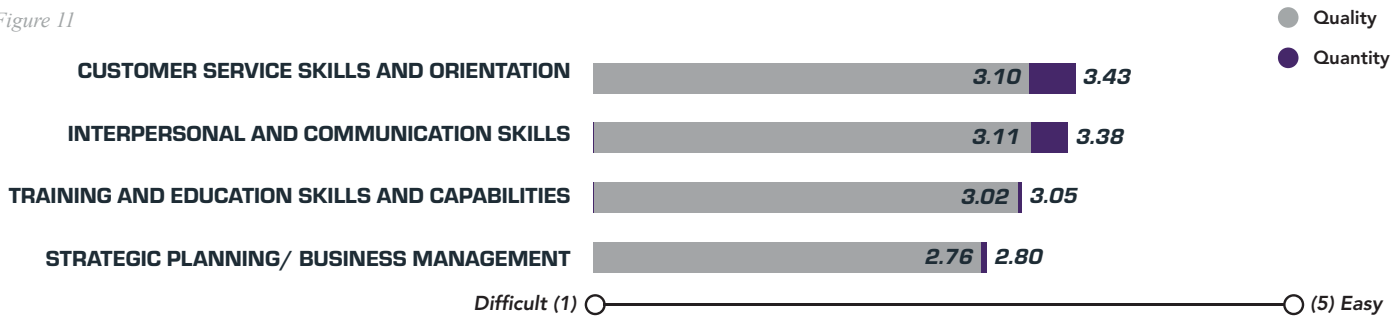
HOW EASY IS IT TO OBTAIN CANDIDATES WITH THESE TECHNOLOGY SKILLS?

Figure 10



HOW EASY IS IT TO OBTAIN CANDIDATES WITH THESE SOFT SKILLS?

Figure 11



Source: The Research Center, Nashville Area Chamber of Commerce, Scale=1-5

Workforce Development Questions and Implications

How can a candidate portray quality of skills during the application process?

How can the hiring process be improved to yield the most relevant candidates?

What are aspects of an individual's performance that constitute quality across industry areas?

How can professional development programs be incorporated by organizations to enhance quality of staff performance?

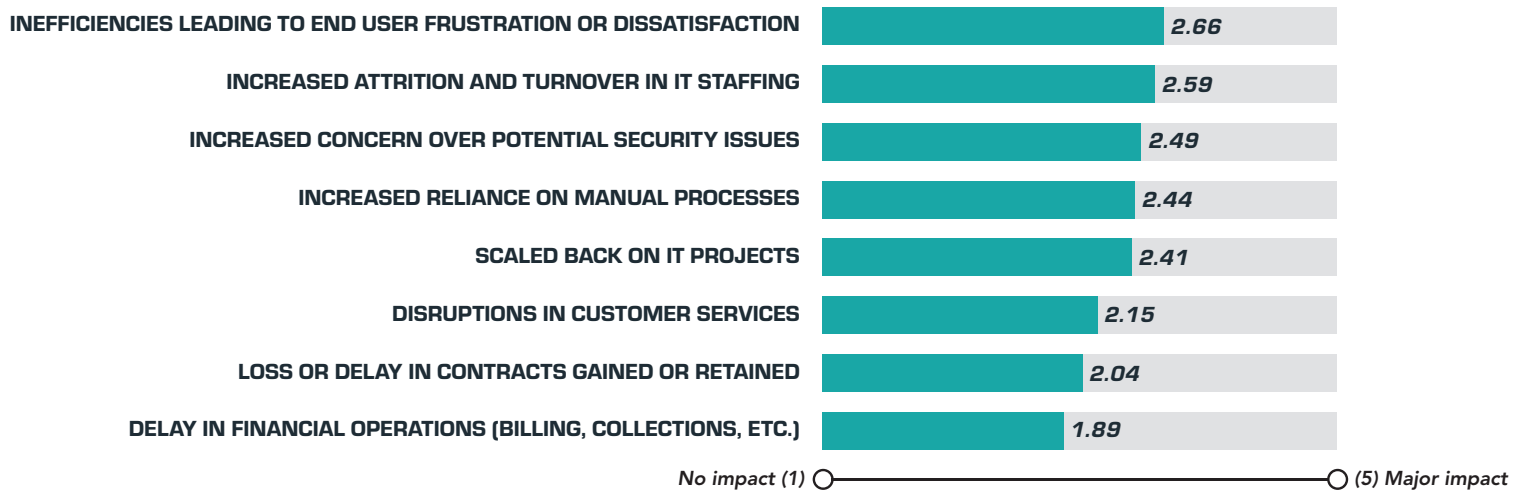
FINDING #3

In a market where demand outstrips supply, employers of tech talent can experience a vicious cycle where staffing gaps make it difficult to retain existing employees, which exacerbates attrition, and makes the organization less attractive to potential employees.

The survey of tech employers asked – in a market where they experience constant gaps in staffing – what were the impacts of the tech workforce shortage? The two most-cited staffing gap impacts are “Inefficiencies Leading to End User Frustration or Dissatisfaction” and “Increased Attrition and Turnover in IT Staffing.” *Figure 12* reviews the intensity with which survey respondents felt the various impacts of IT staffing gaps. A higher number indicates that the impact was perceived to be larger or more significant.

STAFFING GAP IMPACT

Figure 12



Source: The Research Center, Nashville Area Chamber of Commerce, Scale=1-5

The findings suggest a vicious circle. Staffing shortages result in “inefficiencies leading to end user frustration or dissatisfaction.” Put another way, the high turnover rate at an organization makes it more likely that the product or service suffers. However, a staffing gap also makes it more difficult to retain employees and exacerbates attrition, in turn making an organization less attractive to a potential employee. This cycle represents a significant challenge presented in sectors and firms that rely on tech workforce as part of their operation. This challenge is not unique to Nashville. The collective response to this challenge, as compared to peer cities, can distinguish the region as a tech hub.

Workforce Development Questions and Implications

The sector could benefit from professional development programs to upskill existing employees so they can grow, and new entry-level employees can be hired and trained.

Developing a definition for employee satisfaction specifically connected to staffing gaps could be helpful for further research.

How can organizations with tech functions create relationships with staffing organizations to address staffing needs?



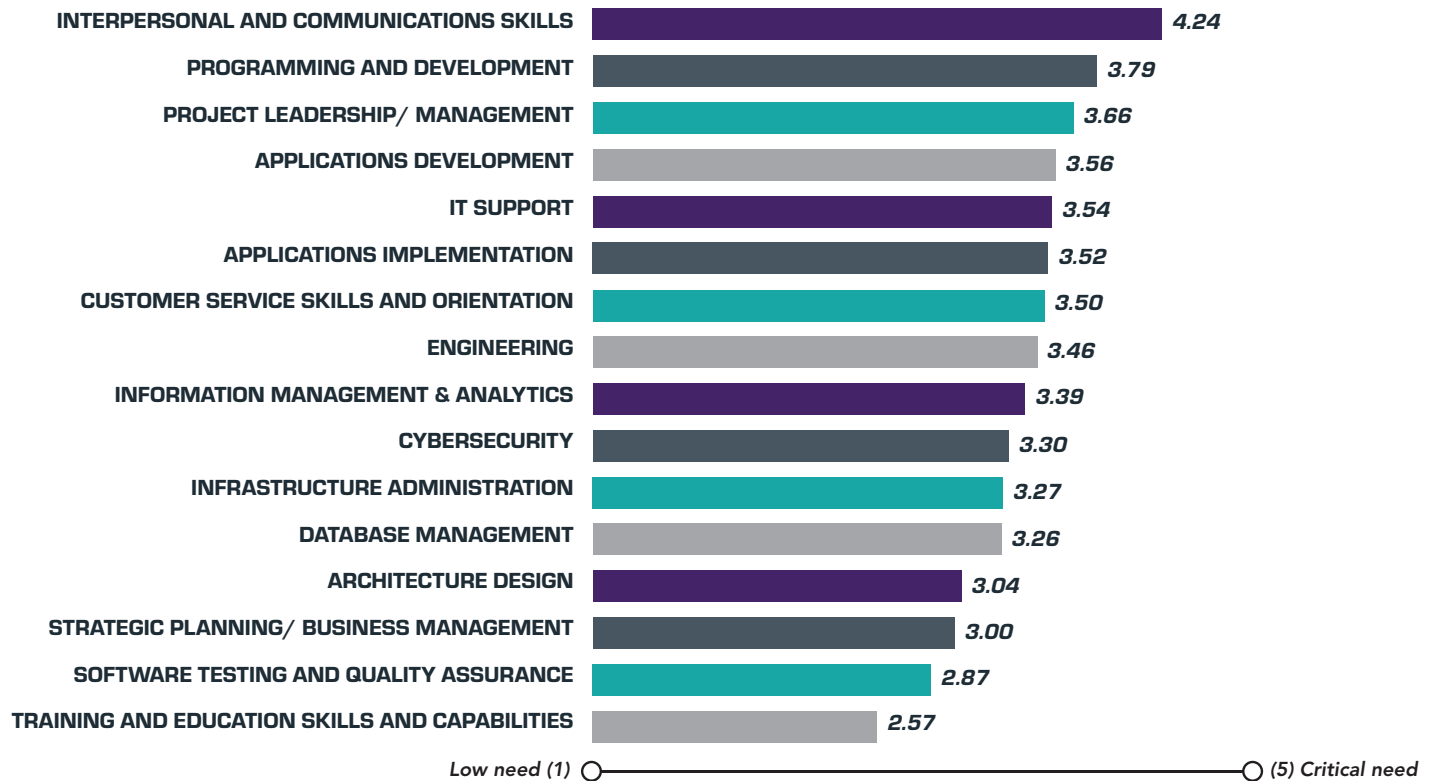
FINDING #4

The most important skillset tech workers can possess is interpersonal skills - for greater success in team settings and to help tech workers understand business and organizational mission and goals.

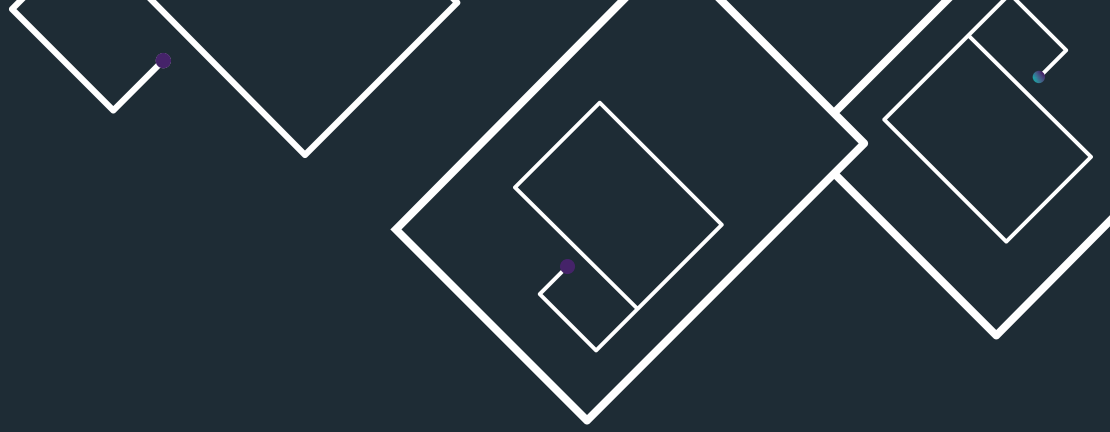
The survey research and subsequent interviews show most organizations cite a need for candidates and employees with developed interpersonal skills. On figure 13, a response of five indicates the greatest need.

TECHNOLOGY & SOFT SKILLS NEEDED IN ORGANIZATION

Figure 13



Source: The Research Center, Nashville Area Chamber of Commerce, Scale=1-5



Increasingly, tech workers must not only possess technical skills, but must also be capable of interacting in team settings that focus on applying technology to business situations, many of which will be new, unusual or otherwise challenging. Interpersonal and communication acuity is needed to interact effectively in work settings with others inside and outside of the organization. Those skills are also needed for employees to be cognizant of, and contribute to achieving, business and organizational missions and goals, and bringing technology to bear in achieving those missions and goals.

During the interview portion of this research, it was clear that employers often look primarily for critical thinking, analytical skills and soft skills. Many technical skills are cultivated internally since role evolution is common and people are required to adapt to new responsibilities. Nashville organizations are willing to develop talent. As one interview participant noted, “We invest a lot in internal development and skills upgrades for our staff.” Another interviewee projected that within a few years, there will be ten or more new technical roles that do not currently exist. Thus, when examining skills, a common remark was “The ability to understand business needs and problem solving is very important for our team members.” In discussions about effectiveness of training methods, many employers pointed to the need for expanding problem solving and interpersonal skills development. Some of the most highly ranked skills development methods are designed to address this need, including simulations, game and app-based training. However, respondents also indicated that social and group learning needs to be further developed at an organizational level.

Workforce Development Questions and Implications

Are current tech training and education providers placing adequate emphasis on interpersonal skills development?

Are there opportunities to practice and hone the interpersonal skills that employers need?

How can current methods for problem solving and social learning be enhanced?



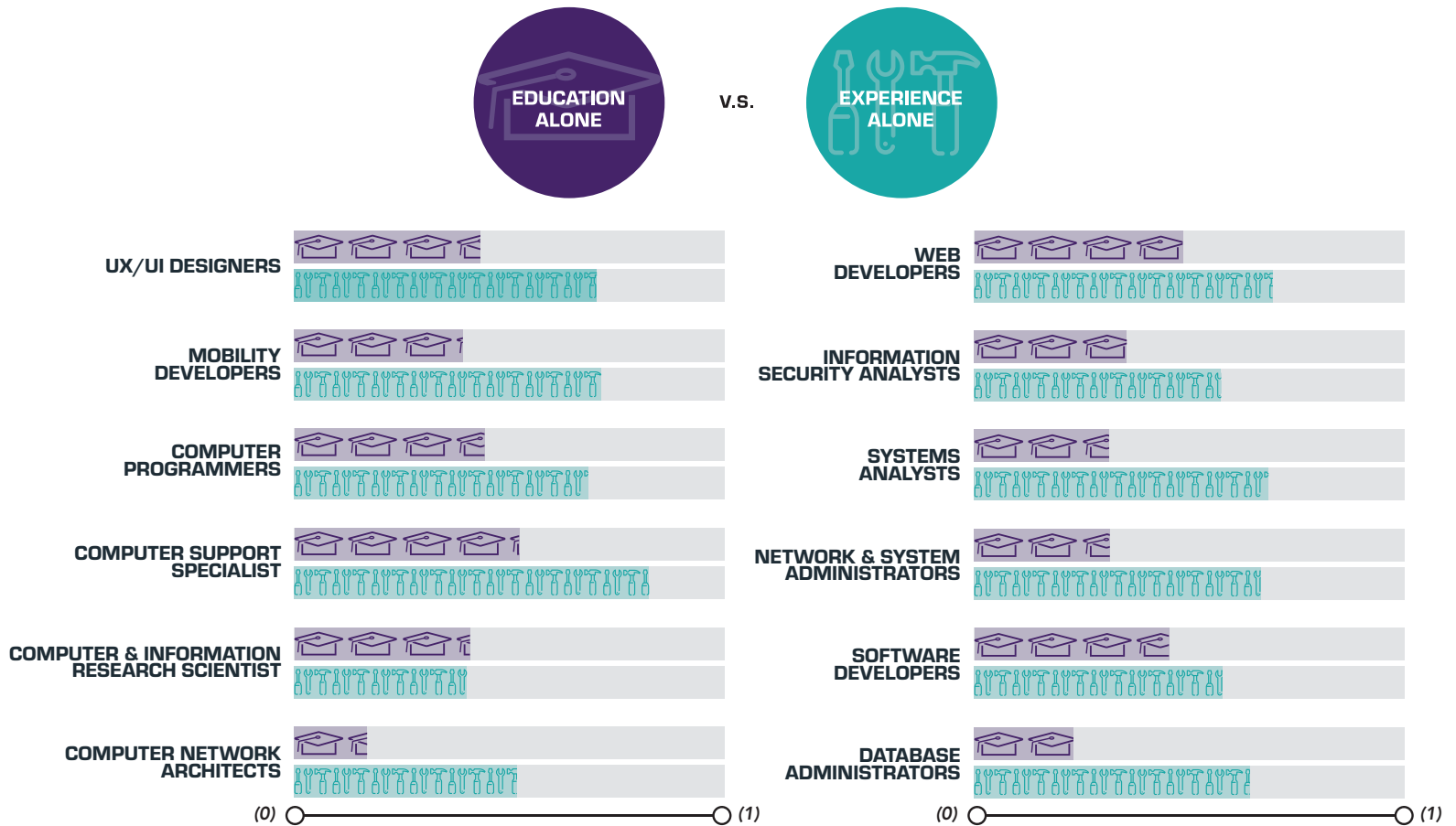
FINDING #5

In hiring, experience alone is perceived more consistently as an indicator of ability than education alone.

