JUNE 2018



MILWAUKEE'S TECH TALENT IMPACT An Overview of Tech Occupations and Tech-Dependent Industries



HULS GROUP



We would like to thank the following partners, who assisted us throughout the project:



THE HULS GROUP positions communities, companies, and organizations for accelerated success in the innovation economy.

www.hulsgroup.com

HULS GROUP



TIP STRATEGIES, INC. is a consulting firm that specializes in economic and workforce development research, analysis, and strategic planning. Established in 1995, TIP is committed to providing quality solutions for public and private sector clients.

www.tipstrategies.com

CONTENTS

1. OVERVIEW	1
APPROACH	1
KEY FINDINGS	1
2. TECH TALENT CLUSTER	3
EMPLOYMENT	3
EARNINGS	4
OPENINGS	7
BENCHMARKING	8
3. TECH TALENT DEPENDENT INDUSTRIES	9
INDUSTRY IMPACT	9
JOBS MULTIPLIERS	0
APPENDIX: METHODOLOGY	2
TECH TALENT CLUSTER DEFINITION	2
TECH TALENT DEPENDENT INDUSTRY DEFINITION 1	6
ABOUT THE DATA	21

1. OVERVIEW

The Milwaukee region has a sizeable base of technology talent that consists of nearly 76,000 workers and supports more than 140 industries. Together, these industries contribute more than \$27 billion to the regional economy.

Access to such a pool of technology workers is increasingly an essential element of successful economies. Yet, the region's technology talent shows signs of lagging growth, especially in comparison to peer regions. To stay competitive, the Milwaukee region can and should come together to strengthen both the talent pipeline and the ecosystem that supports this talent cluster.

In recognition of this fact, this report aims to document the occupations that are a part of this important talent cluster and the industries that depend on them. This analysis provides a baseline state of the talent cluster from which progress over time can be measured.

FIGURE 1. TECH TALENT CLUSTER HIGHLIGHTS



\$27.6 BILLION

Contribution to M7 Region economy from industries that rely on the Tech Talent Cluster



75,900

Number of workers in the Tech Talent Cluster in 2017 in M7 Region.



31,000

Estimated openings in Tech Talent Cluster over the next five years.

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies Note: See appendix for definition of "Tech Talent Cluster."

APPROACH

To support the goal of identifying tech talent and the broader role it plays in the regional economy, the analysis incorporates an occupation-based definition. This Tech Talent Cluster goes beyond the traditional definition—which is typically limited to manufacturing and services directly associated with information technology (IT)—to capture workers across multiple industries. In addition to identifying a more comprehensive talent base, this approach allows the analysis to better reflect the importance of tech talent to the region's major employers. To supplement the occupational analysis, industries that depend on tech talent are identified. These Tech Talent Dependent Industries are defined for this analysis as industries that have 15 percent or more of their workforce comprised of Tech Talent Cluster occupations.

Unless otherwise indicated, the seven counties served by the Milwaukee 7 Regional Economic Development Partnership (M7 Region) were used as the geographic unit of analysis: Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington and Waukesha. Additional information about the methodology, including a list of occupations included in the Tech Talent Cluster, is provided in the appendix.

KEY FINDINGS

 The Tech Talent Cluster supports a broad range of industries in the Milwaukee area. In 2017, Tech Talent Dependent Industries (those having 15 percent or more of their workforce comprised of Tech Talent Cluster occupations) contributed \$27.63 billion in gross regional product to the M7 Region economy. This figure represents nearly one quarter of total economic output in the seven-county region, which was estimated at \$119.26 billion in 2017.

- The Tech Talent Cluster is comprised of 89 different occupations that employed nearly 76,000 workers in 2017 in the M7 Region. Occupations encompassed by the cluster represent a broad range of skills, including information technology, engineering, and business and financial positions.
- The Tech Talent Cluster is projected to generate more than 31,000 job openings in the M7 Region over the next five years, driven primarily by the replacement needs of employers. This projection is based on historic hiring trends and does not include the potential impact of the announced Foxconn operations.
- The occupations expected to have the highest number of openings include several positions with advanced skill levels, such as market research analysts, management analysts, computer systems analysts, software developers, mechanical engineers, and computer and information systems managers.
- The Tech Talent Dependent Industries represent more than 5,300 establishments in the M7 Region. On average, each position in this group of 141 industries supports another 1.75 jobs in the region.
- The pace of job growth for Tech Talent workers exceeds the overall rate of employment growth in the region. Employment in the Tech Talent Cluster grew 8.0 percent between 2010 and 2017, compared with 7.1 percent for all occupations in the M7 Region.
- Estimated earnings of the Tech Talent Cluster exceed \$4.7 billion each year. The vast majority of occupations in the cluster have median hourly wages above the regional median for all occupations.

FIGURE 2. OVERVIEW OF TECH TALENT STUDY METHODOLOGY



What does M7's tech workforce look like?

- The "Tech Talent Cluster" encompases 89 individual occupations across 11 major groups.
- Three occupational groups-computer & mathematical, engineering, and business & financial-acount for 75% of the total cluster.



What is the demand for Tech Talent?

- The Tech Talent Cluster is projected to have more than 31,000 job openings.
- Many of the occupations with the highest number of openings are advanced skill positions.



What industries rely on this talent?

- The Tech Talent Cluster as a group accounts for 15% or more of total employment in 141 industries.
- These "Tech Talent Dependent Industries" include many of the region's largest employers.



What role do "Tech Talent Dependent Industries" play in the M7 economy?

- The 141 industries contributed a combined \$27.6 billion to the M7 Region's GRP in 2017 (23% of the total).
- The Tech Talent Dependent Industries employ more than 145,000 workers.

2. TECH TALENT CLUSTER

This section provides an overview of the 89 occupations that comprise the Tech Talent Cluster. For a discussion of methodology, including how the cluster was defined and a complete list of occupations, see the appendix.

EMPLOYMENT

As a group, the Tech Talent Cluster employs nearly **76,000 workers** in the seven-county M7 Region. The cluster's 25 largest occupations account for 80 percent of the group's total employment. Although employment in many of the largest tech occupations declined during the most recent recession, employment trends for several positions have improved in recent years. The strongest growth rates in the last five years have been in many of the highly skilled IT-related occupations (computer systems analysts, computer and information systems managers, web developers) and data-enabled analysts (management analysts, cost estimators).

LOCATION QUOTIENTS (LQs)

Location quotients compare the share of employment in an industry or occupation with the share of the same industry or occupation at the national level. If local and national employment levels are perfectly proportional, the LQ will be 1.00. See the appendix for additional information.

The M7 Region has a high concentration of employment relative to the US in many of the Tech Talent Cluster occupations, as evidenced by location quotients of 1.20 and above. These occupations are primarily in the engineering category, which is a reflection of the region's manufacturing strength.

