A Labor Analysis of Technology Industries and Occupations in Greater Kansas City

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Talent-to-Industry Exchanges

The Talent-to-Industry Exchange (TIE) concept was introduced in 2016 as a tool to gather real-time information and use it to inform strategies for growing the region's talent pool, strengthening the talent pipeline, and aligning employer and educational stakeholder interests. The concept was recommended by the KC Rising Pilot Project Task Force team and was adopted as the signature strategy in Year Two of KC Rising. With guidance from the KC Rising Human Capital Leadership Committee, project partners outlined a process for each industry-specific TIE. The following elements were deemed critical to success:

- TIEs must be industry led.
- TIEs must be regional and comprehensive in approach, covering the full education continuum, from kindergarten to graduate school.
- TIEs must be data driven and action oriented.

The TIE process has three phases: (1) a detailed economic and labor analysis, (2) a workforce action plan; and (3) plan implementation. An industry leader is identified to champion and lead each TIE. The industry leader may be an association or group of leading businesses in a chosen industry who agree to act as co-convener and recruit employers to participate.

Educational stakeholders are engaged through GradForce KC, a regional network of education and community-based organizations focused on improving educational attainment and creating a talent pipeline for economic and civic vitality. Members of GradForce KC include the region's largest school districts, regional tech academies and representatives from a network of 17 public and nonprofit postsecondary institutions; nonprofit, philanthropic, and workforce organizations that are regional in scope and have a complementary mission; state officials located in the region whose work is related to education; and education intermediaries.

This report provides the economic and labor analysis for the technology occupations. It includes quantitative data about the labor market, as well as qualitative insights gathered through facilitated group discussions, individual interviews with business leaders and one work session conducted in 2020.

This TIE is the fourth in an ongoing series. The Life Sciences TIE was completed in early 2017, and the KC Global Design TIE (engineering and architecture) was completed in August 2018. The Skilled Trades TIE was completed in 2019. All are available online at www.kcworkforce.com/reports.htm.

Key insights

Definition

The tech sector includes 97,000 jobs who either work for firms in tech industries or in tech occupations as defined by CompTIA. As such, it cuts across many traditionally classified industries. There are nearly as many workers in tech occupations (29,906) in non-tech industries as in the tech industries themselves (31,707). The remainder (34,976) are employees of tech firms who are in non-tech occupations.

While the professional, scientific and technical services industry in the largest employer of tech workers, manufacturing is second, ahead of industries more commonly thought to be major employers of tech workers, such as information and finance.

Specialization

The Kansas City area specializes in tech sector jobs. On an industry basis, the percentage of its jobs in tech industries is 1.24 times that of the U.S., while its percentage of jobs in tech occupations is 1.12 times that of the U.S.

Certain industries have much higher location quotients (LQ), as these figures are called. This includes electronic assembly, where Garmin is categorized, with a location quotient of 9.35, computer systems design, where Cerner is categorized, with a location quotient of 2.52, and engineering services, where Burns & McDonnell and Black & Veatch are categorized, at 1.87.

Overall, computer occupations total 40,000 of the 60,000 jobs in tech occupations, followed by 10,000 in engineering. Blue collar tech workers in installation, maintenance and repair or production occupations total nearly 8,5000.

On an occupation basis, the highest location quotients are found for network administrators (1.58), information security analysts (1.37), computer network architects (1.35) and computer systems analysts (1.30). For software developers, the region's largest tech occupation with 12,000 workers, the level of specialization is a more modest 1.15.

Competitiveness

While the Kansas City area economy specializes in tech, the tech composition of its workforce ranks in only in the middle of the 11 metros used to benchmark the region's progress over time (Kansas City plus ten peers). The region's tech occupation location quotient of 1.12 places it behind Austin, Raleigh, Denver, Portland and Minneapolis, respectively, but above Cincinnati, Columbus, Charlotte, Indianapolis and Nashville. The leaders — Austin, Raleigh, and Denver — all have tech occupation location quotients of 1.4 or greater. They also have an even higher specialization in software developers than they do overall of 1.79 or better. The Kansas City region's location quotient for software developers is 1.15, or roughly the same as its overall tech LQ.

Despite ranking in the middle on specialization, the Kansas City area ranks relatively low in tech wages and the growth of tech occupations. The region's overall tech occupation wages rank 9th out of the 11 benchmark metros, and the wages of its software developers ranks last. This undoubtedly hurts metropolitan Kansas City's ability to attract tech talent.

Looking at tech occupation growth rates over the past five years, the story is similar, with the growth of the region's total tech occupations and its software developers both in the lower half of the benchmark metros, ranked 8th and 7th, respectively.

This result is somewhat unexpected. Generally, the greater a region's concentration in a sector, the more likely it is to produce a cluster of firms that compete against each other, both for sales of products and services and for talent. This competition spurs innovation, creating new opportunities for growth and accelerating the competition for workers. As a result, both growth and wages in a region with a successful cluster tend to be higher than average. The region's relatively slow growth and low wages likely feed on each other, with low wages making it more difficult to attract talent and low growth leading to less demand that, in turn, allows wages to remain low relative to faster growing metros.

This indicates that the tech sector in Greater Kansas City is not operating as a typical cluster. Rather it is more consistent with the idea that tech in Kansas City is dominated by a few large firms — e.g., Cerner, Garmin, Sprint/T-Mobile — that operate in sufficiently different industries that they don't directly compete to sell products or hire workers.

Alignment between business and education

Computer occupations account for two-thirds of all tech occupations. Additionally, four of the top five tech occupations in online job postings are computer-related, with computer user support specialists and software developers being sought twice as much as the next highest occupation, network administrators. Yet in the past academic year, only one-third of the degrees or certificates in tech fields awarded by higher educational institutions serving the Kansas City area (roughly a 150-mile radius) were for completing a program related to computer occupations. This suggests there may be a mismatch between the fields of recent graduates and the fields most in demand by tech firms in Greater Kansas City.

Additionally, there may be a mismatch in the type of awards most in demand. Only half of recent job ads for tech occupations specify that a bachelor's degree or higher is required or desired. Yet more than 80% of the degrees and certificates in tech fields awarded by area institutions are for bachelor's or advanced degrees. This suggests that educational opportunities that make it easier for students and workers to achieve continuous, best-in-class learning that results in stackable and evolving credentials rather than a finished degree may be better suited to developing and retaining the talent needed by businesses in the fast-moving tech sector.

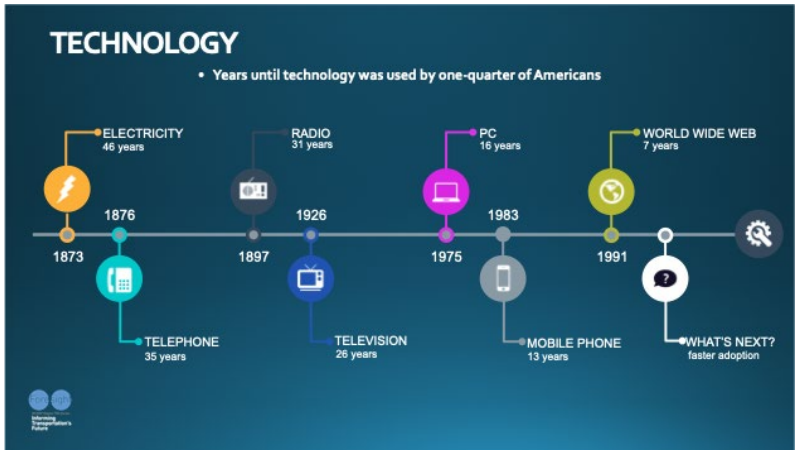
Labor supply gaps

The tech sector is still largely dominated by males — only 20% of current job holders in tech occupations are female when nearly half of Greater Kansas City's overall workforce is. The tech sector does a better job fairly representing the racial composition of the area's workforce, as 80% of tech workers are white, about equal to the 82% of the general workforce that are white. But Blacks are a little over half as likely to be employed in a tech occupation compared to their overall average (7% in tech versus 12% overall) while Asians are three times more likely to be employed in tech (10% in tech versus 3% overall). Like Blacks, Latinos are underrepresented in the tech workforce, but even more so — Latinos only comprise 3% of the tech workforce, one-third their 9% share of the overall workforce. This suggest there are both educational and cultural barriers to encouraging full participation of women and minorities in the tech workforce.

The tech challenge and opportunity

The digital revolution is transforming the global economy, putting a premium on workers with the skills to both create and use the information technologies (IT) that are rapidly being developed in labs, universities and businesses around the world. COVID-19 is accelerating these changes as virtual work becomes more common and enhanced technology is increasingly seen as a substitute for workers, even for those engaged in activities that previously seemed difficult to automate. This potentially affects low-skilled workers the most, but workers at all skill levels are vulnerable.

One thing that distinguishes the digital revolution from previous episodes of significant technological improvement is the dramatically faster pace of adoption



In the past, the chief benefits of a new technology accrued primarily to the users of that technology rather than the creators as its use gradually spread through the economy. The rapid pace of IT adoption means that unless a sizable segment of a metropolitan area's businesses are also involved in creating the technology, they are unlikely to understand how to use it quickly enough to successfully adapt to the disruptions being created. This puts a special emphasis on metropolitan areas developing a successful cadre of IT firms advancing the state of art, not just using tools developed elsewhere, if they are to be important players in the 21st century global economy.

By leading the development as well as the use of new digital technologies, the Kansas City economy can create new types of jobs faster than existing tasks are replaced by automation. Ensuring the area workforce can fill those jobs will require raising the skill levels of area employees across the board, but especially those currently in low-skill jobs.

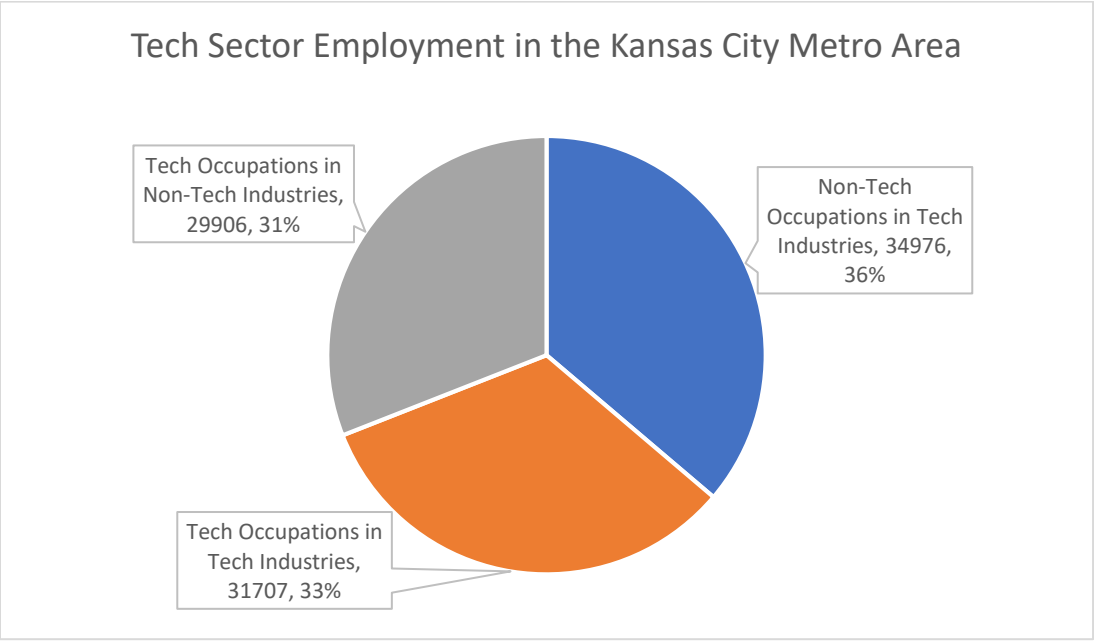
Labor analysis

This report looks at the tech sector from two points of view — from the **industries** that employ tech workers and from that of the **occupations** in which tech workers are employed. In this analysis, the number of workers in tech occupations is viewed as arising from the demands of firms as they sell their goods and services to firms and households in the Kansas City region, the U.S., and the rest of the world. Those goods and services are classified by industry. The kinds and numbers of workers they need depend on what and how much those industries sell.

Of course, one of the most important industries employing tech workers is the tech industry itself. Still, it is important to keep in mind that there are nearly as many tech workers employed by firms in industries outside of the tech industry as there are within it. (Figure 1). This is what makes facilitating the development and attraction of workers with the tech skills that employers demand such a powerful strategy. Information technology cuts across the entire economy and so a more aligned supply of workers with the appropriate skills for the needs of business can boost many sectors of the economy at

once. (Definitions of the tech industry and the tech occupations are based on those provided by CompTIA and can be found in Appendix A. Together, they make up what we define as the tech sector.)

Figure 1: Overall Distribution of Tech Sector Jobs



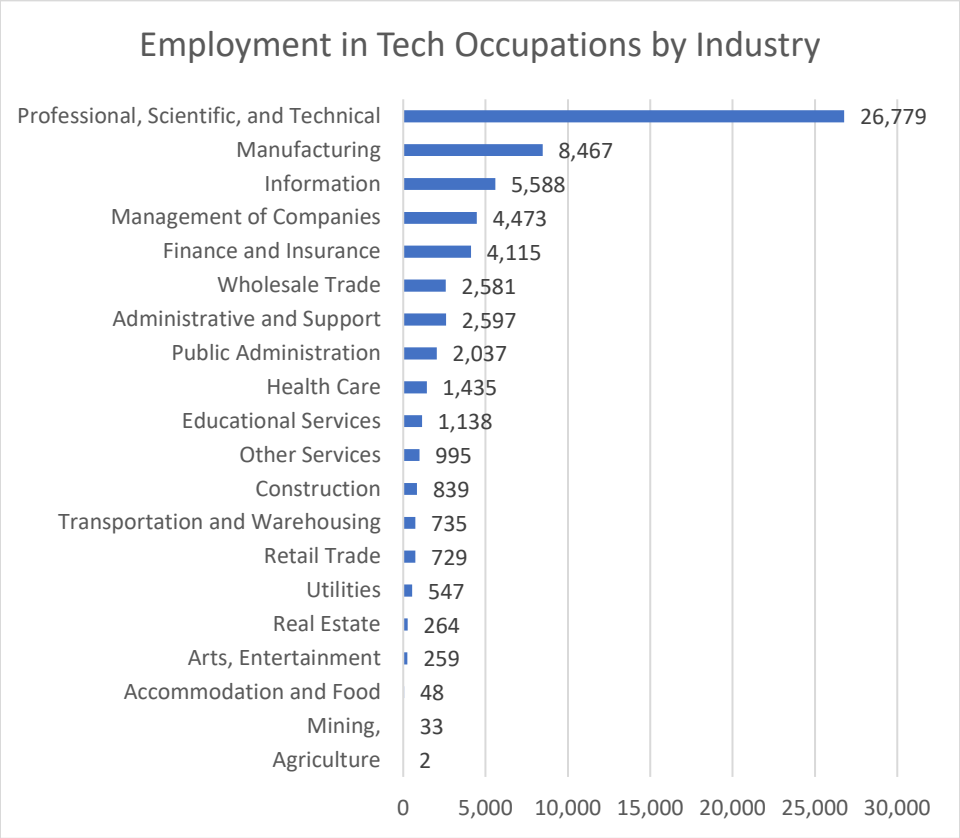
Source: JobsEQ; first quarter 2020

Industry demand

Tech by Industry

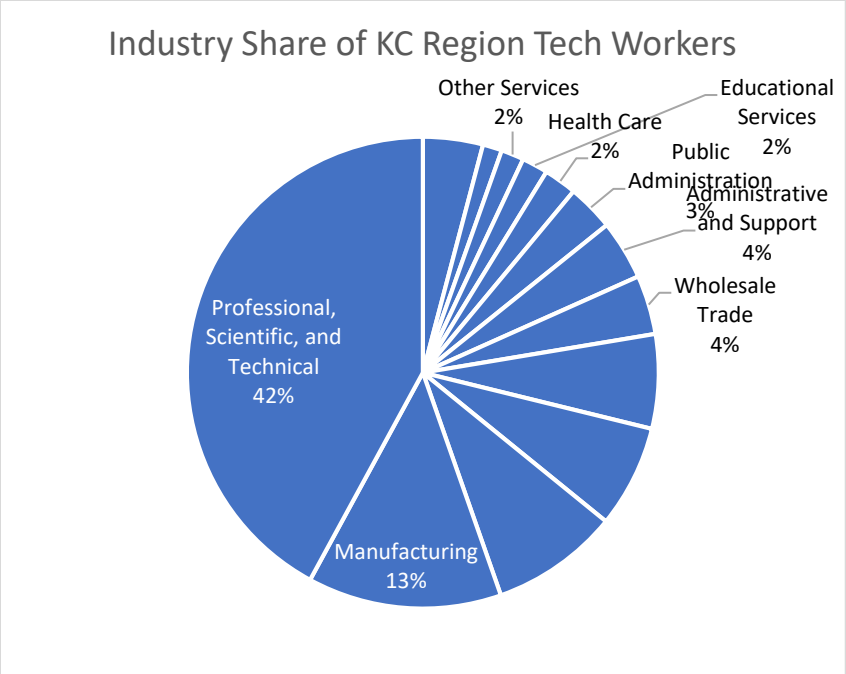
Overall, the professional, scientific and technical services industry employs the largest number of tech workers. (Figure 2) At 26,800, it accounts for nearly 42% of the tech worker employment in the entire region. The manufacturing industry employs the second-most workers in tech occupations, at 8,500, followed by information (5,600), management of companies and enterprises (4,500) and finance and insurance (4,100). Combined, these five industries employ more than three-quarters of the tech workers in the region, with the remaining spread throughout virtually all sectors of the economy. (Figure 3)

Figure 2: Number of Tech Jobs by Industry



Source: JobsEQ; first quarter 2020

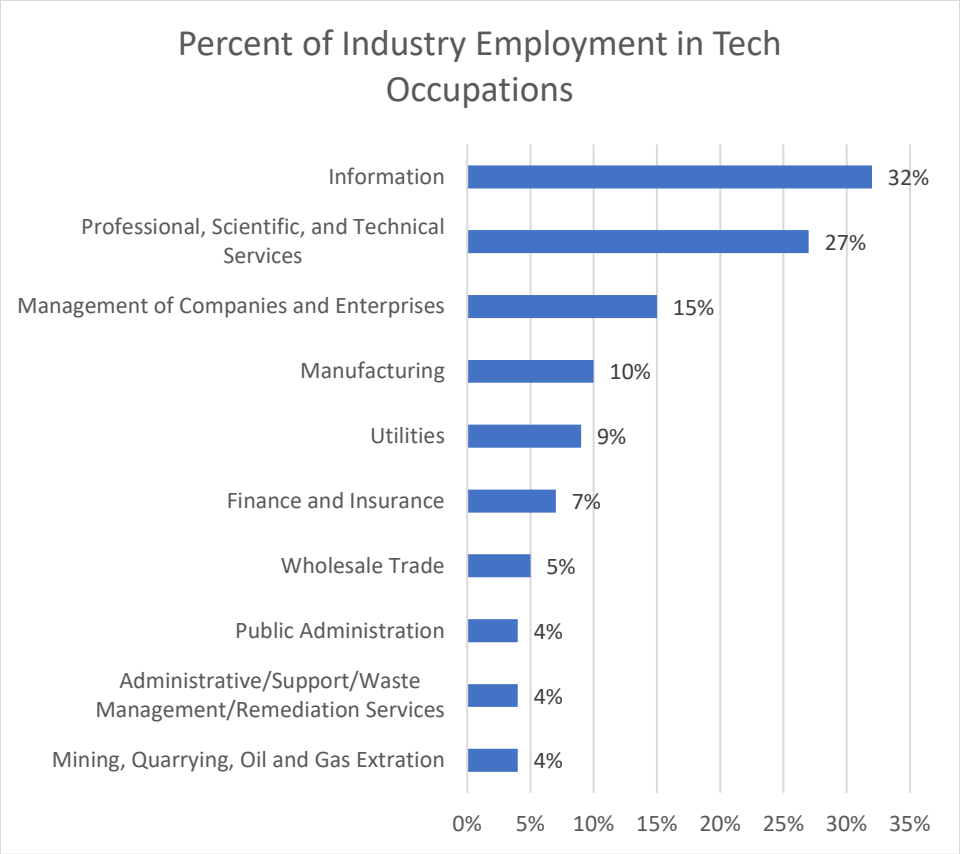
Figure 3: Industry Share of KC Workers in Tech Occupations



Source: JobsEQ

Though the professional, scientific and technical services industry employs the greatest share of the region's tech workforce, it is the information industry that depends the most on workers in tech occupations. (Figure 4) About a third (32%) of the jobs in this industry, which is where telecommunications is categorized, consists of tech workers. The professional, technical and scientific industry is second, with a tech worker share of about one-quarter (27%). This is followed by management of companies and enterprises (15%), manufacturing, (11%), public utilities (9%), and finance and insurance (7%).

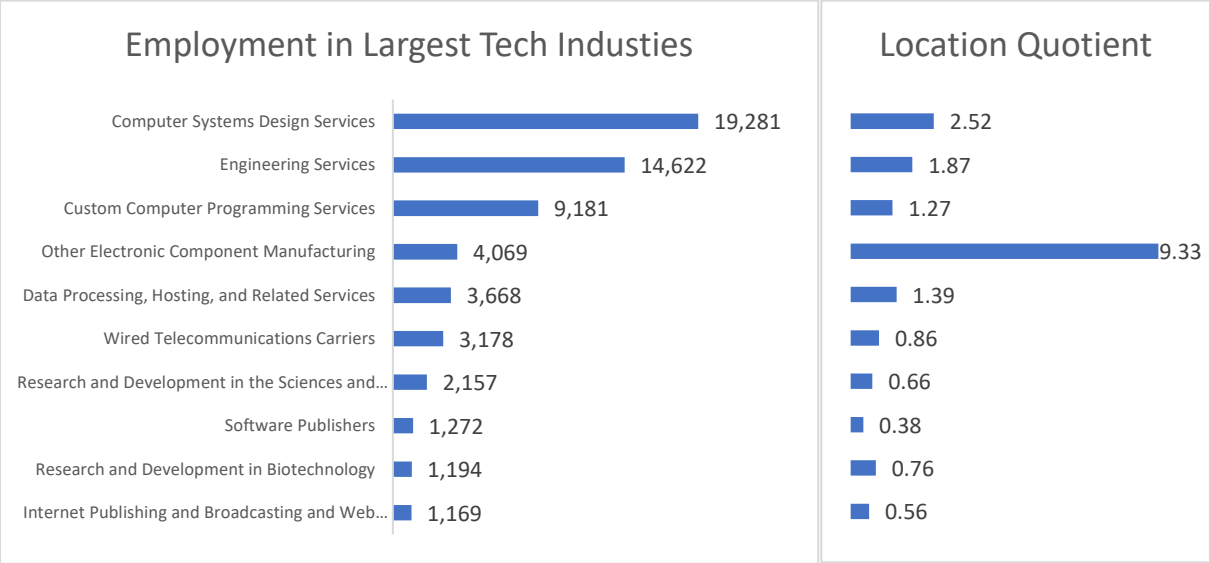
Figure 4: **Share of Industry Workforce in Tech Occupations**



Source: JobsEQ; first quarter 2020

These industry classifications are quite broad. We can gain greater insight into the kinds of firms where tech workers are most in demand by looking at more detailed industries. (Figure 5) Then we find that computer systems design services, which is where Cerner is classified, is the largest employer of tech workers, with roughly 19,300. Given the strength of the region's engineering cluster and it being the headquarters for firms such as Black & Veatch and Burns & McDonnell, it is little wonder that engineering services comes in a relatively close second, at 14,600. Unlike the prior two industries, computer programming services is not dominated by a few major players, but it still employs the third highest number of tech workers at about 9,200. This is followed by other electronic component manufacturing — where Garmin is categorized — at roughly 4,100; data processing and hosting at 3,700; and wired telecommunications at 3,200. The latter includes those employed by Sprint/T-Mobile as measured roughly at the time their merger was being completed.

Figure 5: Employment in Tech Industries Employing 1,000 or More Workers and Their Location Quotients



Source: JobsEQ; first quarter 2020

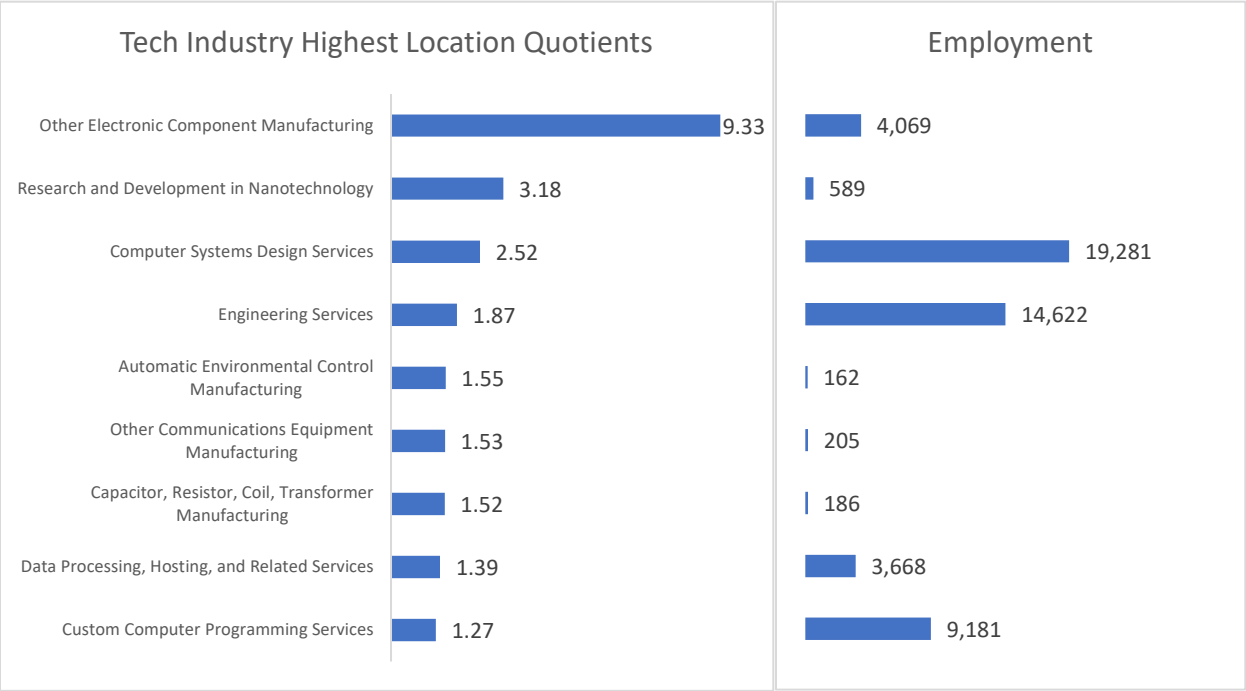
Location quotients (LQs) are a measure of the degree to which an area specializes in an industry or occupation. They calculate proportion of the region's employment in that industry or occupation relative to that of the nation. A location quotient above 1.0 means the region devotes a higher percentage of its workforce to that industry than the national average, with LQ's greater than 1.2 generally thought to be significant. In Kansas City, the region's top five tech industries are also ones in which it has a significant specialization, led by the electronic component manufacturing industry where the proportion of people working in this industry is nine times greater than the national average. These are followed by the computer systems design industry and engineering services.