The study's survey showed that experience is frequently and substantially viewed by employers as more important than education alone when hiring for twelve major tech occupational roles. In *Figure 14*, a response approaching one indicates that either experience or education alone approaches sufficiency as qualification for each of the following roles according to survey respondents. A value of 0.75 would indicate that 75 percent of respondents stated that either education or experience alone would be sufficient for that given role.

IS EDUCATION OR EXPERIENCE ALONE SUFFICIENT?

Figure 14



Source: The Research Center, Nashville Area Chamber of Commerce

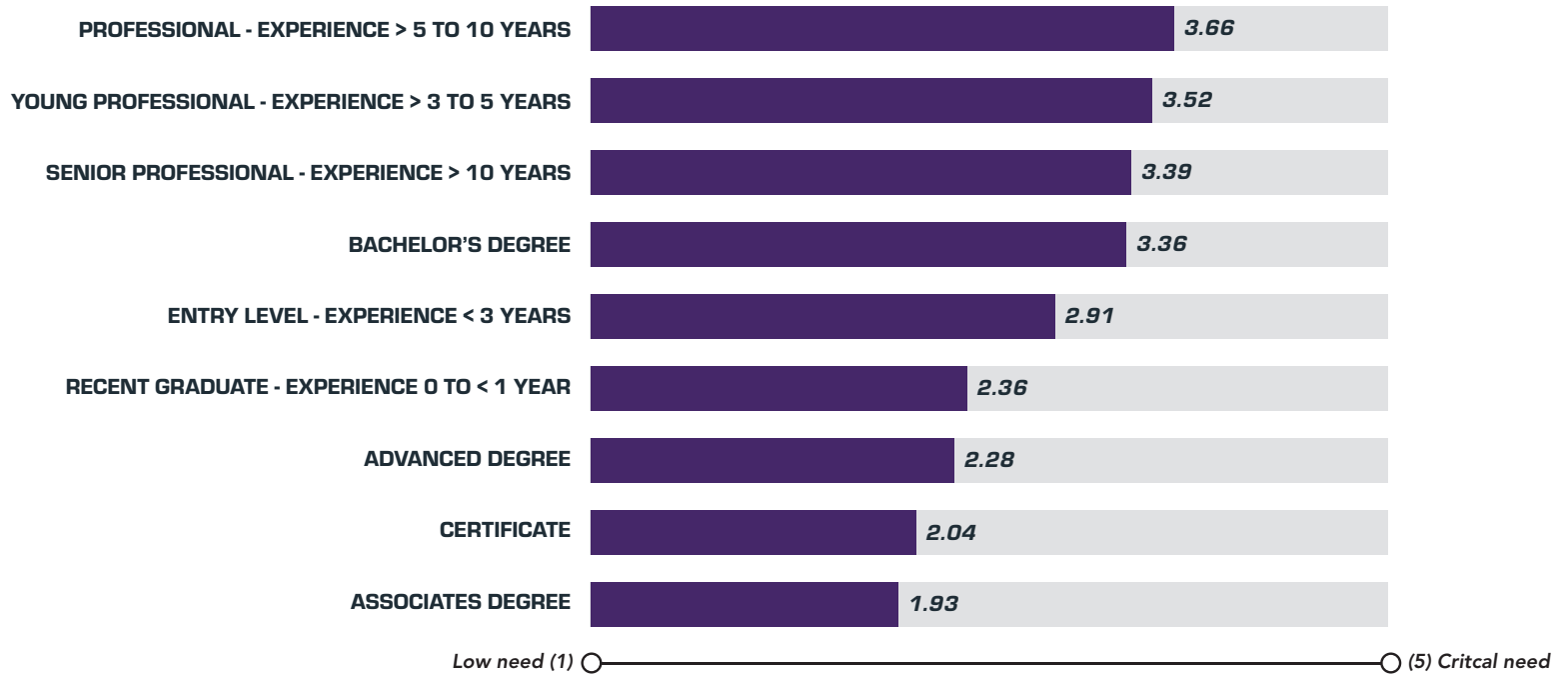
Only computer and information scientists are identified as roles where education alone is preferred slightly more than experience alone, but to a very slight degree. The positions of database administrators, network and systems administrators, systems analysts, computer network analysts, computer support specialists, mobility developers, and UX/UI designers all show that experience alone would inspire more confidence in hiring over education alone by wide margins. Experience alone over education alone is a less pronounced, but still notable, preference in hiring software developers, information security analysts, web developers, computer and information research scientists, and computer programmers.

These results indicate that the technology field is accessible by way of both channels, and that a hybrid of the two can very purposefully result in the abilities that employers are seeking. Interviews and survey research demonstrate an embrace of internships and partnerships with schools as valuable pipelines that allow students to obtain real-world experience. In some degree programs, students are asked to complete a semester or year-long project that tests their skills and abilities. Therefore, a recurring suggestion was to encourage schools to implement more “hands on” lab work and for students to pursue degrees and certifications when necessary.

Another perspective on the give-and-take between experience and education is to look at it from a needs point-of-view; what do organizations simply need more of? Survey respondents were asked about the need in their organization for different levels of education (certificate, associate’s degree, bachelor’s degree or advanced degree) and the need in their organization for different levels of experience from recent graduates to senior professionals with over 10 years of experience. Per the survey results, there is a need in the Nashville region for professionals with substantial workplace experience that outweighs need for professionals with any specific educational award. (See *Figure 15*).

NEED FOR TECHNICAL EXPERIENCE AND EDUCATION

Figure 15

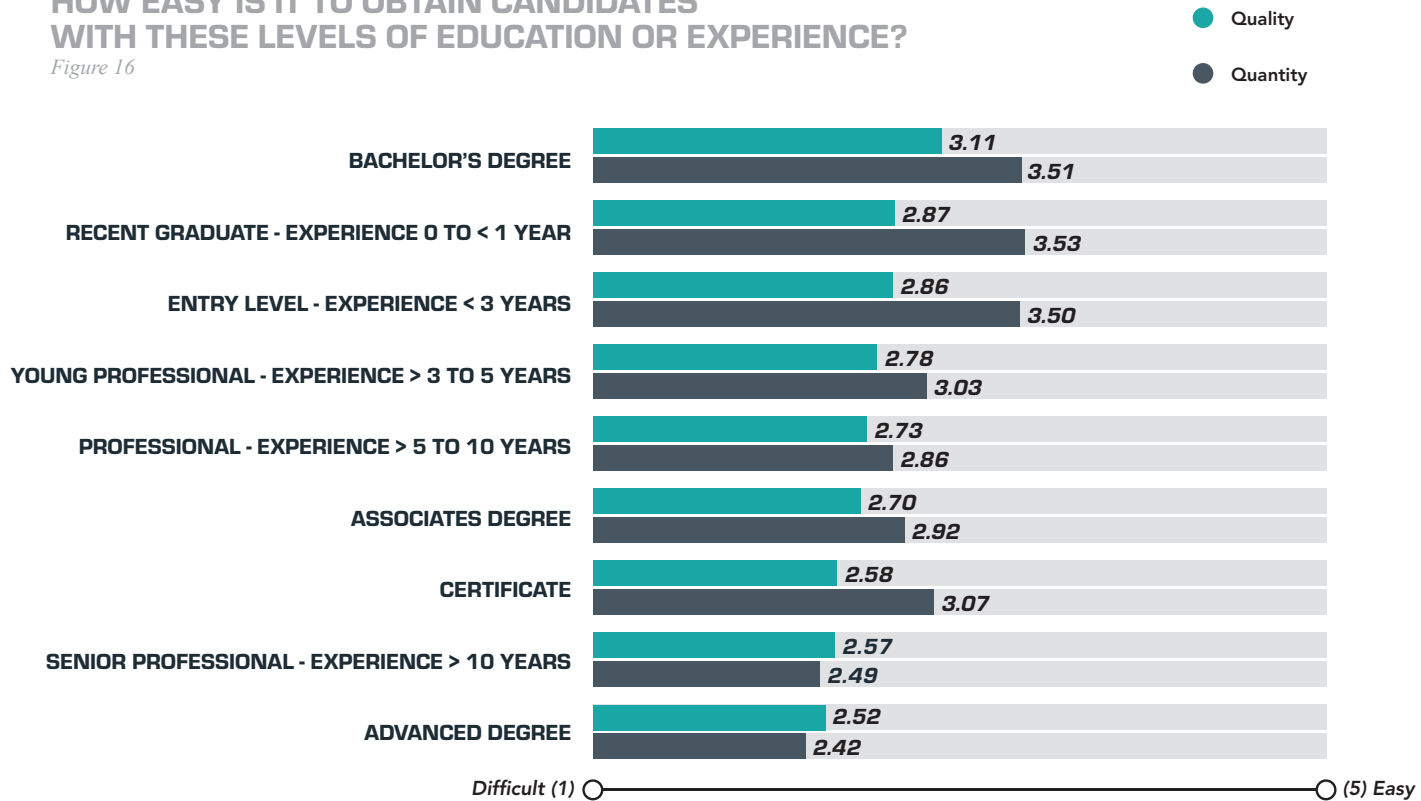


The Research Center, Nashville Area Chamber of Commerce, scale=1-5

Shifting attention from the need for various levels of education or experience to the ability to find high-quality candidates in sufficient quantities, overall, there is a much higher need for quality among candidates than quantity of candidates. At higher levels of education and experience the quality and quantity gap shrinks, indicating that candidates are more likely to have acceptable proficiencies required for hiring when they have more experience and education. On figure 15, a response of five indicates greater ease in finding the quantity or quality of candidates with the particular level of experience or education.

HOW EASY IS IT TO OBTAIN CANDIDATES WITH THESE LEVELS OF EDUCATION OR EXPERIENCE?

Figure 16



The Research Center, Nashville Area Chamber of Commerce, scale=1-5

However, it may be that the “years of experience” and “levels of education” categories are associated more with the expected proficiency resulting from experience and education rather than the attainment levels themselves as milestones. Experience and education heighten the quality of the employee, but the interviews conducted for this research reinforce that it is the skills quality itself that matters more than the years of experience or education. Put another way, organizations place the highest emphasis on quality, and non-exclusively associate it with different pathways to having achieved the quality. This points to a challenge for organizations: obtaining candidates largely based on experience and potential for quality, without basing qualifications completely on concrete milestones in terms of years of experience and education levels as this could inadvertently exclude quality candidates.

Workforce Development Questions and Implications

Are current tech training and education efforts including sufficient experiential learning like internships and relevant project-based assignments?

How early are young people given relevant experiential tech opportunities?

How could hiring practices be improved in order to more efficiently ascertain the right candidates?



FINDING #6

While certifications hold value to organizations, further research is warranted to examine how to fully extract their value at all levels.

For the purposes of this study, the value of certifications in general was examined rather than the value of specific certifications. The study's survey findings reveal that among Nashville-area tech employers, technology certifications are generally regarded positively. However, in order to fully examine the value of certifications, the findings of this report point in two directions for further study. First, how can certifications most effectively function as a proxy for learned skills to hiring managers? Second, at what levels in a professional's development are certifications most beneficial?

The figures below summarize questions asked in the survey to discern employers' thoughts on staff with certifications and if the certifications make the staff more valuable in the workplace. Of staff holding tech certifications, 62 percent were reported to be valuable to their organization.

STAFF HOLDING TECH CERTIFICATIONS ARE VALUABLE TO THE ORGANIZATION

Figure 17



56 percent of employers report that teams of staff with tech certifications benefit from having a common foundation of knowledge.

TEAMS OF STAFF WITH TECH CERTIFICATIONS BENEFIT FROM HAVING A COMMON FOUNDATION OF KNOWLEDGE

Figure 18



In light of this, how can the most value be extracted from technology certifications as a pathway? Regarding current staff, 44 percent of hiring managers are unsure if staff are rewarded for obtaining IT certifications and 37 percent agree that they are. This could have implications for how certifications are built into on-the-job training and what the desired outcomes of this training are. The agreement rate indicates this is a strategy for some employers in the area and that perhaps incentivizing employees to pursue certifications is an effective way to increase the value of the organization as a whole.

STAFF ARE REWARDED FOR OBTAINING TECH CERTIFICATIONS

Figure 19



Note that hiring managers who were unsure in reporting on both of these questions constitute a moderate proportion of the responses. In fact, when hiring managers were asked if staff with IT certifications perform at a higher level than non-certified staff, 44 percent responded they were unsure. This could point to the fact that tangible skills are really what employers are seeking in staff and candidates, and so the pathways to these skills – certifications, in-house training, advanced degrees – can differ without one necessarily holding more value than another.

STAFF WITH TECH CERTIFICATIONS PERFORM AT A HIGHER LEVEL THAN NON-CERTIFIED STAFF

Figure 20



Additionally, 56 percent of hiring managers report that it's important to test after tech certification training to confirm knowledge gains. This is one way that certifications can be tested as a proxy for learned skills and drive down uncertainty around what value is directly derived from the certification process.