SOC	OCCUPATION	2017	HISTORIC 9	6 CHANGE	
TOTAL, AL	L 89 TECH TALENT OCCUPATIONS	75,884	0%	+4%	
15-1121	Computer Systems Analysts	4,948	+13%	+10%	1.20
15-1151	Computer User Support Specialists	4,889	+8%	+7%	1.03
15-1132	Software Developers, Applications	4,809	+9%	+9%	0.84
13-1111	Management Analysts	4,634	+11%	+11%	0.81
13-1161	Market Research Analysts and Marketing Specialists	4,420	+8%	+9%	1.06
17-2141	Mechanical Engineers	4,124	-7%	-2%	2.07
17-2112	Industrial Engineers	2,951	-6%	-0%	1.67
11-3021	Computer and Information Systems Managers	2,753	+10%	+9%	1.08
15-1142	Network/Computer Systems Administrators	2,697	+0%	+3%	1.01
13-2051	Financial Analysts	2,426	+1%	+4%	1.19
27-1024	Graphic Designers	2,190	-8%	+7%	1.09
17-2071	Electrical Engineers	1,841	-2%	-2%	1.43
13-1051	Cost Estimators	1,716	-10%	+16%	1.09
15-1152	Computer Network Support Specialists	1,705	+2%	+4%	1.17
15-1133	Software Developers, Systems Software	1,704	-2%	+1%	0.58

FIGURE 3. 25 LARGEST TECH TALENT CLUSTER OCCUPATIONS IN M7 REGION RANKED BY NUMBER OF JOBS IN 2017

SOC		2017	HISTORIC 9	LQ	
CODE	OCCUPATION	JOBS	10 YEARS	5 YEARS	(US=1.00)
11-9041	Architectural and Engineering Managers	1,665	-5%	+0%	1.34
15-1131	Computer Programmers	1,594	-9%	-3%	0.80
49-2022	Telecomm. Equipment Installers/Repairers*	1,574	-18%	-2%	0.96
15-1199	Computer Occupations, All Other	1,477	+3%	+5%	0.75
29-2034	Radiologic Technologists	1,472	+0%	-1%	1.04
15-1143	Computer Network Architects	1,099	+1%	+5%	0.99
15-1134	Web Developers	1,056	+20%	+12%	0.89
17-3013	Mechanical Drafters	960	-12%	-3%	2.14
51-2023	Electromechanical Equipment Assemblers	854	-8%	+1%	2.66
17-3023	Electrical/Electronics Engineering Technicians	828	-12%	-4%	0.87

FIGURE 3. 25 LARGEST TECH TALENT CLUSTER OCCUPATIONS IN M7 REGION (CONTINUED)

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies

Note: See appendix for details regarding this analysis, including the definition of "Tech Talent Cluster" and an explanation of location quotients (LQs). Occupations with LQs of 1.20 or greater are highlighted.

*Except Line Installers

EARNINGS

The 89 Tech Talent Cluster occupations account for an estimated **\$4.7 billion** in earnings in the M7 Region. Earnings for a number of Tech Talent occupations are among the region's highest. The vast majority of positions in the group (74 out of 89 occupations) feature median earnings above the regional median for all occupations (estimated at \$47,341). Median earnings for the cluster's occupations generally fall below the national median, however, the Milwaukee area's affordability relative to the nation's largest technology regions may help to explain this gap.

FIGURE 4. MEDIAN ANNUAL EARNINGS FOR 25 LARGEST TECH TALENT CLUSTER OCCUPATIONS RANKED BY NUMBER OF JOBS IN 2017

			MEDIAN ANNUAL EARNIN RELA		
SOC		2017	M7		
CODE	OCCUPATION	JOBS	REGION	US	(US=1.00)
15-1121	Computer Systems Analysts	4,948	\$77,506	\$86,076	0.90
15-1151	Computer User Support Specialists	4,889	\$51,742	\$49,443	1.05
15-1132	Software Developers, Applications	4,809	\$82,801	\$99,126	0.84
13-1111	Management Analysts	4,634	\$76,830	\$75,464	1.02
13-1161	Market Research Analysts and Marketing Specialists	4,420	\$57,582	\$62,229	0.93
17-2141	Mechanical Engineers	4,124	\$73,924	\$83,829	0.88
17-2112	Industrial Engineers	2,951	\$75,151	\$84,338	0.89
11-3021	Computer and Information Systems Managers	2,753	\$116,490	\$134,745	0.86

FIGURE 4. MEDIAN ANNUAL EARNINGS FOR 25 LARGEST TECH TALENT CLUSTER OCCUPATIONS (CONTINUED)

		MEDIAN	I ANNUAL E	ARNINGS	
SOC CODE	OCCUPATION	2017 JOBS	M7 REGION	US	RELATIVE EARNINGS (US=1.00)
15-1142	Network/Computer Systems Administrators	2,697	\$72,070	\$79,358	0.91
13-2051	Financial Analysts	2,426	\$72,367	\$81,454	0.89
27-1024	Graphic Designers	2,190	\$45,127	\$42,151	1.07
17-2071	Electrical Engineers	1,841	\$81,103	\$93,669	0.87
13-1051	Cost Estimators	1,716	\$59,439	\$60,907	0.98
15-1152	Computer Network Support Specialists	1,705	\$57,133	\$62,759	0.91
15-1133	Software Developers, Systems Software	1,704	\$88,527	\$105,988	0.84
11-9041	Architectural and Engineering Managers	1,665	\$116,061	\$134,398	0.86
15-1131	Computer Programmers	1,594	\$66,897	\$77,345	0.86
49-2022	Telecomm. Equipment Installers/Repairers*	1,574	\$52,678	\$52,992	0.99
15-1199	Computer Occupations, All Other	1,477	\$66,895	\$84,690	0.79
29-2034	Radiologic Technologists	1,472	\$59,673	\$57,666	1.03
15-1143	Computer Network Architects	1,099	\$97,177	\$100,530	0.97
15-1134	Web Developers	1,056	\$43,506	\$57,102	0.76
17-3013	Mechanical Drafters	960	\$49,951	\$54,747	0.91
51-2023	Electromechanical Equipment Assemblers	854	\$36,714	\$33,342	1.10
17-3023	Electrical/Electronics Engineering Technicians	828	\$51,861	\$62,378	0.83

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies

Note: See appendix for details regarding this analysis, including the definition of "Tech Talent Cluster." Estimated annual earnings represent median hourly earnings for the occupation multiplied by 2,080 hours. Relative earnings: occupations with earnings 10% or more below the US median are shown in orange; those 10% or more above national levels are shown in purple.

*Except Line Installers

While Figure 4 presented median earnings for the 25 *largest* Tech Talent Cluster occupations, Figure 5 (next page) shows median earnings for the 25 highest-paying occupations in the cluster. IT managers (SOC 11-3021) had the highest median annual earnings at more than \$116,000 However, this figure lags US earnings by 14 points. Radiation therapists (SOC 29-1124) had the highest relative earnings, with regional median earnings for this occupation exceeding national levels by 11 points.