The data above suggest the region no longer has a specialization in the wired telecommunications industry, in part because the Sprint/T-Mobile workers at the former Sprint campus were reclassified into the management of companies and enterprises industry once SoftBank took a majority interest in Sprint. It is unknown at this point whether they will again be classified as telecommunications workers now that they are part of T-Mobile.

An alternative way to look at the tech industries is by location quotient, regardless of their current level of employment. (Figure 6) This has the advantage of highlighting what might be emerging industries of excellence for the region. Four additional industries meet the criterion for a significant specialization, though they currently employ relatively few workers. Research and development in nanotechnology is both the largest, at nearly 600 jobs, and has the highest location quotient, 3.18, surpassing that of computer systems design. This industry clearly has significant growth potential.

The remaining three industries – automatic environmental control manufacturing; other communications equipment manufacturing; and capacitor, resistor, coil or transformer manufacturing – are smaller, with 200 or fewer jobs each, with growth potential that is less certain. Still, with location quotients of about 1.5, the regional economy's degree specialization in these industries exceeds its specialization in larger industries such as data processing and custom computer programming.

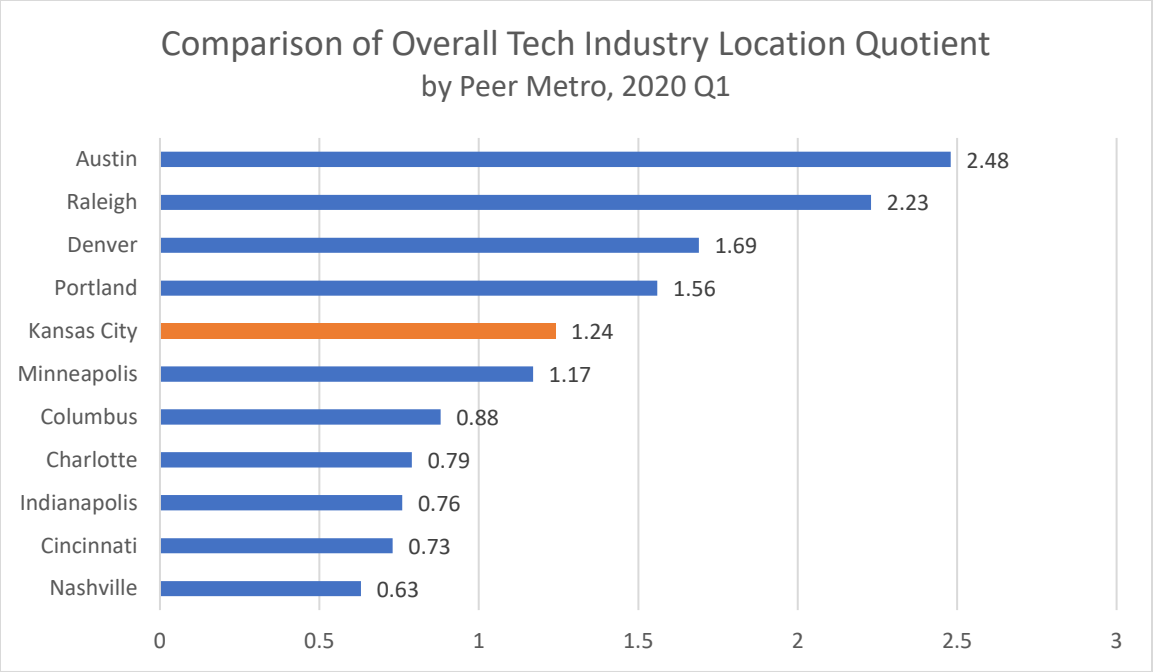
Figure 6: Tech Industries with the Largest Location Quotients



Source: JobsEQ; first quarter 2020

Finally, we can compare Kansas City region's overall tech industry specialization to that of 10 selected peer metros. (Figure 6) Out of the 11 metros, Austin and Raleigh lead the way with tech industry location quotients substantially above 2.0. The Denver and Portland economies are next, with tech industry location quotients just over 1.5. Kansas City and Minneapolis round out the top half, with location quotients of 1.24 and 1.17, respectively. None of the remaining five peers have a location quotient above 1.0.

Figure 7: Comparison of Tech Industry Specialization for Kansas City and Peer Metros



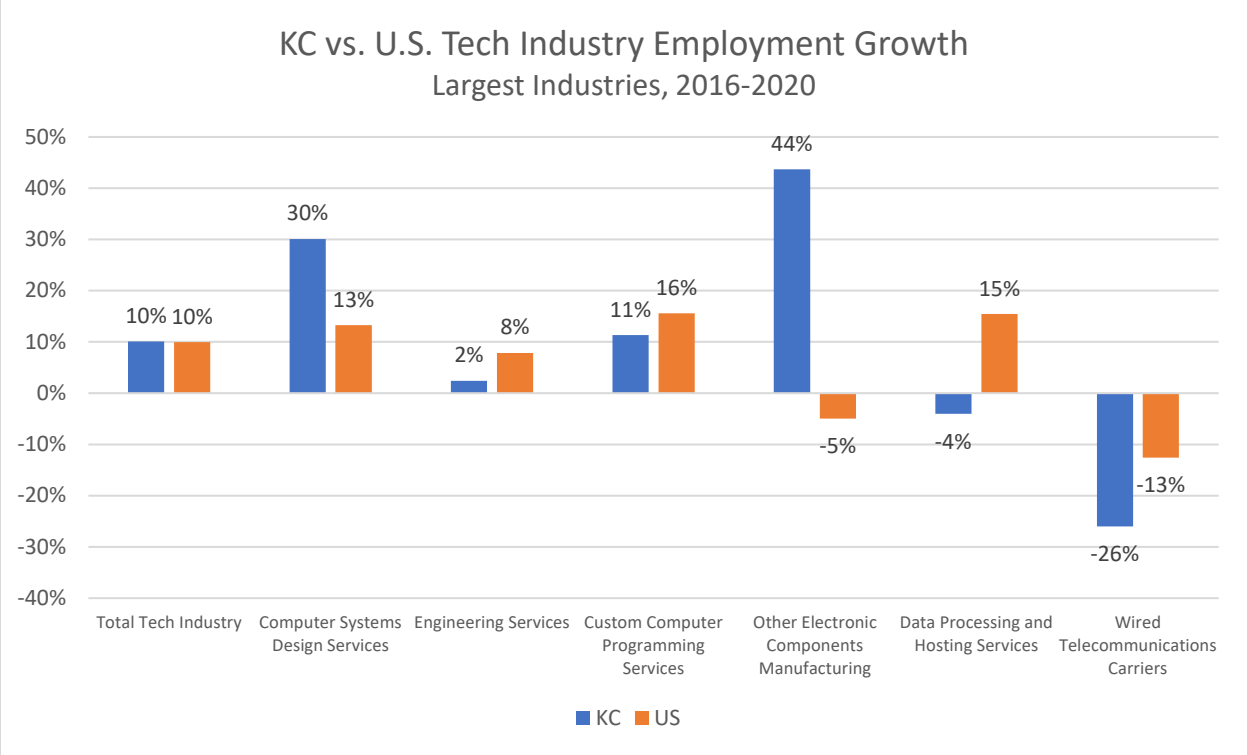
Source: JobsEQ; first quarter 2020

Tech industry trends in major industries

Taken as a whole, the region's tech industries have kept pace with national trends in recent years. (Figure 8) Tech industry employment in both the Kansas City area and the U.S. grew 10% between 2016 and 2020, measured on a first quarter-to-first quarter basis. *(Note: due to industry reclassifications of Sprint, Garmin and others mid-decade, examining longer-term trends proved unreliable).* This pattern is not uniform, though. Key segments of the local tech industry have significantly outperformed the nation. Computer systems design, for example, grew 30% over past four years, more than double the U.S. average of 13%. Other electronic components performed even better relative to the U.S., with local employment growing 44% while national employment in this industry declined by 5%.

On the other hand, the other major tech industries in the region lost ground relative to the U.S over the past four years. In some cases, the growth rate differences were modest. For example, jobs in the custom computer programming industry grew 11% locally compared to 16% nationally. In engineering, local job growth was 2% compared to 8% nationally. But jobs in data processing and hosting shrank here by 4% while they grew 15% nationally between 2016 and 2020. While the employment in wired communications declined both locally and nationally, it declined twice as fast here, 26% vs. 13%, respectively.

Figure 8: Tech Employment Growth, Total and by Largest Industry, 2016-2020

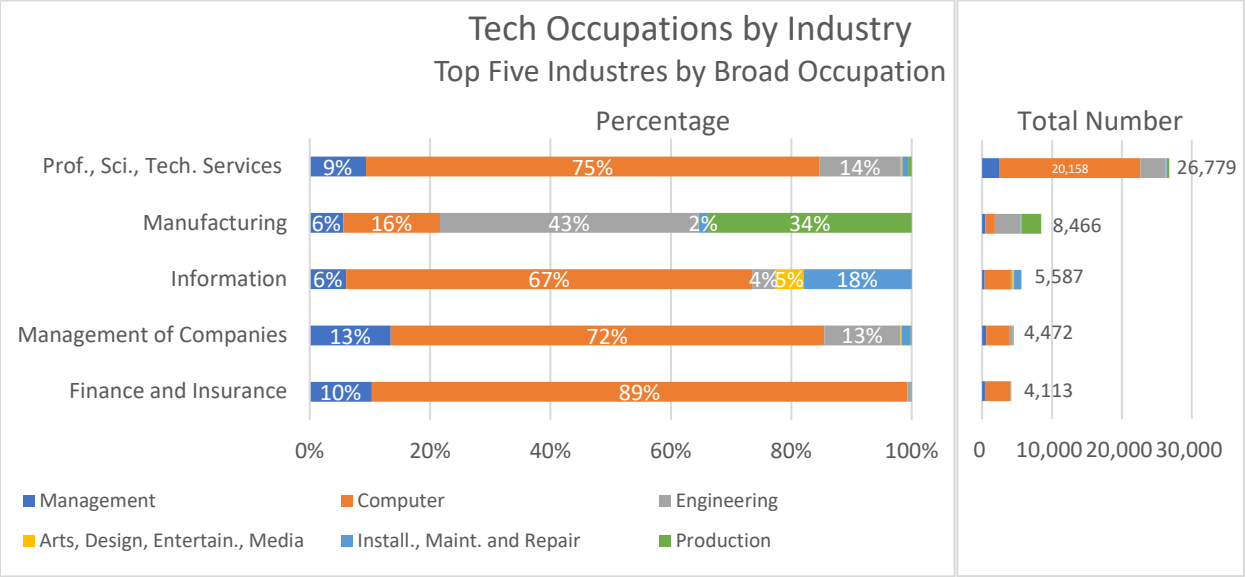


Source: JobsEQ; first quarter 2020

From industries to occupations

The demand for particular tech occupations derives from the performance of the region's industries, both tech and non-tech, since virtually all sectors of the economy require tech talent. Different industries require different kinds of tech talent, however, as can be seen in Figure 9. When looking at the top five industries employing workers in tech occupations, computer occupations comprise at least two-thirds of the tech talent in four of them. The exception is manufacturing, where engineering jobs form the plurality (43%) of its tech talent needs, followed by technical production occupations (34%). Professional, technical and scientific services and management of companies also require significant engineering talent, with a little over one-in-eight tech workers in engineering occupations. The information industry requires the highest percentage of workers involved in installation, maintenance and repair, while management of companies demands the highest proportion of managers of technical processes.

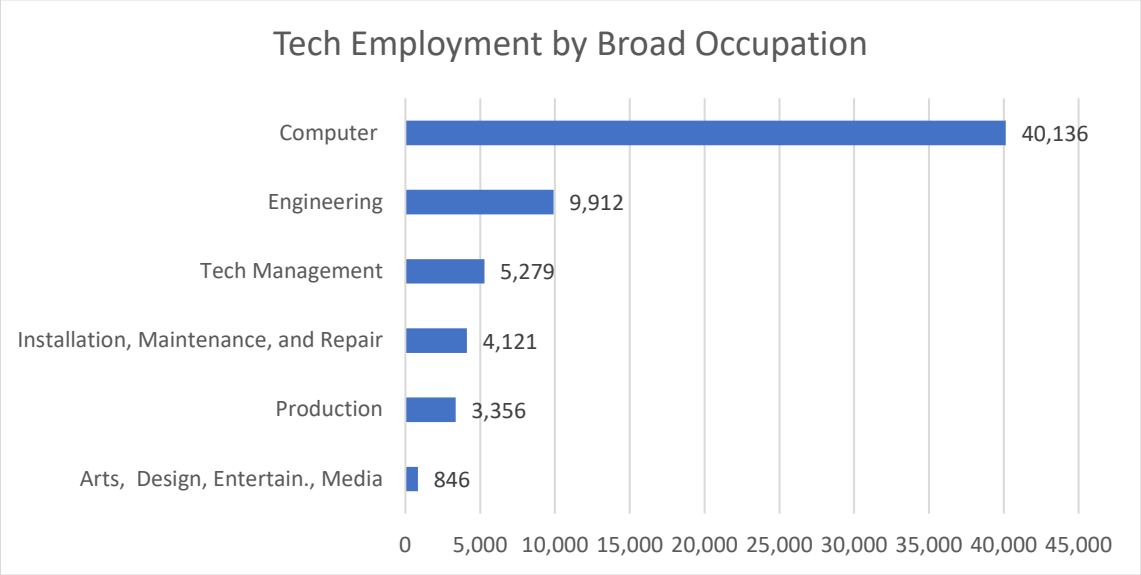
Figure 9: Tech Occupations with the Top Five Industries Employing Tech Workers



Source: JobsEQ; first quarter 2020

Because the professional, scientific and technical services industry employs more than three times the tech workers of any other, its occupational needs tend to swamp those of other sectors. The 20,000 jobs in computer occupations working in the professional, scientific and technical services industry account for half of the entire region's 40,000 workers in computer-related positions. (Figure 10) In turn, the number of workers in computer occupations are four times larger than the next largest segment of the area's tech workforce, engineering.

Figure 10: Tech Employment in Broad Occupation Groups



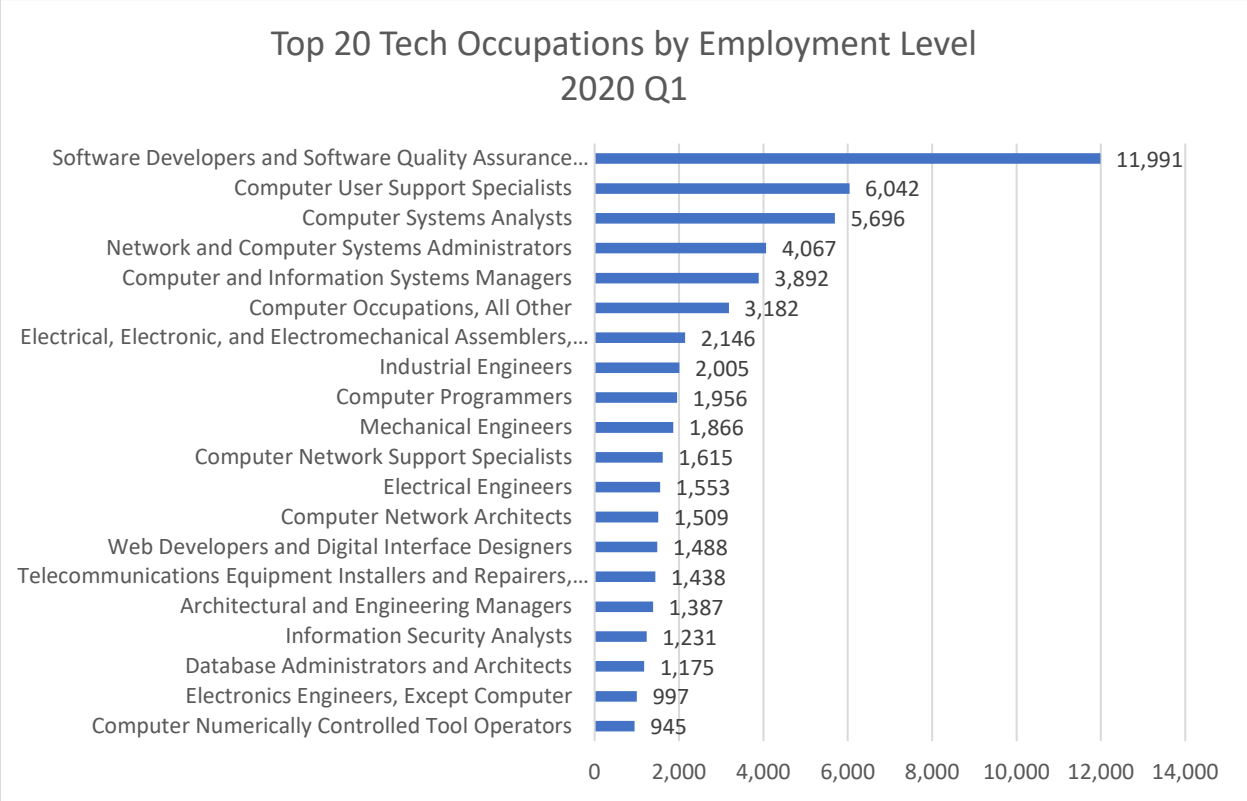
Source: JobsEQ; first quarter 2020

What do Kansas City's tech workers do?

Occupation size, specialization and geographic concentration

Software developers are the largest tech occupation in the Kansas City metropolitan area. (Figure 11) At nearly 12,000, there are roughly double the number of developers as either computer user support specialists or computer systems analysts, the next largest tech occupations. Network administrator and information systems managers follow, each with about 4,000 workers. The largest non-computer technical occupations are electronic assemblers, industrial engineers and mechanical engineers, each with around 2,000 workers.

Figure 11: Top 20 Tech Occupations by Employment

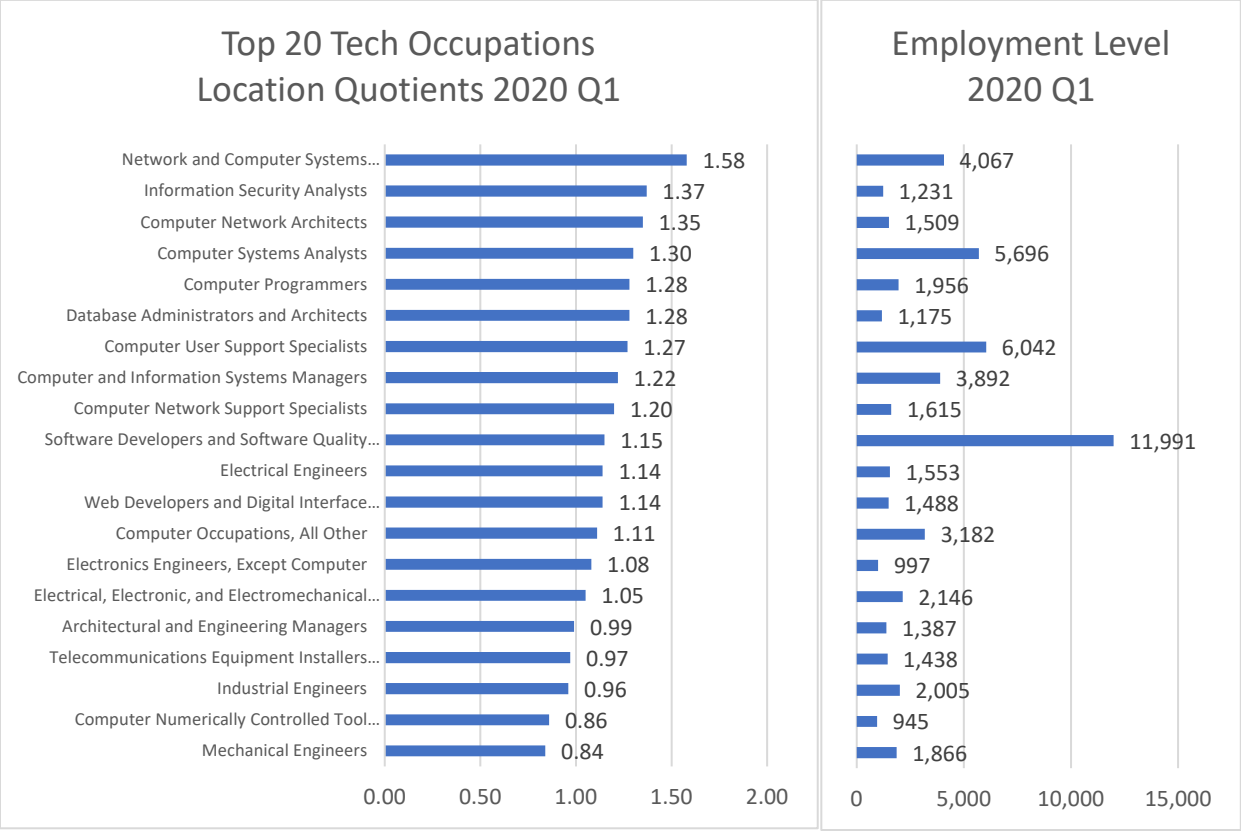


Source: JobsEQ; first quarter 2020

Occupation specialization

Though software developers are the largest tech occupation, Greater Kansas City only has a middling specialization in it, as measured by its employment location quotient of 1.15. (Figure 12) The region's most significant occupational specialization is network and computer systems administrators (LQ = 1.58). This is followed by information security analysts (1.37), computer network architects (1.35) and computer systems analysts (1.3).

Figure 12: Top 20 Tech Occupations and Their Specialization as Measured by Location Quotient, 2020 Q1



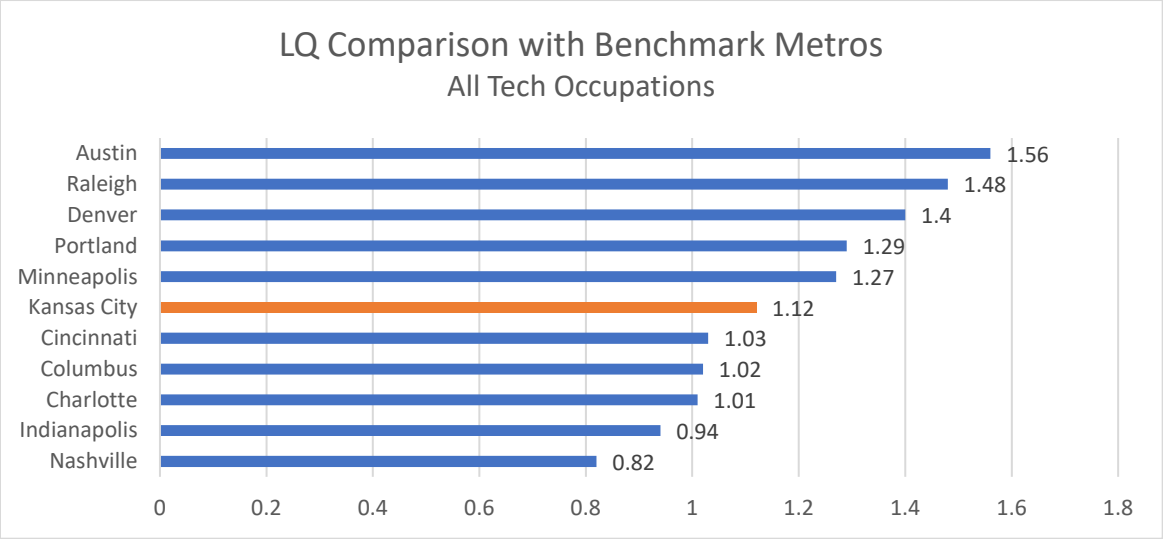
Source: JobsEQ; first quarter 2020

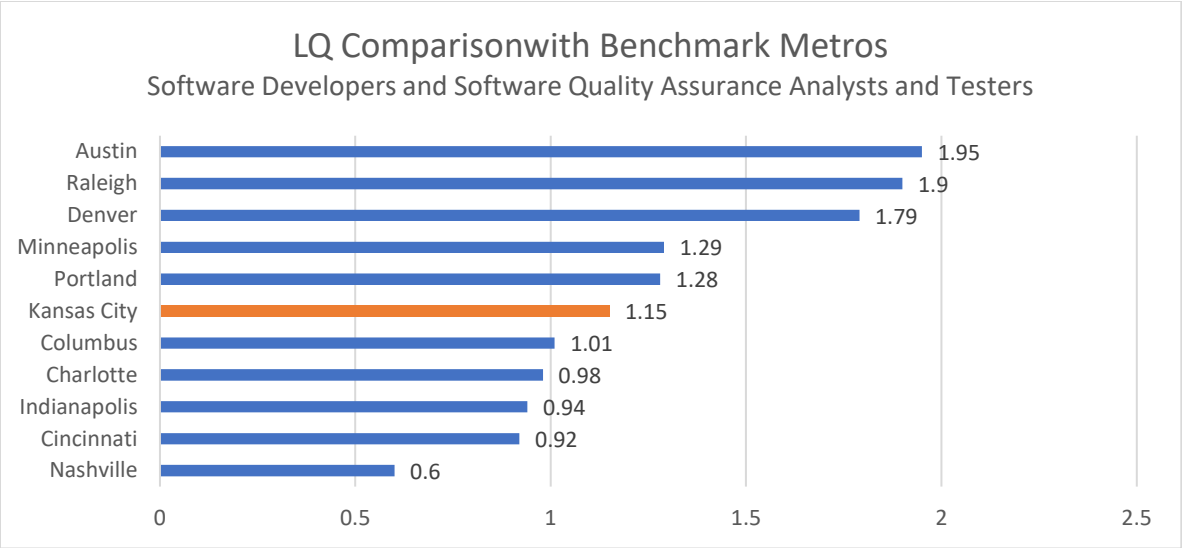
Comparison of specialization with benchmark metros

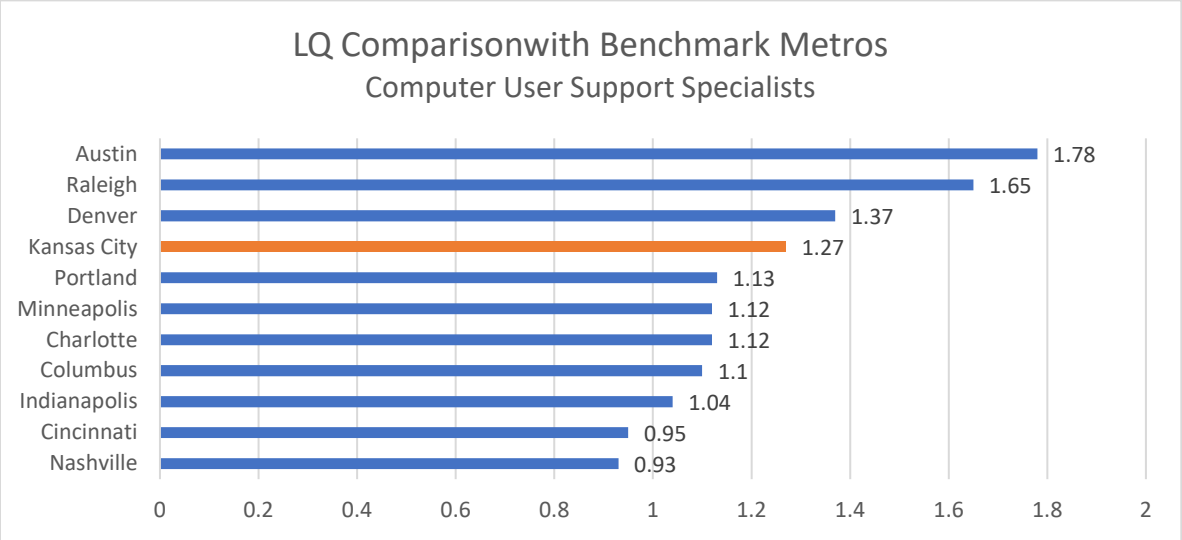
Across all tech occupations, the Kansas City area has a modest specialization as measured by an LQ of 1.12. (Figures 13) This ranks it sixth among the eleven benchmark metros defined by KC Rising. Austin, Raleigh and Denver lead the way with LQs for tech occupations of 1.4 or better, followed by Portland and Minneapolis, with LQs just under 1.3. The other Benchmark metros have tech occupation LQs near 1.0. The exception is Nashville, whose tech occupation LQ is only 0.82, which means that the tech share of its total employment is 18% lower than the national average.