IT'S IMPORTANT TO TEST AFTER TECH CERTIFICATION TRAINING TO CONFIRM KNOWLEDGE GAINS

Figure 21



Source: The Research Center, Nashville Area Chamber of Commerce

Responses to these three questions paint a picture of value, but there is also a notable level of uncertainty about how well certifications function as skills proxies. This warrants further research into how this relatively accessible method of technology education can be leveraged in the workforce pipeline and at an organizational level. This also warrants further research into what stages in individuals' professional development various certifications would be of the most value educationally.

Workforce Development Questions and Implications

How can certifications function effectively both as a tool for learning and as a proxy for skills to potential employers?
Are certifications more valuable to employers for less experienced and/or younger employees?

FINDING #7

Wages in the Nashville region simply do not compete nationally, and the below-average cost of living does not make up the difference. Nashville MSA tech employers indicate there is a need for increasing compensation packages.

Median wages for tech jobs in the US have increased 2 percent on average annually over the past three years. This data reflects workers at employer firms and self-employed workers. As shown in *Figure 22*, the median salary for all tech occupations in the US is \$87,171 compared with \$77,257 in the Nashville MSA. The Nashville MSA's salary is \$37 per hour on average, which is \$4.77 per hour below the national median earnings.

COMPENSATION OF TECHNOLOGY WORKERS

Figure 22

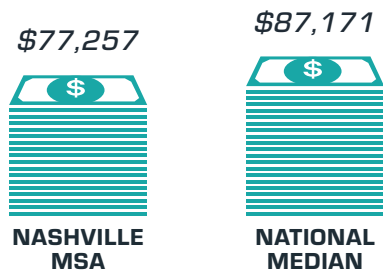
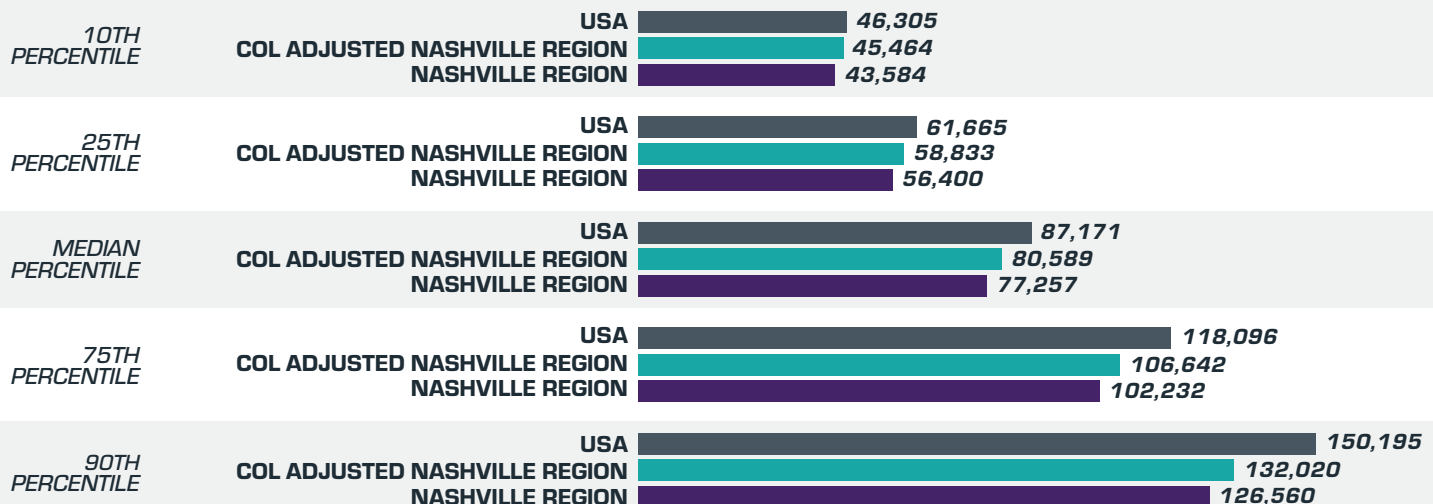


Figure 23 considers the interplay between annual compensation and cost of living for technology occupations in the Nashville MSA and nationally. *Figure 23* breaks down the median annual salary by earning percentile in the Nashville MSA, median salary in the Nashville MSA adjusted for a lower cost of living than the national average, and the national median salary for the same positions. Someone in the 75th percentile, for example, would earn a higher wage than 75 percent of the other individuals in the corresponding group. The data show that companies may pay up to 11 percent less to employ workers, but that employees also experience purchasing power that is 8 percent less than the national median when adjusted for the regional cost of living.

Complementing *Figure 23*, *Figure 24* displays median earnings and cost-of-living-adjusted median earnings in the Nashville MSA for relevant occupations. The cost-of-living-adjusted earnings in the Nashville MSA are comparable to the median annual earnings at the national level.

TECHNOLOGY OCCUPATIONS AND COMPENSATION

Figure 23



Source: EMSI

MEDIAN ANNUAL EARNINGS BY COMPARISON

Figure 24

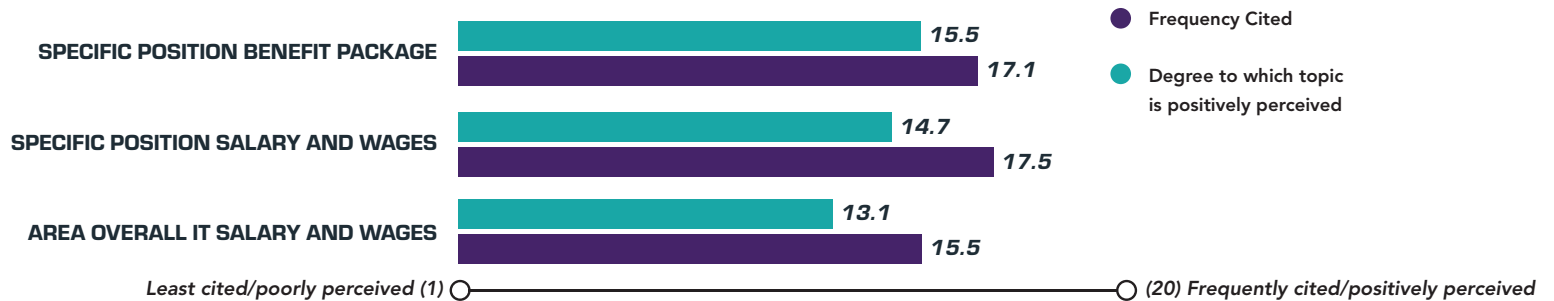
SOC		MEDIAN ANNUAL EARNINGS NASHVILLE MSA	COL ADJUSTED MEDIAN ANNUAL EARNINGS NASHVILLE MSA	MEDIAN ANNUAL EARNINGS USA
11-3021	COMPUTER AND INFORMATION SYSTEMS MANAGERS	116,410	121,260	138,064
15-1111	COMPUTER AND INFORMATION RESEARCH SCIENTISTS	89,423	93,149	114,513
15-1121	COMPUTER SYSTEMS ANALYSTS	74,474	77,578	87,145
15-1122	INFORMATION SECURITY ANALYSTS	78,718	81,998	95,511
15-1131	COMPUTER PROGRAMMERS	74,387	77,487	79,509
15-1132	SOFTWARE DEVELOPERS, APPLICATIONS	92,834	96,702	100,883
15-1133	SOFTWARE DEVELOPERS, SYSTEMS SOFTWARE	86,865	90,484	106,753
15-1134	WEB DEVELOPERS	64,132	66,804	58,653
15-1141	DATABASE ADMINISTRATORS	87,613	91,263	86,899
15-1142	NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS	82,277	85,705	80,765
15-1143	COMPUTER NETWORK ARCHITECTS	99,833	103,993	104,127
15-1151	COMPUTER USER SUPPORT SPECIALISTS	48,597	50,622	50,373
15-1152	COMPUTER NETWORK SUPPORT SPECIALISTS	58,200	60,625	62,536
15-1199	COMPUTER OCCUPATIONS, ALL OTHER	78,155	81,411	86,801

Source: EMSI

When asked what could make hiring more effective, survey respondents acknowledge that increasing compensation packages and expanding alternative work settings (time and location) are critical to future hiring success. This is complemented both by comparisons of the Nashville region's median wage to the national median wage, and by the frequency in which candidates bring up compensation packages as well as employees negative perception of current wages, displayed in Figure 25.

IMPORTANCE AND PERCEPTION OF AREA SALARY AND BENEFITS

Figure 25



Source: The Research Center, Nashville Area Chamber of Commerce

Additionally, compensation-related reasons dominated among both the highest-rated recruitment strategies and named reasons for tech staff departures from organizations.

Some 56 percent of employers surveyed cited increasing compensation packages as a “most effective” recruitment solution. In terms of reasons that employees leave, 76 percent of employers surveyed cited compensation, and 70 percent cited poor benefits as primary reasons IT staff left an organization over the past two years. This reinforces the need for higher compensation by demonstrating that lower pay results in employee attrition which makes an organization less attractive and effective as discussed in [finding 3](#).

Workforce Development Questions and Implications

Nashville MSA tech workers are paid lower than their counterparts in other parts of the country, which cannot be ignored – especially in a time of low unemployment and significant demand for more tech workers.



FINDING #8

Purposefully expanding hiring practices to under-represented groups is seen as an effective recruitment solution to create a broader and more robust talent pool. This appears to recognize that diversity levels among the tech workforce in Nashville are low when compared to diversity of tech workers nationally.

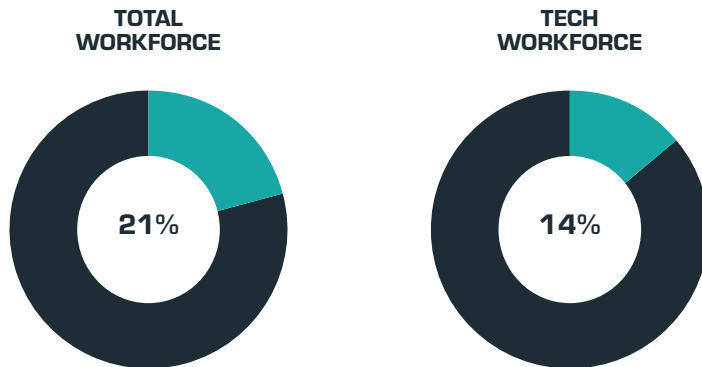
EXPANDING UNDER-REPRESENTED TARGETED GROUPS FOR RECRUITMENT

The technology workforce is generally thought to be disproportionately young, male and white. The EMSI data on the Nashville MSA's technology workforce bears this out, but also shows that the Nashville region's tech workforce is less diverse – in terms of age, race and ethnicity, and sex – than the average for a US region of the same size. Undertaking more inclusive hiring is seen to be one of the best methods to improve hiring success, after simply increasing salary and benefits packages.

In terms of age breakdown, there are fewer technology professionals aged 55+ in the Nashville region than an average US area of the same size. Additionally, professionals aged 55+ make up only 14 percent of the current technology workforce in the area, while they make up 21 percent of the entire area workforce.

PROFESSIONALS AGED 55+, NASHVILLE MSA

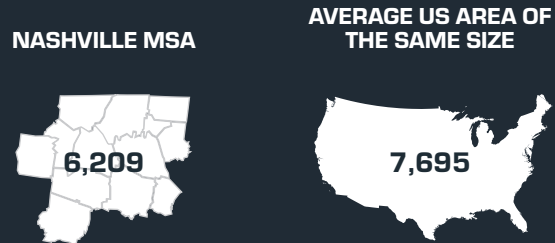
Figure 26



Source: The Research Center, Nashville Area Chamber of Commerce

NASHVILLE MSA MINORITY TECHNOLOGY WORKFORCE COMPARED TO USA

Figure 27



Source: The Research Center, Nashville Area Chamber of Commerce

OUR WORKFORCE

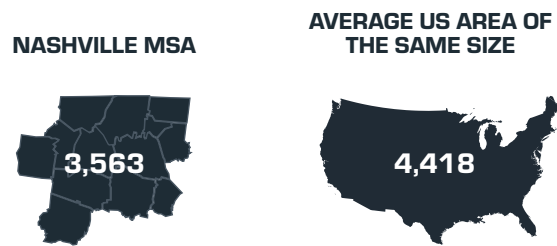
Figure 28

	% NASHVILLE MSA TECHNOLOGY JOBS	% US TECHNOLOGY JOBS	% ALL NASHVILLE MSA JOBS	% ALL US JOBS
WHITE	76.3%	62.5%	74.8%	64.2%
BLACK OR AFRICAN AMERICAN	11.1%	20.8%	16.4%	12.3%
ASIAN	8.8%	7.8%	2.5%	5.9%
HISPANIC OR LATINO	2.4%	6.8%	4.9%	15.3%
TWO OR MORE RACES	1.2%	1.7%	1.2%	1.6%
AMERICAN INDIAN OR ALASKA NATIVE	0.2%	0.2%	0.2%	0.5%
NATIVE HAWAIIAN/OTHER PACIFIC ISLANDER	0.1%	0.1%	0.1%	0.2%

Source: EMSI

TECHNOLOGY PROFESSIONALS, FEMALE

Figure 29



TECHNOLOGY PROFESSIONALS BY GENDER

Figure 30

	MALE	FEMALE
% NASHVILLE MSA TECHNOLOGY JOBS	73.1%	25.9%
% US TECHNOLOGY JOBS	74.7%	25.3%
% ALL NASHVILLE MSA JOBS	51.8%	48.1%
% ALL US JOBS	51.5%	48.5%

Source: The Research Center, Nashville Area Chamber of Commerce

These figures suggest opportunity and potential for a latent and underutilized workforce supply that could be integral to filling the talent needs in the Nashville MSA. Current lack of diversity indicates that there is untapped skill and opportunity for targeted tech workforce development. From another perspective, this indicates that there is opportunity for under-represented groups to gain employment in a field that has high wages compared to other fields and is projected to grow.

Workforce Development Questions and Implications

How are educational institutions – including K through 12 and post-secondary – partnering to expand the talent pool to communities under-represented in the Nashville MSA tech workforce?