FIGURE 5. 25 HIGHEST-PAID TECH TALENT CLUSTER OCCUPATIONS

RANKED BY MEDIAN ANNUAL EARNINGS IN THE M7 REGION

			MEDIAN ANNUAL EARNING		
SOC CODE	OCCUPATION	2017 JOBS	M7 REGION	US	RELATIVE EARNINGS (US=1.00)
11-3021	Computer and Information Systems Managers	2,753	\$116,490	\$134,745	0.86
11-9041	Architectural and Engineering Managers	1,665	\$116,061	\$134,398	0.86
17-2171	Petroleum Engineers	20	\$115,376	\$128,194	0.90
17-2061	Computer Hardware Engineers	187	\$106,521	\$114,984	0.93
17-2011	Aerospace Engineers	44	\$101,662	\$109,658	0.93
17-2041	Chemical Engineers	136	\$97,648	\$98,342	0.99
15-1143	Computer Network Architects	1,099	\$97,177	\$100,530	0.97
15-2011	Actuaries	196	\$90,305	\$100,610	0.90
15-1111	Computer and Information Research Scientists	69	\$90,171	\$111,827	0.81
29-1124	Radiation Therapists	122	\$88,877	\$80,163	
15-1133	Software Developers, Systems Software	1,704	\$88,527	\$105,988	0.84
41-9031	Sales Engineers	573	\$88,382	\$100,006	0.88
19-2021	Atmospheric and Space Scientists	29	\$85,842	\$92,456	0.93
17-2072	Electronics Engineers, Except Computer	628	\$85,302	\$98,808	0.86
19-2032	Materials Scientists	31	\$82,812	\$99,434	0.83
15-1132	Software Developers, Applications	4,809	\$82,801	\$99,126	0.84
17-2161	Nuclear Engineers	26	\$82,497	\$99,467	0.83
19-1021	Biochemists and Biophysicists	51	\$82,067	\$81,733	1.00
15-1122	Information Security Analysts	540	\$81,569	\$92,598	0.88
49-2095	Electr./Electronics Repairers, Powerhouse, Substation, and Relay	40	\$81,508	\$75,670	1.08
17-2071	Electrical Engineers	1,841	\$81,103	\$93,669	0.87
15-1141	Database Administrators	679	\$80,663	\$84,707	0.95
19-3011	Economists	148	\$79,753	\$101,046	0.79
15-1121	Computer Systems Analysts	4,948	\$77,506	\$86,076	0.90
13-1111	Management Analysts	4,634	\$76,830	\$75,464	1.02

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies

Note: See appendix for details regarding this analysis, including the definition of "Tech Talent Cluster." Estimated annual earnings represent median hourly earnings for the occupation multiplied by 2,080 hours. Relative earnings: occupations with earnings 10% or more below the US median are shown in orange; those 10% or more above national levels are shown in purple.

OPENINGS

The Tech Talent Cluster is projected to generate **more than 31,000 job openings** in the *M7* Region over the next five years. These job openings result from both the addition of new positions and the replacement of workers who change careers or who exit the workforce entirely. The majority of the expected openings—roughly 9 out of 10—will be driven by replacement needs of regional employers. Five occupations are expected to account for nearly one-third of total job openings in the cluster, with more than 10,000 openings combined. These data-enabled analysts include positions related to business analytics and business intelligence.

The figures shown below do not reflect the impact of Foxconn's planned liquid crystal display (LCD) manufacturing facility in Racine County. This massive investment will have dramatic impacts across a wide range of occupations, including technology workers.

FIGURE 6. 25 TECH TALENT CLUSTER OCCUPATIONS IN HIGHEST DEMAND IN THE M7 REGION RANKED BY PROJECTED NUMBER OF JOB OPENINGS NEXT FIVE YEARS

	PROJECTED OPI MEDIAN NEXT 5 YEA					
SOC CODE	OCCUPATION	2017 JOBS	HOURLY EARNINGS M7 REGION	TOTAL OPENINGS	SHARE DUE TO REPLACEMENT DEMAND	
TOTAL, A	LL 89 TECH TALENT OCCUPATIONS	75,884	-	31,539	92 %	
13-1161	Market Research Analysts and Marketing Specialists	4,420	\$27.68	2,443	90%	
13-1111	Management Analysts	4,634	\$36.94	2,314	88%	
15-1151	Computer User Support Specialists	4,889	\$24.88	1,993	91%	
15-1121	Computer Systems Analysts	4,948	\$37.26	1,897	86%	
15-1132	Software Developers, Applications	4,809	\$39.81	1,802	87%	
17-2141	Mechanical Engineers	4,124	\$35.54	1,284	98%	
11-3021	Computer and Information Systems Managers	2,753	\$56.00	1,176	88%	
13-2051	Financial Analysts	2,426	\$34.79	1,100	94%	
27-1024	Graphic Designers	2,190	\$21.70	1,061	95%	
17-2112	Industrial Engineers	2,951	\$36.13	972	96%	
15-1142	Network and Computer Systems Administrators	2,697	\$34.65	894	93%	
13-1051	Cost Estimators	1,716	\$28.58	862	97%	
49-2022	Telecommunications Equip. Installers and Repairers*	1,574	\$25.33	783	98%	
15-1152	Computer Network Support Specialists	1,705	\$27.47	654	94%	
15-1133	Software Developers, Systems Software	1,704	\$42.56	626	89%	
17-2071	Electrical Engineers	1,841	\$38.99	589	97%	
11-9041	Architectural and Engineering Managers	1,665	\$55.80	578	97%	
15-1199	Computer Occupations, All Other	1,477	\$32.16	533	93%	
15-1131	Computer Programmers	1,594	\$32.16	489	99%	

soc		2017	PROJECTED OPENINGS MEDIAN NEXT 5 YEARS HOURLY SHARE DUE FARNINGS TOTAL REPLACEME			
CODE	OCCUPATION	JOBS	M7 REGION	OPENINGS	DEMAND	
51-2023	Electromechanical Equipment Assemblers	854	\$17.65	488	99%	
15-1134	Web Developers	1,056	\$20.92	464	83%	
51-2021	Coil Winders, Tapers, and Finishers	760	\$15.34	441	98%	
29-2034	Radiologic Technologists	1,472	\$28.69	406	93%	
17-3013	Mechanical Drafters	960	\$24.01	388	100%	
15-1143	Computer Network Architects	1,099	\$46.72	378	93%	

FIGURE 6. 25 TECH TALENT CLUSTER OCCUPATIONS IN HIGHEST DEMAND IN THE M7 REGION (CONT.)

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies

Note: Median hourly earnings for the Tech Talent Cluster occupations as a group could not be calculated. See appendix for details regarding this analysis, including the definition of "Tech Talent Cluster" and an explanation of openings. *Except Line Installers

BENCHMARKING

This section compares Tech Talent Cluster employment in the Milwaukee area with ten peer and leader metropolitan areas frequently used in regional benchmarking exercises. For consistency with the other areas, the figure below uses the Milwaukee-Waukesha-West Allis, WI metropolitan statistical area (MSA), which consists of the following counties: Milwaukee, Ozaukee, Washington, and Waukesha. Because metro areas are the basis for comparison in Figure 7, the number of Tech Talent Cluster jobs shown for Milwaukee is lower than the M7 Region figures shown in previous sections. This is due to the fact that totals reflect employment in four counties rather than seven. (See the appendix for an explanation of MSAs.)

FIGURE 7. TECH TALENT CLUSTER COMPARISONS TO BENCHMARK METROPOLITAN AREAS RANKED BY CONCENTRATION OF EMPLOYMENT (LOCATION QUOTIENT)

	2010	2017	2010-2017 CHG.		2017 LQ
METRO AREA NAME	JOBS	JOBS	#	%	(US=1.00)
Madison, WI	36,089	45,887	9,798	+27.1%	1.60
Austin-Round Rock, TX	83,457	114,229	30,772	+36.9%	1.54
Portland-Vancouver-Hillsboro, OR-WA	94,156	116,184	22,028	+23.4%	1.31
Kansas City, MO-KS	79,883	92,120	12,237	+15.3%	1.18
Milwaukee-Waukesha-West Allis, WI	62,238	66,848	4,610	+ 7.4 %	1.08
Cincinnati, OH-KY-IN	72,503	82,815	10,312	+14.2%	1.07
Pittsburgh, PA	80,858	88,539	7,681	+9.5%	1.06
Cleveland-Elyria, OH	70,873	77,700	6,827	+9.6%	1.02
Indianapolis-Carmel-Anderson, IN	64,423	75,750	11,327	+17.6%	1.01
Oklahoma City, OK	40,084	42,940	2,856	+7.1%	0.93
Buffalo-Cheektowaga-Niagara Falls, NY	31,472	32,285	813	+2.6%	0.82

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies Note: See appendix for details regarding this analysis, including the definition of "Tech Talent Cluster."