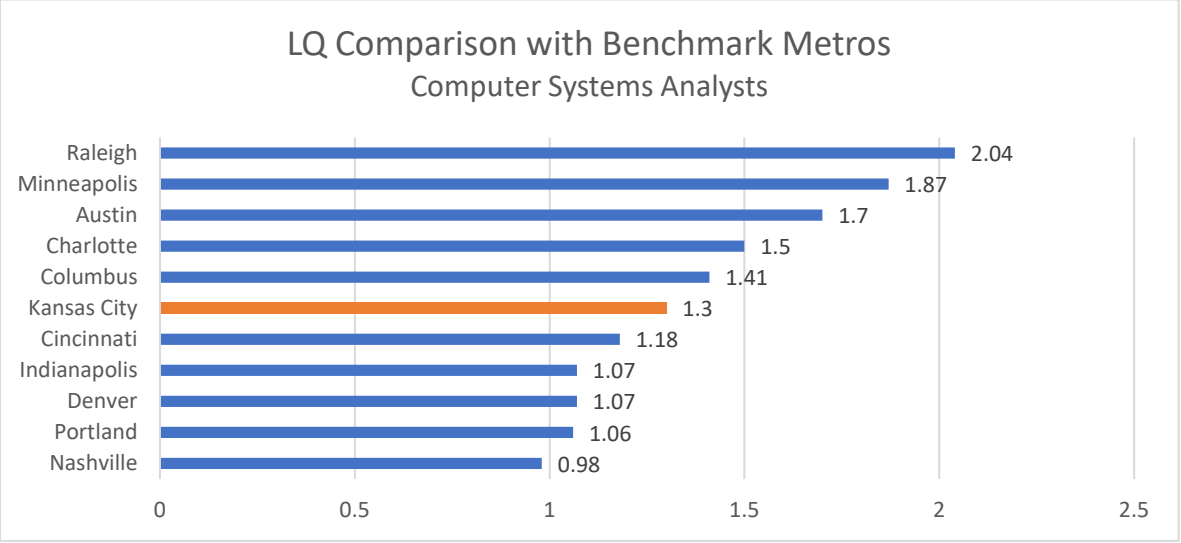
Because software developers are the largest tech occupation, they count heavily in a region's overall tech specialization. Consequently, the LQs for software developers are fairly similar to those for tech occupations in general. However, the tech leaders specialize even more in software development than overall tech, with LQs near 2.0. By contrast KC's LQ for software developers, at 1.15, is virtually the same as its overall tech LQ and it similarly ranks sixth among the benchmark metros.

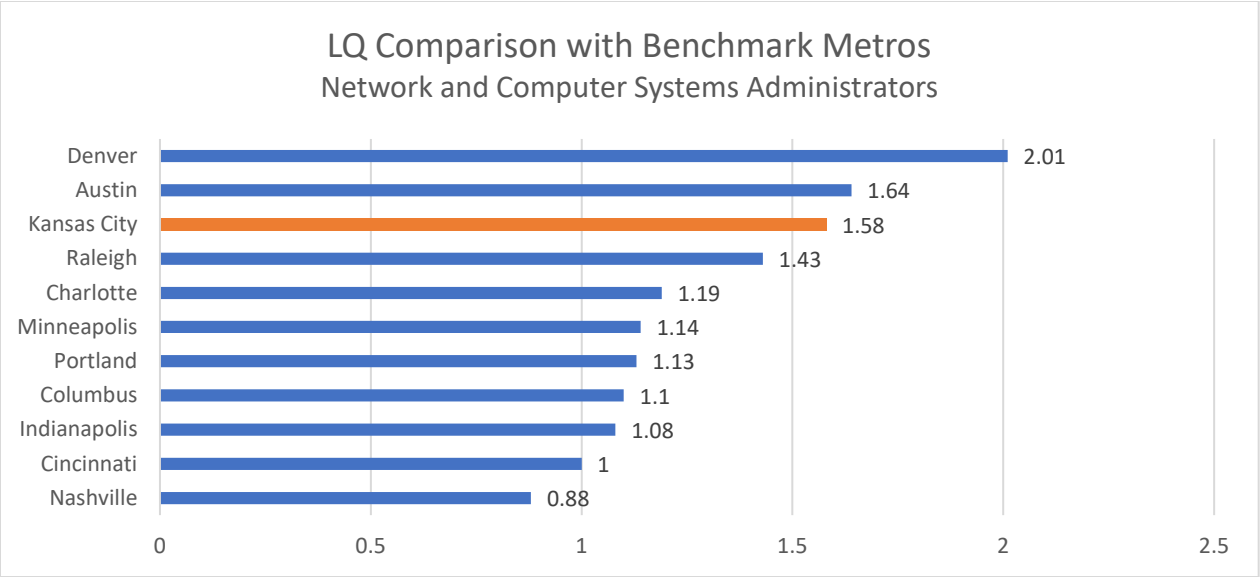
Figures 13: Location Quotient (LQ) Comparison with Benchmark Metros, Total Tech and Five Largest Tech Occupations, 2020 Q1

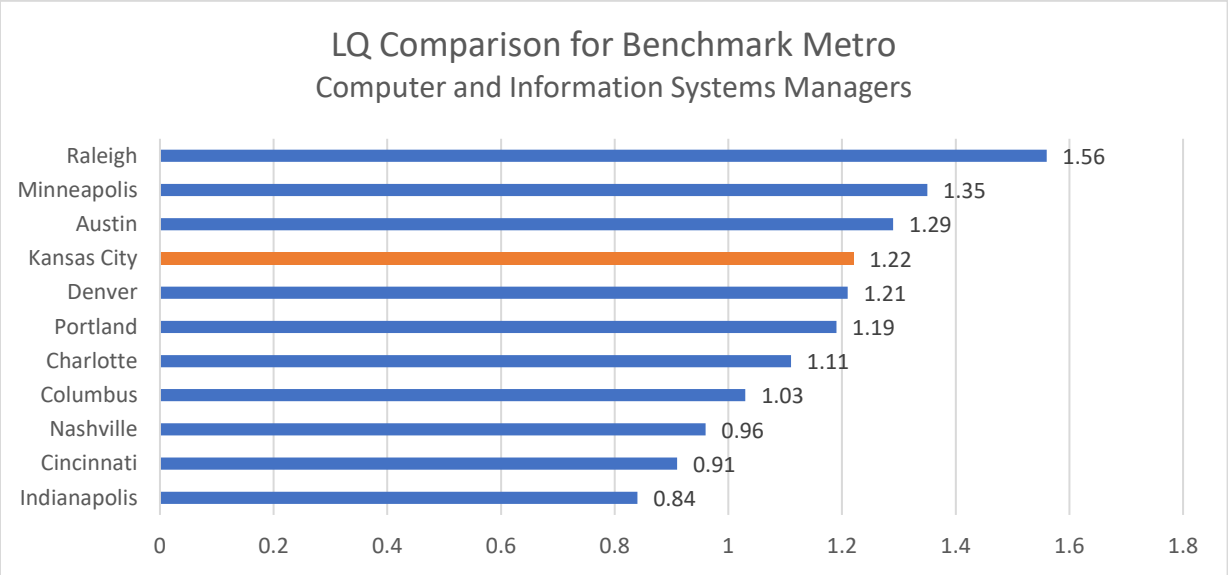



LQ Comparisonwith Benchmark Metros
Software Developers and Software Quality Assurance Analysts and Testers
Austin 1.95
Raleigh 1.9
Denver 1.79
Minneapolis 1.29
Portland 1.28
Kansas City 1.15
Columbus 1.01
Charlotte 0.98
Indianapolis 0.94
Cincinnati 0.92
Nashville 0.6
0 0.5 1 1.5 2 2.5


LQ Comparisonwith Benchmark Metros
Computer User Support Specialists
Austin 1.78
Raleigh 1.65
Denver 1.37
Kansas City 1.27
Portland 1.13
Minneapolis 1.12
Charlotte 1.12
Columbus 1.1
Indianapolis 1.04
Cincinnati 0.95
Nashville 0.93
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2


LQ Comparison with Benchmark Metros
Computer Systems Analysts
Raleigh 2.04
Minneapolis 1.87
Austin 1.7
Charlotte 1.5
Columbus 1.41
Kansas City 1.3
Cincinnati 1.18
Indianapolis 1.07
Denver 1.07
Portland 1.06
Nashville 0.98
0 0.5 1 1.5 2 2.5





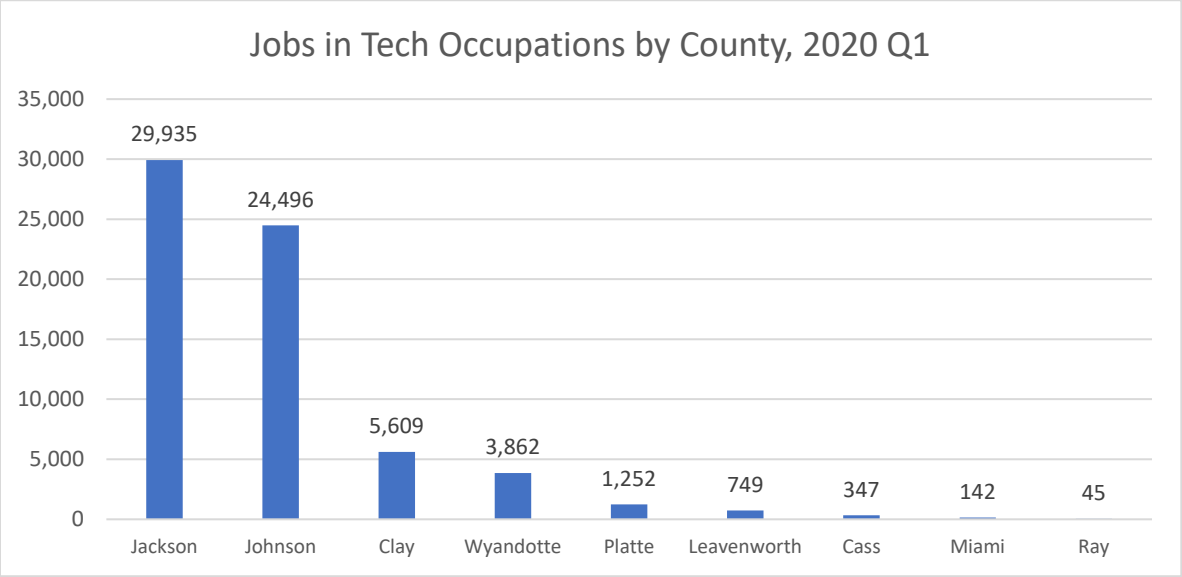
Source: JobsEQ; first quarter 2020

The Kansas City region's LQs for the other large tech occupations are higher, however, ranging from 1.22 for information systems managers and 1.27 for computer user support specialists, both of which it ranks fourth among the benchmark metros, to 1.58 for network administrators, where it ranks third.

Occupation by geographic location

Some 98% of all jobs in the Kansas City area's tech occupations are found in its five most urbanized counties. (Figure 14) Jackson County, with nearly 30,000 tech jobs, accounts for 45% of the total jobs in tech occupations in the region. Johnson County, with nearly 25,000 jobs in the tech occupations, accounts for 37%. Clay, Wyandotte and Platte together are the location for another nearly 11,000 jobs in the region's tech occupations, or 16%.

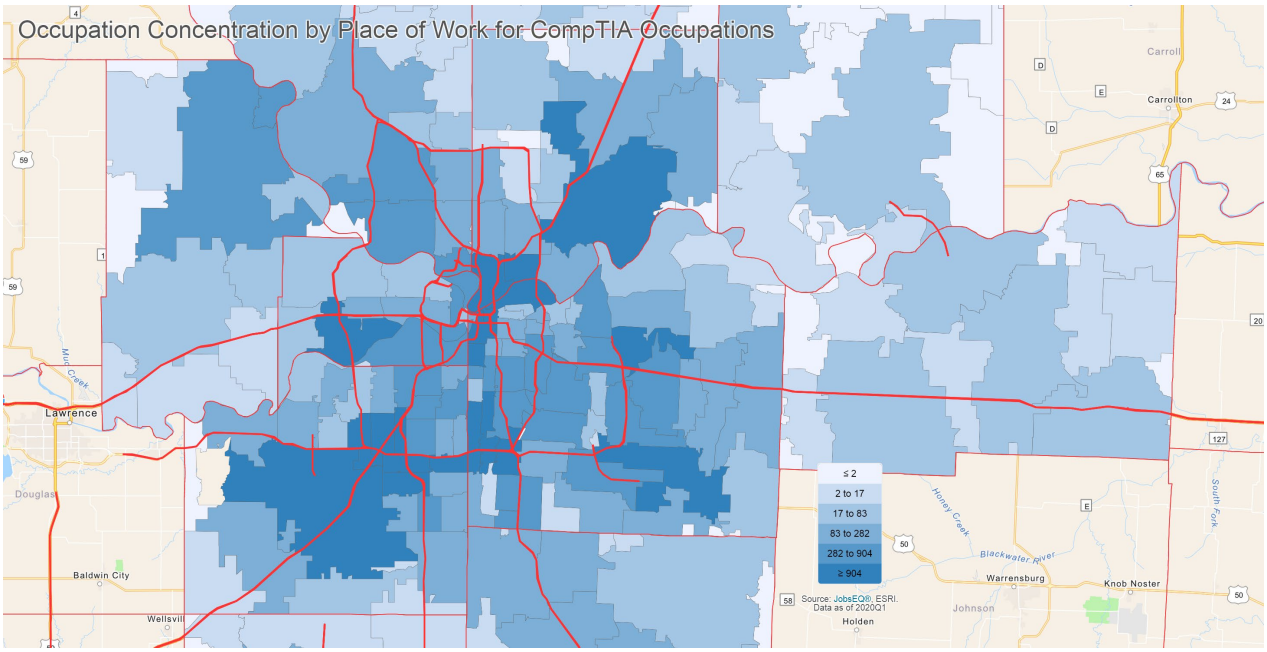
Figure 14: Jobs in Tech Occupations by County



Source: JobsEQ; first quarter 2020

The geographic concentrations of jobs in tech occupations can be seen in more detail by zip code in the map below. (Figure 15). The biggest concentrations in Jackson County are currently around downtown, Kansas City, Missouri, and in southern Kansas City and near Lee's Summit. Cerner's new campus at 87th and I-435 is in the process of adding an additional node of tech activity in Jackson County. In Johnson County, tech industry jobs can be mostly found along the I-435 corridor and in Olathe. But there are also concentrations in Clay County in North Kansas City and near Liberty, in western Wyandotte County near the Village West area, and in Leavenworth County, making tech jobs fairly accessible throughout the region.

Figure 15: Jobs in Tech Occupations by Zip Code, 2020 Q1



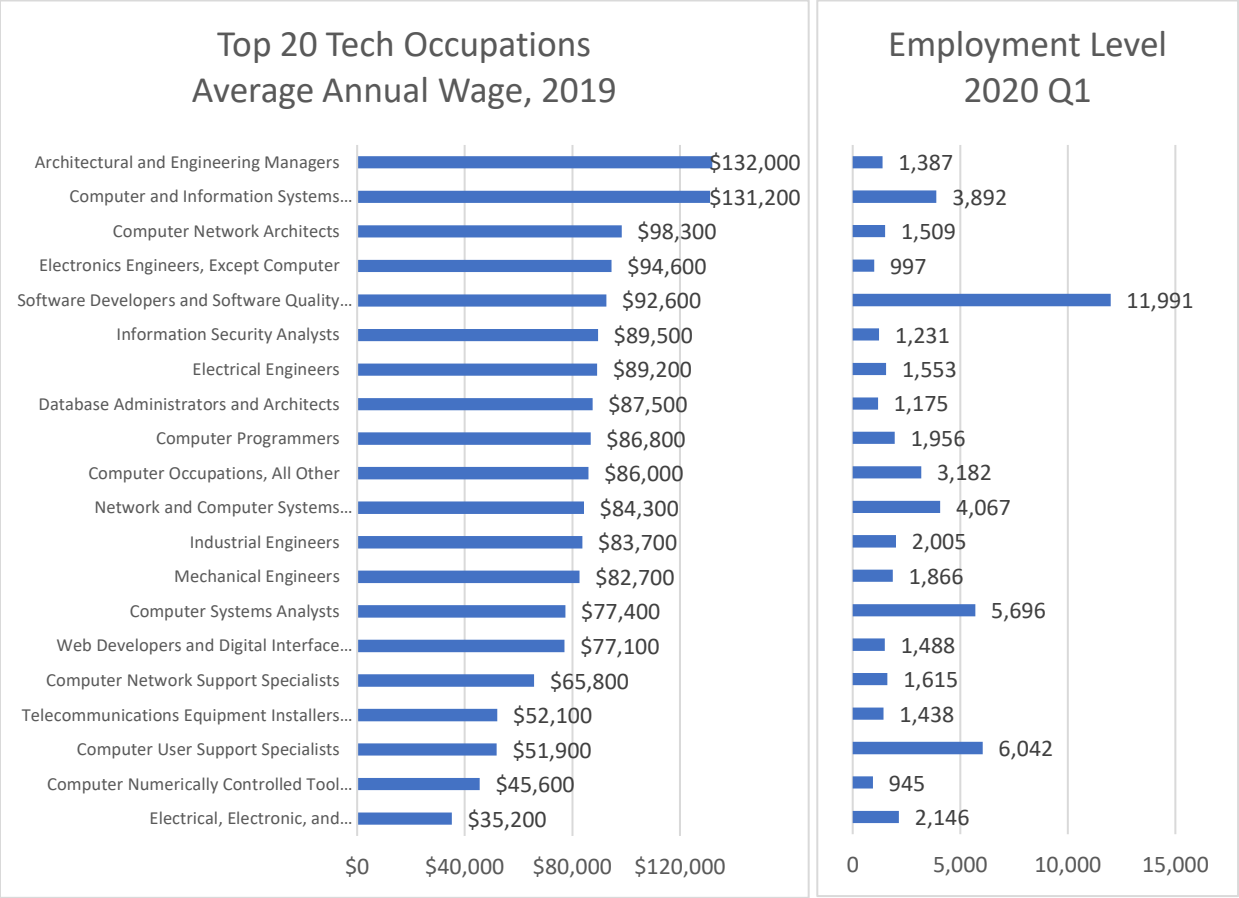
Source: JobsEQ; first quarter 2020

Wages

In general, tech occupations pay well. (Figure 16) As of 2019, their mean annual salary is $81,100, well above the regional average of $51,500. Architectural and engineering managers and computer and information systems managers earn the highest annual wages, on average, with each exceeding $130,000 per year.

Most of the other tech occupations earn between $75,000 and $100,000 per year. Computer network architects, electronics engineers and software developers all make more than $90,000 a year, on average, while information security analysts, electrical engineers, database administrators and computer programmers make more than $85,000.

Figure 16: Top 20 Largest Tech Occupations by Wage, 2019

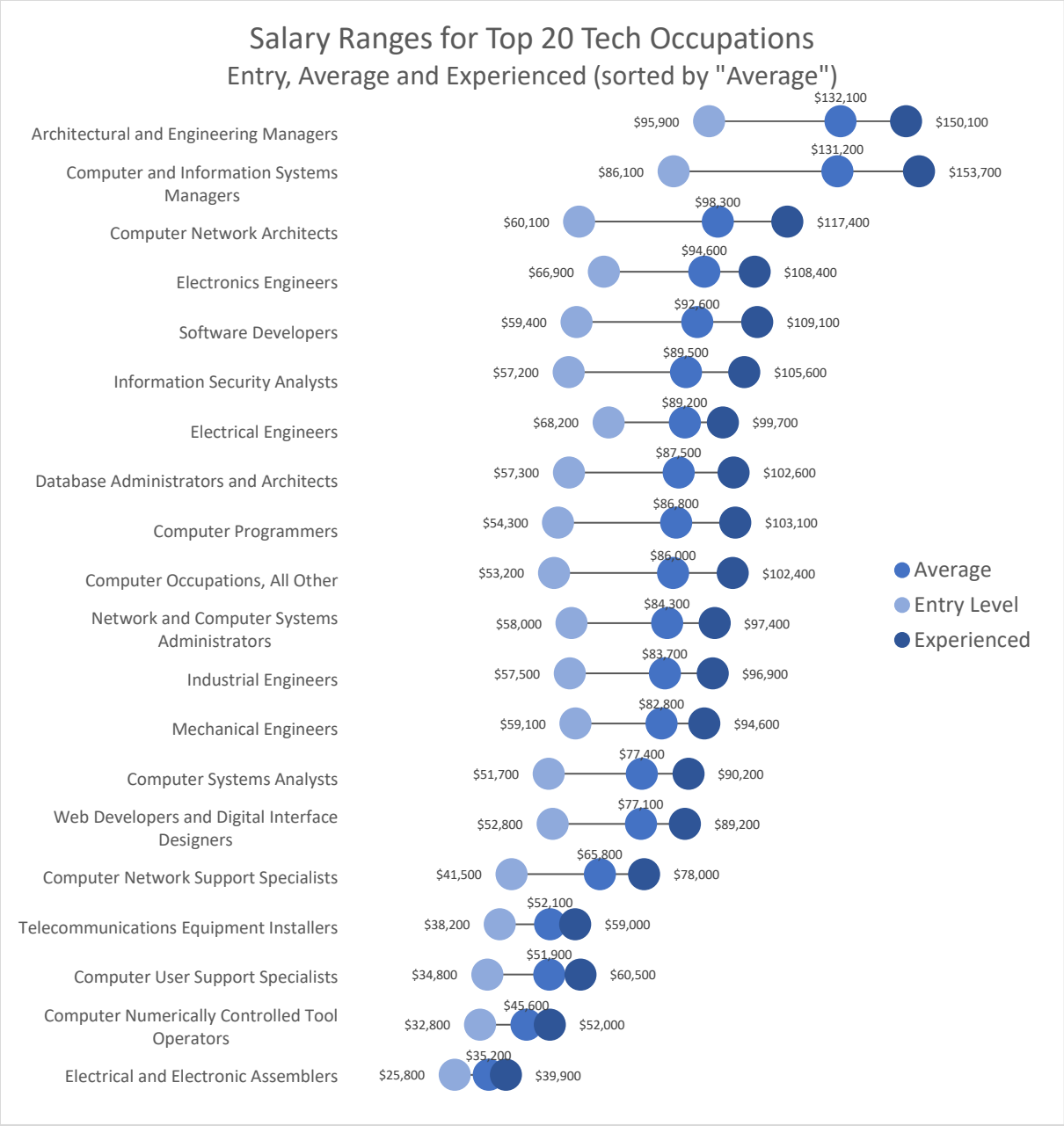


Source: JobsEQ; first quarter 2020

Among the five occupations earning less than $75,000 a year, three of them still earn more than the regional average – computer network support specialists, telecommunications equipment installers and computer user support specialists. Only computer numerically controlled tool operators and electrical and electronic assemblers have average annual earnings that are lower than the regional average.

Once experience is gained, only electrical and electronic assemblers continue to earn less than the regional average. (Figure 17) In general, entry level workers in tech occupations receive two-thirds to three-quarters of the average wage, while experienced workers receive 10 to 20% more.