FINDING #9

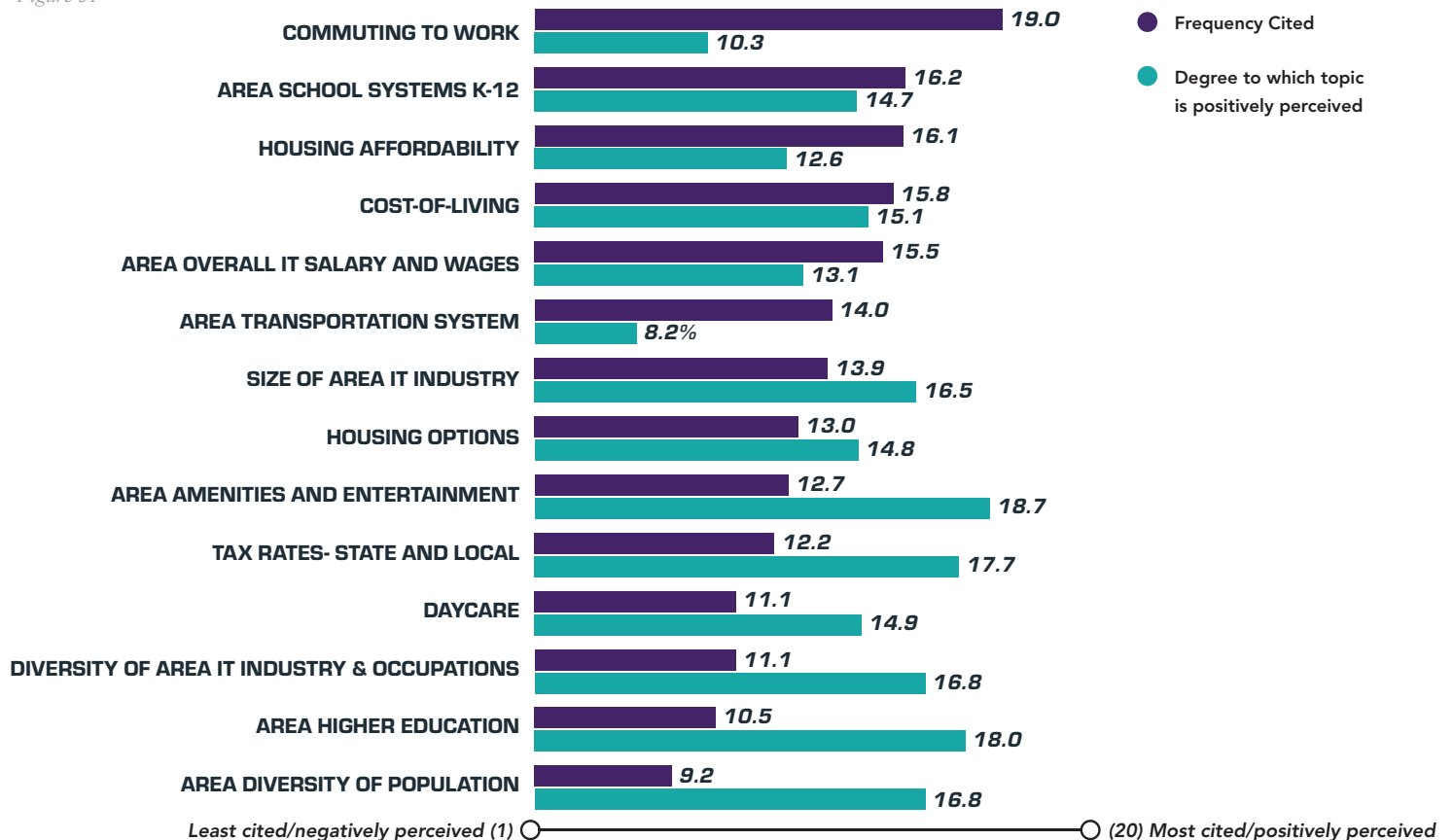
Tech candidates are positive about many quality of life factors and about individual companies' organizational culture. However, they are concerned about both compensation and commute times in the region.

Survey respondents were asked to rank the frequency with which tech job candidates raised concerns about issues specific to the company and about the Nashville area, and the degree to which candidates had a positive or negative perception of the issue. For example, a survey respondent may note that tech job candidates frequently raised the issue of commuting and gave the Nashville area poor marks on how difficult it was to commute.

The three topics that candidates mentioned most with regard to the Middle Tennessee area were (in order): commuting to work, area K-12 school systems and housing affordability. The higher the value, the more respondents reported that candidates always brought up that topic as an important feature.

AREA FEATURES

Figure 31

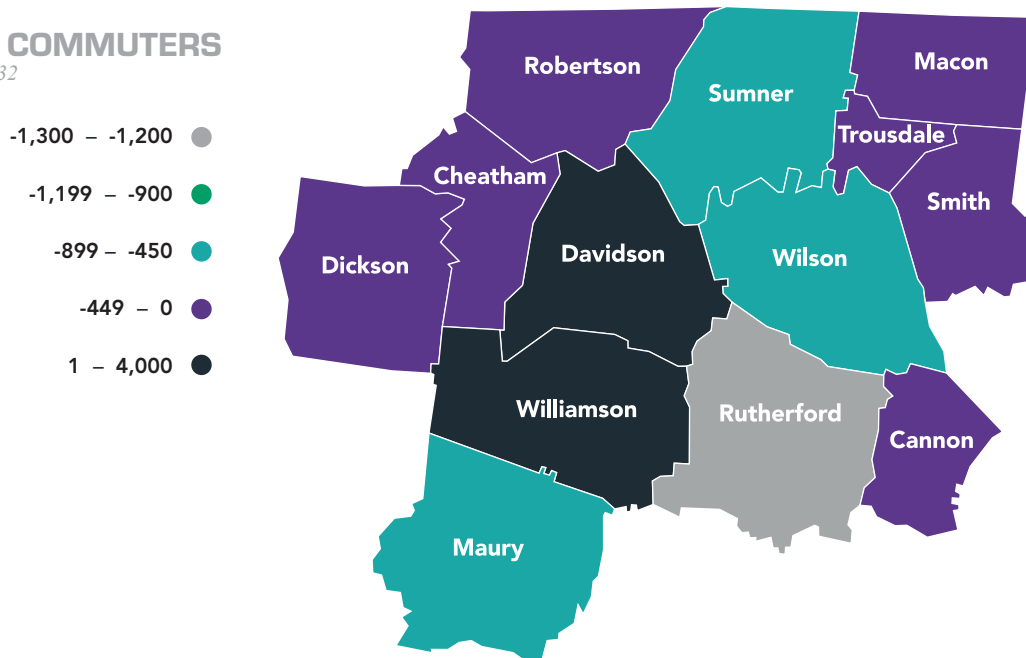


Respondents report that candidates have a positive perception of area amenities and entertainment, area higher education, and state and local tax rates. However, candidates have a negative perception of the area transportation system, commuting to work and housing affordability. These are well recognized issues in the region with the public sector, faith, labor and social justice groups, and the business community all participating in conversations and initiatives to address these challenges.

To further demonstrate that commuting is a regional issue for the technology sector, below is a map displaying the net tech commuters in the Nashville MSA. Davidson and Williamson Counties are the only counties with positive inflow, and Sumner, Wilson and Rutherford Counties have the highest outflow. This indicates that there is a high level of daily migration within the MSA affecting both regional congestion and stress and well-being levels for employees.

NET COMMUTERS

Figure 32



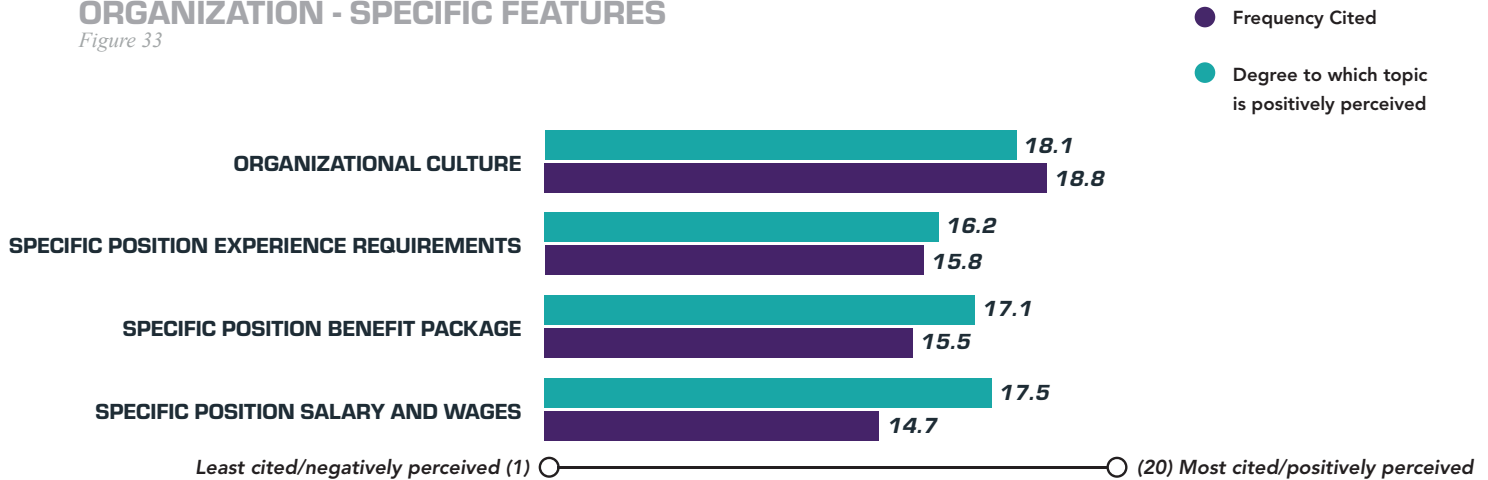
It is becoming more common for firms to explore mobility solutions for their own employees. Telecommuting, company transportation pooling and offset hours are only a few.

On a broader level, there is precedent for employers to contribute resources to improving quality of life in their regions; many local employers of tech talent are engaged in volunteer and philanthropy work and many contributed time, funding and put their voice to supporting the recent transit referendum initiative to address their employees' (and potential employees') concerns. The quality of life in the Nashville area is an often-cited, elusively defined and much sought-after trait. However, there is useful feedback from a slice of the population here about some of its tangible components.

Shifting to the findings for individual companies, “organizational culture” was the topic most frequently cited during interviews by potential employees and it was the issue perceived most positively. This implies that there are factors that candidates may value over simply a higher wage. Organizational culture can have many meanings and further study is warranted on perceptions of optimal organizational culture.

ORGANIZATION - SPECIFIC FEATURES

Figure 33



Source: The Research Center, Nashville Area Chamber of Commerce

Finally, among the findings from the survey, concern and negative perception about salary and wages for Nashville tech positions corresponds with EMSI data on comparative wages for tech jobs in the Nashville region and is explored thoroughly in finding 7.

Workforce Development Questions and Implications

More research is warranted on what tech candidates seek in organizational culture; what it is that they perceive as positive?

How are tech employers contributing to quality of life factors in the region?

Finally, tech employers should consider all options available in addressing commuting – from transit to work hours to off-site working – as this issue was a top concern for candidates.

<Conclusion>

The Nashville area's tech sector is becoming a more prominent feature of the region's economy. Meanwhile, tech workers are present all other industry sectors in Middle Tennessee, influencing and improving these companies and their products and services. While the announcement of a new re-location or a new start-up draws media attention, Middle Tennessee employers know that they need a continuous supply of quality tech workers to maintain and grow the ecosystem in terms of numbers and economic impact, but also in terms of new ideas and to stay ahead in an ever-evolving sector. Meanwhile, Middle Tennessee educators are interested in creating and supplying tech workforce talent and Middle Tennessee elected officials and policymakers are very interested in ensuring that more, and more diverse, members of their communities are able to get tech training, education and well-paying tech jobs.

This study attempts to aid all of these stakeholders in understanding the Nashville region's current supply of tech workers, what the tech workforce of the future needs to meet the Nashville region's demands, and what actions employers, educators, policy makers and local elected officials can take to address the training and experience tech workers need. It also addresses some of the other issues that are impacting the Nashville region's ability to grow, recruit and retain tech talent – issues including wages, hiring in under-represented groups, and quality of life issues such as transportation and housing options that are critical to tech talent.

This study provides some immediate areas for action including: placing a greater value in training and education on critical interpersonal skills; thinking more creatively about where and how to conduct hiring; and providing employers insight on the competitive challenges between Nashville and peer cities around tech workforce wages. The study also provides many areas for further study and discussion, such as: how to make certifications more valuable and use them to strengthen the value of current and future employees; what changes to make to K-12 education to strengthen and expand the tech workforce pipeline; and what aspects of organizational culture drive employee satisfaction and retention.

The overall issues and challenges of meeting the demand for tech workforce – growing, training and retaining tech workers – is not unique to Middle Tennessee. This research seeks to establish an understanding of the Nashville area's current tech workforce, the demands in the future, and the unique features – both positive and challenging – of the environment so employers, educators, elected officials and policymakers can address the issues and maintain, support and grow Middle Tennessee's tech workforce and tech sector.

<Appendix>

DATA AND METHODOLOGY

The Research Center incorporated a combination of data in order to obtain an overview of the current tech workforce and firsthand accounts as described below. This research extends over an occupational group found in a large number of local industries and covers the 13-county Nashville MSA. The survey questions were designed to ask respondents to think back over the past two years and make informed projections on tech workforce needs into the near future.

In addition to original research as the foundation of this report, other data sources were used. ESRI, or Environmental Systems Research Institute, was used to pull industry breakdown in the Nashville MSA. The EMSI (Economic Modeling Specialists, Inc.) database tool was a key tool, providing aggregated demographic and employment data. Also useful were technology industry resources such as CompTIA, which is widely regarded as the world's leading information technology association and provider of original research on the current state of IT workforce in the US and abroad. Together, various resources offer a valuable research platform for population and workforce forecasts, and economic and demographic modeling. This research relies on data, study designs and methods, and thought leadership to guide inquiry into the complex needs of a dynamically growing and changing field in the Nashville region.

The data derived from EMSI comprises past, current and projected series for industry and occupational employment. These employment data represent "complete" employment that includes workers covered by unemployment insurance ("covered" employment) as reported by the Tennessee Department of Labor and Workforce Development and U.S. Department of Labor and Bureau of Labor Statistics, as well as those that are sole proprietors and government workers. This is noted since these workers are not necessarily covered by unemployment insurance.

2018 NASHVILLE MSA ECONOMIC BASE

Figure 34



Source: EMSI

THE NASHVILLE MSA ECONOMIC BREAKDOWN BY INDUSTRY

Figure 35

	NUMBER OF BUSINESSES	PERCENT OF TOTAL BUSINESSES
AGRICULTURE, FORESTRY, FISHING & HUNTING	220	0.3
MINING	61	0.1
UTILITIES	102	0.2
CONSTRUCTION	4489	6.6
MANUFACTURING	2124	3.1
WHOLESALE TRADE	2228	3.3
RETAIL TRADE	9950	14.6
TRANSPORTATION & WAREHOUSING	1380	2
INFORMATION	1813	2.7
FINANCE & INSURANCE	4148	6.1
REAL ESTATE, RENTAL & LEASING	3926	5.8
PROFESSIONAL, SCIENTIFIC & TECH SERVICES	6140	9
MANAGEMENT OF COMPANIES & ENTERPRISES	81	0.1
ADMINISTRATIVE & SUPPORT & WASTE MANAGEMENT, REMEDIATION SERVICES	2531	3.7
EDUCATIONAL SERVICES	1638	2.4
HEALTH CARE & SOCIAL ASSISTANCE	5975	8.8
ARTS, ENTERTAINMENT & RECREATION	1320	1.9
ACCOMMODATION & FOOD SERVICES	5044	7.4
OTHER SERVICES (EXCEPT PUBLIC ADMINISTRATION)	8663	12.8
PUBLIC ADMINISTRATION	2385	3.5

Source: ESRI

PRIOR RESEARCH ON MIDDLE TENNESSEE'S TECH WORKFORCE THE MTSU STUDY

Prior to this study, research by Middle Tennessee State University in 2018 created a profile of occupational groups that encompass a large portion of the technology workforce in both the Nashville MSA and the Clarksville MSA, as well as occupational groups that have some tech workers as these occupational groups are closely related to tech. The MTSU study included data developed from EMSI, which is also used as the basis for data in this report. The Research Center study relies on a subset of the data used in the MTSU study, focusing on occupational groups that are solely tech in nature, with the goal of understanding specific skills and characteristics of a narrow range of information technology occupations. The Research Center study also focuses solely on the Nashville MSA, which has a larger and denser ecosystem of tech jobs. The Research Center's work serves as a complement to the research to MTSU, with a narrower geographic and occupational focus.