3. TECH TALENT DEPENDENT INDUSTRIES

To understand the Tech Talent Cluster's role in the regional economy, the 89 occupations were matched to industries in the region assuming national staffing patterns. This analysis identified 141 industries that were identified as dependent upon this workforce. This section presents data for this group of Tech Talent Dependent Industries. (Additional information, including a list of industries, is provided in the appendix.)

INDUSTRY IMPACT

Workers in the Tech Talent Cluster support a range of industries in the M7 Region. As a group, the 89 occupations encompassed by this definition account for more than 15 percent of total employment in 141 individual industries (6-digit NAICS level). Taken together, these "Tech Talent Dependent Industries" account for **\$27.6 billion** of the combined gross regional product for the region's seven counties. Many of M7's largest employers are classified within these industries. Examples include corporate headquarters (NAICS 551114), insurance (NAICS 524113 and 524114), and medical devices (NAICS 334517, 423450, and 334510).

Along with GRP, Figure 8 shows the share the Tech Talent Cluster comprises of each industry's employment and the estimated number of workers that share represents. Workers in the 89 Tech Talent Cluster occupations account for about one-third (31.2 percent) of the nearly 146,000 workers employed across the 141 identified industries in 2017, or roughly 45,400 workers.

		TECH TALENT JOBS			
NAICS		2017		% OF	2017 GRP
CODE	INDUSTRY	JOBS	#	INDUSTRY	(in millions)
TOTAL, 1	41 TECH TALENT DEPENDENT INDUSTRIES	145,720	45,421	31.2%	\$27,625.7
551114	Corporate, Subsidiary, and Regional Managing Offices	28,888	6,857	23.7%	\$4,039.9
524113	Direct Life Insurance Carriers	5,790	1,297	22.4%	\$2,705.9
334517	Irradiation Apparatus Manufacturing	3,885	1,459	37.6%	\$1,086.7
517311	Wired Telecommunications Carriers	2,636	1,356	51.4%	\$1,047.9
335314	Relay and Industrial Control Manufacturing	5,276	1,554	29.5%	\$900.8
518210	Data Processing, Hosting, and Related Services	4,403	2,268	51.5%	\$814.5
524114	Direct Health and Medical Insurance Carriers	2,605	544	20.9%	\$768.7
423450	Medical, Dental, and Hospital Equip./Supplies Wholesalers	3,077	837	27.2%	\$754.7
541511	Custom Computer Programming Services	5,515	3,938	71.4%	\$749.2
523920	Portfolio Management	1,851	309	16.7%	\$700.0
221112	Fossil Fuel Electric Power Generation	883	190	21.5%	\$563.0
541512	Computer Systems Design Services	4,370	3,105	71.1%	\$501.8
541330	Engineering Services	4,405	1,868	42.4%	\$482.7
423430	Computer and Computer Peripheral Equip./Software Wholesalers	1,480	388	26.2%	\$456.2
423610	Electrical App. and Equip., Wiring Supplies, and Related Wholesalers	2,444	439	18.0%	\$434.0

FIGURE 8. TOP 25 TECH TALENT DEPENDENT INDUSTRIES IN THE M7 REGION RANKED BY 2017 GROSS REGIONAL PRODUCT (GRP)

			TECH TA	LENT JOBS	
NAICS		2017		% OF	2017 GRP
CODE	INDUSTRY	JOBS	#	INDUSTRY	(in millions)
541611	Administrative Mgmt. and General Mgmt. Consulting Services	3,090	1,251	40.5%	\$380.5
333618	Other Engine Equipment Manufacturing	2,328	482	20.7%	\$377.9
221122	Electric Power Distribution	987	244	24.7%	\$371.2
523930	Investment Advice	1,711	273	16.0%	\$354.4
333120	Construction Machinery Manufacturing	1,813	307	16.9%	\$331.9
511210	Software Publishers	1,385	794	57.3%	\$314.4
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	854	320	37.5%	\$311.5
533110	Lessors of Nonfinancial Intangible Assets (exc. Copyrighted Works)	114	23	20.2%	\$288.7
517312	Wireless Telecommunications Carriers (except Satellite)	612	318	52.0%	\$265.4
221210	Natural Gas Distribution	456	82	18.0%	\$265.0

FIGURE 8. TOP 25 TECH TALENT DEPENDENT INDUSTRIES IN THE M7 REGION (CONTINUED)

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies

Note: See appendix for details regarding this analysis, including the definition of "Tech Talent Dependent Industries" and an explanation of GRP.

JOBS MULTIPLIERS

To further illustrate the reach of this workforce, the figure below presents total jobs multipliers for the top 25 Tech Talent Dependent Industries based on gross regional product. Jobs multipliers show the ripple effects of regional job creation by modeling the impact of spending between businesses within the industry's supply chain and between consumers and other firms as workers spend their earnings. The total jobs multipliers shown in Figure 9 include the initial job, as well as the direct, indirect, and induced jobs it supports. Thus, a total jobs multiplier of 2.75 means that each job in the Tech Talent Dependent Industries supports an additional 1.75 jobs on average in the regional economy.

FIGURE 9. JOBS MULTIPLIERS FOR TOP 25 TECH TALENT DEPENDENT INDUSTRIES RANKED BY 2017 GROSS REGIONAL PRODUCT (GRP), WITH NUMBER OF PAYROLLED BUSINESSES IN 2017

NAICS CODE	INDUSTRY	TOTAL JOBS MULTIPLIER	PAYROLLED BUSINESSES	2017 GRP (in millions)
TOTAL,	ALL 141 TECH TALENT DEPENDENT INDUSTRIES	2.75	5,359	\$27,625.7
551114	Corporate, Subsidiary, and Regional Managing Offices	2.73	365	\$4,039.9
524113	Direct Life Insurance Carriers	4.90	33	\$2,705.9
334517	Irradiation Apparatus Manufacturing	3.64	26	\$1,086.7
517311	Wired Telecommunications Carriers	3.96	71	\$1,047.9
335314	Relay and Industrial Control Manufacturing	2.60	27	\$900.8
518210	Data Processing, Hosting, and Related Services	3.41	69	\$814.5
524114	Direct Health and Medical Insurance Carriers	3.58	40	\$768.7
423450	Medical, Dental, and Hospital Equip./Supplies Wholesalers	2.95	125	\$754.7
541511	Custom Computer Programming Services	1.94	472	\$749.2
523920	Portfolio Management	2.06	115	\$700.0

NAICS CODE	INDUSTRY	TOTAL JOBS MULTIPLIER	PAYROLLED BUSINESSES	2017 GRP (in millions)
221112	Fossil Fuel Electric Power Generation	5.06	8	\$563.0
541512	Computer Systems Design Services	1.91	334	\$501.8
541330	Engineering Services	2.40	332	\$482.7
423430	Computer and Computer Peripheral Equip./Software Wholesalers	3.40	114	\$456.2
423610	Electrical App. and Equip., Wiring Supplies, and Related Wholesalers	2.53	123	\$434.0
541611	Administrative Mgmt. and General Mgmt. Consulting Services	1.91	357	\$380.5
333618	Other Engine Equipment Manufacturing	3.56	8	\$377.9
221122	Electric Power Distribution	3.37	17	\$371.2
523930	Investment Advice	2.31	217	\$354.4
333120	Construction Machinery Manufacturing	3.31	18	\$331.9
511210	Software Publishers	2.56	65	\$314.4
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	3.12	9	\$311.5
533110	Lessors of Nonfinancial Intangible Assets (exc. Copyrighted Works)	25.96	16	\$288.7
517312	Wireless Telecommunications Carriers (except Satellite)	5.58	17	\$265.4
221210	Natural Gas Distribution	4.17	17	\$265.0

FIGURE 9. JOBS MULTIPLIERS FOR TOP 25 TECH TALENT DEPENDENT INDUSTRIES (CONTINUED)

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies Note: See appendix for details regarding this analysis, including the definition of "Tech Talent Dependent Industries" and an explanation of jobs multipliers.