Figure 17: Salary Ranges for 20 Largest Tech Occupations, 2019

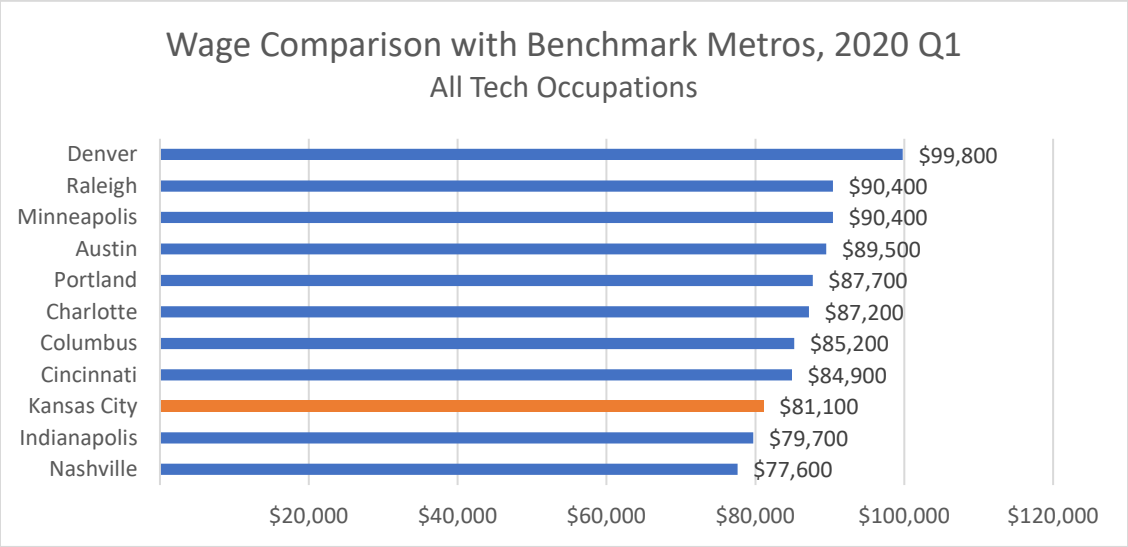


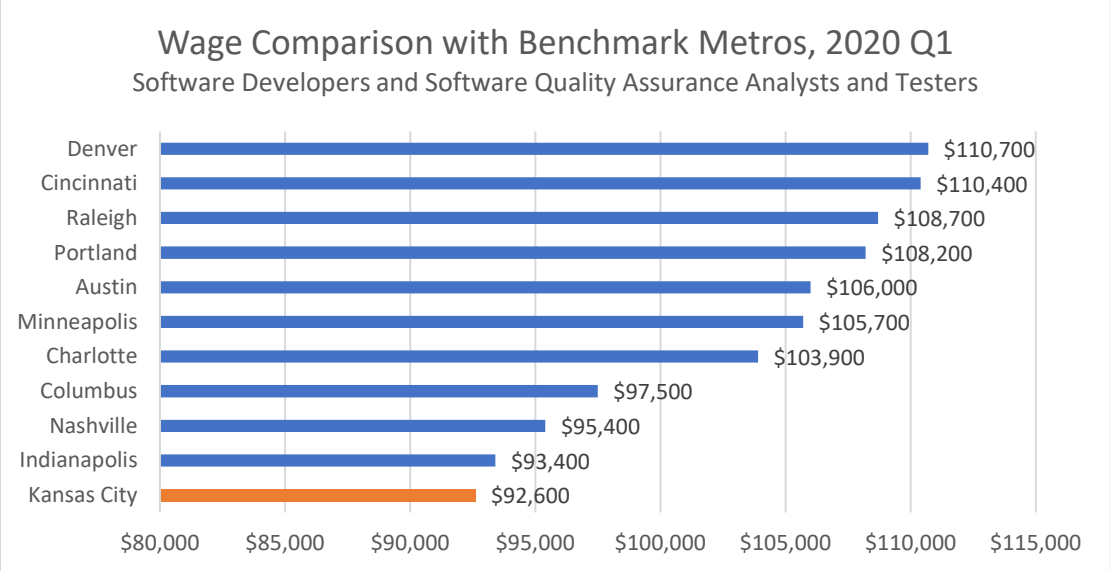
Source: JobsEQ

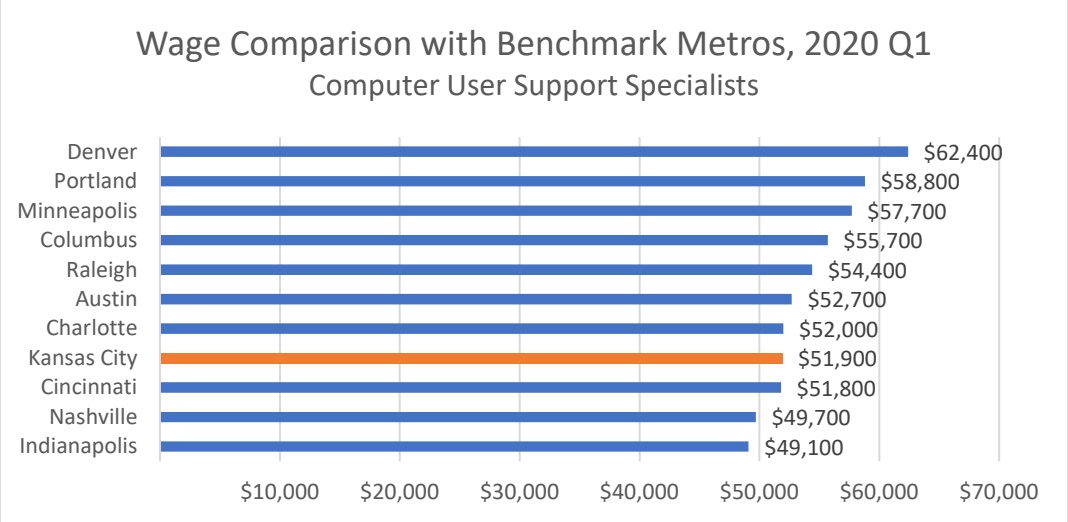
Comparison of wages to benchmark metros

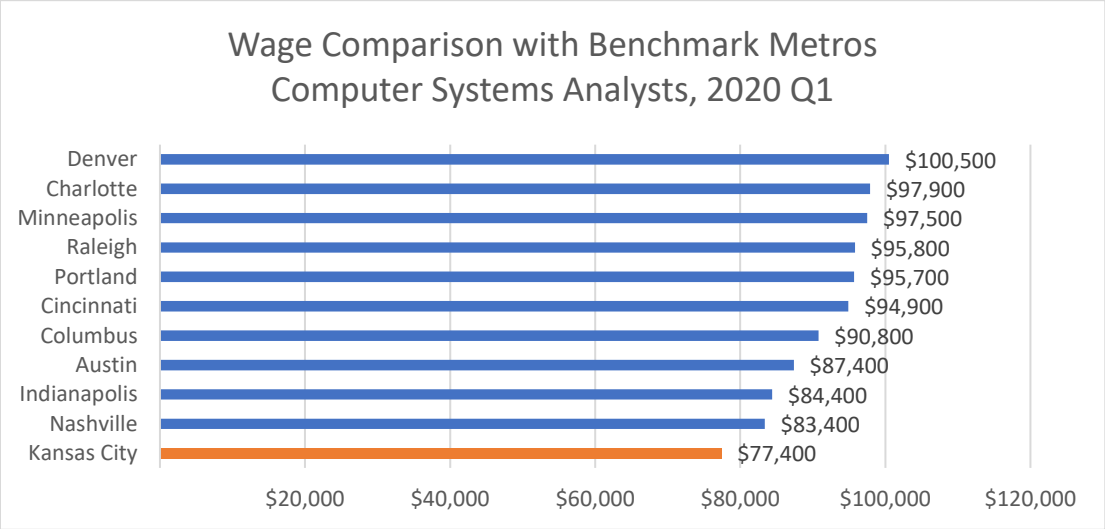
Wages for tech occupations in Greater Kansas City rank in the bottom third of the region's benchmark wages. (Figures 18) While this may be attractive for employers as they seek to manage costs, low wage can also inhibit a region's ability to attract and retain high-end talent, a category that most tech workers fall into. This seems especially true for software developers, and it is there where KC's wages rank last among the metros used to benchmark its progress. It also ranks last in the wages it pays computer systems analysts and second from the last in the wages for computer and information systems managers. The region's pay is most competitive for the lower-skilled job of computer user support specialists, where it ranks 8th among the 11 comparison metros.

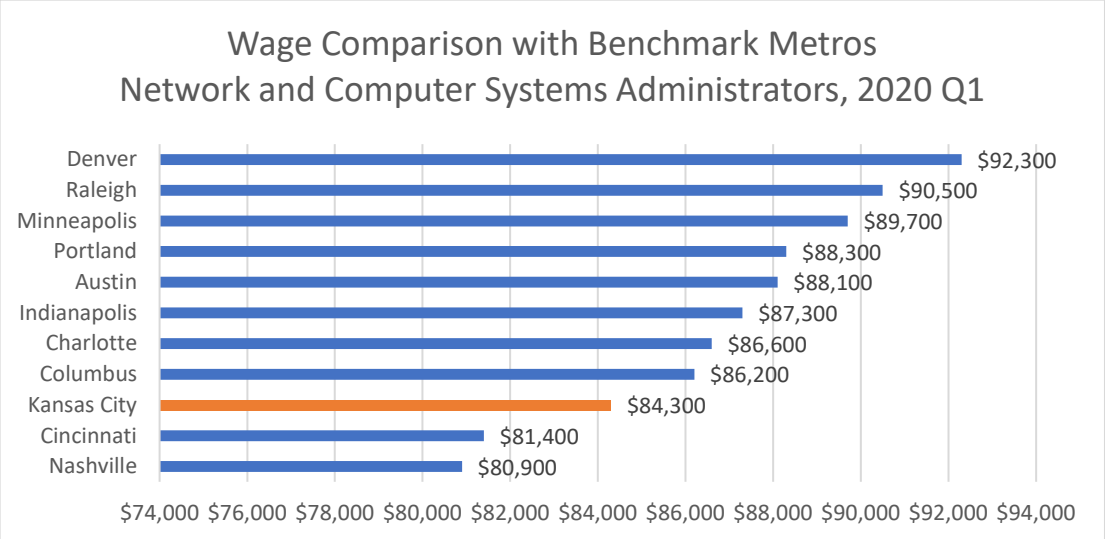
Figures 18: Wage Comparison with Benchmark Metros, Total and Five Largest Tech Occupations, 2020 Q1

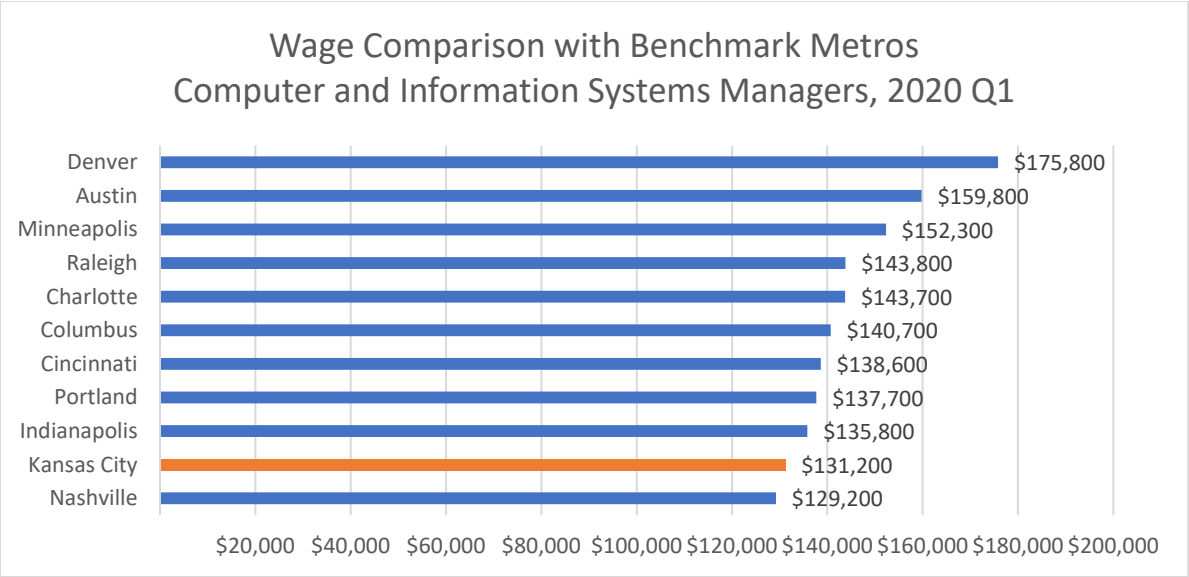





Wage Comparison with Benchmark Metros, 2020 Q1
Computer User Support Specialists
Denver $62,400
Portland $58,800
Minneapolis $57,700
Columbus $55,700
Raleigh $54,400
Austin $52,700
Charlotte $52,000
Kansas City $51,900
Cincinnati $51,800
Nashville $49,700
Indianapolis $49,100
$10,000 $20,000 $30,000 $40,000 $50,000 $60,000 $70,000


Wage Comparison with Benchmark Metros
Computer Systems Analysts, 2020 Q1
Denver $100,500
Charlotte $97,900
Minneapolis $97,500
Raleigh $95,800
Portland $95,700
Cincinnati $94,900
Columbus $90,800
Austin $87,400
Indianapolis $84,400
Nashville $83,400
Kansas City $77,400
$20,000 $40,000 $60,000 $80,000 $100,000 $120,000


Wage Comparison with Benchmark Metros
Network and Computer Systems Administrators, 2020 Q1
Denver $92,300
Raleigh $90,500
Minneapolis $89,700
Portland $88,300
Austin $88,100
Indianapolis $87,300
Charlotte $86,600
Columbus $86,200
Kansas City $84,300
Cincinnati $81,400
Nashville $80,900
$74,000 $76,000 $78,000 $80,000 $82,000 $84,000 $86,000 $88,000 $90,000 $92,000 $94,000



Source: JobsEQ; first quarter 2020

The Kansas City region's relatively low ranking on the wages it pays its tech workers is somewhat surprising. While it is known for being a low-cost place to do business, it also prides itself in having a strong tech cluster. Generally, firms in a cluster compete with each other, both in terms of sales of products and services and in terms of talent. In a strong cluster, this competition spurs innovation that allows the cluster overall to specialize further, expand its market share and so its exports to the rest of the world.

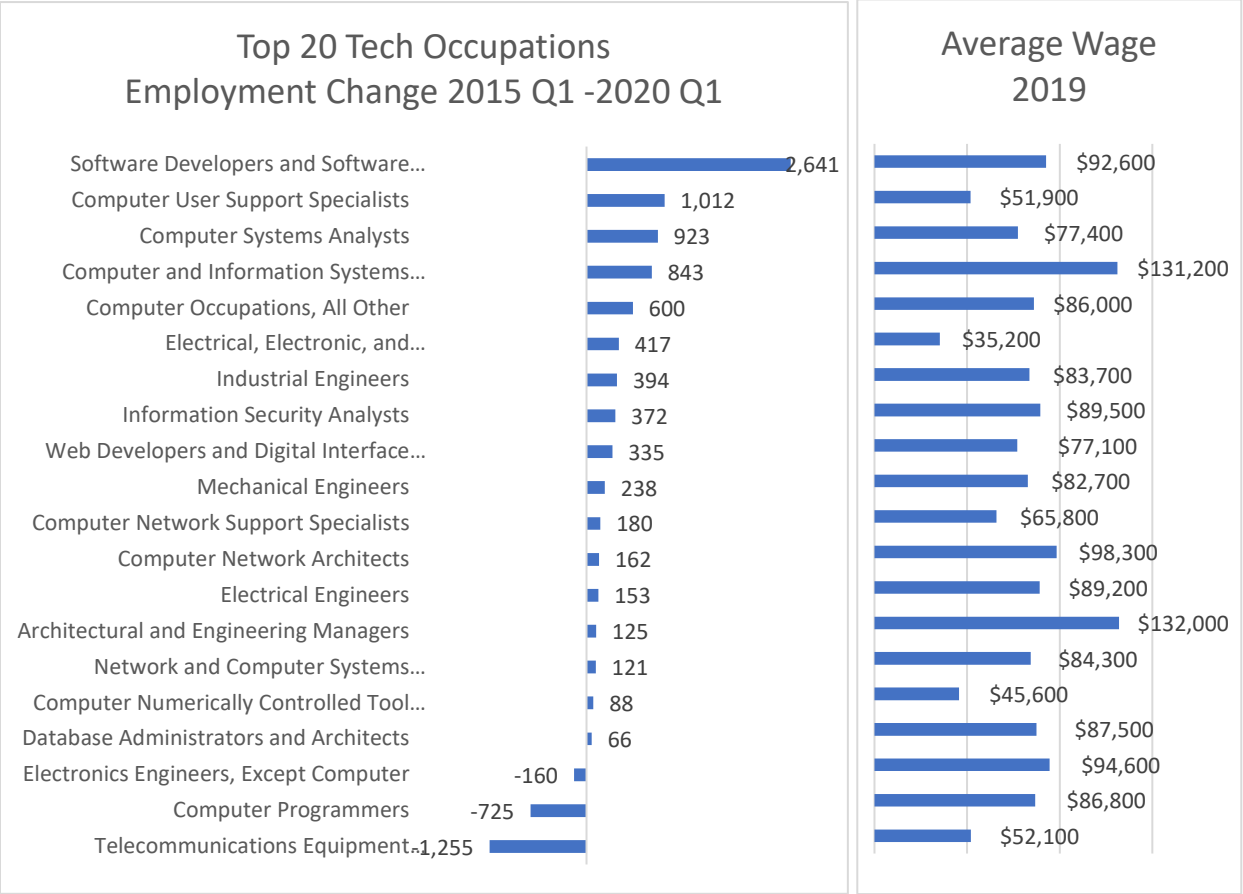
That tech wages remain relatively low in Greater Kansas City despite having a tech specialization is something of a puzzle. This may indicate that its firms are not really competing with each other for the same talent. This would be consistent with the view that the tech sector in KC is dominated by a few firms that operate in different industries. The specialized skills required for success in one industry may not transfer to the others, limiting the mobility of workers from one firm to another.

Best opportunities for tech employment

Historical growth of tech occupations

Software developers have seen the strongest net growth over the last five years (2015 Q1 to 2020 Q1), increasing by more than 2,600 jobs over this period. (Figure 19) This is 2 ½ times faster than the next highest occupation, computer user support specialists. Computer systems analysts, computer and information systems managers and otherwise unclassified computer occupations "All other" round out the tech occupations that grew by more than 500 workers over this period. Most of the job growth is in well-paid tech positions, as only computer user support pays significantly less than the tech occupation average among the most rapidly growing occupations.

Figure 19: Net Growth of the 20 Largest Tech Occupations, 2015 Q1 – 2020 Q1, and Their Wages



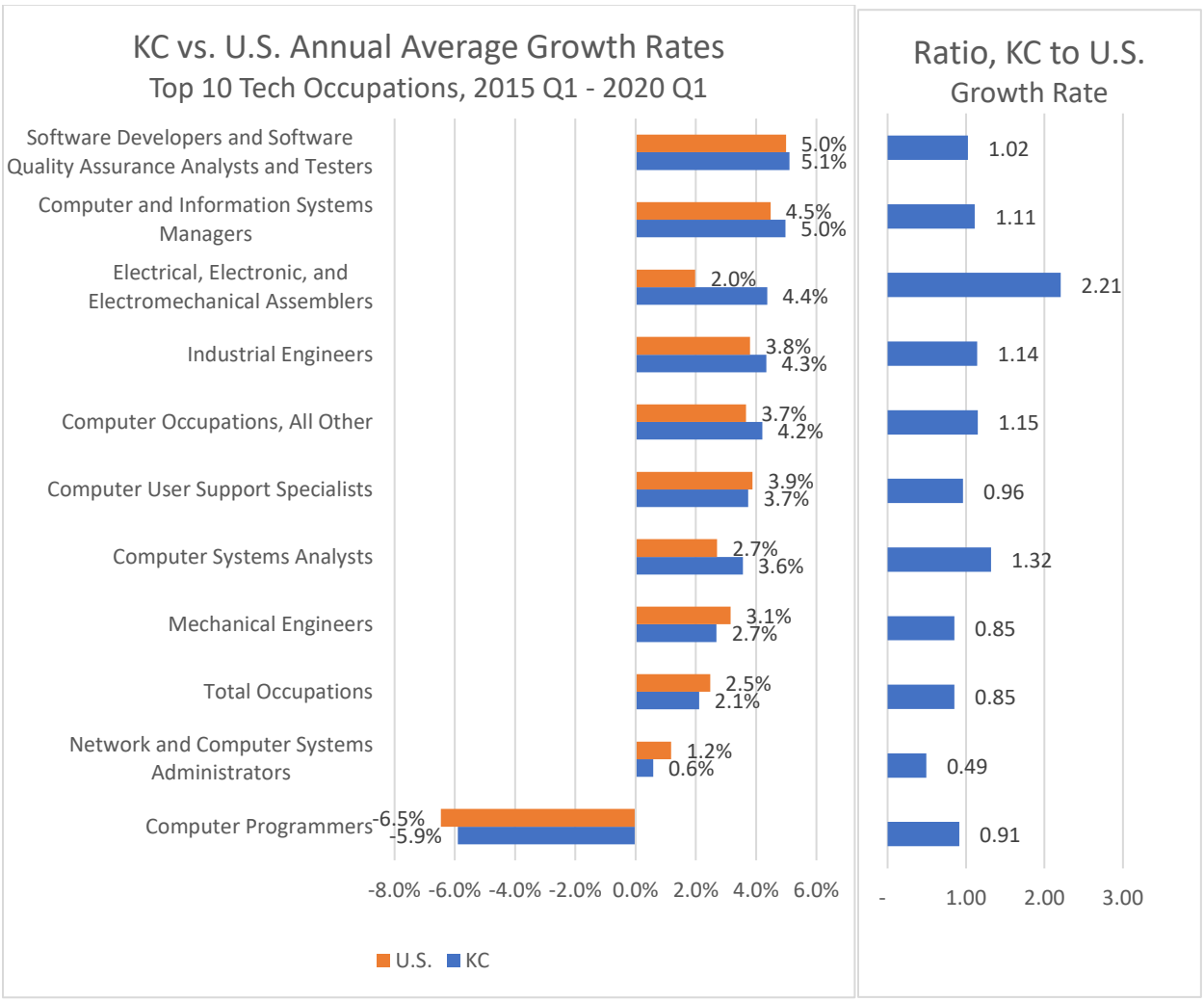
On the other hand, some tech occupations actually lost jobs over the preceding 5-year period. Telecommunications equipment installers declined by nearly 1,300 as Sprint continued losing market share and sold off some of their network operations. Computer programmers also saw a loss of employment, though this may represent more a re-classification of programmers from a more general category to something more specific, such as software or web developers.

Tech occupation growth relative to the U.S. and benchmark metros

The growth of tech occupations in Greater Kansas City pretty much mirrors that of the nation overall, with growth rates that are within 15% of the national average across most of the 10 largest tech

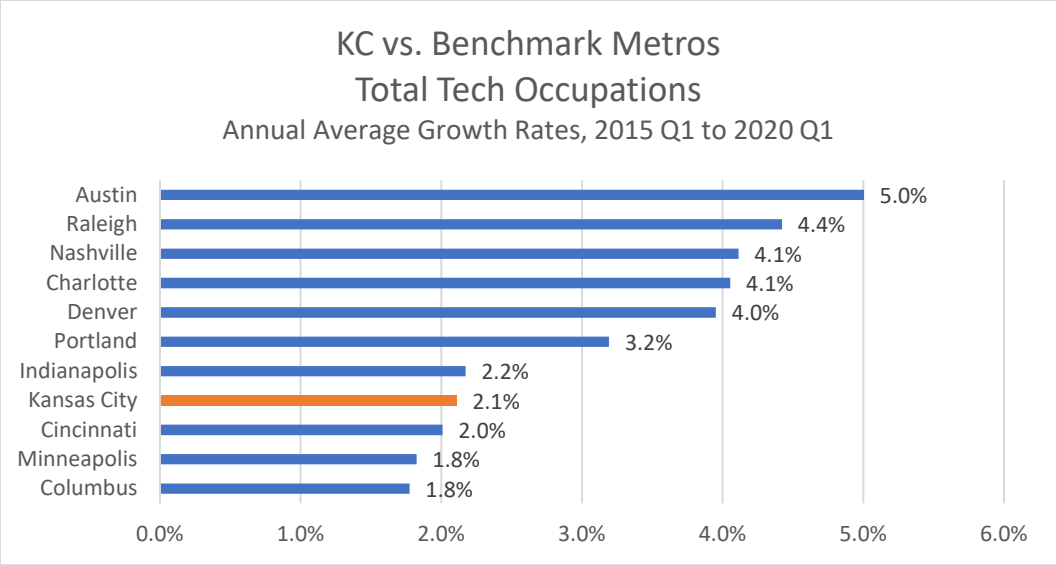
occupations. (Figure 20) The most notable exceptions are electronic assemblers, which grew twice as fast here as nationally, largely to the presence of Garmin, and network and computer systems administrators, which grew half as fast for reasons that aren't entirely clear. Additionally, computer systems analysts grew about a third faster in the Kansas City area than they did on average in the U.S.

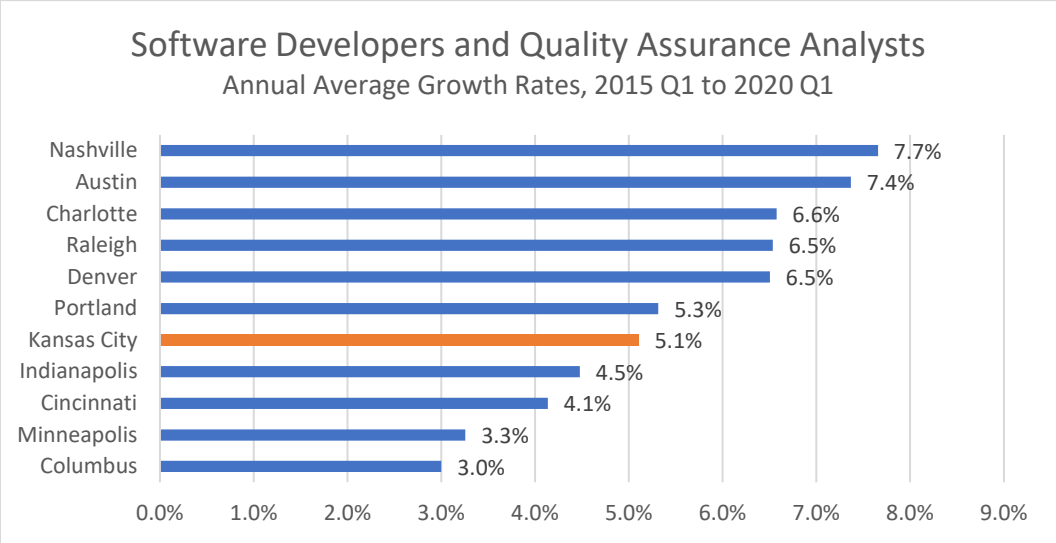
Figure 20: Average Annual Growth Rates of Top 10 Largest Tech Occupations Relative to the U.S.