NASHVILLE AREA CHAMBER OF COMMERCE RESEARCH CENTER'S EMSI CLUSTER STUDY

Figure 36

11-3021	COMPUTER AND INFORMATION SYSTEMS MANAGERS
15-1111	COMPUTER AND INFORMATION RESEARCH SCIENTISTS
15-1121	COMPUTER SYSTEMS ANALYSTS
15-1122	INFORMATION SECURITY ANALYSTS
15-1131	COMPUTER PROGRAMMERS
15-1132	SOFTWARE DEVELOPERS, APPLICATIONS
15-1133	SOFTWARE DEVELOPERS, SYSTEMS SOFTWARE
15-1134	WEB DEVELOPERS
15-1141	DATABASE ADMINISTRATORS
15-1142	NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS
15-1143	COMPUTER NETWORK ARCHITECTS
15-1151	COMPUTER USER SUPPORT SPECIALISTS
15-1152	COMPUTER NETWORK SUPPORT SPECIALISTS
15-1199	COMPUTER OCCUPATIONS, ALL OTHER

Source: EMSI

MIDDLE TENNESSEE STATE UNIVERSITY EMSI CLUSTER FOR THEIR 2018 STUDY

Figure 37

11-2021	MARKETING MANAGERS
11-3021	COMPUTER AND INFORMATION SYSTEMS MANAGERS
13-1081	LOGISTICIANS
13-1111	MANAGEMENT ANALYSTS
13-1161	MARKET RESEARCH ANALYSTS AND MARKETING SPECIALISTS
13-2051	FINANCIAL ANALYSTS
15-1111	COMPUTER AND INFORMATION RESEARCH SCIENTISTS
15-1121	COMPUTER SYSTEMS ANALYSTS
15-1122	INFORMATION SECURITY ANALYSTS
15-1131	COMPUTER PROGRAMMERS
15-1132	SOFTWARE DEVELOPERS, APPLICATIONS
15-1133	SOFTWARE DEVELOPERS SYSTEMS SOFTWARE
15-1134	WEB DEVELOPERS
15-1141	DATABASE ADMINISTRATORS
15-1142	NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS
15-1143	COMPUTER NETWORK ARCHITECTS
15-1151	COMPUTER USER SUPPORT SPECIALISTS
15-1152	COMPUTER NETWORK SUPPORT SPECIALISTS
15-1199	COMPUTER OCCUPATIONS, ALL OTHER
15-2031	OPERATIONS RESEARCH ANALYSTS
15-2041	STATISTICIANS
17-2061	COMPUTER HARDWARE ENGINEERS
27-1014	MULTIMEDIA ARTISTS AND ANIMATORS
27-1024	GRAPHIC DESIGNERS
43-9011	COMPUTER OPERATORS
49-2011	COMPUTER, AUTOMATED TELLER, AND OFFICE MACHINE REPAIRERS

Source: EMSI

REGIONAL CONCENTRATION

Figure 38 displays technology job concentration among the counties constituting the Nashville MSA.

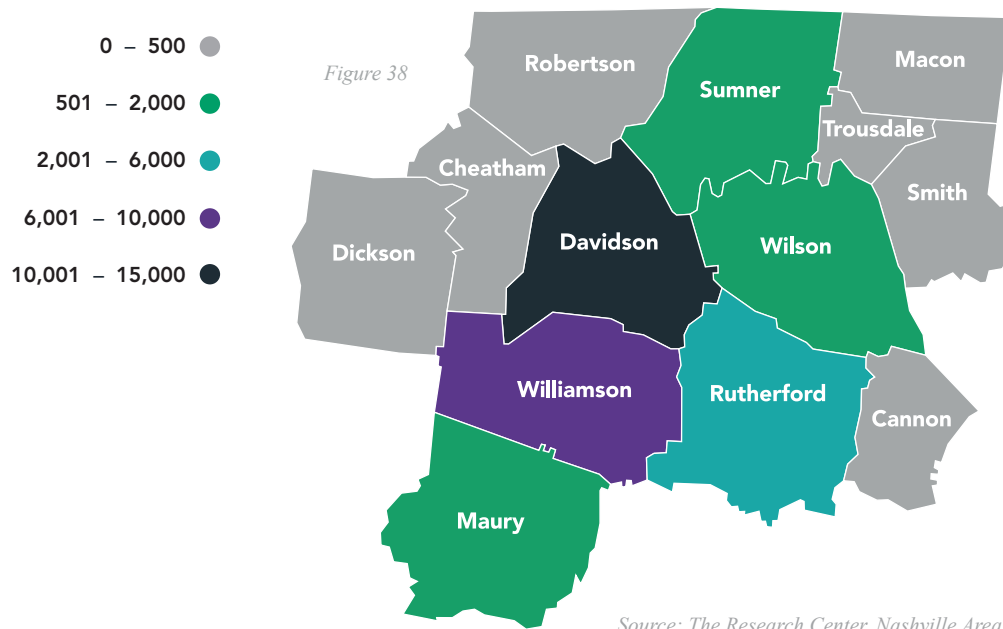
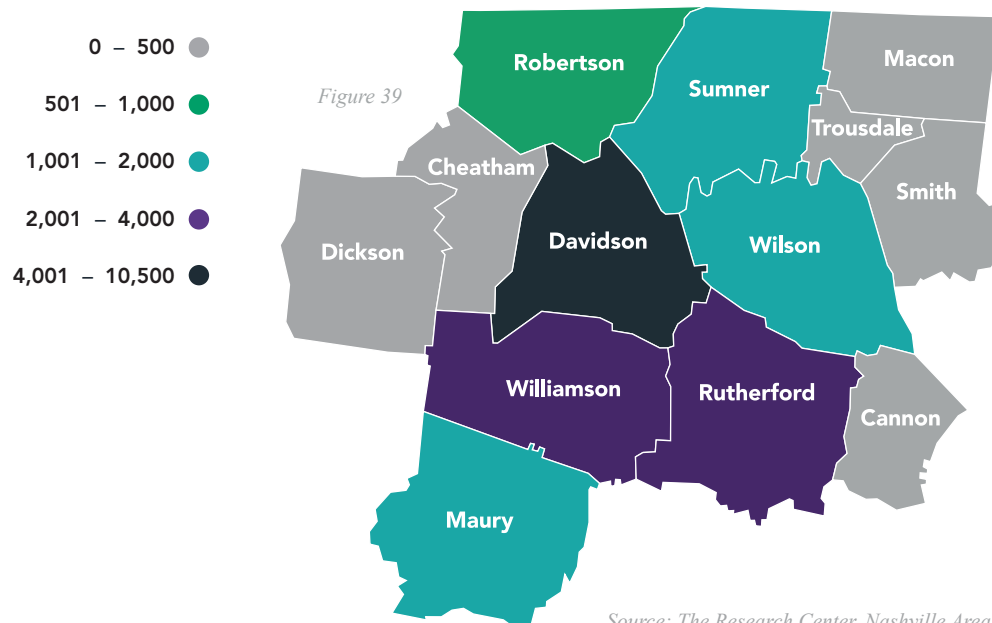


Figure 39 displays the concentration of resident tech workers within the counties constituting the Nashville MSA.

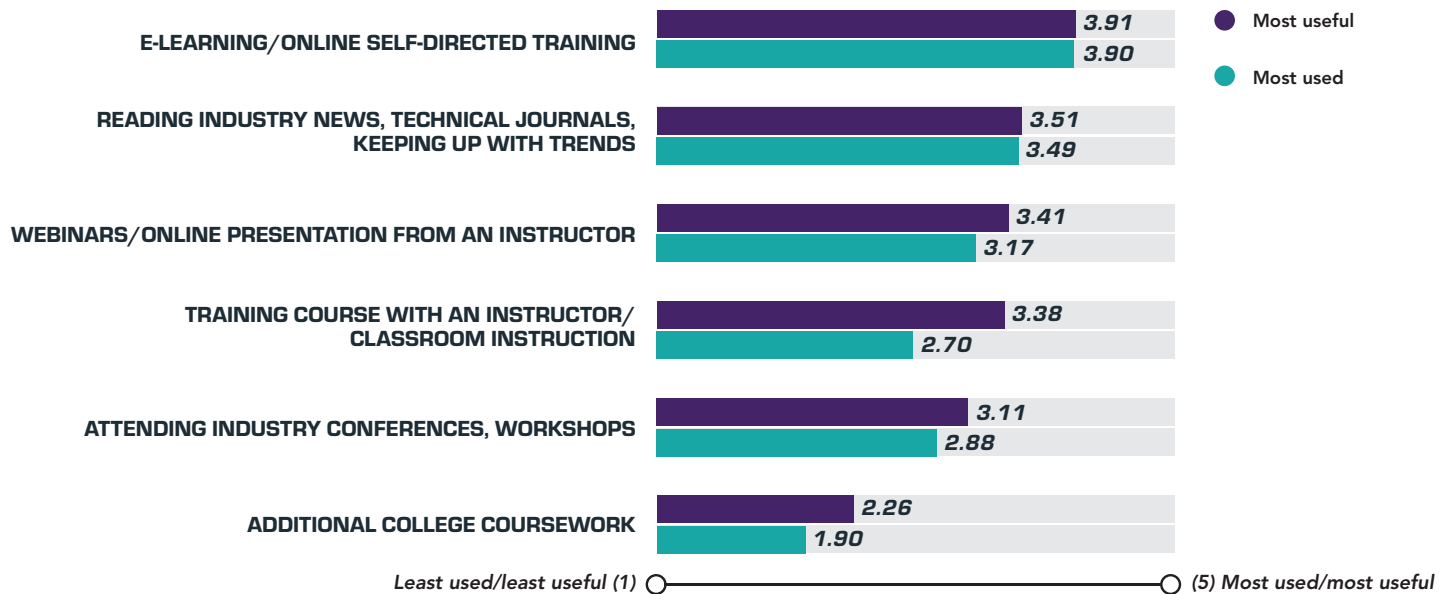


TECHNOLOGY WORKFORCE RECRUITMENT, HIRING AND RETENTION

Participants were asked to identify the most used methods of training for IT staff in their organizations over the last two years on a scale of 1-5 (1 being the least used, 5 being the most used). Afterwards, they were asked to rank the usefulness of these methods on a scale of 1-5 (1 being the least useful, 5 being the most useful).

METHODS FOR TECHNICAL TRAINING

Figure 40

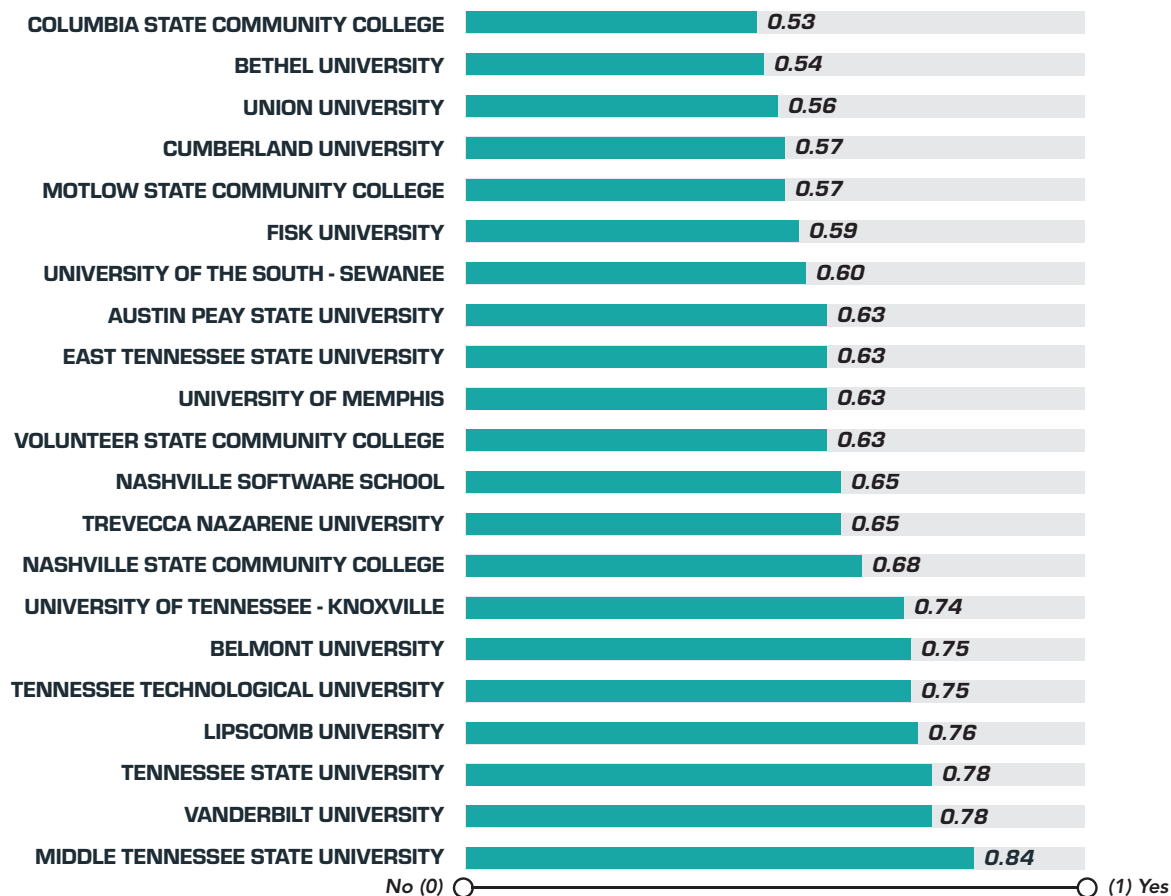


Source: The Research Center, Nashville Area Chamber of Commerce

Employers in the region benefit from a wide array of educational institutions in the area, some of which focus very specifically on training persons in technical fields. Organizations typically hire candidates from across the range of local institutions based on number of completers in relevant fields, graduate retention in the Nashville region, and existing relationships and experiences that employers have with particular institutions and programs. Figure 41 portrays in a general way the variety of hiring that has occurred in the area recently among employers with technology-related occupational needs. Responses relate to whether their organizations had hired locally by educational institution in the last two years. The values are presented out of 1 (0 indicates no, 1 indicates yes).

