

# TECHNOLOGY2030



Introduction	3
Executive Summary	4
Missouri Tech Sector Overview	2
Missouri Tech Sector State Comparisons 2	2
Advanced Industries in Missouri	26
Missouri Tech Occupations	0
Missouri Tech Infrastructure	4
Conclusion	6
Appendix	8
I.Methodology	

#### **ABOUT THE AUTHORS**

This report was written by Ted Abernathy and Sara Casey, with contributions by Missouri Chamber Foundation staff.

**Ted Abernathy** is the managing Partner of Economic Leadership LLC, a Raleigh, North Carolina based company that helps businesses — and places — increase their competitiveness. Ted has 40 years of experience directing economic development and workforce development programs. From 2008 to 2013, Ted was the executive director of the Southern Growth Policies Board, a 42-year old public policy think tank that provided research to states and communities across the South.

Before Southern Growth, Ted was a practicing economic developer for 28 years, including eight years as executive vice president/COO for the Research Triangle Regional Partnership. His latest research has focused on reimagining workforce development, making manufacturing more competitive and analyzing 25 years of rural economic development policy. Ted received his bachelor's degree from the University of North Carolina at Chapel Hill and his master's from Johns Hopkins University. He is a graduate of the Economic Development Institute and is an Eisenhower Fellow for global economics.

Sara Casey specializes in data collection, analysis and visualization on a variety of economic topics. Her research efforts have included conducting economic impact analysis, determining in-demand workforce needs and characterizing emerging clusters in regional economies. Sara has worked with clients including federal government agencies, international NGOs, research foundations, trade associations and economic development groups. She has worked with Economic Leadership LLC for more than five years. Before joining the Economic Leadership LLC team, Sara was an economist at RTI International.

### Introduction

Much has changed in Missouri's economy since the first printing of the Technology 2030 Report, most significant being the impact of the COVID-19 pandemic. Yet, despite widespread job loss and economic turmoil caused by COVID-19, Missouri's technology and innovation economy has shown resilience and opportunity for our state.

To explore the impact of the tech sector and its potential for Missouri, the Missouri Chamber Foundation commissioned Economic Leadership LLC to conduct a second review of the tech industry, with an additional focus on COVID-19 and postpandemic opportunities. This report provides comparisons of Missouri to other states, including tech labor trends and diversity, research and development infrastructure, venture capital and entrepreneurship. The Technology 2030 Report aims to understand tech trends in Missouri and highlight areas where the state could improve its knowledge economy to be even more attractive to tech firms seeking to relocate or expand.

In recent years, tech growth has spread from the coastal cities, such as the San Francisco Bay Area with which it has long been associated, to new markets across America. Consider this: Costs for a 500-employee tech firm in Kansas City or St. Louis are more than 35 percent lower than at a same-sized company in the San Francisco Bay Area. Companies are taking advantage of an accelerating trend to secure cost savings by locating outside more recognized, and often more expensive, technology hubs. And often, they are choosing Missouri.

Meanwhile, home-grown technology giants like Cerner, World Wide Technology and Brewer Science are thriving in the Show-Me State. Missouri's agtech titan, Monsanto, has merged with Bayer to become one of the world's largest pharmaceutical companies. Technology manufacturers like Boeing and Honeywell have deep roots in Missouri and are part of the region's National Security Crossroads. But it is not just large companies that are making strides and getting attention. Missouri has one of the largest concentrations of animal health companies in the world. Companies large and small make up the KC Animal Health Corridor. And across the state you will find one of the world's most impressive life sciences concentrations - hundreds of biotech companies large and small — anchored by the Donald Danforth Plant Science Center in St. Louis.

Missouri needs to position to take advantage of these assets, and we believe one of the best ways is to look at the data and create an actionable plan to leverage our strengths.