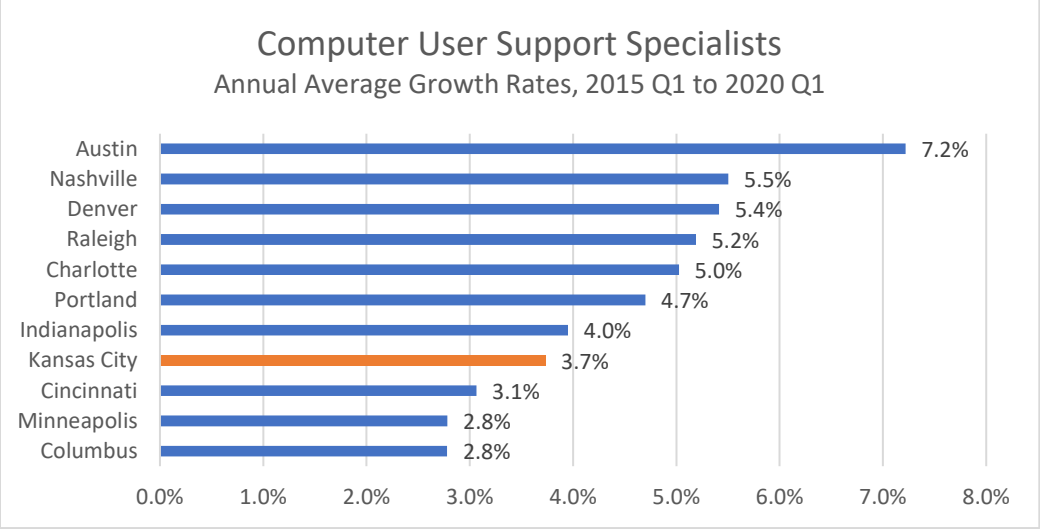


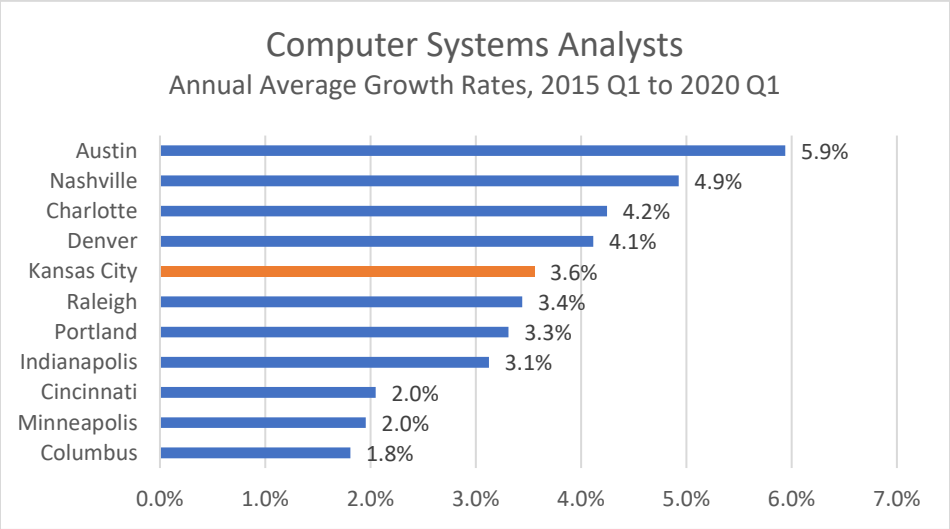
Growth that is around average for the nation, though, puts Kansas City in the lower half of its Benchmark metros. Overall, tech occupations in the region grew an average of 2.1% over the last five years ending in first-quarter 2020, which ranked eighth among the 11 comparison metros. Looking at the top five largest tech occupations, only one broke into the top half of the benchmark metros, computer systems analysts, ranked fifth. The region's growth in software developers and information systems managers ranked seventh, while its growth in computer user support specialists and network administrators also ranked eighth.

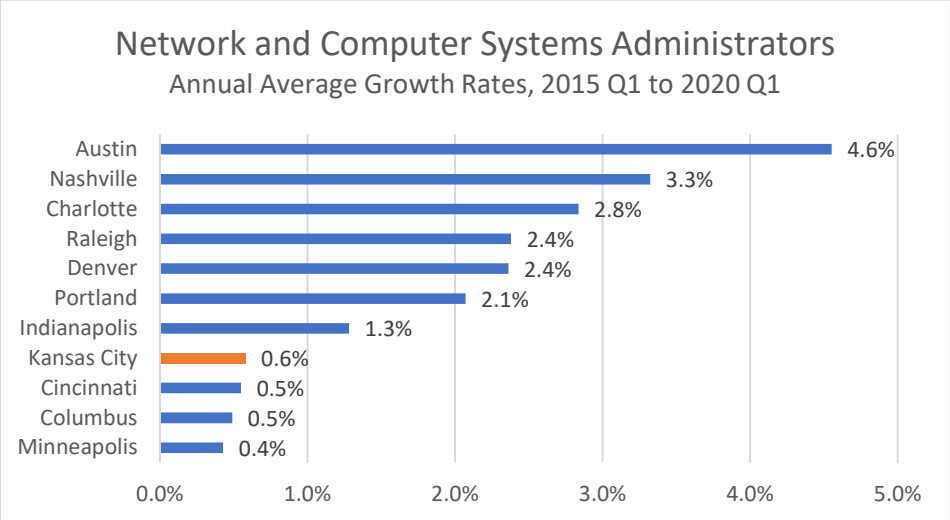
Figures 21: KC vs. Benchmark Metros, Annual Average Growth Rates, 2015 Q1 to 2020 Q1

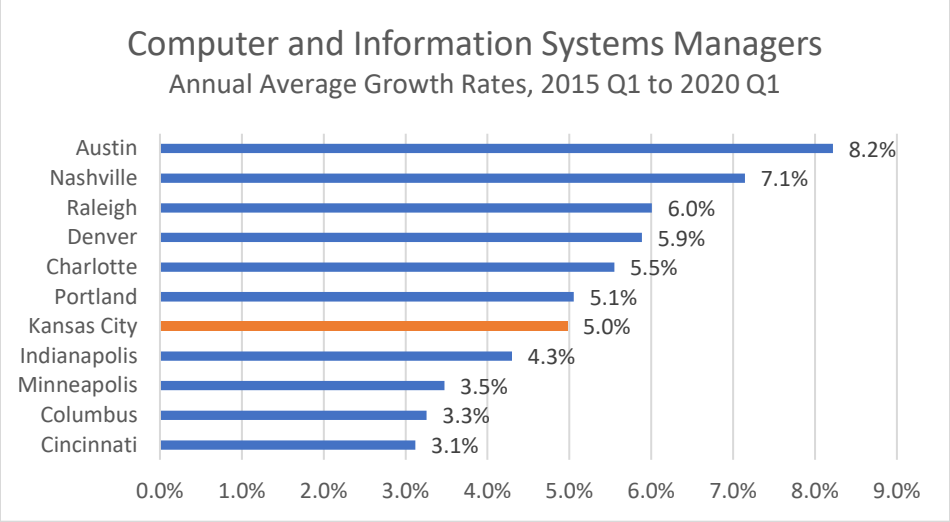





Computer User Support Specialists
Annual Average Growth Rates, 2015 Q1 to 2020 Q1
Austin 7.2%
Nashville 5.5%
Denver 5.4%
Raleigh 5.2%
Charlotte 5.0%
Portland 4.7%
Indianapolis 4.0%
Kansas City 3.7%
Cincinnati 3.1%
Minneapolis 2.8%
Columbus 2.8%
0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0% 8.0%


Computer Systems Analysts
Annual Average Growth Rates, 2015 Q1 to 2020 Q1
Austin 5.9%
Nashville 4.9%
Charlotte 4.2%
Denver 4.1%
Kansas City 3.6%
Raleigh 3.4%
Portland 3.3%
Indianapolis 3.1%
Cincinnati 2.0%
Minneapolis 2.0%
Columbus 1.8%
0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0%


Network and Computer Systems Administrators
Annual Average Growth Rates, 2015 Q1 to 2020 Q1
Austin 4.6%
Nashville 3.3%
Charlotte 2.8%
Raleigh 2.4%
Denver 2.4%
Portland 2.1%
Indianapolis 1.3%
Kansas City 0.6%
Cincinnati 0.5%
Columbus 0.5%
Minneapolis 0.4%
0.0% 1.0% 2.0% 3.0% 4.0% 5.0%



Source: Jobs EQ

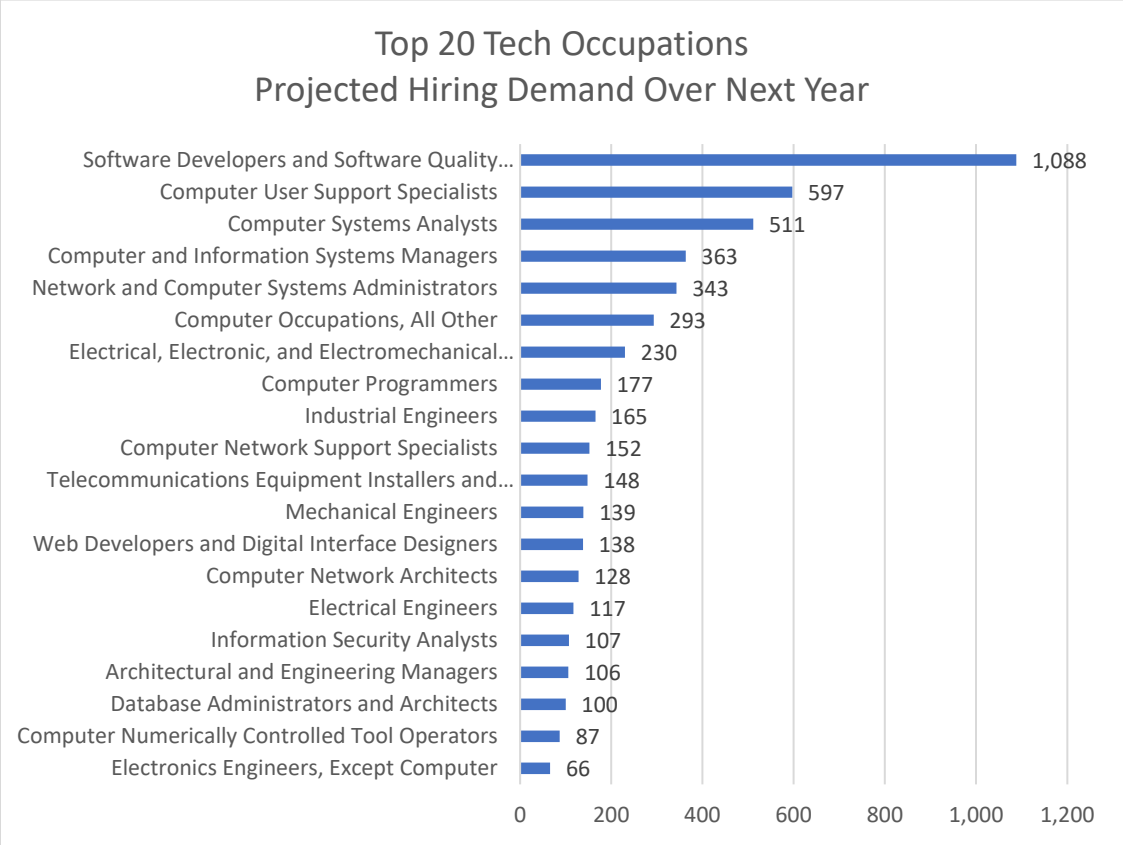
For a metropolitan tech sector to produce the level of exports needed for its sales to further accelerate tech growth likely requires a high level of tech concentration. Yet, despite having the lowest concentration of tech employment, Nashville had the fastest growth in software developers over the last five years and ranked third in overall tech occupation growth. This indicates that Nashville's tech growth is in support of growth from other industries, such as entertainment and healthcare, rather than being responsible for that growth.

Conversely, for the tech leaders — Austin, Raleigh and Denver — it is likely that their tech concentrations generate enough exports to create self-reinforcing cycles that spur broader metropolitan growth. For Kansas City, with its middle-of-the-road specialization, the tech sector plays a smaller role, though still significant.

Demand for new tech hires

Growth is a small component of the demand for new hires, even in such rapidly growing jobs as tech occupations. New hires are also needed when existing workers retire, transition to a new career or leave the labor force entirely. In the next year, approximately 1,100 software developers will need to be hired based on projections that combine net growth with such workforce turnover. (Figure 22)

Figure 22: Hiring demand for the Top 20 Tech Occupations



Source: JobsEQ; first quarter 2020

Nearly twice as many developers will need to be hired in the next year as the next highest occupation, computer user support specialists. Computer systems analysts, information systems managers, network administrators round out the tech occupations needing at least 300 new workers in the next year

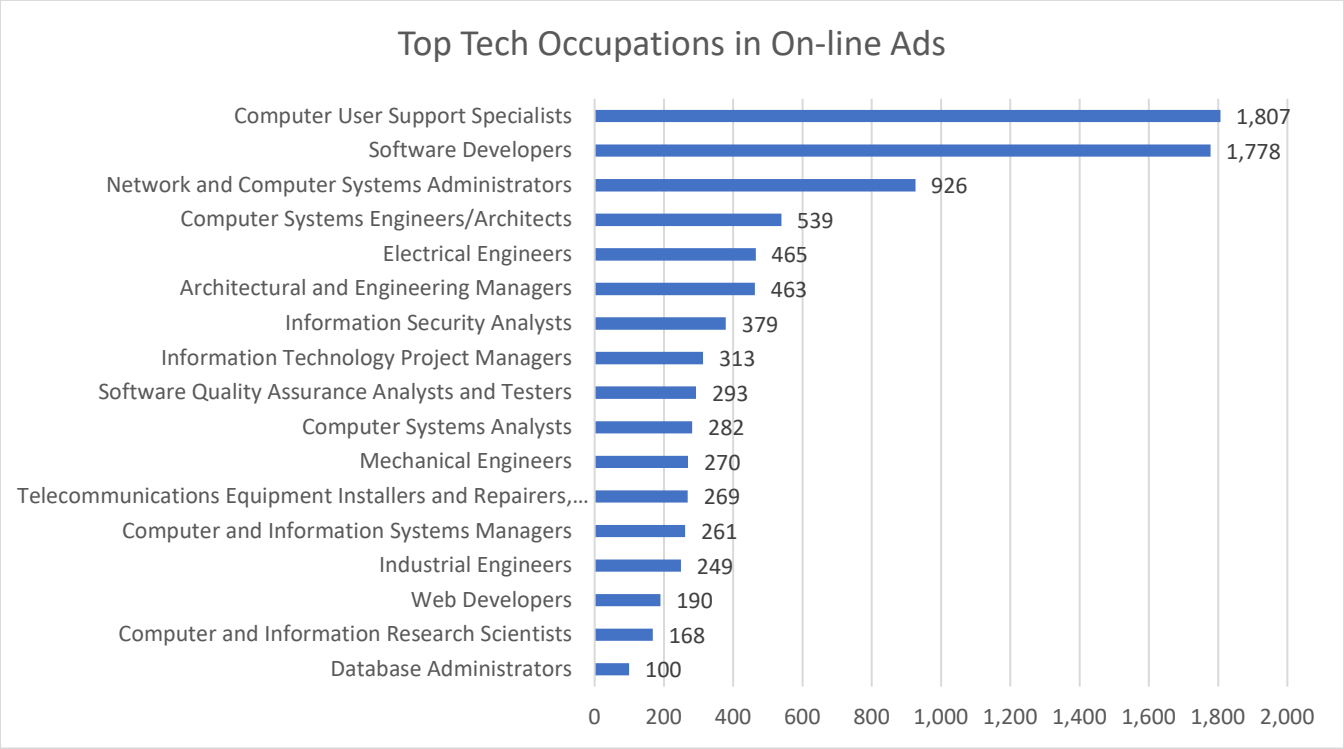
In addition to the projections of hiring demand, the kinds of workers employers are seeking can also be estimated by looking at on-line job postings.

Currently (or more accurately, from mid-July to mid-October 2020), there are actually slightly more postings for computer user support specialists than software developers (Figure 23), perhaps because postings also reflect the level of effort firms feel is needed to find enough applicants to successfully fill a position. These are followed by network administrators, computer systems engineers, electrical engineers, architectural and engineering managers and information security analysts.

This last occupation is the one most directly related to the burgeoning field of cybersecurity. Unfortunately, there is not yet a direct translation of cybersecurity into standard occupation

classifications. Aspects of several occupations, including network administration and computer systems engineering, also involve cybersecurity activities.

Figure 23: Largest Online Job Postings for Tech Occupations — Occupations With at Least 100 Postings in the last 90 days

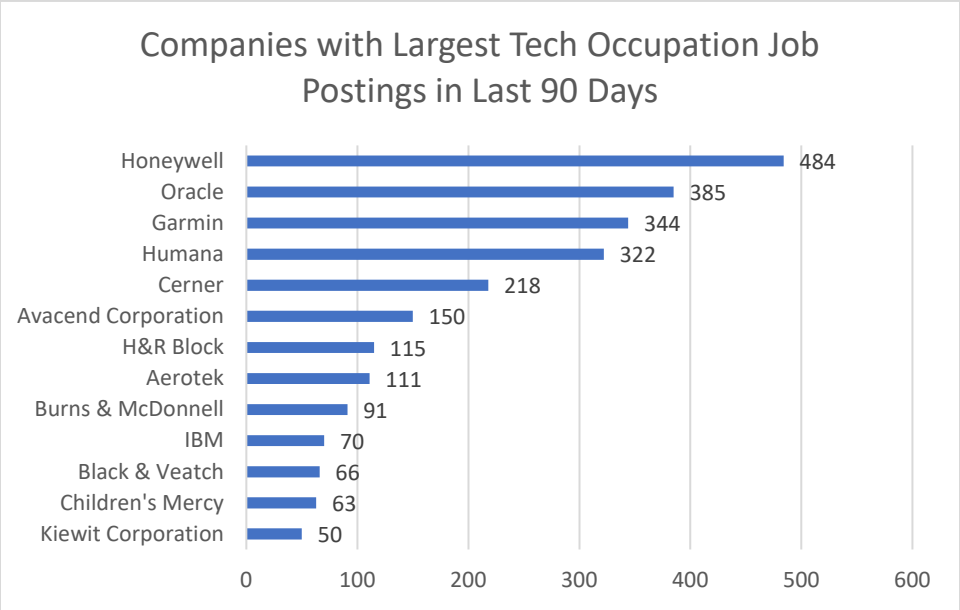


Source: JobsEQ; first quarter 2020

What are employers looking for in workers?

Some of the companies that are doing the most hiring of tech workers in Greater Kansas City are listed in Figure 24. They represent firms from many industries, including manufacturing, software, health care and health IT, engineering, construction and consulting.

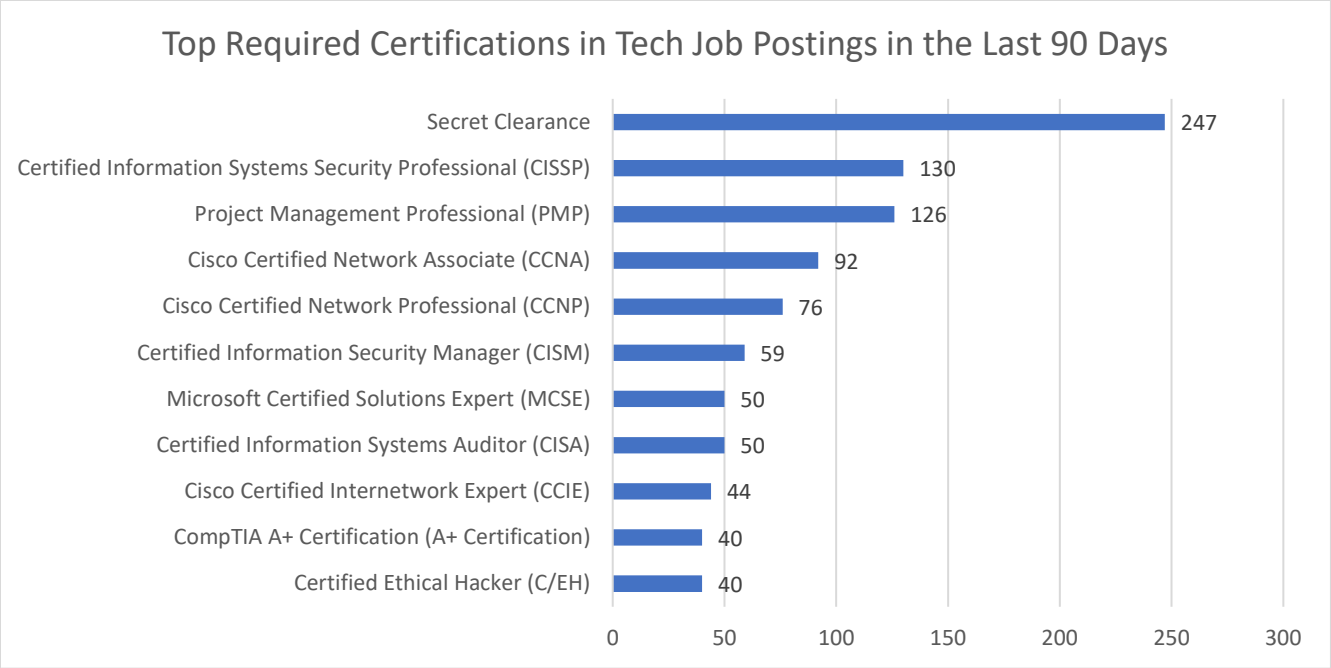
Figure 24: Companies with the Largest Number of Tech Job Postings in the Last 90 Days



Source: JobsEQ. Exported on Oct. 13, 2020.

Specific tech certifications most often required are listed in Figure 25. In addition to general IT certifications, several are specifically related to cybersecurity. Networking and project management certifications are also often required.

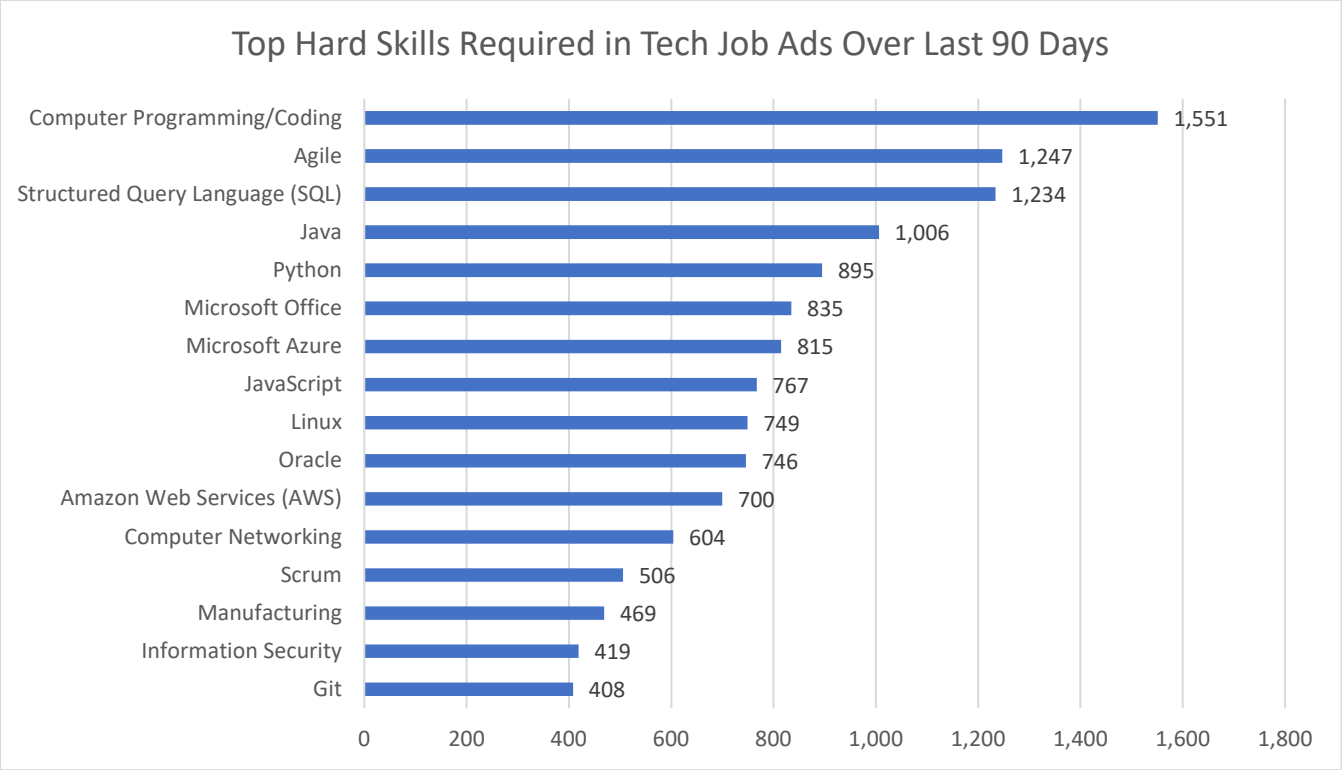
Figure 25: Top Required Certifications in Tech Job Postings



Source: JobsEQ. Exported on Oct. 13, 2020.

The most commonly required hard skills in job ads for tech occupations are listed in Figure 26. The most common are related to coding using particular programming languages or methodologies, as would be expected from the demand for software developers. Also common is familiarity more software that is in more general use, such as Microsoft Office, as would be expected from the demand for computer user support specialists. There is a demand for expertise in cloud computing, as shown by the inclusion of Microsoft Azure and Amazon Web Services in the list. Information security and computer networking skills likely reflect the demand for cybersecurity expertise. Employers in non-IT industries, such as manufacturing, are looking for people with subject area knowledge in addition to IT knowledge.

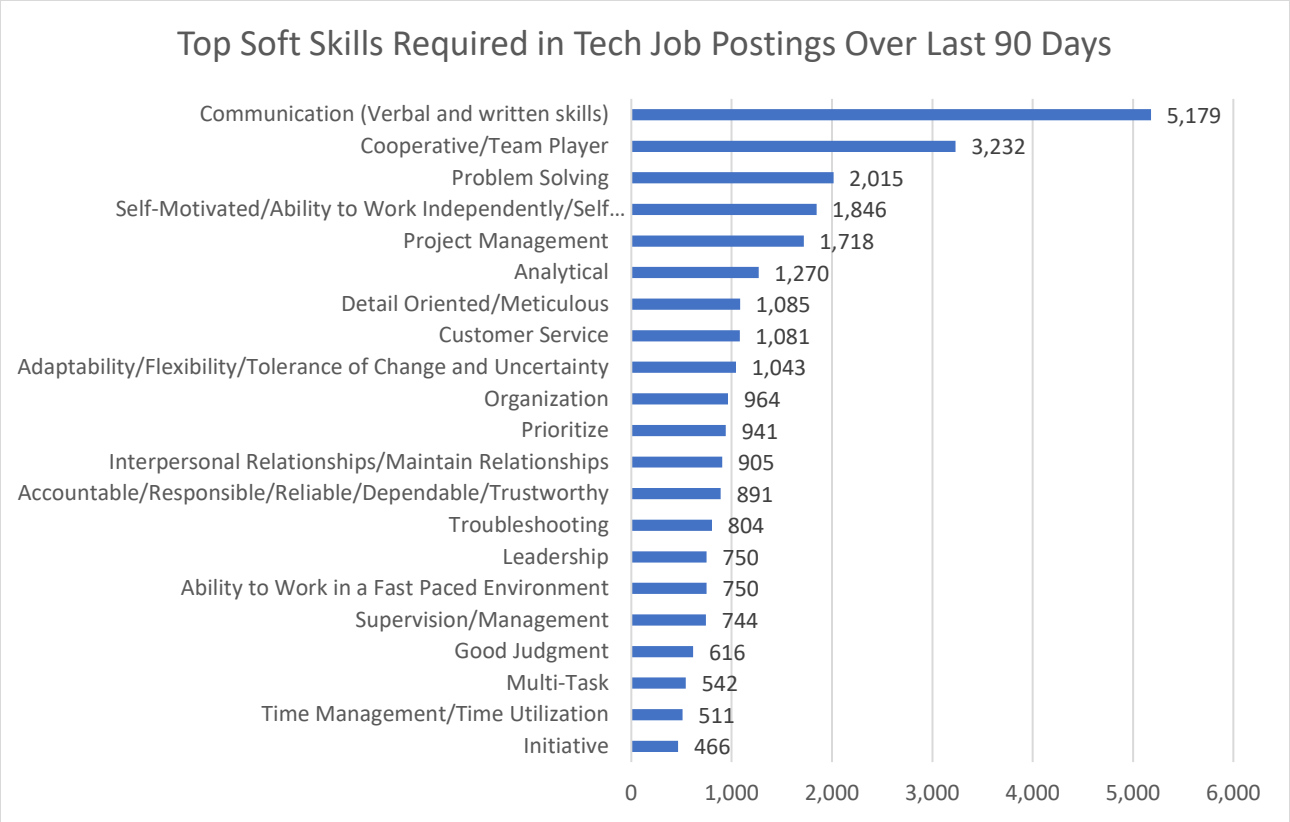
Figure 26: Top Hard Skills Required in Tech Job Ads Over Last 90 Days



Source: JobsEQ. Exported on October 13, 2020.