APPENDIX: METHODOLOGY

TECH TALENT CLUSTER DEFINITION

The Tech Talent Cluster takes an occupation-based view of the technology sector, rather than the more traditional industry-based approach. The "tech" occupations delineated in CompTIA's *Cyberstates 2017* research report formed the starting point for the definition used in this report. This initial list of occupations was modified using a November 2017 analysis prepared by the Brookings Institute, entitled *Digitalization and the American Workforce*, in conjunction with local input. The final definition, comprised of 89 occupations, is presented in Figure 10.

FIGURE 10. TECH TALENT CLUSTER DEFINITION (OCCUPATION-BASED)

		ΝΤΙΑ	NOILI
SOC CODE	& DESCRIPTION	COM	ADD
INFORMA	TION TECHNOLOGY OCCUPATIONS		
11-3021	Computer and Information Systems Managers	~	
15-1111	Computer and Information Research Scientists	✓	
15-1121	Computer Systems Analysts	~	
15-1122	Information Security Analysts	~	
15-1131	Computer Programmers	~	
15-1132	Software Developers, Applications	~	
15-1133	Software Developers, Systems Software	~	
15-1134	Web Developers	~	
15-1141	Database Administrators	~	
15-1142	Network and Computer Systems Administrators	~	
15-1143	Computer Network Architects	~	
15-1151	Computer Support Specialists	~	
15-1152	Computer Network Support Specialists	~	
15-1199	Computer Occupations, All Other	~	
BUSINESS	& FINANCIAL OCCUPATIONS		
15-2011	Actuaries		\checkmark
15-2021	Mathematicians		✓
15-2031	Operations Research Analysts		\checkmark
15-2041	Statisticians		✓
13-1161	Market Research Analysts and Marketing Specialists		\checkmark
13-1051	Cost Estimators		✓
13-2051	Financial Analysts		\checkmark
13-1111	Management Analysts		\checkmark

FIGURE 10. TECH TALENT CLUSTER DEFINITION (OCCUPATION-BASED) (CONTINUED)

		MPTIA	DITION
SOC CODE	& DESCRIPTION	0	AD
ENGINEER	ING & ENGINEERING TECHNICIANS OCCUPATIONS		
11-9041	Engineering Managers	√	
17-1021	Cartographers and Photogrammetrists		~
17-1022	Surveyors		✓
17-2011	Aerospace Engineers	\checkmark	
17-2021	Agricultural Engineers		√
17-2031	Biomedical Engineers	\checkmark	
17-2041	Chemical Engineers		√
17-2061	Computer Hardware Engineers	\checkmark	
17-2071	Electrical Engineers	\checkmark	
17-2072	Electronics Engineers, Except Computer	\checkmark	
17-2112	Industrial Engineers	\checkmark	
17-2131	Materials Engineers	\checkmark	
17-2141	Mechanical Engineers	\checkmark	
17-2161	Nuclear Engineers		\checkmark
17-2171	Petroleum Engineers		√
17-2199	Engineers, All Other	\checkmark	
17-3011	Architectural and Civil Drafters		√
17-3012	Electrical and Electronics Drafters		\checkmark
17-3013	Mechanical Drafters		√
17-3021	Aerospace Engineering and Operations Technicians	\checkmark	
17-3023	Electrical and Electronics Engineering Technicians	\checkmark	
17-3024	Electro-Mechanical Technicians	\checkmark	
17-3026	Industrial Engineering Technicians	\checkmark	
17-3027	Mechanical Engineering Technicians	\checkmark	
17-3029	Engineering Technicians, Except Drafters, All Other	√	
17-3031	Surveying and Mapping Technicians		√
41-9031	Sales Engineers		√
LIFE, PHYS	SICAL, AND SOCIAL SCIENCE OCCUPATIONS		
19-2011	Astronomers		\checkmark
19-1021	Biochemists and Biophysicists		\checkmark
19-1041	Epidemiologists		\checkmark

FIGURE 10. TECH TALENT CLUSTER DEFINITION (OCCUPATION-BASED) (CONTINUED)

		PTIA	TION
SOC CODE	& DESCRIPTION	WO	ADDI
19-2021	Atmospheric and Space Scientists		✓
19-2031	Chemists		✓
19-2032	Materials Scientists		\checkmark
19-2042	Geoscientists, Except Hydrologists and Geographers		√
19-2043	Hydrologists		√
19-3011	Economists		√
19-3092	Geographers		√
ARTS, DES	IGN, MEDIA OCCUPATIONS		
27-1011	Art Directors		\checkmark
27-4011	Audio and Video Equipment Technicians	\checkmark	
27-4012	Broadcast Technicians	\checkmark	
27-4014	Sound Engineering Technicians	\checkmark	
27-1024	Graphic Designers		√
27-3042	Technical Writers		√
27-4032	Film and Video Editors		√
HEALTHCA	RE TECHNICIANS / TECHNOLOGIESTS		
29-2033	Nuclear Medicine Technologists		√
29-2034	Radiologic Technologists		\checkmark
29-2035	Magnetic Resonance Imaging Technologists		\checkmark
29-1124	Radiation Therapists		\checkmark
OFFICE &	ADMINISTRATIVE SUPPORT OCCUPATIONS		
43-9011	Computer Operators	\checkmark	
43-9031	Desktop Publishers		✓
43-9111	Statistical Assistants		√
EQUIPMEN	IT INSTALLERS AND REPAIRERS		
49-2011	Computer, Automated Teller, and Office Machine Repairers	√	
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairs	\checkmark	
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	\checkmark	
49-2091	Avionics Technicians	\checkmark	
49-2092	Electric Motor, Power Tool, and Related Repairers	✓	
49-2093	Electrical and Electronics Installers and Repairers, Transportation Equipment	\checkmark	
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	\checkmark	

FIGURE 10. TECH TALENT CLUSTER DEFINITION (OCCUPATION-BASED) (CONTINUED)

		ΑΡΤΙΑ	NOITION
SOC CODE	& DESCRIPTION	COA	ADD
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	✓	
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	\checkmark	
49-2097	Electronic Home Entertainment Equipment Installers and Repairers	✓	
49-2098	Security and Fire Alarm Systems Installers	✓	
49-9062	Medical Equipment Repairers		\checkmark
PRODUCTI	ON – ASSEMBLERS, MACHINE OPERATORS		
51-2021	Coil Winders, Tapers, and Finishers	✓	
51-2023	Electromechanical Equipment Assemblers	✓	
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	√	
51-5111	Prepress Technicians and Workers		\checkmark

Source: TIP Strategies based on existing analyses (including CompTIA's *Cyberstates 2017* research report and Brookings' *Digitalization and the American Workforce* [published November 2017]) and local input.