CANDIDATES HIRED LOCALLY IN THE PAST TWO YEARS

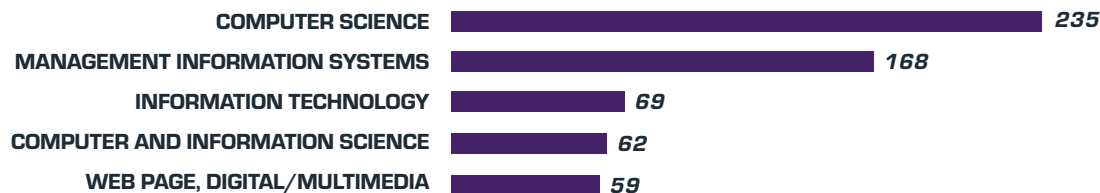
Figure 41



Source: The Research Center, Nashville Area Chamber of Commerce

COMPLETIONS, 2017

Figure 42



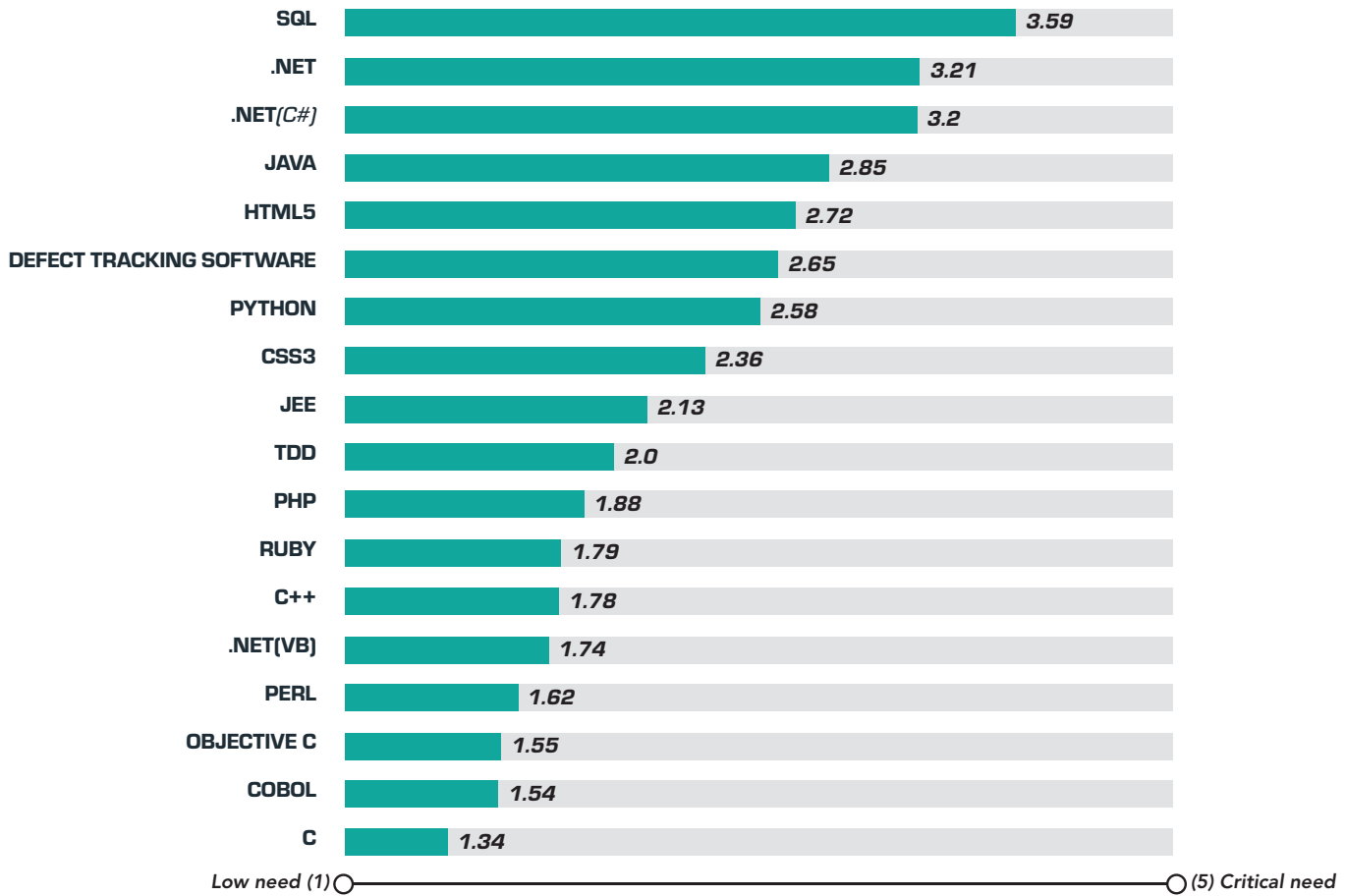
Source: EMSI

These data show the top programs and top schools by completions. In the region, there are 42 programs that can train for these jobs, however only 25 have produced completions. In 2017 there were 779 completions from all regional institutions for all degree types.

This graph indicates which software development technologies are in highest demand.

NEED: SOFTWARE DEVELOPMENT TECHNOLOGIES

Figure 43

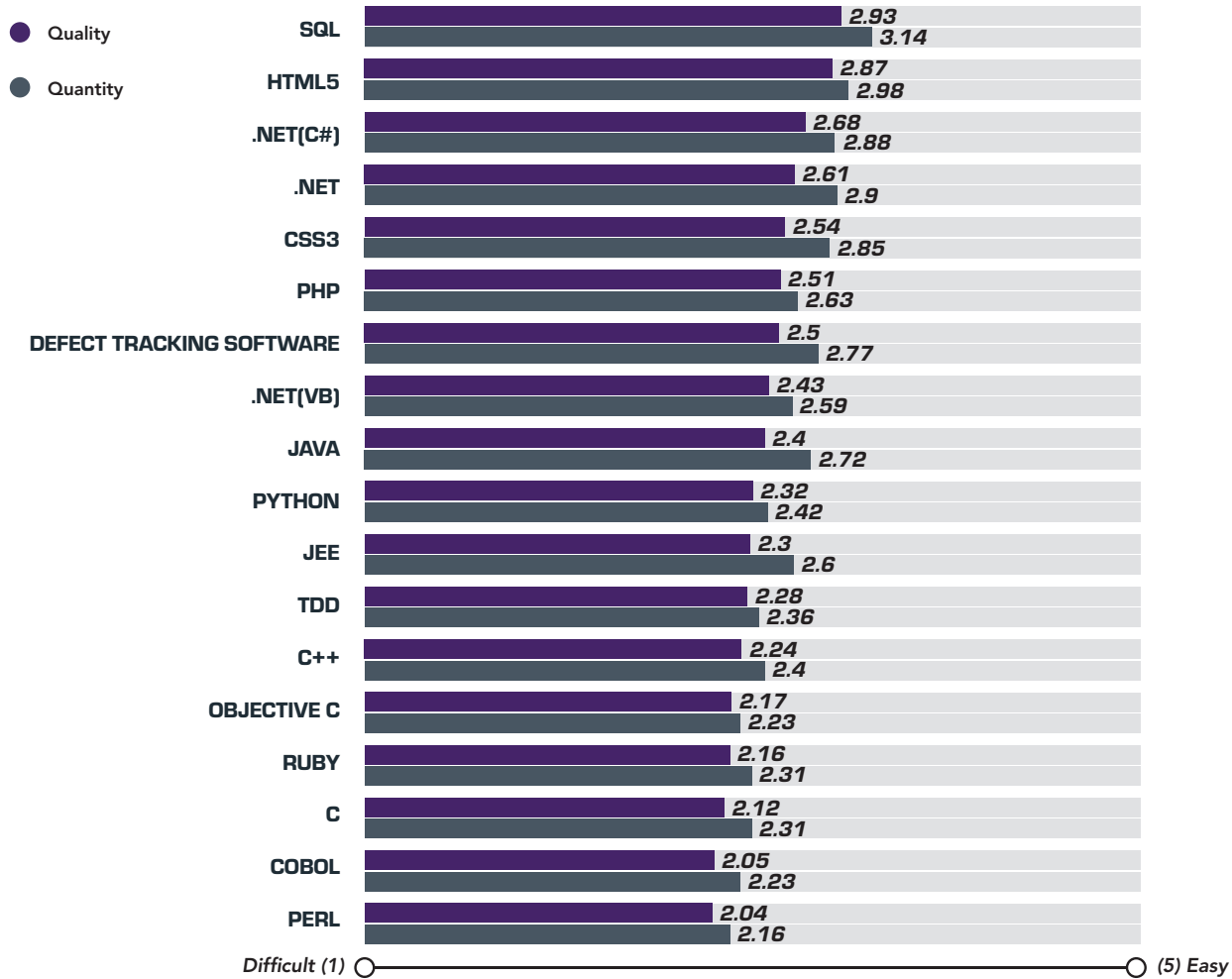


Source: The Research Center, Nashville Area Chamber of Commerce

This graph indicates which software development technology skills are easy or difficult to find in both quality and quantity.