### **Executive Summary**

The Technology 2030 Report is part of the Missouri Chamber Foundation's overall strategic initiative to reposition our state as a global economic leader. The strategic plan, called Missouri 2030, revealed that technology is one of the greatest areas of opportunity for our state. Missouri has a rich and growing technology sector, and the state can be even more competitive, grow even faster and be more broadly recognized as a leading technology state.

To explore the impact of the tech sector and its potential for the state's economy, the Missouri Chamber Foundation contracted Economic Leadership LLC to conduct a review of the tech industry. This report reviews employment, growth, concentration and wages for the tech sector in Missouri. The state's performance is measured against other states for comparison. The report also evaluates a variety of technology infrastructure indicators to gauge the state's competitiveness in the tech sector. Charts are highlighted in green where Missouri is in the top 15 state rankings and highlighted in red where Missouri is in the bottom 15 state rankings.

In this report, the total technology sector was divided into four sub-

categories that were the most relevant:

- Energy Technology
- Environmental Technology
- Life Sciences/Health Care/Agtech
- IT (Tech Core)

Overall, tech accounted for more than 5 percent of the state's total employment and about 6 percent of its establishments. However, the tech industry has a greater impact on the state's wages and sales. In 2020, the tech industry provided almost \$16 billion in wages, which accounted for 9 percent of all wages in the state. Missouri's robust technology sector includes more than 12,170 employers employing almost 150,000 people.

#### **State Total** Technology Indicator **State Total** Sector Percentage 149,744 2,890,844 5.2% Employees 5.7% **Establishments** 12,172 215,332 Wages (millions) \$15,719 \$175,412 9.0% Sales (millions) \$45,847 \$598,313 7.7%

#### **Missouri Total Tech Sector, 2020**

National

Location

0.56

0.92

0.70

0.91

0.81

\$45,847

Deeper analysis revealed economic performance in specific tech categories. IT makes up the largest share of jobs, accounting for 58 percent of jobs with a total of 86,500 employees. IT is also growing quickly, expanding at a rate of 12.5 percent in the last five years. The sector even expanded throughout the COVID-19 pandemic.

#### Job Job Sales, Change, 2019-Establishments, Jobs, Change, 2019-2020 2020 Category 2020 2020 (millions) Quotient 2020 **Energy Tech** 10,828 359 \$8,051 -1.1% -1.3% **Environmental Tech** 13,113 -1.4% 9.3% 996 \$2,547 39,273 Life Sciences 0.7% 4.1% 2,908 \$11,260 IT 86,530 7,909 \$23,988 1.3% 12.5%

0.7%

#### Missouri Sub-Categories of Total Tech Sector, 2020

Source: EL calculations based on EMSI 2021.2

TOTAL

The tech sector was also divided and analyzed for manufacturing and services. Tech manufacturing in Missouri has grown by nearly 18 percent in the last five years. The national rate of change for all manufacturing firms across the country experienced a 0.5 percent decline. Driving the growth in Missouri is the manufacturing of electronic components, automatic environmental controls, biopharmaceuticals, battery storage and pesticide products.

8.8%

12,172

#### Missouri Total Tech Sector by Output, 2020

149,744

Output	Jobs, 2020	Job Change, 2019-2020	Job Change, 2015- 2020	Establishments, 2020	Sales, 2020 (millions)	National Location Quotient
Tech Services	124,074	0.8%	7.1%	11,634	\$37,085	0.83
Tech Manufacturing	25,670	0.7%	17.9%	538	\$8,761	0.72
TOTAL	149,744	0.7%	8.8%	12,172	\$45,847	0.81

Source: EL calculations based on EMSI 2021.2

Tech industries spark significant economic activity in other sectors of the economy. The tech sector in Missouri has a job multiplier of 2.75, meaning for every job created, nearly 2 additional indirect jobs were added. Total direct and indirect jobs attributable to the tech sector is just under 412,000, approximately 14 percent of all Missouri jobs.

The growth trends for the total tech sector have slowed slightly since the 2018 report. However, the IT subsector is still projecting a five-year growth rate of 11.6 percent compared to the national average of 9.6 percent. This projected growth rate for the IT subsector ranks as the 12th-highest among the states and the District of Columbia.