TECH TALENT DEPENDENT INDUSTRY DEFINITION

Economic impact is typically measured in terms of indicators such as output (sales) and employment multipliers, data which are only published for *industries*, not occupations. To illustrate the impact of the M7 Region's Tech Talent Cluster, the 89 occupations were matched to industries in the region assuming national staffing patterns. (For an explanation of staffing patterns, see the appendix.)

Based on the staffing composition of the region's largest employers, a threshold of 15 percent was used to establish an industry as being "dependent" on the Tech Talent Cluster. Using this threshold, 141 industries were identified. These industries are listed in the figure below. In addition to showing employment in the M7 Region, Figure 11 also indicates the share that the Tech Talent Cluster comprises of total employment and the industry's gross regional product in 2017 (in millions of dollars).

FIGURE 11. TECH TALENT DEPENDENT INDUSTRIES

RANKED BY GROSS REGIONAL PRODUCT (GRP) IN 2017

		2017	TECH TALENT	
		JOBS IN	CLUSTER	
NAICS		M7	SHARE OF	2017 GRP
CODE	INDUSIRY	REGION	JOR2	(in millions)
	TOTAL ALL 141 "TECH TALENT DEPENDENT INDUSTRIES"	145,720	31.2%	\$27,625.7
551114	Corporate, Subsidiary, and Regional Managing Offices	28,888	23.7%	\$4,039.9
524113	Direct Life Insurance Carriers	5,790	22.4%	\$2,705.9
334517	Irradiation Apparatus Manufacturing	3,885	37.6%	\$1,086.7
517311	Wired Telecommunications Carriers	2,636	51.4%	\$1,047.9
335314	Relay and Industrial Control Manufacturing	5,276	29.5%	\$900.8
518210	Data Processing, Hosting, and Related Services	4,403	51.5%	\$814.5
524114	Direct Health and Medical Insurance Carriers	2,605	20.9%	\$768.7
423450	Medical, Dental, and Hospital Equipment/Supplies Wholesalers	3,077	27.2%	\$754.7
541511	Custom Computer Programming Services	5,515	71.4%	\$749.2
523920	Portfolio Management	1,851	16.7%	\$700.0
221112	Fossil Fuel Electric Power Generation	883	21.5%	\$563.0
541512	Computer Systems Design Services	4,370	71.1%	\$501.8
541330	Engineering Services	4,405	42.4%	\$482.7
423430	Computer and Computer Peripheral Equipment/Software Wholesalers	1,480	26.2%	\$456.2
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	2,444	18.0%	\$434.0
541611	Administrative Mgmt. and General Mgmt. Consulting Services	3,090	40.5%	\$380.5
333618	Other Engine Equipment Manufacturing	2,328	20.7%	\$377.9
221122	Electric Power Distribution	987	24.7%	\$371.2
523930	Investment Advice	1,711	16.0%	\$354.4

NAICS CODE	INDUSTRY	2017 JOBS IN M7 REGION	TECH TALENT CLUSTER SHARE OF JOBS	2017 GRP (in millions)
333120	Construction Machinery Manufacturing	1,813	16.9%	\$331.9
511210	Software Publishers	1,385	57.3%	\$314.4
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	854	37.5%	\$311.5
533110	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	114	20.2%	\$288.7
517312	Wireless Telecommunications Carriers (except Satellite)	612	52.0%	\$265.4
221210	Natural Gas Distribution	456	18.0%	\$265.0
325412	Pharmaceutical Preparation Manufacturing	702	17.7%	\$252.0
335312	Motor and Generator Manufacturing	1,699	30.5%	\$249.3
333914	Measuring, Dispensing, and Other Pumping Equipment Manufacturing	1,148	16.2%	\$241.6
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	1,165	37.8%	\$237.6
541810	Advertising Agencies	1,514	18.8%	\$236.5
325414	Biological Product (except Diagnostic) Manufacturing	383	19.6%	\$234.9
335313	Switchgear and Switchboard Apparatus Manufacturing	1,453	28.5%	\$228.4
335311	Power, Distribution, and Specialty Transformer Manufacturing	1,368	29.5%	\$220.1
551112	Offices of Other Holding Companies	1,151	23.8%	\$218.4
221121	Electric Bulk Power Transmission and Control	495	26.1%	\$210.9
541613	Marketing Consulting Services	1,899	41.3%	\$202.9
515120	Television Broadcasting	899	36.6%	\$176.7
333991	Power-Driven Handtool Manufacturing	670	17.8%	\$168.1
333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing	1,263	21.9%	\$165.6
334514	Totalizing Fluid Meter and Counting Device Manufacturing	399	37.6%	\$152.0
335210	Small Electrical Appliance Manufacturing	1,337	15.9%	\$151.5
541612	Human Resources Consulting Services	701	38.4%	\$150.4
423420	Office Equipment Merchant Wholesalers	998	26.4%	\$147.8
333613	Mechanical Power Transmission Equipment Manufacturing	991	20.8%	\$145.1
523991	Trust, Fiduciary, and Custody Activities	1,234	18.6%	\$143.3
333922	Conveyor and Conveying Equipment Manufacturing	877	17.8%	\$134.0
423690	Other Electronic Parts and Equipment Merchant Wholesalers	617	18.6%	\$133.3
511120	Periodical Publishers	1,051	23.4%	\$131.2
541310	Architectural Services	1,187	34.1%	\$124.6
333318	Other Commercial and Service Industry Machinery Manufacturing	1,279	23.6%	\$122.5

NAICS CODE	INDUSTRY	2017 JOBS IN M7 REGION	TECH TALENT CLUSTER SHARE OF JOBS	2017 GRP (in millions)
541430	Graphic Design Services	1,069	38.0%	\$112.7
333993	Packaging Machinery Manufacturing	819	17.7%	\$112.6
334419	Other Electronic Component Manufacturing	1,044	35.5%	\$109.1
333999	All Other Miscellaneous General Purpose Machinery Manufacturing	960	17.8%	\$106.8
333249	Other Industrial Machinery Manufacturing	937	22.9%	\$105.2
423620	Household Appliances, Electric Housewares, and Consumer Electronics Merchant Wholesalers	175	18.3%	\$104.2
333131	Mining Machinery and Equipment Manufacturing	645	17.1%	\$102.1
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	1,015	36.5%	\$95.5
515112	Radio Stations	454	23.6%	\$86.8
541614	Process, Physical Distribution, and Logistics Consulting Services	1,070	36.7%	\$84.8
512230	Music Publishers	157	32.5%	\$82.3
335931	Current-Carrying Wiring Device Manufacturing	760	15.7%	\$81.1
333415	HVAC and Commercial/Industrial Refrigeration Equipment Manufacturing	643	15.6%	\$80.8
541890	Other Services Related to Advertising	872	18.3%	\$80.5
325411	Medicinal and Botanical Manufacturing	378	16.7%	\$78.9
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	464	37.9%	\$76.0
423440	Other Commercial Equipment Merchant Wholesalers	357	26.6%	\$70.4
333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing	396	17.9%	\$67.7
541690	Other Scientific and Technical Consulting Services	597	43.7%	\$65.4
334519	Other Measuring and Controlling Device Manufacturing	327	33.3%	\$60.9
541715	R&D in Physical, Engineering, and Life Sciences (except Nano/Biotech)	566	39.9%	\$59.8
333243	Sawmill, Woodworking, and Paper Machinery Manufacturing	465	23.7%	\$58.1
512110	Motion Picture and Video Production	347	18.4%	\$57.9
541860	Direct Mail Advertising	581	18.8%	\$57.9
335929	Other Communication and Energy Wire Manufacturing	331	17.2%	\$57.6
541380	Testing Laboratories	675	31.4%	\$56.7
511130	Book Publishers	181	23.2%	\$53.1
423460	Ophthalmic Goods Merchant Wholesalers	397	21.9%	\$52.2
333921	Elevator and Moving Stairway Manufacturing	315	18.1%	\$49.9