EASE IN FINDING SOFTWARE DEVELOPMENT TECHNOLOGY SKILLS

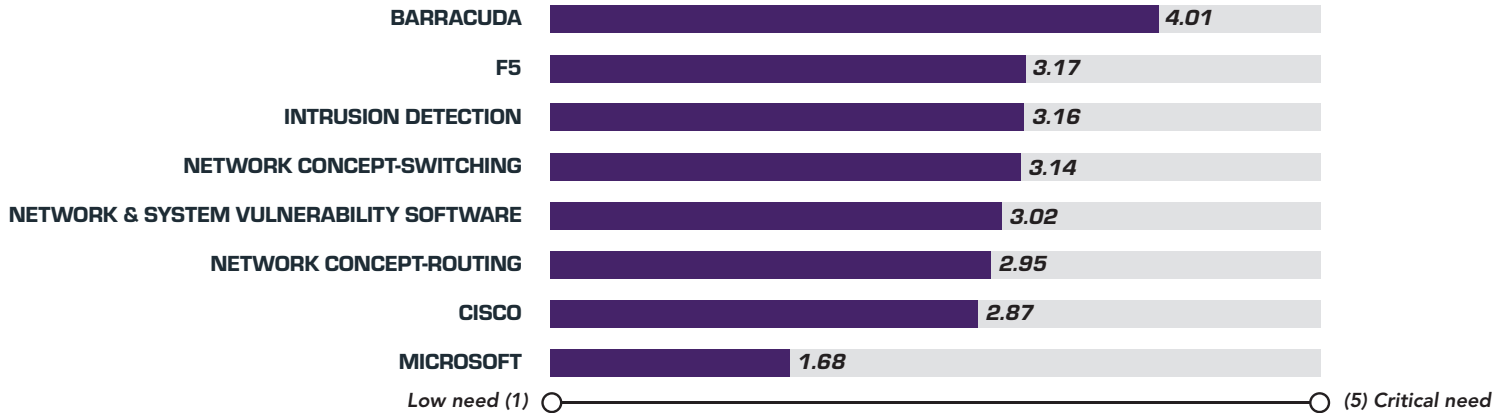
Figure 44



Source: The Research Center, Nashville Area Chamber of Commerce

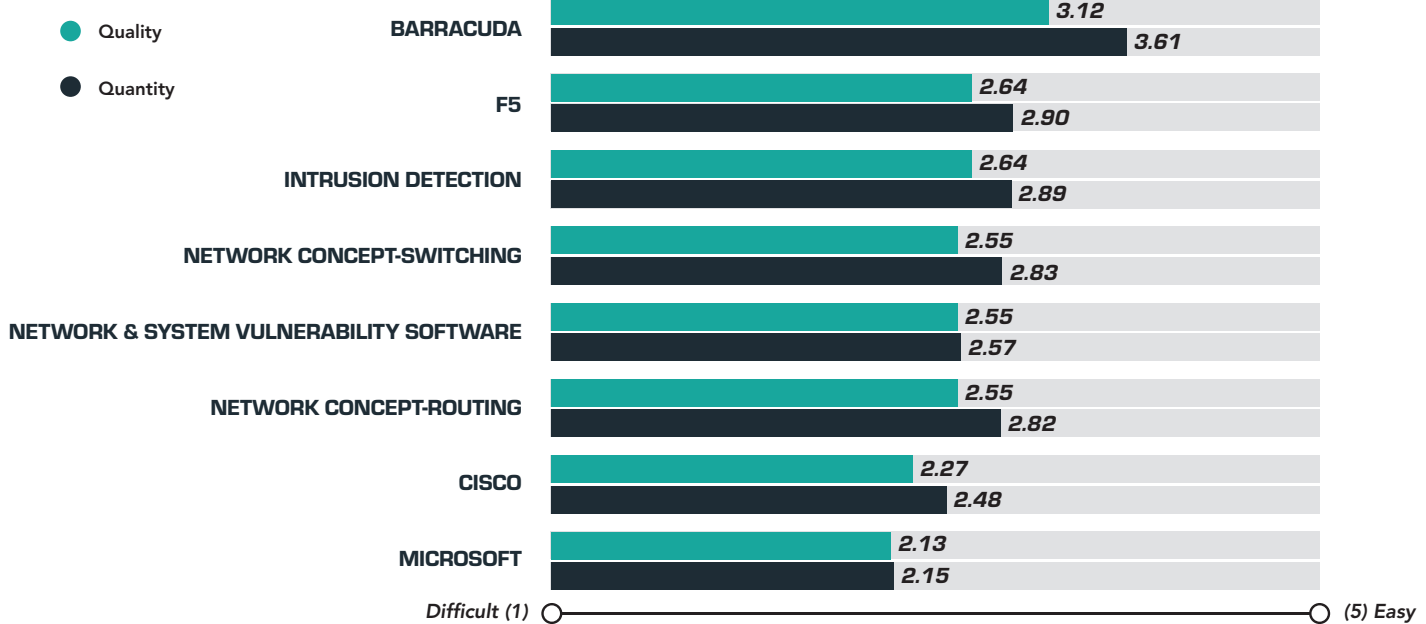
NEED: NETWORK ARCHITECTURE TECHNOLOGIES

Figure 45



EASE IN FINDING NETWORK ARCHITECTURE TECHNOLOGY SKILLS

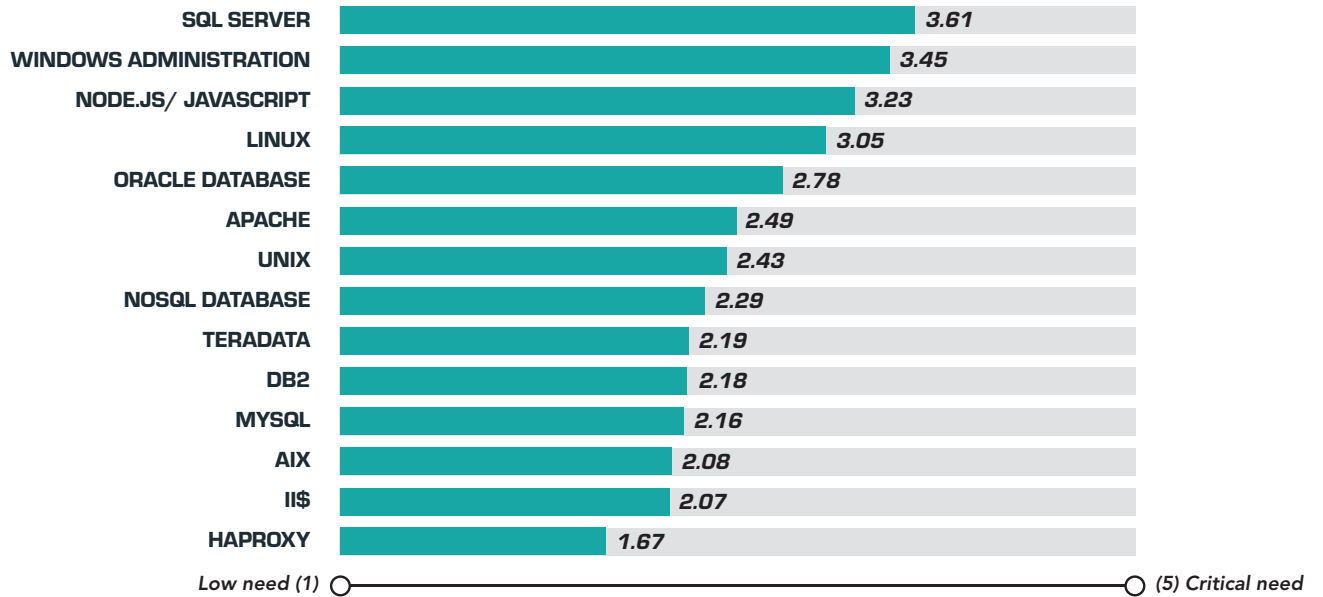
Figure 46



Source: The Research Center, Nashville Area Chamber of Commerce

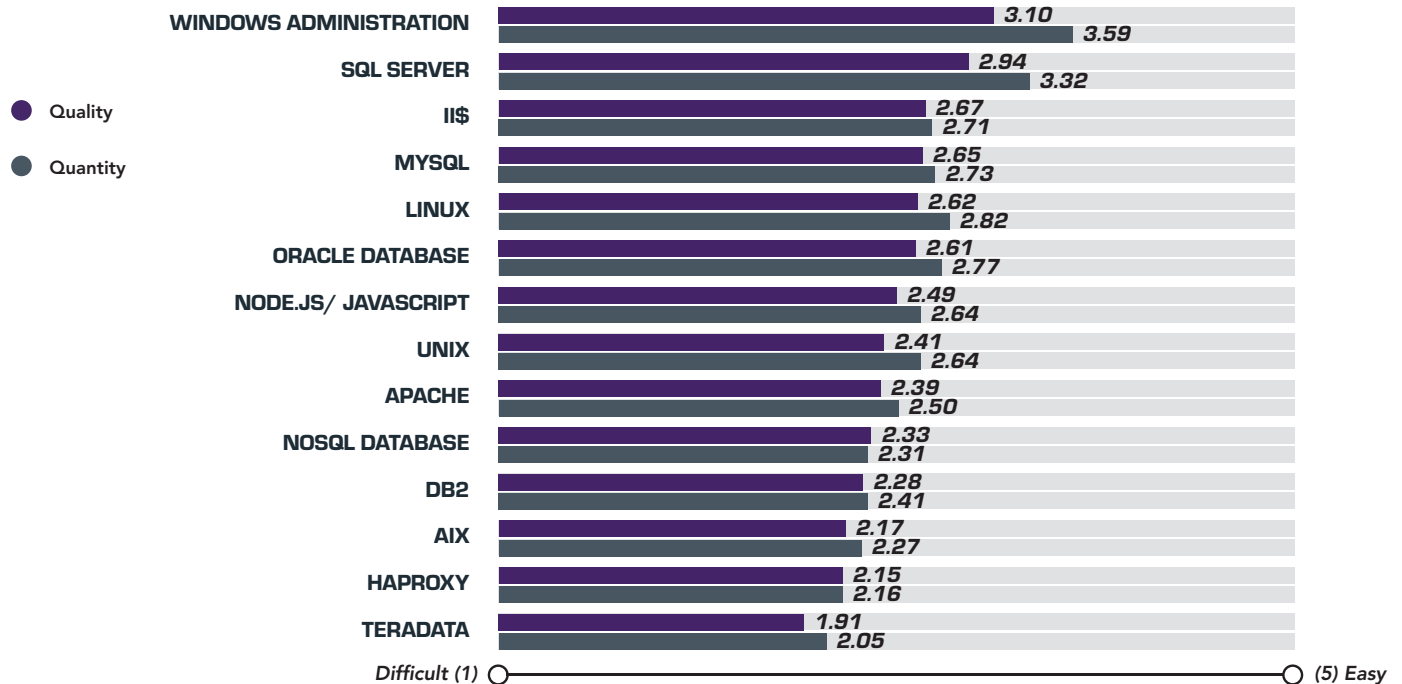
NEED: DEVELOPMENT OPERATIONS TECHNOLOGIES

Figure 47



EASE IN FINDING DEVELOPMENT OPERATIONS TECHNOLOGY SKILLS

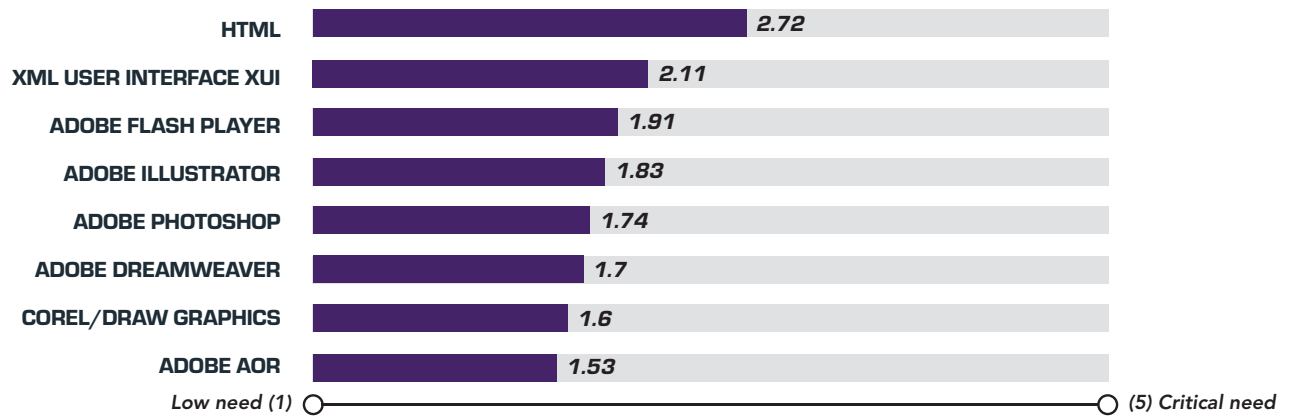
Figure 48



Source: The Research Center, Nashville Area Chamber of Commerce

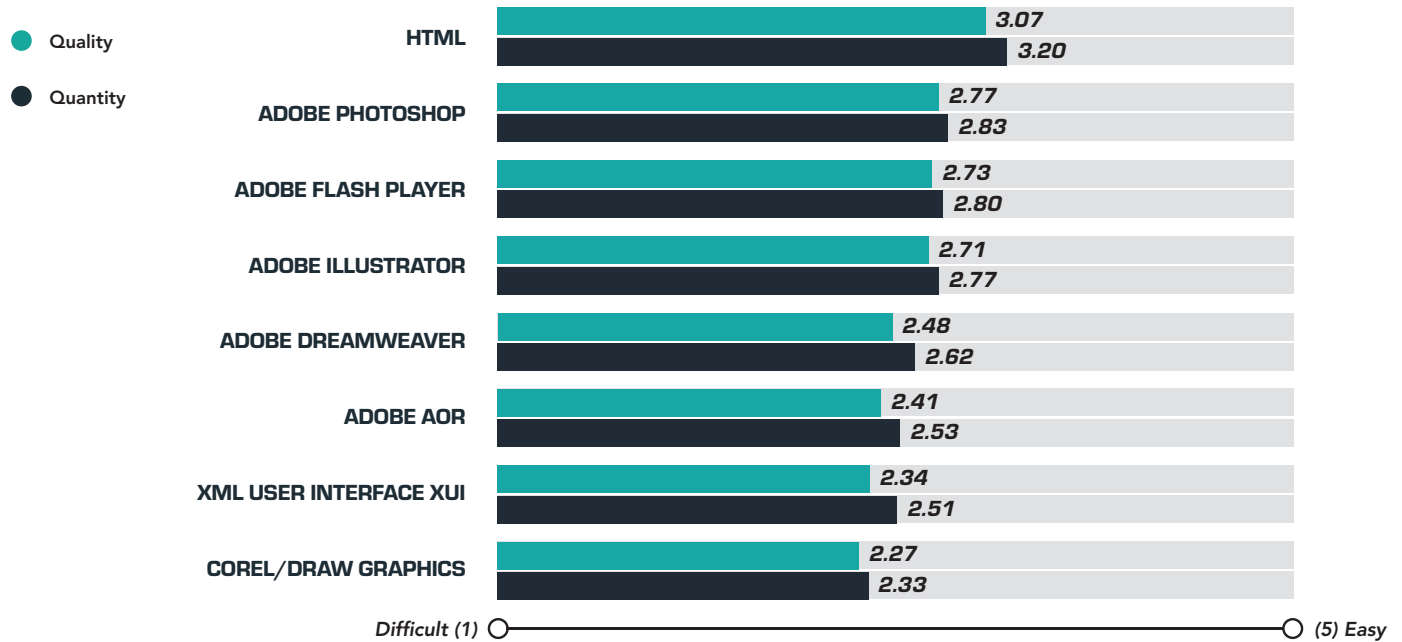
NEED: DESIGN TECHNOLOGIES

Figure 49



EASE IN FINDING DESIGN TECHNOLOGY SKILLS

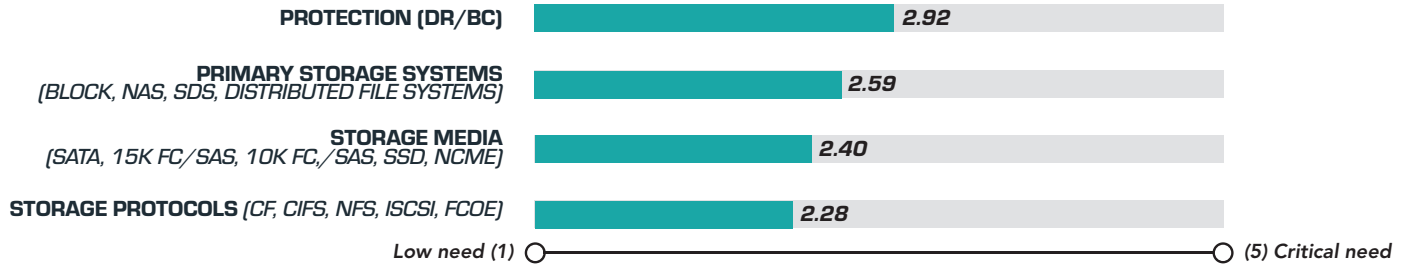
Figure 50



Source: The Research Center; Nashville Area Chamber of Commerce

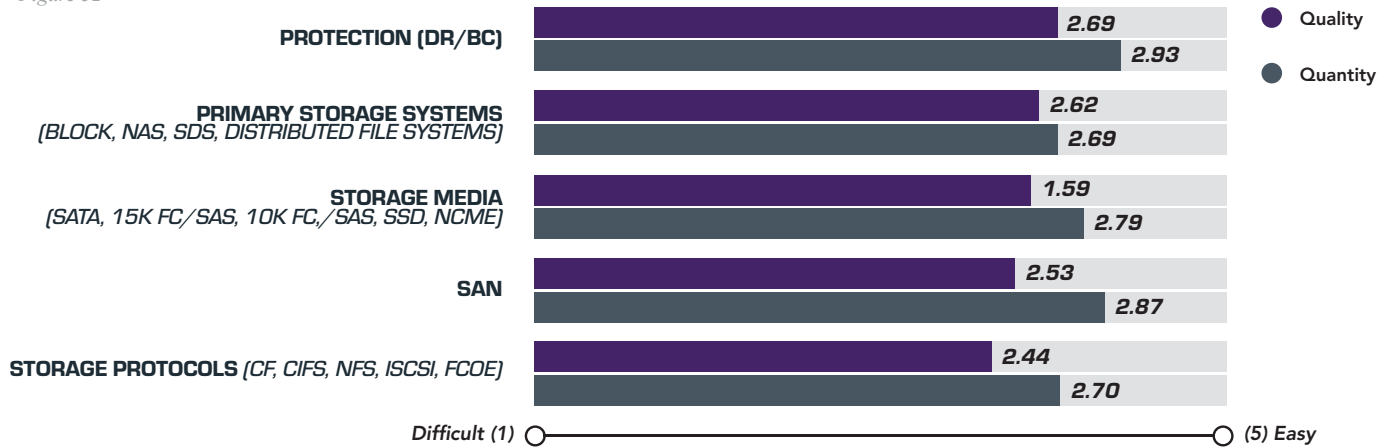
NEED: STORAGE TECHNOLOGIES

Figure 51



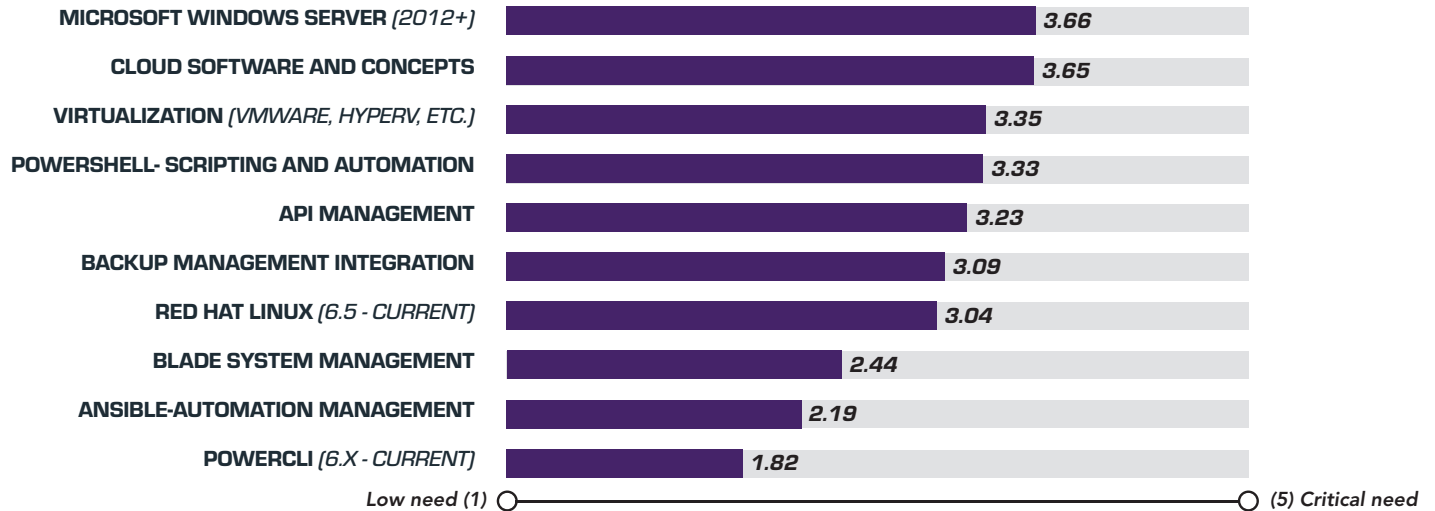
EASE IN FINDING STORAGE TECHNOLOGY SKILLS

Figure 52



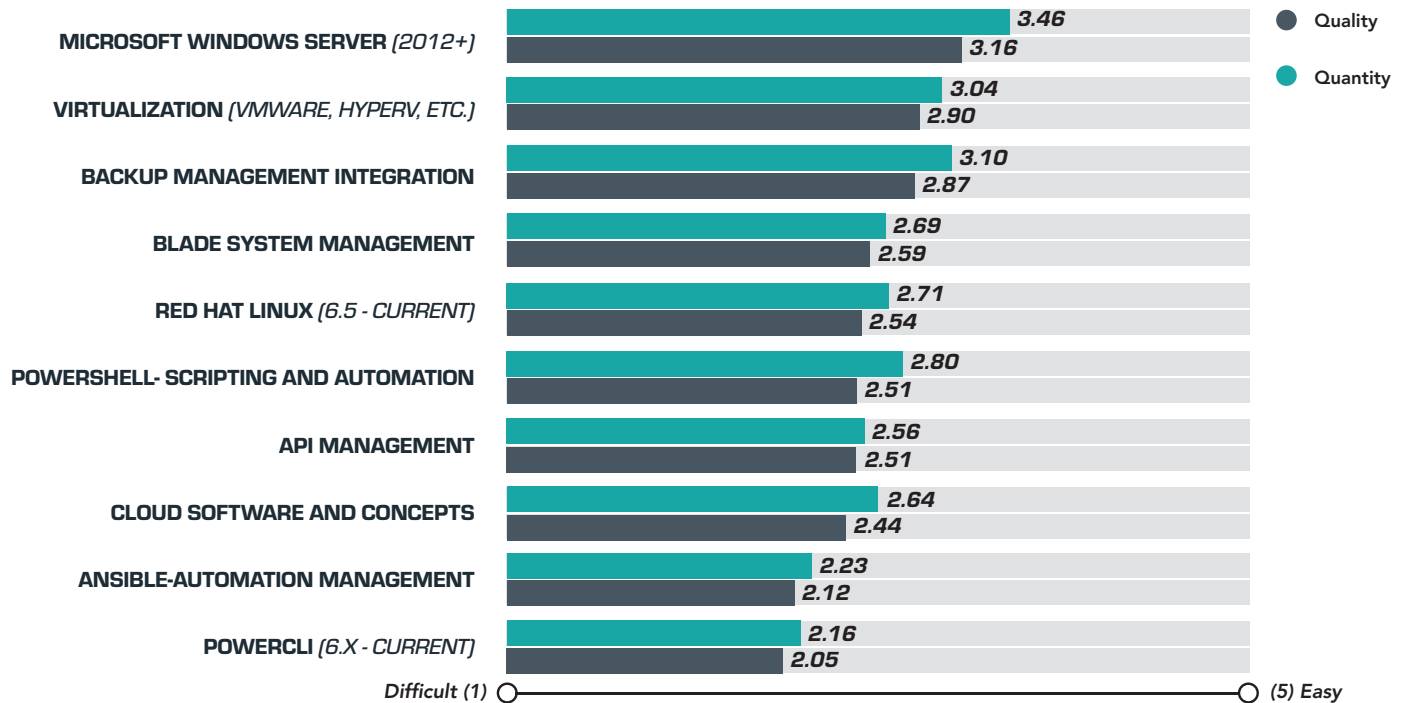
NEED: COMPUTER TOOLING TECHNOLOGIES

Figure 53



EASE IN FINDING COMPUTER TOOLING TECHNOLOGIES

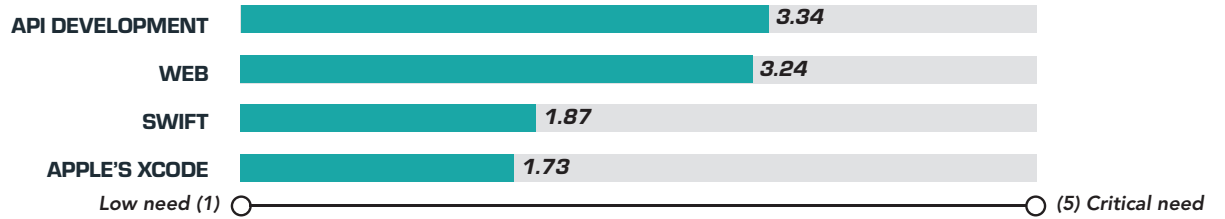
Figure 54



Source: The Research Center, Nashville Area Chamber of Commerce

NEED: MOBILITY

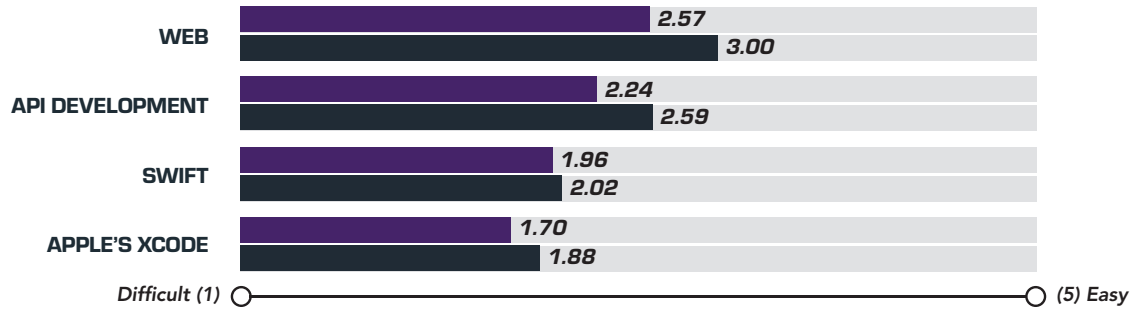
Figure 55



EASE IN FINDING MOBILITY SKILLS

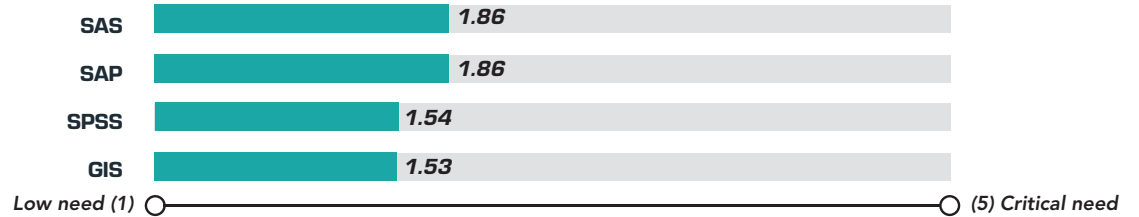
Figure 56

- Quality
- Quantity



NEED: OTHER TECHNOLOGIES

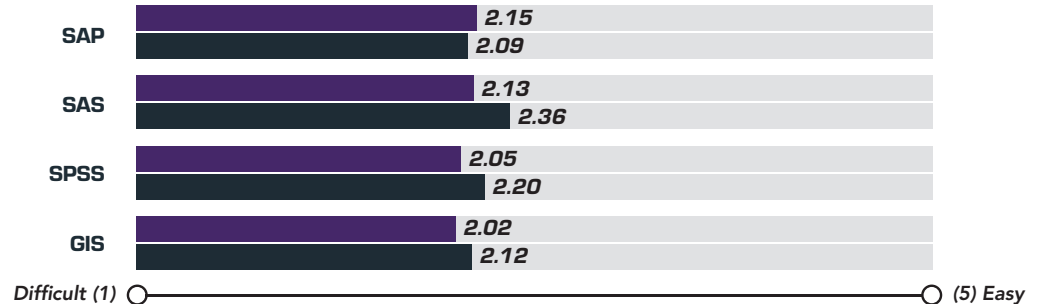
Figure 57



EASE IN FINDING OTHER TECHNOLOGIES

Figure 58

- Quality
- Quantity



Source: The Research Center, Nashville Area Chamber of Commerce

<Glossary>

15-1141 DATABASE ADMINISTRATORS

Description Administer, test, and implement computer databases, applying knowledge of database management systems. Coordinate changes to computer databases. May plan, coordinate, and implement security measures to safeguard computer databases.

Job title examples Data Architect, Database Administration Manager, Database Administrator (DBA), Database Analyst, Database Coordinator, Database Developer, Database Programmer, Information Systems Manager, Management Information Systems Director (MIS Director), System Administrator

15-1133 SOFTWARE DEVELOPERS, SYSTEMS SOFTWARE

Description Research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. Set operational specifications and formulate and analyze software requirements. May design embedded systems software. Apply principles and techniques of computer science, engineering, and mathematical analysis.

Job title examples Developer, Infrastructure Engineer, Network Engineer, Publishing Systems Analyst, Senior Software Engineer, Software Architect, Software Developer, Software Engineer, Systems Coordinator, Systems Engineer

15-1132 SOFTWARE DEVELOPERS, APPLICATIONS

Description Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team. May supervise computer programmers.

Job title examples Application Developer, Application Integration Engineer, Applications Developer, Computer Consultant, Information Technology Analyst (IT Analyst), Software Architect, Software Developer, Software Development Engineer, Software Engineer, Technical Consultant

15-1131 COMPUTER PROGRAMMERS

Description Create, modify, and test the code, forms, and script that allow computer applications to run. Work from specifications drawn up by software developers or other individuals. May assist software developers by analyzing user needs and designing software solutions. May develop and write computer programs to store, locate, and retrieve specific documents, data, and information.

Job title examples Analyst Programmer, Application Programmer Analyst, Computer Programmer, Computer Programmer Analyst, Internet Programmer, Java Developer, Programmer, Programmer Analyst, Web Applications Programmer, Web Programmer

15-1142 NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS

Description Install, configure, and support an organization's local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Monitor network to ensure network availability to all system users and may perform necessary maintenance to support network availability. May monitor and test Web site performance to ensure Web sites operate correctly and without interruption. May assist in network modeling, analysis, planning, and coordination between network and data communications hardware and software. May supervise computer user support specialists and computer network support specialists. May administer network security measures.

Job title examples Information Analyst, Information Systems Manager (IS Manager), Information Technology Specialist (IT Specialist), LAN Specialist (Local Area Network Specialist), Local Area Network Administrator (LAN Administrator), Network Administrator, Network Coordinator, Network Manager, Network Specialist, Systems Administrator

15-1121 COMPUTER SYSTEMS ANALYSTS

Description Analyze science, engineering, business, and other data processing problems to implement and improve computer systems. Analyze user requirements, procedures, and problems to automate or improve existing systems and review computer system capabilities, workflow, and scheduling limitations. May analyze or recommend commercially available software.