#### Tech Manufacturing Job Change, 2011-2031

100 = 2011 levels

#### **Missouri State Rankings for Tech Performance Indicators**

The tech industry offers many advantages that are discussed in this report. Throughout the COVID-19 pandemic, the tech sector has proven to be an adaptable and resilient anchor for the American economy. The industry offers workers high wages and jobs that are less likely to be automated in the future. Significantly, the average earnings for all jobs in Missouri was \$64,000 in 2020, while the average earnings for a worker in the tech industry in the state are nearly double that at \$112,100 annually.

In this report, the total tech sector and each of the subsectors were compared to other states. The economic performance of the Missouri tech sector ranked strongest in measures of workforce diversity, cost of living adjusted wages and IT growth rates. For 8 of the 31 technology performance indicators, Missouri ranked in the top 15 states.

#### Missouri State Rankings for Tech Performance Indicators

Tech Manufacturing Growth Rate	7				
Expected Future Tech Manufacturing Growth	8				
Tech Sector Diversity Index	8				
Energy Tech Growth Rate	9				
Women in the Tech Sector Workforce	10				
Expected Future IT Growth Rate	12				
Tech Occupation Wages	14				
IT Growth Rate	15				
Life Science Earnings	16				
IT Concentration	18				
Tech Sector Growth Rate	18				
Energy Tech Earnings	19				
IT Earnings	20				
Expected Tech Sector Growth Rate	21				
Environmental Tech Growth Rate		23			
Expected Future Tech Occupations Growth Rate		23			
Tech Services Growth Rate		24			
Tech Sector Earnings		25			
Tech Services Concentration		26			
Tech Occupations Concentration		28			
Tech Manufacturing Concentration		29			
Energy Tech Concentration			32		
Environmental Tech Concentration			32		
Environmental Tech Earnings			32		
Expected Future Environmental Tech Growth Rate			33		
Tech Sector Concentration			33		
Expected Future Energy Tech Growth Rate			34		
Life Science Growth Rate			35		
Tech Occupations Growth Rate			35		
Life Science Concentration				41	_
Expected Future Life Science Growth Rate				43	
(	0 10 20	30		40	50

A second set of state comparisons measured Missouri's technology infrastructure, the foundations of a vibrant knowledge economy. Missouri ranked in the top 15 states for two of these indicators, including business-sponsored research and development and entrepreneurship levels. This report also identifies areas that need improvement. Missouri did not compare as well in broadband access, internet adoption and start-up survival rates.



#### **Missouri State Rankings for Tech Infrastructure Indicators**

#### **Advanced Industries in Missouri Indicators**

A new addition, not covered in the 2018 report, is an examination of the more broadly-defined advanced industries in Missouri. In this report, "Advanced industries" are industries that have high value-added products and are conducting research and development to further their offerings, thus fostering tech growth as they continue to expand and evolve. A few years ago, The Brookings Institute developed a list of 49 specific industries they considered advanced industries.

In 2020, there were 17,730 business establishments in advanced industries in Missouri. These companies employed almost 250,000 workers across the state, about 8.6 percent of all Missouri jobs. Job growth in advanced industries in the last five years was 6.1 percent (about 14,400 jobs), on par with the national average, and far outpacing Missouri's overall job growth.

In addition to strong job growth, the advanced industry sector contributes about \$53.8 billion to Missouri's economy, accounting for about 17 percent of Missouri's total Gross State Product. The largest contributor to Missouri's GSP is Motor Vehicle Manufacturing, which has grown by 24 percent in the last five years and accounts for almost 15 percent of all advanced industry GSP and 2.6 percent of total Missouri GSP. The top growing advanced industries are Software Publishing (56%), Management, Scientific, and Technical Consulting Services (42%) and Computer Systems Design (34%), and Data Processing, Hosting, and Related Services (28%).