Figure 27 lists the most often required soft skills, and the most important thing to notice is probably how many more ads list these soft skills than any particular set of hard skills. In particular, of the nearly 6,000 total ads for tech occupations, more than 5,000 of them specifically mentioned the need for communication skills, over half required being a team player, and roughly a third required problem-solving skills, being self-motivated, and project management skills.

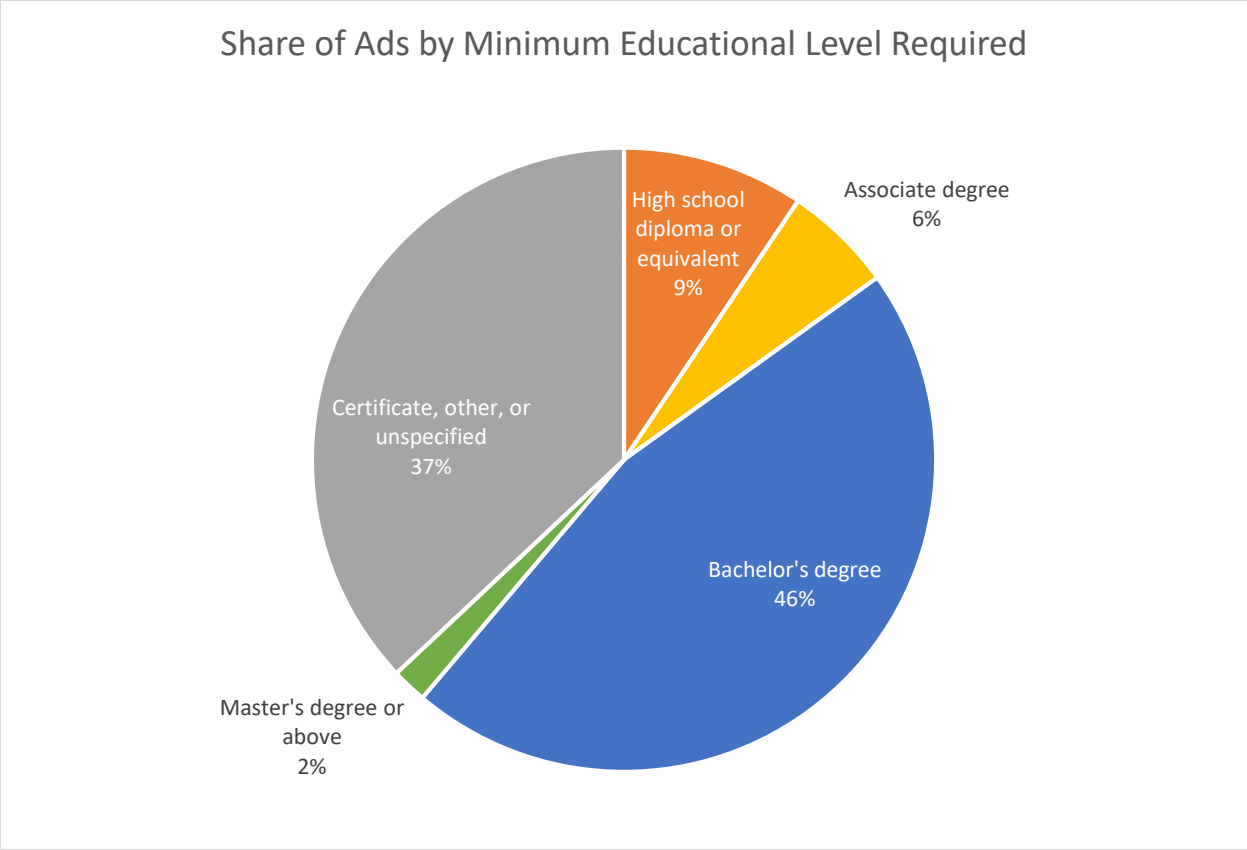
Figure 27: Top Soft Skills Required in Tech Job Postings Over Last 90 Days



Source: JobsEQ. Exported on Oct. 13, 2020.

Just under half of the ads for tech occupations required a bachelor's degree or above while just over half did not. (Figure 28) Only 6% required an associate degree and 9% required a high school degree. The rest of the ads — 37% — required either some other credential like a certificate or the education required was left unspecified. In any case, it is unlikely such jobs required a bachelor's degree or it would have been explicitly specified in the ad.

Figure 28: Share of Ads by Minimum Educational Level Required

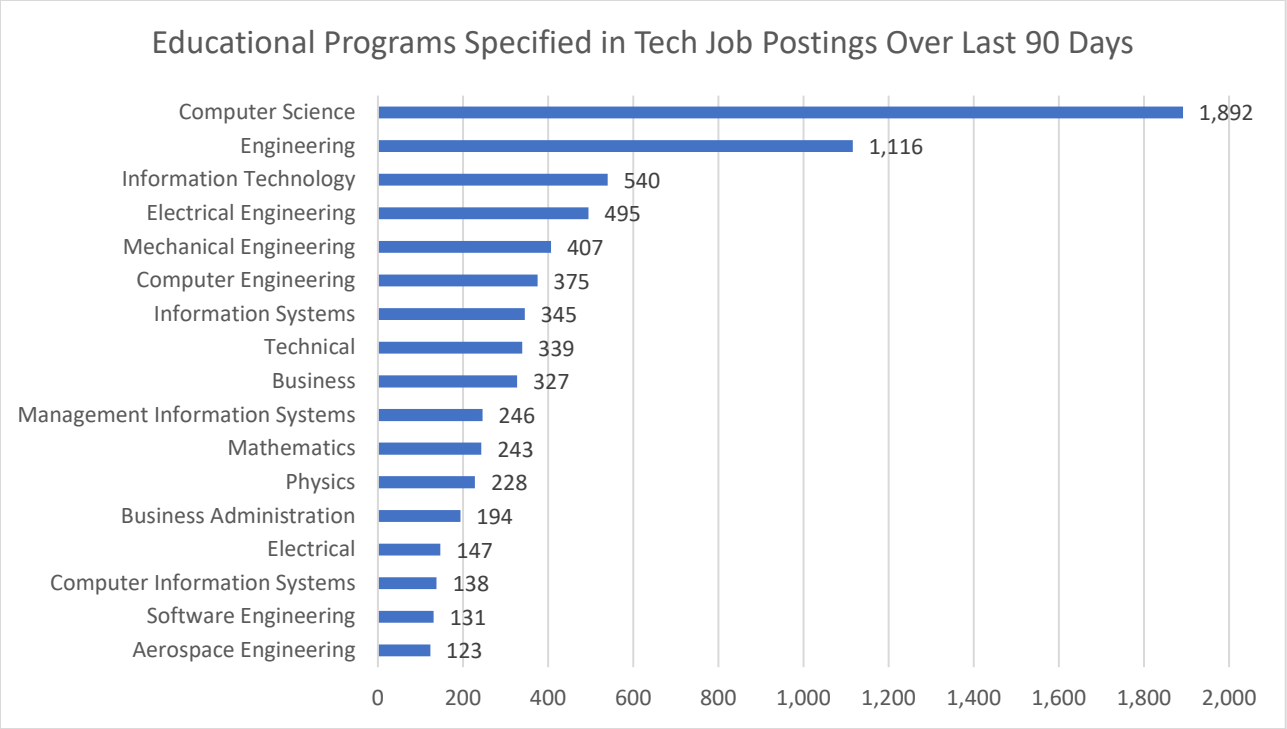


Source: JobsEQ. Exported on October 13, 2020.

In the two-thirds of postings that do indicate a type of degree required, a desire for candidates with degrees from computer science programs was specified in about 1,900 online job ads in the past 90 days, far surpassing the 1,100 ads that desired graduates from general engineering programs. (Figure 29) But if we also include the ads that mentioned particular subdisciplines of both computer and engineering occupations, then the number of ads specifying graduation from computer/IT and engineering programs becomes more equal, 2,900 and 2,650, respectively.

Performing similar aggregations, we find that graduation from a business-related degree program is required in about 500 jobs ads. Assuming an electrical program is one type of technical program, graduation or completion from a technical program is also required in about 500 job postings.

Figure 29: Educational Programs Specified in Tech Job Postings Over Last 90 Days



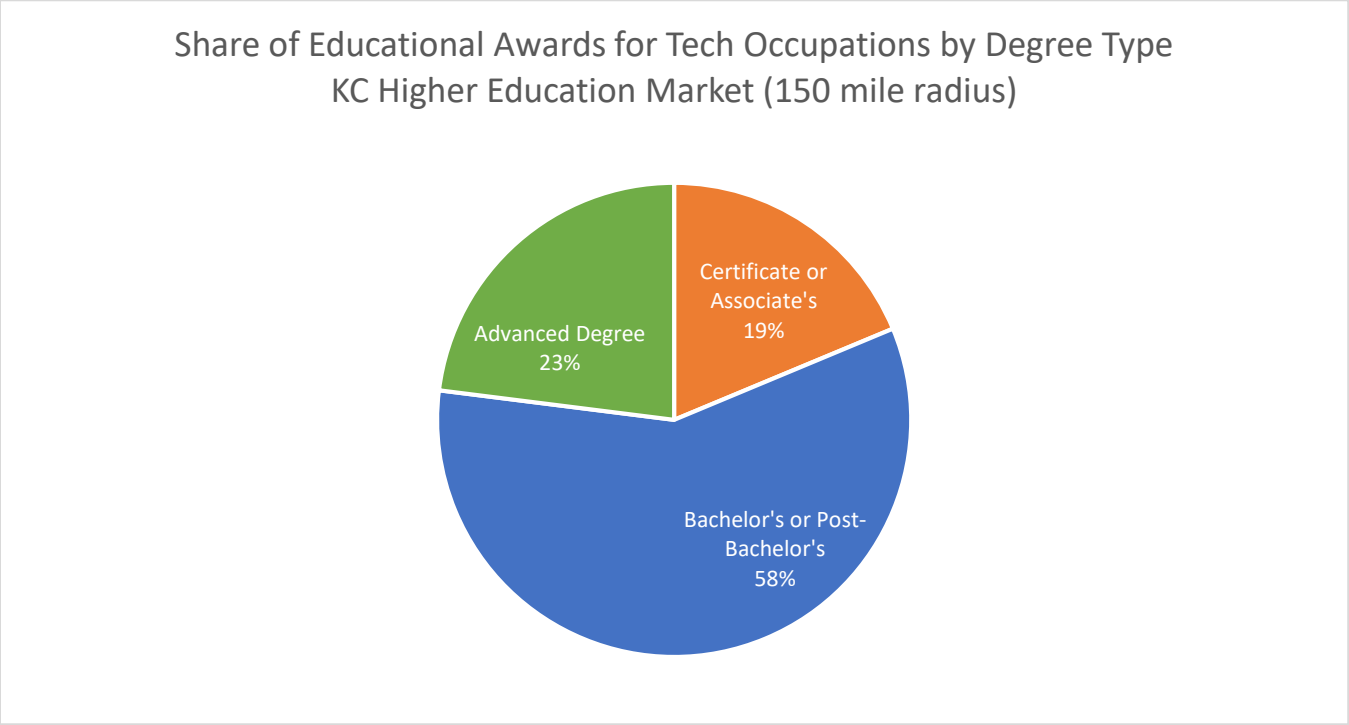
Labor supply and gaps

What kinds of education do area institutions provide?

More than 80% of the awards granted by the higher educational institutions serve the Kansas City area. The higher educational institutions serving the Kansas City area include schools within a 150-mile radius that stretches from Kansas State in Manhattan, Kansas, on the west side to the University of Missouri flagship campus in Columbia, Missouri, on the east. When examining the awards related to tech occupations that were granted by these institutions for the 2018-19 academic year (the latest for which data is available), more than 80% were for a bachelor's degree or higher. (Figure 30)

This contrasts sharply with the distribution of degrees that area job postings say are required, where a bachelor's degree or higher is required by fewer than 50% of ads. The reasons for this misalignment are not clear. It may be that the local demand for tech talent with at least a four-year degree is still high enough to justify this distribution of educational output. It may also be that a significant portion of students at area institutions are earning tech-oriented degrees that they then choose to employ in metropolitan areas outside Kansas City. But it could also mean that there is not the kind of close coordination between employers and educators that would produce a tech workforce with the skills aligned with needs. In particular, the business need for tech talent engaged in continuous learning of stackable skills may not be being met.

Figure 30: Share of Educational Awards Suitable for Tech Occupations by Degree Type, KC Higher Education Market (150-mile radius)



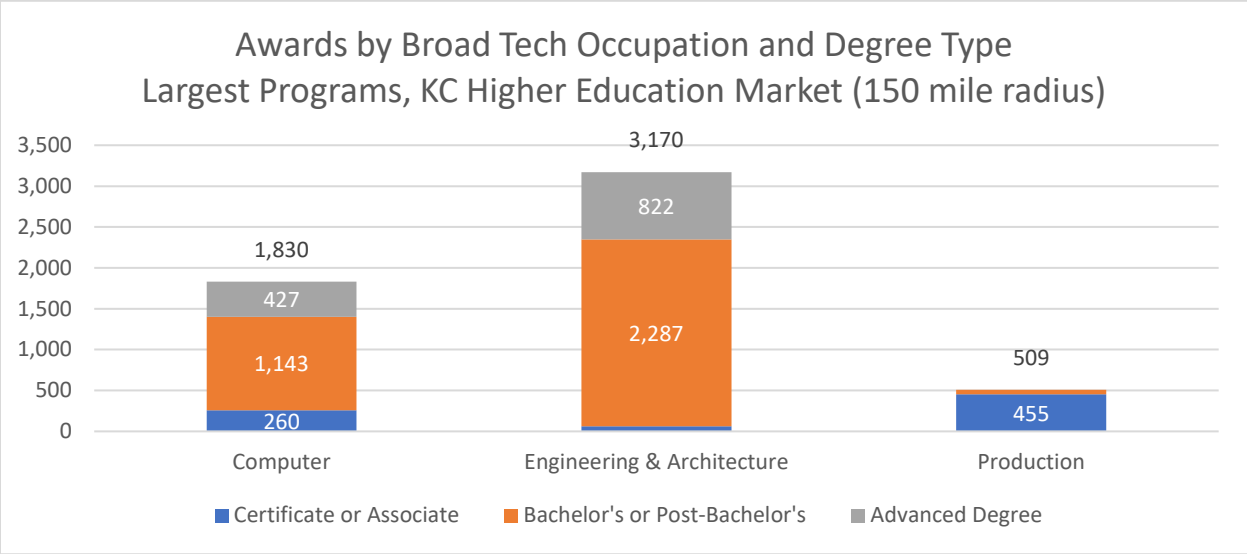
Source: JobsEQ. 2018-19 academic year.

When broken down by broad tech occupation, it become clear that only for production occupations are awards for less than a bachelor's degree typically earned. (Figure 31) For the largest programs, defined here as those with at least 65 awards per year, associate degrees or certificates account for nearly 90%

of the total awards for programs related to production occupations, but only 15% of programs related to computer occupations and 2% of those related to engineering occupations.

There also seems to be an imbalance in the generalized fields of study between the job postings and the awards. Job postings for tech occupations sought workers who had completed computer programs and those who had completed engineering programs in roughly equal numbers. Computer occupations also account for roughly two-thirds of the area tech workforce. However, area schools are generally producing 1.7 times the number of engineering graduates as graduates in computer-related fields.

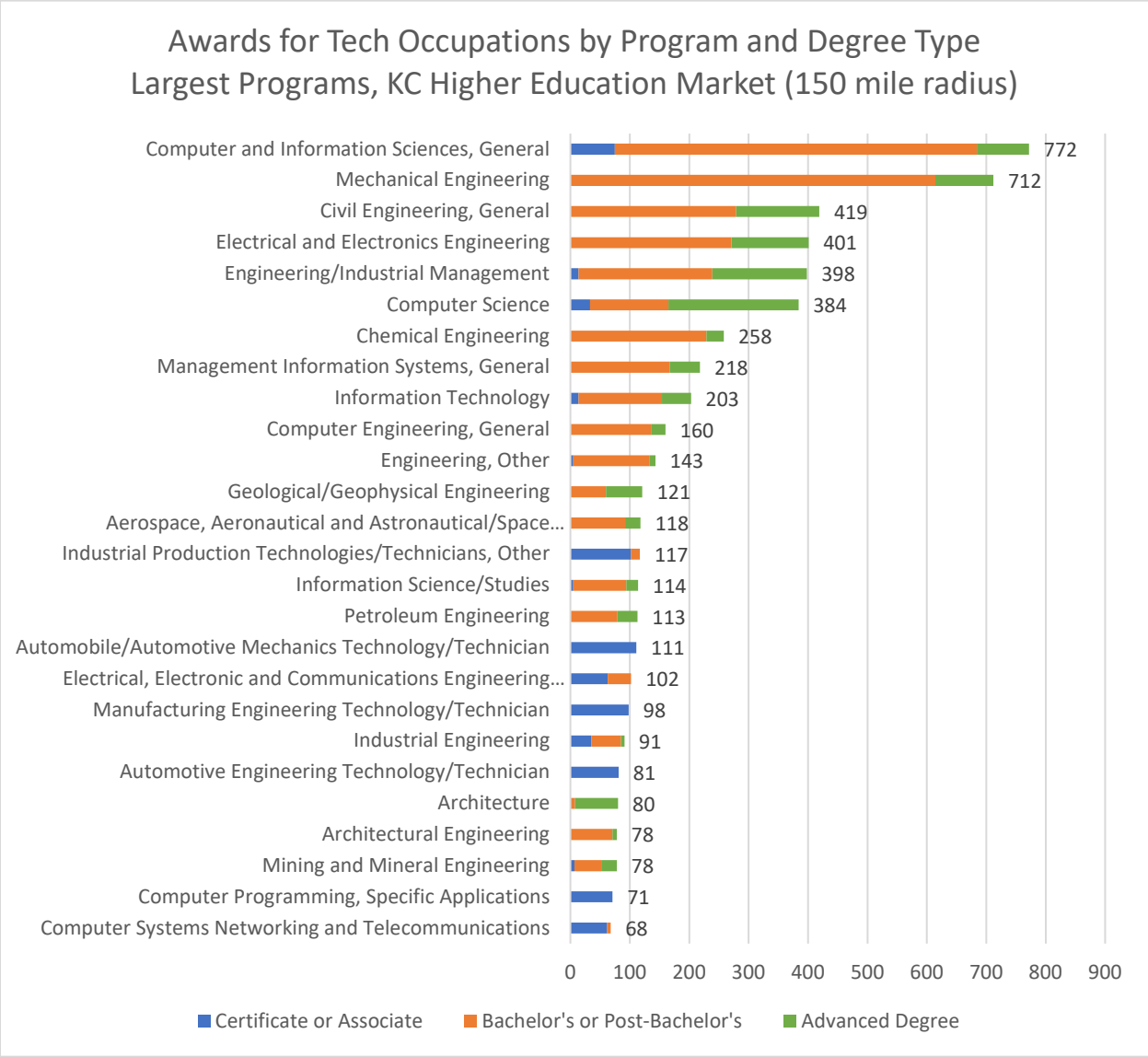
Figure 31: Awards by Broad Tech Occupation and Degree Type, KC Higher Education Market (150-mile radius) with at least 65 awards in the 2018-19 academic year



Source: JobsEQ. 2018-19 academic year.

Among the computer occupations, degrees in computer science and information technology are most often awarded. (Figure 32) Mechanical engineering is the engineering discipline awarding the most degrees, followed by civil, electrical and engineering management. Automotive technicians, electrical and electronic technicians, and manufacturing technicians receive the highest number of production-oriented awards.

Figure 32: Awards by Detailed Tech Occupation and Degree Type, KC Higher Education Market (150-mile radius) with at least 65 awards in the 2018-19 academic year

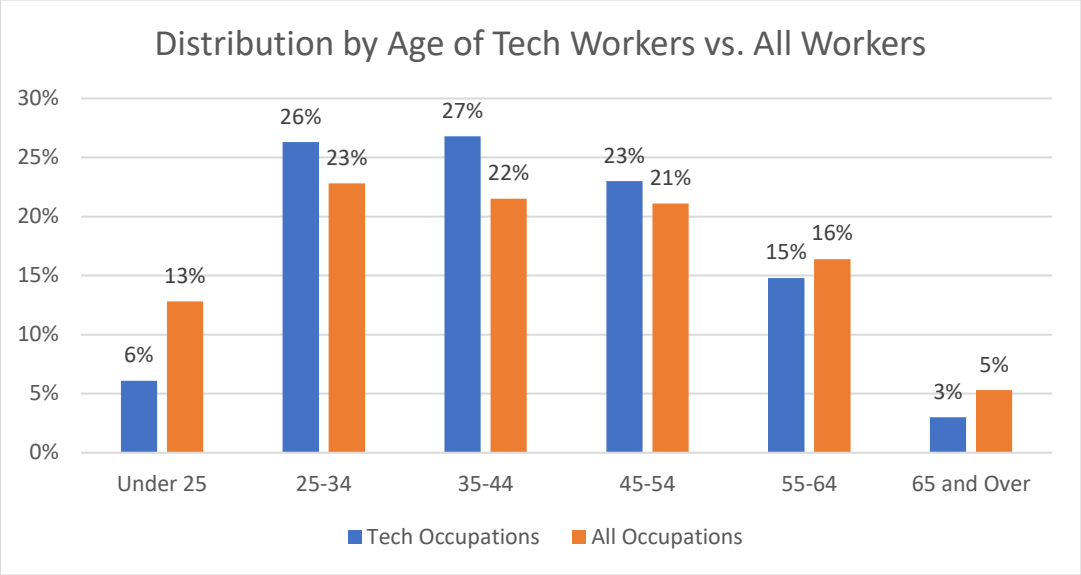


Source: JobsEQ. 2018-19 academic year.

Demographic characteristics of tech workforce

In general, tech workers are not broadly representative of the region's overall workforce. For example, in the prime workforce years of 25-64, tech workers skew significantly younger, with 53% between the ages of 25-44 compared to 45% for the general workforce. (Figure 33)

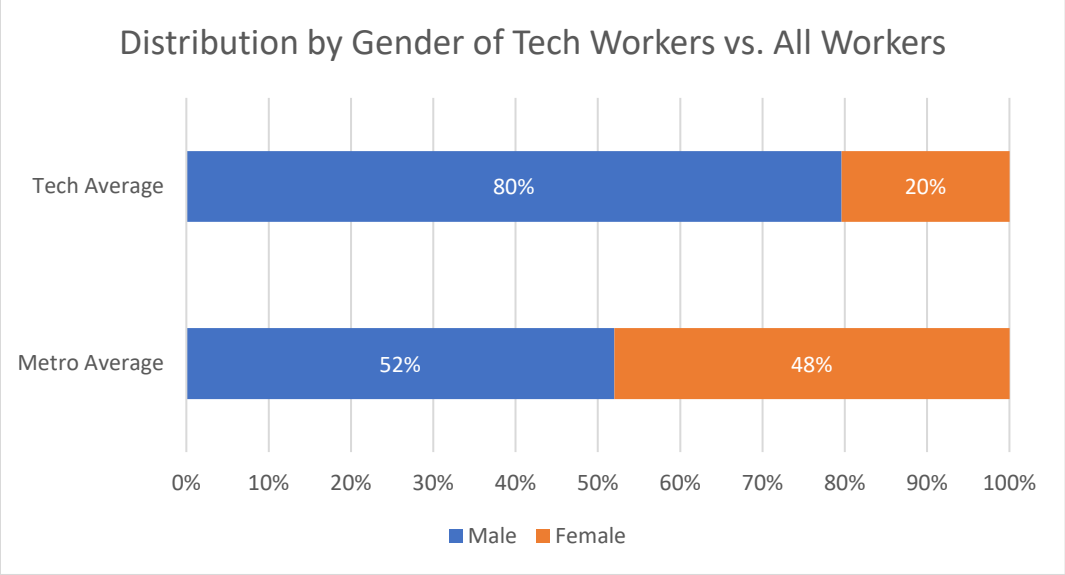
Figure 33: Distribution of Tech Workers by Age versus All Workers



Source: JobsEQ; first quarter 2020

The tech workforce is also male dominated, unlike the region's overall workforce. (Figure 34) Fully 80% of tech workers are male, compared to just 52% of the total workforce.

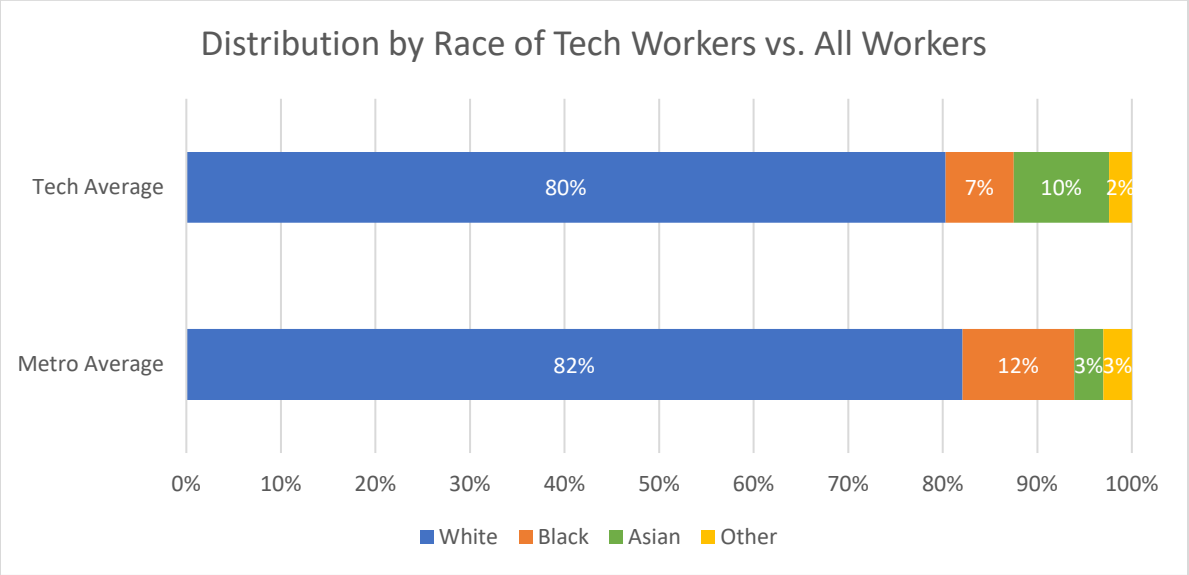
Figure 34: Distribution by Gender of Tech Workers vs. All Workers



Source: JobsEQ; first quarter 2020

Similarly, 80% of the tech workforce is white. However, this does mirror the composition of the Kansas City area workforce. (Figure 36). What is different is the composition of the minority populations. Asians are employed in tech occupations at more than 3 times the rate as they are in the overall workforce, while Blacks are employed at about half the rate.