NAICS CODE	INDUSTRY	2017 JOBS IN M7 REGION	TECH TALENT CLUSTER SHARE OF JOBS	2017 GRP (in millions)
515210	Cable and Other Subscription Programming	68	36.8%	\$49.5
811219	Other Electronic and Precision Equipment Repair and Maintenance	439	52.6%	\$48.6
541620	Environmental Consulting Services	482	40.0%	\$47.6
335911	Storage Battery Manufacturing	296	16.2%	\$47.3
333995	Fluid Power Cylinder and Actuator Manufacturing	524	17.9%	\$46.7
333413	Industrial/Commercial Fan and Blower and Air Purification Equip. Mfg.	326	16.6%	\$46.3
335999	All Other Miscellaneous Electrical Equipment and Component Mfg.	369	15.4%	\$43.0
517911	Telecommunications Resellers	321	40.8%	\$41.9
541519	Other Computer Related Services	274	72.6%	\$39.0
335129	Other Lighting Equipment Manufacturing	267	15.4%	\$38.8
541820	Public Relations Agencies	247	17.8%	\$38.8
423490	Other Professional Equipment and Supplies Merchant Wholesalers	199	25.6%	\$38.8
334416	Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing	364	39.3%	\$38.3
336510	Railroad Rolling Stock Manufacturing	316	15.2%	\$37.0
334290	Other Communications Equipment Manufacturing	287	38.7%	\$36.5
541410	Interior Design Services	346	41.0%	\$34.3
333996	Fluid Power Pump and Motor Manufacturing	314	15.6%	\$34.2
541910	Marketing Research and Public Opinion Polling	381	21.0%	\$34.1
333611	Turbine and Turbine Generator Set Units Manufacturing	203	21.7%	\$33.3
325413	In-Vitro Diagnostic Substance Manufacturing	101	19.8%	\$33.2
541850	Outdoor Advertising	253	18.6%	\$31.1
541513	Computer Facilities Management Services	259	72.2%	\$29.3
333992	Welding and Soldering Equipment Manufacturing	243	17.7%	\$28.7
519130	Internet Publishing and Broadcasting and Web Search Portals	99	40.4%	\$28.0
336412	Aircraft Engine and Engine Parts Manufacturing	211	29.9%	\$27.9
333994	Industrial Process Furnace and Oven Manufacturing	223	17.9%	\$27.4
541420	Industrial Design Services	201	37.8%	\$27.4
541830	Media Buying Agencies	161	18.6%	\$25.6
335991	Carbon and Graphite Product Manufacturing	211	16.1%	\$23.8
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Mfg.	80	17.5%	\$23.8
333241	Food Product Machinery Manufacturing	232	22.4%	\$23.8

NAICS CODE	INDUSTRY	2017 JOBS IN M7 REGION	TECH TALENT CLUSTER SHARE OF JOBS	2017 GRP (in millions)
333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	133	18.0%	\$22.6
523999	Miscellaneous Financial Investment Activities	116	17.2%	\$22.5
811212	Computer and Office Machine Repair and Maintenance	207	54.1%	\$21.9
334210	Telephone Apparatus Manufacturing	95	38.9%	\$21.6
524130	Reinsurance Carriers	69	18.8%	\$20.6
336411	Aircraft Manufacturing	119	32.8%	\$20.3
334111	Electronic Computer Manufacturing	135	63.7%	\$20.1
541930	Translation and Interpretation Services	379	21.1%	\$19.8
334614	Software/Other Prerecorded Compact Disc, Tape, and Record Reproducing	134	32.1%	\$19.4
541713	Research and Development in Nanotechnology	121	41.3%	\$17.9
517919	All Other Telecommunications	41	41.5%	\$15.3
541320	Landscape Architectural Services	145	33.8%	\$14.3
334220	Radio and TV Broadcasting and Wireless Communications Equip. Mfg.	53	37.7%	\$14.2
334516	Analytical Laboratory Instrument Manufacturing	80	36.3%	\$14.0
334310	Audio and Video Equipment Manufacturing	65	33.8%	\$13.1
541350	Building Inspection Services	158	33.5%	\$13.1
541618	Other Management Consulting Services	99	46.5%	\$13.0
333244	Printing Machinery and Equipment Manufacturing	107	23.4%	\$11.5
541340	Drafting Services	115	33.0%	\$11.3
336611	Ship Building and Repairing	77	18.2%	\$10.9
334412	Bare Printed Circuit Board Manufacturing	141	38.3%	\$10.8
334112	Computer Storage Device Manufacturing	22	63.6%	\$10.1
336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing	44	31.8%	\$9.2
515111	Radio Networks	45	24.4%	\$8.0
334118	Computer Terminal and Other Computer Peripheral Equipment Mfg.	42	73.8%	\$7.9
541370	Surveying and Mapping (except Geophysical) Services	92	34.8%	\$6.6
541490	Other Specialized Design Services	78	41.0%	\$5.5
551111	Offices of Bank Holding Companies	43	23.3%	\$4.9
811211	Consumer Electronics Repair and Maintenance	81	55.6%	\$4.1
517410	Satellite Telecommunications	26	65.4%	\$2.6
811213	Communication Equipment Repair and Maintenance	30	56.7%	\$2.4

Source: Emsi 2018.1 – QCEW Employees, Non-QCEW Employees, and Self-Employed; TIP Strategies

ABOUT THE DATA CLASSIFICATION SYSTEMS

Much of the data presented in this report are organized under one of two federal classification systems:

The North American Industry Classification pronounced System (NAICS, Nakes) was developed for use by federal statistical agencies in classifying business establishments for the collection, tabulation, presentation, and analysis of statistical data describing the US economy. The classification system was developed jointly with government agencies in Canada and Mexico to allow for a high level of comparability in business statistics among the North American countries. It classifies industries into 20 sectors based on production processes. These sectors are broken into subsectors, industry groups, and individual industries, with an additional level of detail to accommodate industry codes specific to the three countries.

The Standard Occupational Classification (SOC) System is used by federal statistical agencies to classify workers into categories for the purpose of collecting, calculating, or disseminating data. This system groups all occupations in which work is performed for pay or profit according to the type of work performed and, in some cases, on the skills, education, or training needed to perform the work at a competent level. Under the 2010 SOC System, workers are classified into one of 840 detailed occupations, which are combined to form 461 broad occupations, 97 minor groups, and 23 Federal agencies will major groups. be implementing an update to the SOC System throughout 2018.

EMSI

The data presented in this report were compiled by TIP Strategies using employment by industry and occupation for the seven-county region produced by proprietary data provider, Emsi. The company

FIGURE 12. CLASSIFICATION SYSTEMS STRUCTURE

NORTH AMERICAN INDUSTRIAL CLASSIFICATION SYSTEM



EXAMPLE: Sector 31-33 Manufacturing

- **Subsector 336** Transportation equipment manufacturing
 - Industry group 3361 Motor vehicle manufacturing
 - **Industry 33611** Automobiles & light duty motor vehicles, incl. chassis
 - **Country-specific 336111** Automobiles & light duty motor vehicles, incl. chassis

STANDARD OCCUPATIONAL CLASSIFICATION SYSTEM



EXAMPLE: Major group 51-0000 Production occupations

- Minor group 51-2000 Assemblers & fabricators
 - **Broad occupation 51-2090** Miscellaneous assemblers & fabricators
 - Detailed occupation 51-2092 Team assemblers

integrates economic, labor market, demographic, and education data from over 90 government and private sector sources, creating a comprehensive and current database that includes both published data and detailed estimates, with full coverage of the US. The following provides additional information on selected data elements.