Job title examples Applications Analyst, Business Analyst, Business Systems Analyst, Computer Analyst, Computer Systems Analyst, Computer Systems Consultant, Information Systems Analyst (ISA), Information Technology Analyst (IT Analyst), System Analyst, Systems Analyst

15-1122 INFORMATION SECURITY ANALYSTS

Description Plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses.

Job title examples Data Security Administrator, Information Security Officer, Information Security Specialist, Information Systems Security Analyst, Information Systems Security Officer, Information Technology Security Analyst (IT Security Analyst), Information Technology Specialist, Network Security Analyst, Security Analyst, Systems Analyst

15-1134 WEB DEVELOPERS

Description Design, create, and modify Web sites. Analyze user needs to implement Web site content, graphics, performance, and capacity. May integrate Web sites with other computer applications. May convert written, graphic, audio, and video components to compatible Web formats by using software designed to facilitate the creation of Web and multimedia content.

Job title examples Designer, Technology Applications Engineer, Web Architect, Web Design Specialist, Web Designer, Web Developer, Web Development Director, Web Development Instructor, Webmaster

15-1143 COMPUTER NETWORK ARCHITECTS

Description Design and implement computer and information networks, such as local area networks (LAN), wide area networks (WAN), intranets, extranets, and other data communications networks. Perform network modeling, analysis, and planning. May also design network and computer security measures. May research and recommend network and data communications hardware and software.

Job title examples Design Engineer, Network Analyst, Network and Security Engineer, Network Consultant, Network Systems Consultant, Networking Systems and Distributed Systems Engineer, Solutions Architect, Telecommunications Analyst

15-1111 COMPUTER AND INFORMATION RESEARCH SCIENTISTS

Description Conduct research into fundamental computer and information science as theorists, designers, or inventors. Develop solutions to problems in the field of computer hardware and software.

Job title examples Computer Scientist, Control System Computer Scientist, Scientific Programmer Analyst

15-1151 COMPUTER USER SUPPORT SPECIALISTS

Description Provide technical assistance to computer users. Answer questions or resolve computer problems for clients in person, or via telephone or electronically. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.

Job title examples Computer Specialist, Computer Support Specialist, Computer Technician, Desktop Support Technician, Help Desk Analyst, Help Desk Technician, Information Technology Specialist (IT Specialist), Network Technician, Support Specialist, Technical Support Specialist

15-1152 COMPUTER NETWORK SUPPORT SPECIALISTS

Description Analyze, test, troubleshoot, and evaluate existing network systems, such as local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Perform network maintenance to ensure networks operate correctly with minimal interruption.

Job title examples Computer Network Specialist, IT Consultant (Information Technology Consultant), Network Engineer, Network Specialist, Network Support Specialist, Network Technical Analyst, Network Technician, Personal Computer Network Analyst, Senior IT Assistant (Senior Information Technology Assistant), Systems Specialist

<Acknowledgments>

The Nashville Area Chamber of Commerce Research Center thanks HCA and Vaco for their underwriting of the Tech Workforce Study. The foresight of these companies – to see and value the need for deeper understanding of the tech industry and tech workforce across industries – made this report possible and the actions the report will generate in improving and expanding the tech workforce pipeline are a credit to these corporate leaders.

The Research Center also thanks HCA, Vaco and the many other companies employing tech talent, for allowing their staff to complete the rigorous survey and participate in the interviews that provided the original findings on supply of tech talent in Middle Tennessee for the Tech Workforce Study.

The Greater Nashville Tech Council also provided critical on-the-ground knowledge of tech workers and the tech industry. GNTC's breadth and depth of knowledge was tremendously helpful in understanding the nuances of the findings from the surveys and interviews and translating these findings into concrete future study and action.

Former Research Center staff members Dr. Garrett Harper, Rene Dillard, and Riley Scholer crafted the scope for the Tech Workforce Study as well as the survey and interview protocol; they also initiated the numerous surveys and interviews across companies. Their early thought and leadership are greatly appreciated. Thanks too, to current Research Center staff members Joanna McCall and Amanda Short for their review of the findings and drafting the final report. Visual design by Landon Matney.

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HCA