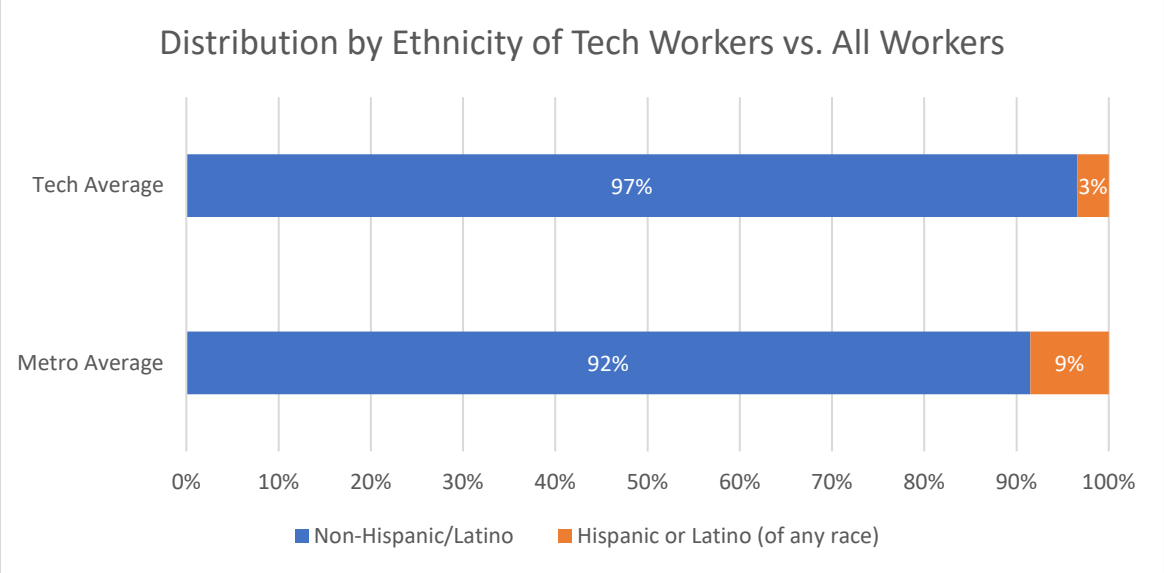
Figure 36: Distribution by Race of Tech Workers vs. All Workers



Source: JobsEQ; first quarter 2020

The situation is even more bleak for Latinos. They are employed in tech occupations at only one-third the rate they are employed in the overall workforce.

Figure 37: Distribution by Ethnicity of Tech Workers versus All Workers



Source: JobsEQ; first quarter 2020

These gender, race and ethnicity gaps in the tech workforce means substantial talent is likely being left on the table. Unlike manufacturing and the construction trades, tech doesn't have a perception problem that keeps folks from considering employment. Moreover, tech is ubiquitous in people's lives, so there isn't an awareness issue. This means that the issues with female and minority recruitment into the tech workforce are likely cultural as well as educational. A workplace dominated by white males does not make for the most welcoming environment for those who are neither white nor male without intentional policy and actions to increase their sense of belonging. Continued gaps in access to high-quality STEM educational opportunities at all levels by people of color also inhibit their capacity to participate in the tech workforce and take advantage of the many opportunities being created in the tech sector.

Business insights

The main objectives of the Talent to Industry Exchange process are to better understand the current and future talent needs of the tech sector in the region and to aid in developing workforce strategies to grow the regions tech talent pipeline. The research methodology includes four main sections:

1. An industry and occupation analysis.
2. Facilitated discussions with industry and education.
3. An analysis of career pathways and job postings, skills and competencies.
4. A virtual work session to create action steps from insights.

> "United voices will come to help; divided voices will not serve anybody. My dream is to see Kansas City, the heart of the nation, house and create technology talent. We can serve any part of the united states, any part of the world, if we really get our act together. We don't have any oceans or mountains to distract."
>
> — Business Leader

In 2020, the Mid-America Regional Council hosted facilitated discussions with local industry leaders and educators to capture their insights on trends, challenges and opportunities in the technology sector. Discussions were conducted virtually, either in small groups, or through one-on-one interviews. The technology sector presented some unique challenges, primarily because the sector is very large, with occupations in virtually every industry. Therefore, instead of engaging leaders from every industry, MARC chose stakeholders that represented both a broad perspective of the tech sector and occupations as well as specific industry knowledge.

The tech sector also has a more diverse landscape of education and training providers than some of the other industries analyzed in previous TIEs. This includes traditional 2-year and 4-year degree programs at public and private colleges and universities, as well as certificates, industry recognized credentials, boot camps, and competency-based education. There are also instances of work-based learning opportunities such as apprenticeship programs and models where a business plays a dual role of providing services to end users and being a training provider to students. MARC strategically engaged stakeholders to represent the variety of program types. In total, 19 tech executives and educators across 15 organizations participated in the facilitated discussions and one-on-one interviews.

Many of the findings in the quantitative analysis are supported by the insights gained from the facilitated discussions. The key insights were grouped into five categories:

1. Industry Landscape
2. Talent Pool
3. Equity and Inclusion in Tech
4. Experiential Learning
5. Educator Challenges

The following section will summarize the key insights identified in each category as well as opportunities for improvement. The next section will map out the findings of the career pathway analysis, and the final section will summarize the action steps and recommendations from the working sessions.

Industry landscape

Fast-changing industry

The technology sector is arguably the most innovative and rapidly evolving sector. Corporations and entrepreneurs are continually creating new products, services, and ways of doing things. There are constant updates, changes and upgraded versions of software programs, applications, mobile technologies and virtually all electronic equipment. These improvements and technological advancements are predicted to continue into the foreseeable future.

> "In the tech world, the only constant you can prepare for is that everything changes. What's at the top of the heap today is dead and no good just 18 months later."
>
> — Business Leader

While this provides remarkable economic benefits and efficiencies for businesses and consumers, it also poses quite a challenge for educators trying to keep up with the knowledge, skills, and competencies that employers need today and in the future. At the same time, the rate of change makes upskilling a critical component in this industry. The self-motivated and ongoing pursuit of knowledge and professional development also referred to as life-long learning is both a core value and a required competency of many tech employers in the region.

Ample but undefined opportunities

One of the greatest challenges identified, by employers and educators in growing the talent pipeline is a lack of clarity about the occupational pathways and opportunities within the industry. Stakeholders agreed that by providing comprehensive descriptions of career opportunities, required skills, and education programs in a centralized location, it could help more educators and students access the information needed to assist with career and education planning. Stakeholders identified that clear and transparent information is needed in the following areas:

> "The idea of remaining completely flexible with what people's goals might be, we give them every opportunity for new certifications, new technologies, to take new classes to attend seminars. If you're not up on the bleeding edge of all this stuff, it's amazing how fast a rock star who doesn't keep those skills honed can become relatively ineffectual."
>
> — Business Leader

- **Career Pathways**: What are the highest demand tech careers and what are the needed skills and competencies?
- **Education Programs:** What education/training is available?

- **Job Opportunities**: What jobs are available at tech companies and non-tech companies?
- **Growth Opportunities**: How do I continue to learn and develop my skills?

Awareness of career opportunities must be combined with opportunities to experience work activities in different industries either through internships or other work-based learning experience. Early exposure helps young students connect academic concepts with real world career opportunities. And adults can benefit from paid work-experiences that provide opportunities to develop skills and competencies on the job.

Talent pool

Developing a skilled and trained workforce that is prepared with both the key essential and technical skills is of vital importance to both employers and educators. While technology industries are recognized as one of the most in demand and exciting occupations, employers are perplexed to understand why students are not entering these career fields in greater numbers. Employers identified two common misperceptions that often prevent prospective students from entering the field.

> "Fifteen years ago, I would have said you definitely need a degree to be in tech. Now, I just don't think it's always necessary. Some people do well with the structure a degree provides, but I have people who haven't had training, but they've been programming for the last five years in a hole and just love to do it every day; they are obsessed with it. Those are great programmers."
>
> — Business Leader

- **A bachelor's degree in computer science, or a related field is required.** Many employers, particularly large corporations and software development firms still require a bachelor's degree to gain employment in entry-level positions, particularly in software development and programming. However, employer perceptions that a 4-year degree is the only pathway are beginning to shift. Increasingly, educators and employers are embracing alternative credentials and pathways, such as certificate programs, apprenticeships, and competency-based education programs and bootcamps as viable and successful training options. In fact, out of the 3,083 job postings for Software Developers and Software Quality Assurance Analysts and Testers only 51% explicitly required candidates to have a bachelor's degree or higher.
- **Candidates lack confidence because they feel they need high-level math and science skills.** Educators and employers expressed that some candidates may believe that they are not a good fit for a tech career because they do not have extensive technical or mathematical backgrounds. However, employers find that candidates from a variety of education backgrounds and employment experience can be excellent candidates. This can be an even greater issue for women and minorities who don't frequently see themselves represented in this field. Hearing directly from people in the industry, especially those who are living it every day, can help set expectations and create confidence for potential students.

Essential skills

A candidate's employability and success in the workplace is determined just as much by their non-technical skills as it is by their technical skills. Employers identified some critical skills that they believe are universal to all tech occupations.

- **Adaptability** — The ability to rapidly learn new skills and behaviors in response to changing circumstances.
- **Problem-Solver** — The ability to understand complex issues and develop technological solutions.
- **Life-long learning** — Displaying a willingness to learn and apply new knowledge and skills.
- **Communication** — The ability to speak in technical and nontechnical terms in a clear, effective and efficient way to a variety of audiences.
- **Collaboration** — The ability to work effectively in group settings and leverage the input of others to create solutions.

These findings were consistently supported by the job postings data across a variety of tech occupations.

Equity and inclusion in tech

Women account for only 20% of tech workers in the Kansas City region. There are also extreme racial disparities between white males, who make up 80% of the workforce, and Black and Hispanic/Latino individuals who are employed at only 7% and 3% respectively. Several black male and female tech leaders and entrepreneurs shared their experiences with employment in the Kansas City tech sector. The insights and opportunities discussed fit largely within the broader categories of Equity and Inclusion.

> There's this mindset that they can solve the problems with diversity, yet our [minority] voices are not heard. You have to have a seat for us at the table."
>
> — Business Leader

Equity insights

Minorities and women often feel they are undercompensated compared to others with the same skills and experience.

- Minorities and women often feel they are undercompensated compared to others with the same skills and experience.
- They do not feel they have control over their job or career.
- They do not see a path to upward mobility and leadership in their organizations.

Inclusion insights

- Minorities and women do not feel heard or feel like they have a seat at the table.
- They often do not have a support system or network and must work harder to find a group of people they feel supported by.
- They do not have mentors or role models to model a career pathway.

Former tech employees turned tech entrepreneurs, also shared a common experience of being motivated to pursue an entrepreneurial pathway as a result of the perceived lack of opportunities in the tech labor market.

Tech employers recognize the challenges with recruiting women, black and Hispanic/Latino candidates. Several employers expressed a desire to hire more candidates from groups that are not typically employed in tech occupations, however, they have been unable to recruit diverse tech talent at scale. There could be many reasons for this, such as a lack of outreach and connection to diverse talent pools

or a lack of available diverse talent, or a need to create more opportunities for diverse talent--women, Black, Hispanic/Latino people — to connect to tech career training, exploration and employment opportunities.

Based on the group discussions, it is clear that the tech sector and tech employers in the KC region have an opportunity to take the lead and create an environment that cultivates diverse tech talent. Some examples of this could include industry wide mentorship programs for current employees of color, expanding experiential learning opportunities across school districts with a large share of Black and Hispanic/Latino students, sponsoring tech academies and other tech training in partnership with local programs that work with targeted populations.

The tech industry is not alone in tackling this challenge. These findings align with many of the discussions held by The Diversity and Inclusion task force, convened by KC Rising in 2019. The purpose of this task force, made up of corporate HR leaders and business executives, was to identify opportunities and initiatives that could help regional employers recruit and hire more diverse talent. Helping corporate employers measure their diversity and inclusion goals was a recommended outcome as well as increasing mentoring and other programs.

Experiential learning

As with previous TIEs, an important element of talent development for the sector is an urgency for more opportunities for youth, adults and teachers to have experiential learning opportunities.

Experiential learning encompasses a broad range of activities whereby students learn by doing and reflecting on their experiences. Within specific industry and career context, these activities can include, but are not limited to, internships, labs, incubators, field exercises, work-based projects and other hands-on experiences. Also included are opportunities for reflection, critical analysis, decision making, and accountability.

Employers and educators collectively identified these opportunities as extremely important to developing a long-term sustainable pipeline of talent. The expressed benefits of experiential learning included:

- Bridge the gap between theory and practice.
- Provide critical hands-on experience.
- Teach company culture.
- Allow hands-on learning of proprietary competencies.
- Build confidence.
- Increase engagement.
- Enable personalized learning.

The employers in the tech sector can benefit from engaging in regional best practices such as aligning with some of the thirty area school districts participating in the **Real World Learning Initiative** through which the Ewing Marion Kauffman Foundation is supporting school districts in developing and executing plans to create real-world learning opportunities for students.

Additional opportunities for strengthening the talent pipeline through experiential learning exist at the post-secondary level. Employers should expand and scale the availability of internships and other skill

building opportunities through partnerships with faculty, staff and academic and career advisors at area institutions and training programs. They should also focus on expanding relationships with the regional public workforce agencies — the Workforce Partnership in Kansas and Full Employment Council in Missouri — and other community agencies working with adult talent. These systems provide a readily available pool of talent, often have funding and programs to support training and apprenticeships and can assist in accessing diverse candidates.

Most importantly, there is a significant gap in training and experiential learning opportunities for faculty at both the secondary and post-secondary levels. Employers could utilize a train-the-trainer approach — build the capacity, skills and knowledge of tech faculty who can then transfer that knowledge to a larger number of students. This could be accomplished by creating short intensive and immersive workshops and hands-on experiences in areas such as coding/programming, cybersecurity, or network administration. Employers and faculty could expand these options as needed.

Educator challenges

In addition to the need for more experiential learning opportunities, educators expressed a variety of challenges with improving the systems that deliver tech learning and skill development. The top challenge identified were:

- Communication
- Lack of resources (money and equipment)
- Programs/content being outdated
- Lack of industry guidance
- Lack of awareness/access to continued learning opportunities
- Faculty not included in decision making

> "Our organization has created advisory boards, which has helped a lot. These are companies that we work with often. It has allowed us to better understand their businesses and it has given them insight into our program. We get a lot of great information directly from the employer's mouth, which we are then able to implement straight into our curriculum. This is a newer process for us, but we are seeing a lot of success with it."
>
> — Educator

Communication with industry

One of the clear drivers of an effective learning system and talent pipeline is a strong relationship and communication between industry and educators. This is critical to keep up with demand and prepare for the future needs of the industry. Educational institutions that have direct and collaborative relationships with industry leaders are having proven success. However, there are many smaller and diversity-focused training programs that have less exposure and lack the established relationships with industry to benefit.

Industry professionals identified these challenges when trying to communicate with educators:

- Tech covers such a broad range of industries, jobs, and skills that needs vary greatly, and change often.
- Industries do not have a comprehensive talent demand strategy which can make it more difficult for long-range planning.
- Communicating with individual programs and institutions consumes time and resources.

- Lack of awareness of different types of education and training programs in the region.

Educators identified these as their top challenges when communicating with industry:

- Struggle to get industry to engage with them or follow up on their requests.
- Do not have a formal way to engage with industry professionals.
- Need more information from industry about their education and skill development needs
- Desire to speak directly with HR and hiring managers.

Career pathways and career pathway systems

The talent development pipeline in a region is a direct result of the effectiveness of its career pathway system. The U.S. Department of Education describes an effective Career Pathway System as one that supports youth and adults in acquiring the academic, technical, and employability skills that employers demand within a particular sector. This requires aligning programs and resources across K-12, post-secondary, career and technical, and adult basic education systems to bring greater efficiency and transparency to the routes from each starting point to credentials recognized by industry.

Ultimately, the goal is to create a more integrated system of academic and technical education providers who are responding to industry demand by delivering modular training that builds upon each other, enabling more students to progress along in demand career pathways. A career pathway is a small group of occupations within sectors that share common skills, knowledge, and interests. Within the information technology sector there are a variety of different career pathways.

The Career Pathway analysis consisted of:

1. A comprehensive review of the literature and data related to Standard Occupation Classifications, and other frameworks from the Bureau of Labor Statistics and the Department of Labor and Employment.
2. A comprehensive review of relevant industry association pathway and occupation description such as CompTIA.
3. A comprehensive review of relevant job postings from the first and second quarters of 2020.

The resulting career pathways help articulate the range of occupations along in-demand tech careers and describe the progression of skills and competencies required by local employers. They also aim to identify education and training providers as well as degrees and certificates offered and identify strategies for strengthening the regional tech career pathway system.

See Appendix B for Career Pathways for Computer User Support Specialist, Cyber Security, and Software Development Computer Programming.

Post-secondary education and training

There are a variety of computer science and information technology degrees and certificates being offered at traditional post-secondary institutions in our region. The following pages from our annual Education Asset Inventory offer an overview of educational credentials currently available.

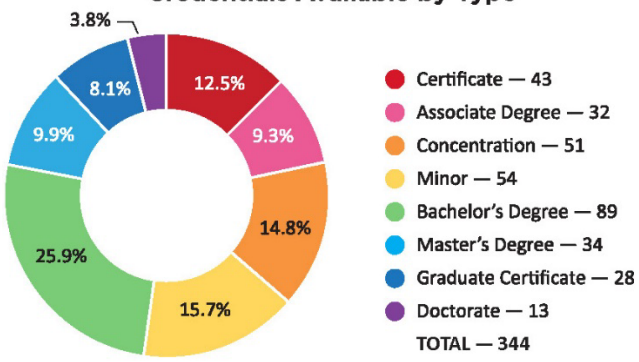
2019 Education Asset Inventory

Information Technology

Industry Insights

- In the Kansas City region, there were forty cybersecurity firms in 2018 that have generated $2 billion dollars in revenue.[1]
- There are currently 41,114 workers employed in IT occupations in the region.[2]
- The average annual wage in this sector is $77,900.[2]
- Total demand (replacement and growth) is expected to add 20,237 jobs in this sector over the next five years.[2]
- In the next five years, there will be a need for an additional 6,585 software developers and programmers.[2]

Credentials Available by Type



Credentials Available by Institution Type

	Public	Private Non-Profit	For-Profit
Certificate	31	6	6
Associate	25	3	4
Concentration	25	15	11
Minor	38	16	—
Bachelor	50	30	9
Master	26	4	4
Graduate Certificate	25	2	1
Doctorate	13	—	—
Total	233	76	35

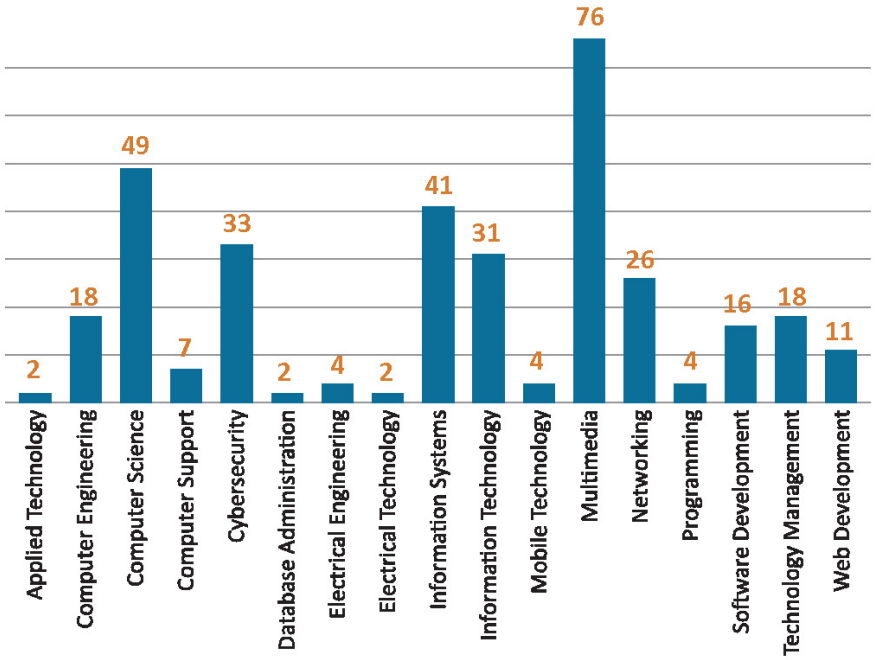
Types of Firms:
Health IT, software publishers, data processing, hosting and related services, computer systems design services

Local Examples:
Cerner, DST, Jack Henry & Associates, Netsmart Tech

Total Employment: 41,114 jobs

[1] Enterprise KC
[2] Jobs EQ

Information Technology Credentials Available by Program

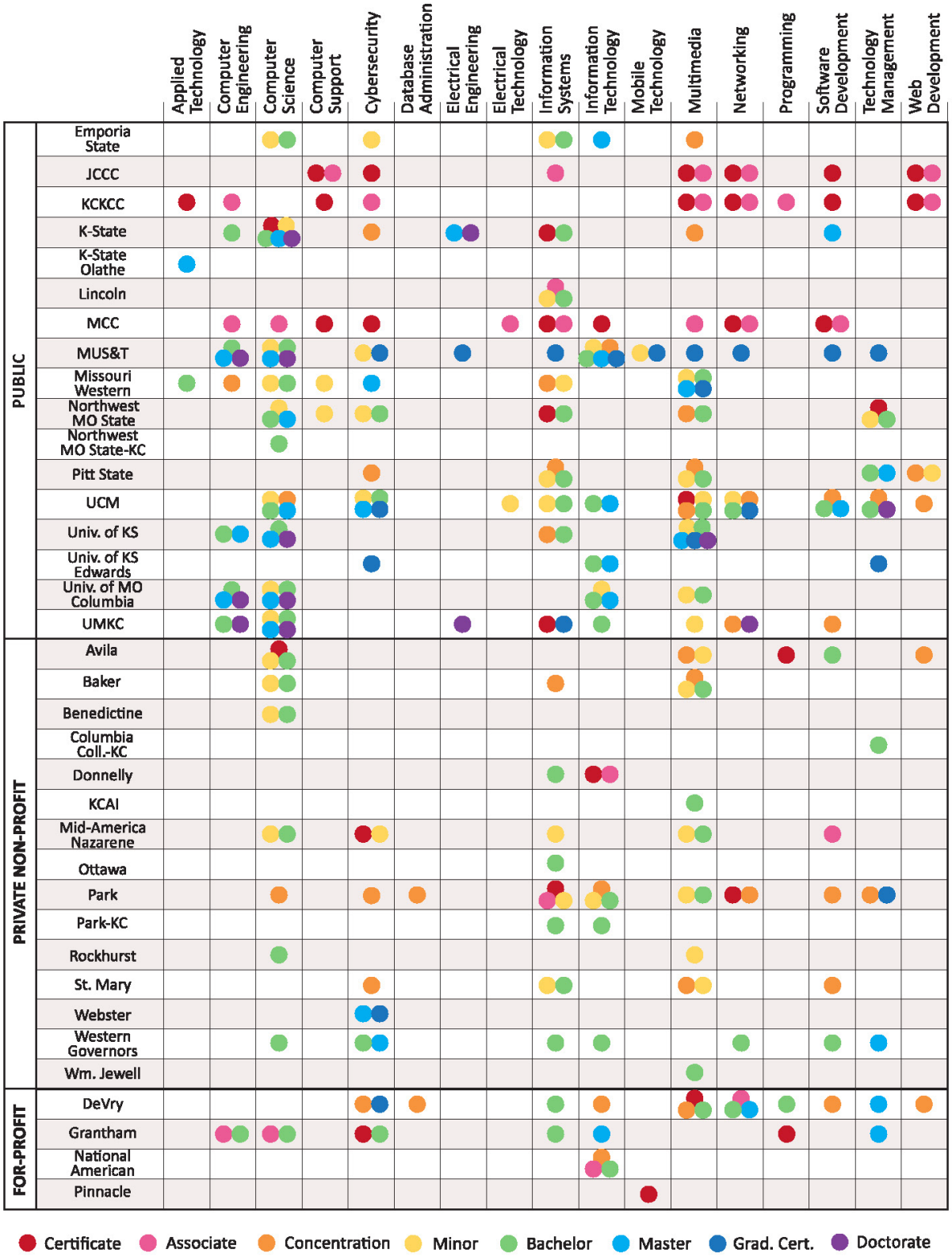


344
Total Credentials

Information Technology Credentials by Program and Type

	Certificate	Associate	Concentration	Minor	Bachelor	Master	Grad Certificate	Doctorate
Applied Technology	1				1			
Computer Engineering		4	1		6	4		3
Computer Science	2	2	2	12	19	7		5
Computer Support	4	1		2				
Cybersecurity	5	1	7	5	4	5	6	
Database Administration			2					
Electrical Engineering						1	1	2
Electrical Technology		1		1				
Information Systems	5	5	4	8	14		5	
Information Technology	2	2	4	4	10	7	2	
Mobile Technology	1			1			2	
Multimedia	6	6	15	18	23	2	5	1
Networking	8	5	4	1	3	1	3	1
Programming	2	1			1			
Software Development	3	2	5		3	2	1	
Technology Management	1		2	1	5	5	3	1
Web Development	3	2	5	1				

Information Technology Programs by Institution



Strategic Considerations

Industry executives, tech entrepreneurs, and education stakeholders came together for a half-day working session which included:

- A comprehensive review of the findings from each of the facilitated discussions.
- A review of the themes and recommendations.
- Development of strategic action items and considerations for next steps.

The opportunities and action steps were grouped in three board categories: Create a unifying voice, define career pathways and map out education, and foster diversity.