STAFFING PATTERNS/INVERSE STAFFING PATTERNS

To illustrate the relationship between occupations and industries, Emsi incorporates staffing patterns data produced by the US Bureau of Labor Statistics as part of two major programs: the Occupational Employment Statistics (OES) program and the National Industry-Occupation Employment Matrix. Staffing patterns data show the percentage an occupation represents of a given industry, while inverse staffing patterns are used to show the distribution of an occupation across regional industries. As an example, staffing patterns might reveal that nurses typically represent 20% of total employment in hospitals. Inverse staffing patterns, on the other hand, can be used to understand what percentage of all nurses typically work in hospitals.

LOCATION QUOTIENTS (LQS)

Location quotient analysis is a statistical technique used to suggest areas of relative advantage based on a region's employment base. LQs are calculated as an industry or occupation's share of total local employment divided by the same industry or occupation's share of employment at the US level.

(local employment in occupation x / total local employment -all occupations) (national employment in occupation x / total national employment-all occupations)

If local and national employment levels in the occupation are perfectly proportional, the LQ will be 1.00. LQs greater than 1.25 are presumed to indicate a comparative advantage; those below 0.75 suggest areas of weakness but also point to opportunities for retention or attraction of talent.

EARNINGS

Earnings figures are prepared by Emsi as part of the construction of its proprietary employment data set. According to the company's website, these figures rely "heavily" on earnings data reported by the US Bureau of Labor Statistics as part of the agency's OES program.

For **data presented by occupation**, earnings represent hourly earnings, excluding benefits, of a worker in that occupation. Occupational earnings figures include the base rate paid to the worker, along with any additional compensation such as commissions, bonuses, tips, cost of living allowances, hazard pay, etc. Median hourly earnings represent the mid-point of the data. In other words, one-half of the workers have lower hourly earnings; one-half have higher earnings.

<u>Calculation of total earnings across multiple occupations</u>: Occupational earnings are not calculated in Emsi for groups of occupations. TIP Strategies calculated total earnings for the Tech Talent Cluster using the following approach:

1) Figures prepared by the US Bureau of Labor Statistics showing the number of workers by "usual" full- or part-time status according to broad occupational categories were used to estimate the share (%) of workers by employment status for each of the 89 Tech Talent occupation.

- 2) The percentages from step 1 were applied to total employment figures to arrive at an estimate of the number of full-time and part-time workers in each occupation.
- 3) Median hourly wage rates for each occupation were translated into median annual earnings by multiplying the hourly rate times 2,080 hours for full-time workers and by 1,040 hours for part-time workers.
- 4) For each occupation, the estimated number of workers in each category (full-time and part-time) calculated in step 2 was multiplied by the appropriate median annual earnings figure calculated in step 3 to arrive at an estimate of total earnings for the occupation.
- 5) Total earnings by occupation calculated in step 4 were summed to approximate total earnings for the group of occupations.

For **data analyzed on an industry basis**, average earnings per job should be interpreted carefully. It represents the total annual earnings of a regional industry (wages, salaries, profits, benefits, and other compensation) divided by the number of jobs in the industry. It is not synonymous with wages paid to workers in the industry and should not be interpreted as such.

OPENINGS

Openings provides a measure of demand for a given occupation. Figures are comprised of two components: an estimate of net job change during the period of analysis and anticipated replacement demand during the same period due to workers leaving the profession for reasons including retirement, changing careers, etc. The latter portion of the openings calculation is produced by the US Bureau of Labor Statistics as part of its Employment Projections Program.

GROSS REGIONAL PRODUCT (GRP)

Gross regional product (GRP) measures the final market value of all goods and services produced in a region. Also known as "Value Added," this figure represents the sum of earnings, property income, and taxes on production. The data is prepared by Emsi as part of its proprietary input-output model based primarily on data from the Bureau of Economic Analysis (BEA) and the Bureau of Labor Statistics (BLS) as part of its Quarterly Census of Employment and Wages (QCEW) data series.

JOBS MULTIPLIERS

In addition to providing an estimate of GRP, Emsi's input-output model is used to estimate the "multiplier" effects of changes in employment, earning, and sales for a given industry. For this analysis, jobs multipliers are presented for individual industries that are identified as being dependent on the Tech Talent Cluster.

Jobs multipliers provide an indication of the spillover effects of job creation in a given industry. For example, a jobs multiplier of 3.00 would mean that for every job created by that industry, two other jobs would be created in other industries (for a *total* of three jobs). The jobs multiplier is comprised of three parts, which are described by Emsi as follows:

- <u>Direct.</u> The effect of new input purchases by the initially changed industries. This first round of impacts is due to inter-industry effects.
- <u>Indirect.</u> The subsequent ripple effect in further supply chains resulting from the direct change. In more awkward terms, this shows the sales change in the supply chains of the supply chain, as a result of the

direct change. This is the sum of the second and subsequent rounds of impact (see "Direct"). This change is due to inter-industry effects.

• <u>Induced.</u> This change is due to the impact of the new earnings, investment, and government created by the initial, direct, and indirect changes. Induced effects enter the economy as employees spend their paychecks in the region, businesses invest to grow their operations, and government spends more to support the changes.

The total jobs multiplier represents the sum of the three components described above, plus the initial job.

<u>Calculation of jobs multipliers across multiple industries:</u> Jobs multipliers are not calculated in Emsi for groups of industries. Jobs multipliers and the associated employment figures shown in Figure 9 (page 10) were calculated by TIP Strategies using the following approach:

- Jobs multiplier generated by Emsi for each 6-digit industry -direct, indirect, induced, and total-were
 applied to 2017 employment in the industry to arrive at an estimate of the number of jobs supported by
 category. (i.e., direct, indirect, induced, and total).
- 2) The estimates calculated in step 1 were summed to arrive at an estimate of the total number of jobs supported by the group of industries in each of the four categories (i.e., an estimate of the number of direct, indirect, induced, and total jobs).
- 3) Figures resulting from step 2 were then used to calculate multipliers in each category (i.e., direct, indirect, induced, and total) relative to total employment for the group of industries.

METROPOLITAN STATISTICAL AREAS

Since the 1950s, the US Office of Management and Budget (OMB) has delineated specific geographic areas to be used for statistical purposes by federal agencies. These areas include metropolitan statistical areas, micropolitan statistical areas, and combined statistical areas. The metropolitan statistical area (MSA) is perhaps the most widely recognized of these classifications.

In broad terms, the OMB defines an MSA as "a core area containing a substantial population nucleus, together with adjacent communities having a high degree of economic and social integration with that core." To facilitate data collection, the OMB uses counties as the building blocks for its statistical area definitions. For example, the Milwaukee MSA (which is officially named the Milwaukee-Waukesha-West Allis, WI Metropolitan Statistical Area) is comprised of four counties: Milwaukee, Ozaukee, Washington, and Waukesha.

In determining the component counties, the OMB considers a range of factors, including population trends and commuting patterns. Although MSAs are often thought of as urban centers, the designation of a county as part of an MSA should not be thought of as an urban-rural classification, since component counties are often a mix of both. For example, outlying counties that are predominantly rural in terms of their land use may be designated as part of an MSA based on the strength of commuting ties.