Create a unifying voice

Opportunities

- Create a regional tech advisory board to guide regional tech education and workforce development strategies
- Industry led and sponsored
- Partner with KC Tech Council
- Focus on a broad membership to include manager, entrepreneurs, HR, faculty at a variety of programs and institutions

Action Steps

- Define a clear, actionable mission/plan to guide the board and its efforts
- Identify and communicate the benefit/value of growing tech in KC to create excitement and to engagement within industry; share message via social media, news outlets, and through regional and industry influencers
- Engage large tech and non-tech companies (Cerner, Garmin, Honeywell, BCBS, H&R Block, Black and Veatch, Burns and Mac, Sprint/T-Mobile), as well as smaller/start-up tech businesses, and entrepreneurs

Define career pathways and map out education

Opportunities

- Identify key tech career pathways in the region
- Provides “one-stop shopping” for potential future talent
- Helps align educators to better prepare for future demand and identify symbiotic relationships
- Identify opportunities to reduce redundancy, leverage existing efforts, and match like-minded institutions

Action Steps

- Identify and leverage relationships with organizations who are already doing some of this work (KC Stem Alliance, Kauffman, etc.)
- Engage smaller businesses and start-ups and connected organizations (e.g., Startland) as well as HR professional organizations (e.g., Society for Human Resource Management KC)
- MARC should be the conveners of these efforts; they are considered a credible voice and have the relationships and ability to engage others

Foster diversity

Opportunities

- Make space for women and minorities
- Ensure a "seat at the table" for the underrepresented
- Build networking/mentorship/support systems for women and minorities in tech
- Identify ways to get into more underrepresented communities to diversify future talent

Action steps

- It is critical to invite diverse voices in tech to drive meaningful change
- Connect with non-tech organizations that are working towards creating diversity (i.e., Big Brothers Big Sisters, Connecting for Good)
- Engage current tech talent of color to mentor and provide guidance to new and potential tech students
- Educate business leaders and encourage them to "roll up their sleeves" and play a more active role in these communities; provide guidance on how to do this in a meaningful way (i.e., CEO Pledge)
- Create a social media campaign to highlight successes in creating diversity in tech, and to demonstrate commitment to growing diversity (i.e., "Faces of Tech" campaign)

Conclusion and Next Steps

Tech occupations are some of the fastest growing and highest earning occupations in the region and the tech sector is expected to continue growing at a steady pace as technological advancements continue, particularly in areas such as cybersecurity, artificial intelligence and machine learning. However, these technologies and career pathways are just emerging, and the increased demand for these skills may not materialize for at least another five years. While we must prepare for these future skills, we also have a great opportunity to focus on developing local talent — diverse talent — with the tech skills that are in demand today, such as software development, coding, cybersecurity, and network administration.

By investing in education and training at the secondary level, companies can create a wider pool of talent, preparing students for future skills and industry demand. Additionally, there are many adults that have good foundational skills and by tapping into and upskilling these populations employers can expand their talent pool and help with regional economic development. Repeatedly we heard from stakeholders the benefits of employer engagement and the need for more experiential and work-based learning opportunities. One of the greatest considerations to take away from this analysis is: how can we work collectively to strengthen our tech talent pipeline system and who will take the lead?

Though we did not address this directly in our analysis, we must consider the impact of COVID-19 on our tech workforce and labor market. There are some potential opportunities such as a possible increase in tech positions created as a result of more remote working and an increase in available talent due to people being unemployed or looking for a new career. There are also some potential risks to consider such as the increased availability of remote tech position across the country luring people away from Kansas City. The opposite could also happen, however, with people choosing to relocate to more affordable markets while still working remotely in another market. It is still too early to tell the real impact, but we will continue to monitor these changes over the coming months.

If we are to have a robust technology workforce, we must first ensure that we are preparing youth and adults at the local level by broadening access to experiential learning, fostering partnerships with educators and creating an ecosystem that supports diverse talent development. Many companies are looking for ways to recruit a skilled and trained workforce. Until businesses focus on local workforce development, they will continue to struggle with finding talent with the necessary skills. By creating an inclusive culture, that encourages the integration of the local career pathway partners into their system companies can tackle skill shortages and create a more stable workforce.

Appendix A: Tech occupations and tech industries

Tech Occupations

SOC	Occupation
'11-3021	Computer and Information Systems Managers
'11-9041	Architectural and Engineering Managers
15-1211	Computer Systems Analysts
15-1212	Information Security Analysts
15-1221	Computer and Information Research Scientists
15-1231	Computer Network Support Specialists
15-1232	Computer User Support Specialists
15-1241	Computer Network Architects
15-1244	Network and Computer Systems Administrators
15-1245	Database Administrators and Architects
15-1251	Computer Programmers
15-1256	Software Developers and Software Quality Assurance Analysts and Testers
15-1257	Web Developers and Digital Interface Designers
15-1299	Computer Occupations, All Other
17-2011	Aerospace Engineers
17-2031	Bioengineers and Biomedical Engineers
17-2061	Computer Hardware Engineers
17-2071	Electrical Engineers
17-2072	Electronics Engineers, Except Computer
17-2112	Industrial Engineers
17-2131	Materials Engineers
17-2141	Mechanical Engineers
17-2199	Engineers, All Other
17-3021	Aerospace Engineering and Operations Technologists and Technicians
17-3023	Electrical and Electronic Engineering Technologists and Technicians
17-3024	Electro-Mechanical and Mechatronics Technologists and Technicians
17-3026	Industrial Engineering Technologists and Technicians
17-3027	Mechanical Engineering Technologists and Technicians
17-3098	Calibration Technologists and Technicians and Engineering Technologists and Technicians, Except Drafters, All Other
27-4011	Audio and Video Technicians
27-4012	Broadcast Technicians
27-4014	Sound Engineering Technicians
49-2011	Computer, Automated Teller, and Office Machine Repairers
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairers
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers
49-2091	Avionics Technicians
49-2092	Electric Motor, Power Tool, and Related Repairers
49-2093	Electrical and Electronics Installers and Repairers, Transportation Equipment

49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles
49-2097	Audiovisual Equipment Installers and Repairers
49-2098	Security and Fire Alarm Systems Installers
51-2021	Coil Winders, Tapers, and Finishers
51-2028	Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers
51-9161	Computer Numerically Controlled Tool Operators
51-9162	Computer Numerically Controlled Tool Programmers

Tech Industries

NAICS	Industry
334111	Electronic Computer Manufacturing
334112	Computer Storage Device Manufacturing
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing
334210	Telephone Apparatus Manufacturing
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing
334290	Other Communications Equipment Manufacturing
334310	Audio and Video Equipment Manufacturing
334412	Bare Printed Circuit Board Manufacturing
334413	Semiconductor and Related Device Manufacturing
334416	Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing
334417	Electronic Connector Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing
334419	Other Electronic Component Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables
334514	Totalizing Fluid Meter and Counting Device Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
334516	Analytical Laboratory Instrument Manufacturing
334517	Irradiation Apparatus Manufacturing
334519	Other Measuring and Controlling Device Manufacturing
334614	Software and Other Prerecorded Compact Disc, Tape, and Record Reproducing
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
511210	Software Publishers
517311	Wired Telecommunications Carriers

517410	Satellite Telecommunications
517911	Telecommunications Resellers
517919	All Other Telecommunications
518210	Data Processing, Hosting, and Related Services
519130	Internet Publishing and Broadcasting and Web Search Portals
541330	Engineering Services
541380	Testing Laboratories
541511	Custom Computer Programming Services
541512	Computer Systems Design Services
541513	Computer Facilities Management Services
541519	Other Computer Related Services
541713	Research and Development in Nanotechnology
541714	Research and Development in Biotechnology (except Nanobiotechnology)
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)
611420	Computer Training
811211	Consumer Electronics Repair and Maintenance
811212	Computer and Office Machine Repair and Maintenance
811213	Communication Equipment Repair and Maintenance
811219	Other Electronic and Precision Equipment Repair and Maintenance

Appendix B: Career pathways

CAREER PATHWAY: Computer User Support Specialist

As of the second quarter of 2020, total employment for **Computer User Support Specialists** in the Kansas City area was 5,992, making it the **second largest tech occupation** in the region. Over the past three years, this occupation added 439 jobs in the region and is expected to increase by 583 jobs over the next seven years, or at an annual average rate of 1.3%. There is an above-average concentration of these occupations as computer support specialists are employed at 1.3 times the national rate. IT support specialists are entry-level jobs that can allow an individual to evolve into a variety of more advanced roles such as network administration, cloud or cybersecurity admins or developers.

Salaries and outlook

Employment of computer support specialists will continue to increase as organizations become more dependent on computer equipment and continue to upgrade computers and software. Smaller businesses that do not have IT departments will contract services from staffing and consulting firms. The average annual wage for a tech support role is $51,900; entry-level positions may start as low as $34,800 with advanced workers making as much as $60,500.

What they do

Computer support specialists, also called help desk support/technician, listen to customers' description of their computer problems and ask questions to properly diagnose the problem. They provide technical assistance to computer users and assist clients in resolving their computer problem, either in person, via telephone or electronically.

How to become one

Get education and training

Education requirements vary due to the wide range of skills used in different computer support jobs. Interested applicants that have some computer knowledge, have taken some computer technical training, and/or have some computer working experience may be qualified for these jobs. Of the postings, 38% did not specify the requirement of either a bachelor's or associate degree.

More technical roles, or roles in larger software companies that provide direct support to business customers often require applicants to have a bachelor's degree or sometimes an associate degree in a field such as computer or information science. An associate degree was requested by only 12% of employers and a bachelor's degree was required by 24%.

Get a certification

Certifications can be a good way to demonstrate and validate the knowledge and abilities required of computer support specialists. Certification programs are generally offered by vendors or from vendor-neutral industry recognized certification providers. The top certifications requested by area employers in 2020 are:

- CompTIA A+ Certification (A+ Certification)
- CompTIA Network+ Certification
- Cisco Certified Network Associate (CCNA)
- Microsoft Certified Solutions Associate (MCSA)
- Microsoft Certified Professional (MCP)

- Microsoft Certified Solutions Expert (MCSE)
- Microsoft Technology Associate (MTA)
- Microsoft Certified Technology Specialist (MCTS)

Who is hiring?

Computer support roles are needed across every industry including hospitals, large enterprise and software development firms and banking institutions. Some of the largest employers in the Kansas City region include:

- Honeywell
- Cerner
- Oracle
- H&R Block
- Best Buy
- TEKsystems

Top essential skills & competencies

Based on job postings from 2020, the top essential skills requested by employers are:

- **Adaptability —** The ability to tolerate change and quickly respond to industry shifts and innovations.
- **Communication (verbal and written skills)** —Strong written and verbal communications skills. and the ability to communicate clearly and concisely with a variety of audiences.
- **Cooperative** — The ability to work with others as an effective team member.
- **Detail oriented** — The ability to pay attention to the small particulars of a task project with little to no errors.
- **Problem solving** — The ability to understand complex issues and develop technological solutions.
- **Self-motivated** — The ability to work independently.

Top technical skills

Being an effective computer user support specialist requires the following technical skills based on recent job postings:

- Working knowledge of common operating systems and software applications
- Knowledge of computer hardware and peripheral equipment
- Microsoft active directory
- Basic computer networking
- Basic computer programming/coding

Resources

Association of Support Professionals — The Association of Support Professionals is an international membership organization for customer support managers and professionals.

Help Desk Institute — HDI is the leading events and services organization empowering the technical support and service management industry and its people.

CAREER PATHWAY: Cyber Security

There is a high demand for a skilled cybersecurity workforce in the Kansas City region. Between June 2019 and May 2020 there were 3,586 job openings, over twice the national average during this same time period (www.cyberseek.org/heatmap.html). Between 2015-2020 employment for **Information Security Analysts grew by 7.5%**; faster than all other tech occupations. With the growing threat of cyberattacks, companies will increasingly look for professionals that can protect their data and networks. Cybersecurity professionals work in almost every industry from government agencies and contractors, to banking institutions, software development firms, and hospitals.

Salaries and outlook

The increased demand for skilled cybersecurity professionals combined with a scarcity of talent supply has resulted in high wages for qualified applicants in the Kansas City region and nationally. Information Security Analysts earn an average annual wage of $89,500 in the Kansas City area as of 2019. Average entry-level wages were $57,200 while experienced professionals earn an average of $105,600. This occupation is expected to increase by 118 jobs over the next seven years, or at an annual average rate of 1.3%.

Career path options

Cybersecurity is a catch-all term that refers to many unique roles that utilize different skill sets. From Information Security Analysts that protect an organizations computer systems and networks to Ethical Hackers that test, probe, and exploit security vulnerabilities, cybersecurity professionals' primary purpose is to protect confidential information and data from being compromised in an attack.

Job titles vary from company to company but here are some popular careers based on experience level:

- **Entry-level roles —** systems engineer, systems administrator, web developer, IT technician, network engineer, security specialist
- **Mid-level roles —** security technician, security analyst, incident responder, IT auditor, cybersecurity consultant, penetration tester
- **Advanced-level roles —** cybersecurity manager, cybersecurity architect, cybersecurity engineer, chief information security officer

Cybersecurity analyst

Cybersecurity analyst, also called **Information Security Analyst** (ISA), is the fastest growing tech occupation in the region. This role requires a bachelor's degree in computer science or a related area. Also, most employers are looking for someone with some solid IT-related experience with computer networks and systems operations and sometimes additional certifications. Day to day, cybersecurity analysts keep constant tabs on threats and monitor their organization's networks for breaches, install software and encryption, and educate leadership and staff on security risks and best practices. This role requires a combination of strong analytical and problem-solving skills with the ability to communicate complex information to a variety of technical and nontechnical staff.

IT auditor

IT auditors identify flaws in a system's network, evaluate and observe security policies and controls and develop a detailed action plan to correct security breaches and prevent future problems. The role requires a meticulous eye for detail and the ability to accurately record complex information and communicate to both technical and nontechnical staff, however, IT auditors do not participate in fixing

any of the problems that are detected. IT auditors may conduct audits remotely or on-site at their client's location. Successful candidates for this role may have a bachelor's degree in a computer science field or they may transition into the role from non-IT related audit experience such as finance or law. Attaining the Certified information Systems Auditor (CISA) certification is another way of demonstrating skills and knowledge to employers.

Ethical hacker

The ethical hacker, also called a penetration tester, evaluates computer and network systems in order to find any gaps before real hackers uncover and exploit them. They follow authorized protocols and testing techniques to discover and service problems and educate team members to strengthen the system. Employers generally look for candidates with a bachelor's degree and sometimes additional certifications.

Cybersecurity engineer

Cybersecurity engineers, also called information security engineers, are highly skilled professionals whose main role is to design computer systems that can withstand malicious cyberattacks or even natural disasters. Day to day responsibilities often include analyzing computer networks, performing security checks, anticipating security issues and tracking security incidents. Employers require at least a bachelor's degree in engineering or computer science and a strong background and experience in the field.

How to become one

The cybersecurity field has a wide range of career options across almost every industry. Therefore, there are a variety of pathways to working in cybersecurity and people from diverse backgrounds-- computer science, engineering, even history and liberal arts—can transition into this field with the right training, education and experience.

Get education and training

If you are new to the field or want to explore all the options in cybersecurity, you may want to begin your career by enrolling in short-term training or an associate degree program. Look for programs that will prepare you in IT fundamentals such as administering and configuring systems, networks, database management and coding as well as real-world business operations. While it is possible to find some entry-level cybersecurity positions with an associate degree or technical training program, most jobs require a four-year bachelor's degree in cyber security, computer science or a related field. Coursework in ethics, computer forensics, programming, database and network security prepare students with the technical and analytical skills required for success in this field. (See pages 57-59 for a full listing of information technology related programs in the area).

Find a focus

Cybersecurity is a diverse and complex field and experts advise that it is best to consider what you are best at and most interested in and specialize in a specific area such as risk assessment, vulnerability testing, or incident response.

Gain real-world experience

Many employers prefer candidates with some level of previous experience, so it is important to identify opportunities for internships, volunteer work or other relevant real-world experience. These opportunities are vital in helping candidates develop the fundamental IT skills required from employers.

Get a certification

There are also a variety of certifications that can be earned by cybersecurity professionals. Choosing the most effective program depends on an individual's specific interests/goals and job requirements. Entry-level cybersecurity certifications include CompTIA Security+ and MTA Security fundamentals. Advanced - level certifications are also available in more specialized skill sets such as Certified Ethical Hacker (CEH) or Certified information System Security Professional (CISSP).

Keep learning

In this fast-paced environment of every changing threats and technologies it is essential to be committed to life-long learning. Pursue advanced level training, join industry association and find ways to stay abreast of the latest trends and information to remain successful and competitive in the field.

Who is hiring?

The Cybersecurity career path includes occupations in almost every industry: government, healthcare, finance, manufacturing, retail. The following is a list of the top area employers ranked by the number of job ads posted during quarter two of 2020**.**

- Humana
- Oracle
- Crowdstrike
- Honeywell
- Cerner
- Navy
- Garmin
- H&R Block
- Cisco

Top essential skills and competencies

The cybersecurity employment market requires several core skills and competencies, whether starting an entry-level career or transitioning from another computer related field. Here are a few of the common requirements:

- **Adaptability —** The ability to tolerate change and quickly respond to industry shifts and innovations.
- **Analytical thinking** — The ability to understand complex information, diagnose and solve problems
- **Communication (verbal and written skills)** — Strong written and verbal communications skills. and the ability to communicate clearly and concisely with a variety of audiences.
- **Cooperative** — The ability to work with others as an effective team member.
- **Detail oriented** — The ability to pay attention to the small particulars of a task project with little to no errors.
- **Understanding of security principles** — An understanding of basic security principles, such as privacy, confidentiality, authentication, access control, and others.
- **Network protocols** — A working knowledge of common network protocols, their similarities and differences, how they work and what they are used for.

- **Integrity and discretion** — Sensitivity to an organization's security vulnerability issues, data and information.

Top technical skills

The technical skills required of cybersecurity professional are primarily related to software programs and technology designed to protect against hackers and viruses. Here are some of the top skills requested:

- Amazon Web Services (AWS)
- Computer Programming/Coding
- Computer networking
- Firewalls
- Information Security
- Microsoft Azure
- Microsoft PowerShell
- Python Linux

Resources

Information Systems Security Association — The Information Systems Security Association (ISSA)® is a not-for-profit, international organization of information security professionals and practitioners. It provides educational forums, publications, and peer interaction opportunities that enhance the knowledge, skill, and professional growth of its members.

The National Initiative for Cybersecurity Education (NICE) Cybersecurity Workforce Framework (NICE Framework) — The National Initiative for Cybersecurity Education (NICE) Cybersecurity Workforce Framework (NICE Framework), published by the National Institute of Standards and Technology is a nationally focused resource that establishes a taxonomy and common lexicon to describe cybersecurity work, and workers, regardless of where, or for whom, the work is performed.

National Initiative for Cybersecurity Careers and Studies — NICCS is an online resource for cybersecurity training that connects Government employees, students, educators, and industry with cybersecurity training providers throughout the Nation.

National initiative for Cybersecurity Careers and Studies Cyber Career Pathways Tool — This tool presents a new and interactive way to explore work roles within the NICE Cybersecurity Workforce Framework. It depicts the Cyber Workforce according to five distinct, yet complementary, skill communities. It also highlights core attributes among each of the 52 work roles and offers actionable insights for employers, professionals, and those considering a career in Cyber.

CyberSeek Cybersecurity Supply/Demand Interactive Heat Map — This interactive heat map provides a granular snapshot of demand and supply data for cybersecurity jobs at the state and metro area levels and can be used to grasp the challenges and opportunities facing your local cybersecurity workforce.

CyberSeek Cybersecurity Career Pathway Tool — This interactive career pathway shows key jobs within cybersecurity, common transition opportunities between them, and detailed information about the salaries, credentials, and skillsets associated with each role.

K-12

Project Lead the Way Cybersecurity Course (Course Mapping) — A course with several lessons aligned to knowledge and ability statements from the NICE Framework.

Post-secondary

CARE: Cybersecurity in Action, Research & Education — Experiential learning projects that have been mapped to the NICE Framework.

NICCS Education and Training Catalog — A central location where cybersecurity professionals across the nation can find over 3,000 cybersecurity-related courses that are aligned to the specialty areas of the NICE Framework.

NICE Challenge Project — Real-world cybersecurity challenges within virtualized business environments that bring students the workforce experience through the completion of tasks aligned to the NICE Framework.

Cybersecurity Competency Model — The Employment and Training Administration (ETA) worked with the Department of Homeland Security and more than 20 federal departments and agencies that make up the National Initiative for Cybersecurity Education (NICE) to develop a comprehensive competency model for the cybersecurity workforce.

National Cyber security Student Association — As the largest association of cyber security students, NCSA provides members with access to the latest cyber security research and development, conferences and training events, and networking opportunities.

CAREER PATHWAY: Software Development and Computer Programming

The programming and software development pathway includes occupations involved in the design, development, implementation and maintenance of computer systems and software, requiring knowledge of computer operating systems, programming languages and software development. These occupations are highly in demand across a variety of industries including healthcare, finance and insurance, manufacturing and software publishing and engineering. In the first quarter of 2020 there were **11, 991 Software Developers and Software Quality Assurance Analysts and Testers** employed in the Kansas City region accounting for **19%** of the area tech employment; **Computer Programmers** make up a much smaller percentage of tech workers totaling **1,956, or just 3% of tech workers in 2020**.

Salaries and outlook

Software Developers and Computer Programmers earn salaries well above the average wage of most occupations. Entry-level **Software Developers and Software Quality Assurance Analysts and Testers** in the Kansas City region earn $59,500; the average annual earnings for developers is $92,600 and experienced workers can earn up to $109,100. **Computer programmers** earn a similar, although slightly lower wage. Entry-level programmers earn $54, 400; the average wage is $86,800; experienced programmers earn $103, 100. Both occupations are expected to see modest growth over the next five years. Software Developers are expected to gain 984 new positions and computer programmers are projected to gain 162 new positions. Additionally, many of the current openings will continue to remain unfilled as demand significantly outpaces the supply of qualified talent.

Career path options

The terms **Software Engineer, Software Developer and Computer Programmer** are often used interchangeably, depending on the company or the person. While there are similarities in some skills, such as using programming languages, there are also distinct differences. The U.S. Department of Labor Occupational Outlook Handbook provides the following descriptions: **Software Developers** create the applications or systems that run on a computer or another device. **Computer programmers** write and test the code that allows computer applications and software programs to function properly. These positions typically work closely together, however, Software Developers/Engineers have a broader range of skills and responsibilities that encompass the entire scope of a project including architecture and design, documentation and implementation of the software. This requires being able to see a problem, figure out how to fix it, and identify and implement the best option based on time, cost, scalability and other factors. Computer programmers' primary responsibility is to write the code that will make the software design work and/or test code by looking for errors. In practice, computer programmers do much more than programming. In fact, many companies are replacing the title programmer with other working titles that reflect all the many roles and responsibilities included in the process. There are many opportunities for growth and development along the software developer pathway, the progression of roles and responsibilities generally looks like this:

- Intern
- Junior developer
- Senior developer
- Lead developer/architect
- Developer manager/director

- Senior leadership (VP, CTO, CIO)

How to become one

Be passionate about coding

Software development and programming require you to spend much of your day working with code or thinking about creative ways to solve problems with code. Lifelong learning is a requirement in this field as the rate of change in the industry is extremely high, so to be successful in this field you must enjoy constantly learning and exploring new technologies and new ways of doing things.

Get education and training

Completing a formal education/training program is the first step toward becoming a developer or programmer. For entry-level roles, most employers prefer candidates with a four-year degree in computer science or a related field, however, an associate degree in a computer science field or other industry recognized training program along with experience in different aspects of development, can also open the door to entry-level jobs in the field. Due to the high demand, and rapid pace of technology, prospective students can choose from a variety of traditional 2-year and 4-year programs at colleges and universities as well as several new educational pathways such as bootcamps and competency-based education programs. You will also find that some developers and programmers are self-taught and learned code on their own by studying and practicing.

Gain real-world experience

Internships provide students with valuable real-world experience and help to contextualize theories and concepts while practicing work activities. Companies should begin providing these immersive learning experiences as early as possible by partnering with K-12 education systems and Career and Technical Education programs and other STEM/STEAM focused organizations.

Students pursuing or who have completed a bachelor's or master's degree should also leverage partnerships with college and university faculty and career center staff to attain internships with companies to work on specific projects or products related to their skills.

Real world experience can also be gained by building up your own portfolio of coding work by getting involved with open-source projects, putting together a side software project, or volunteering to build a website.

Find a focus

Developers and programmers will generally specialize in either web and mobile applications or software and systems. Some may choose to become experts in a single programming language such as JAVA, SQL, PHP or Python while others may specialize in a specific type of development such as web development or mobile development. Some common types of developer specialties include:

- Front-end developer
- Backend developer
- Full stack developer
- Game developer
- DevOps
- Mobile developer

Get a certification

Professional certifications in software development and computer programming demonstrate a conceptual understanding and technical expertise in specific areas of the profession. A variety of credentialing programs are available based on your career needs and professional goals.

Keep learning

Lifelong learning is a requirement in this field as the rate of change in the industry is extremely high, so to be successful in this field you must enjoy constantly learning and exploring new technologies and new ways of doing things. To excel in this field you will need to supplement your learning through sites like StackOverflow, CodingGame and Code Wars to help you sharpen and improve your skills.

Who is hiring?

The employment outlook for software developers and programmers in the Kansas City region is very good over the next five years. Companies across every sector, from healthcare to financial services, are looking for talent. Some of the top employers of software developers and computer programmers in the region include:

- Cerner
- H&R Block
- YRC Worldwide Inc
- Iron Systems
- Burns & McDonnell
- T-Mobile
- Valorem
- Community America Credit Union
- Dairy Farmers of America
- DST Systems

Top non-technical skills

Non-technical or essential skills are very valuable to employers because developers and programmers work with a variety of non-engineers and end users such as customers and vendors.

To understand the type of non-technical and technical skills most sought after by area hiring managers when they are reviewing resumes, we examined active job postings for software developers in the Kansas City area in the first and second quarters of 2020 and created a list of the most commonly required abilities for these occupations.

- **Collaborating** — The ability to work effectively in group settings and leverage the input of others to create solutions.
- **Communicating** — The ability to speak in technical and nontechnical terms in a clear, effective and efficient way to a variety of audiences.
- **Creative Thinking** — The ability to develop new approaches to solving a problem.
- **Critical Thinking** — The ability to assess a variety of potential approaches and choose the best option.
- **Detail Oriented** — The ability to pay close attention to all of the small particulars of a project.
- **Lifelong Learning** — Displaying a willingness to learn and apply new knowledge and skills.

- **Problem Solving** — The ability to understand complex issues and develop technological solutions.

Top technical skills

Software development requires a comprehensive skill set and knowledge base that includes programming languages, database, web as well as business requirements and testing products. Some of the required skills include:

- HTML
- CSS
- Agile Scrum
- SQL
- Linux

Understanding of fundamental programming concepts, with experience in one or more of the following languages: PHP, JavaScript, Ruby, Python, or similar development language

Experience working with web technologies and APIs

Experience with the following Microsoft technologies: C# .Net, ASP .Net, XML, SQL, MS Access.

Resources

Blogs

- DiscoverDev
- Morning Cup of Coding

Podcasts

- CodeNewbie
- DevDiscuss
- The Changelog
- Developer Tea
- Software Engineering Daily

YouTube

- freeCodeCamp

Forums

- Hacker News

IT professional associations and organizations

Computing Technology Industry Association (CompTIA) is the voice of the world's information technology (IT) industry.

EDUCAUSE is a nonprofit association and the foremost community of IT leaders and professionals committed to advancing higher education.