Description	2020 GSP (\$M)	2015-2020 Change (\$M)	2015-2020 Change (%)
Motor Vehicle Manufacturing	\$8,233	\$1,576	24%
Computer Systems Design and Related Services	\$5,928	\$1,520	34%
Wired and Wireless Telecommunications Carriers	\$5,141	(\$1,791)	-26%
Electric Power Generation, Transmission and Distribution	\$4,314	\$429	11%
Aerospace Product and Parts Manufacturing	\$4,314	(\$193)	-4%
Data Processing, Hosting and Related Services	\$3,709	\$807	28%
Architectural, Engineering and Related Services	\$2,964	\$257	9%
Management, Scientific and Technical Consulting Services	\$2,743	\$805	42%
Pharmaceutical and Medicine Manufacturing	\$1,927	\$235	14%
Basic Chemical Manufacturing	\$1,611	\$298	23%
Scientific Research and Development Services	\$1,182	\$128	12%
Semiconductor and Other Electronic Component Manufacturing	\$987	\$176	22%
Software Publishers	\$964	\$347	56%
Motor Vehicle Parts Manufacturing	\$812	\$5	1%
MISSOURI TOTAL ADVANCED INDUSTRIES	\$53.8B	\$5.3B	11%

#### **Top Advanced Industries in Missouri, 2020**

Source: EMSI 2021.2

Advanced industry annual wages averaged \$103,900 in 2020 and have increased 8.3 percent over the last five years. The average annual wage for all Missouri jobs in 2020 was \$64,000. The top advanced industries when considering wages are discussed later in the report.

#### **Tech Sector Occupations**

Tech jobs are not only created by technology industries. Tech permeates nearly every industry, so to provide a complete look at technology in Missouri an occupational analysis was also conducted. Recent tech occupation growth has not been quite as strong as tech industry job growth in Missouri, but the data reflects an emerging market. Looking forward, Missouri is predicted to grow tech occupations by 7.1 percent.

The results of this analysis reveal that Missouri's tech sector is currently small in concentration compared to more traditional technology states like California or Washington. However, Missouri is an emerging tech hub with high levels of growth and important assets in place, particularly in the IT subsector. The state benefits from tech infrastructure that includes high levels of private R&D funding, the presence of corporate headquarters in finance and agriculture and strong entrepreneurship. With continued support and attention, the tech sector can be a strong contributor to the Missouri economy and help the state grow and remain competitive.

#### State Comparisons for Technology Occupations, 2020

Metric	Value (%)	Rank
Median Annual Earnings Adjusted for Purchasing Power (2020)	\$88,452	14
Expected Tech Occupations Growth (2020-2025)	7.1%	23
Tech Occupations Concentration (2020)	0.86	28
Tech Occupations Growth (2015-2020)	10.8%	35

#### Conclusion

The findings of this report show that Missouri remains an emerging hub for the tech sector. The stability of the tech sector helped Missouri's economy survive during the COVID-19 pandemic and can continue to help Missouri adapt to a rapidly changing economy. Beyond being a low-cost alternative to the high prices of major coastal cities, the state has particular competitive advantages. Growth in IT and tech manufacturing is among the top in the nation. The state's resources show that Missouri could become a major player in the emerging tech subsectors such as advanced manufacturing, agtech and fintech.

To continue growth in the state, deficiencies will need to be addressed. The tech sector will likely continue to concentrate in the urban areas until broadband access is available and adopted in the rural portions of the state. Rural broadband may help other parts of the state capitalize on the proliferation of remote work after the pandemic. The state must put more focus on investment in research and development to leverage what private employers are investing in finding new innovations. More support to help entrepreneurs thrive is also needed.

### Missouri Tech Sector Overview

The review of the 95 separate NAICS codes used to define the technology sector of Missouri found that 149,740 workers were employed in the industry in 2020. These workers were spread across more than 12,170 tech establishments. Overall, tech accounted for just over five percent of the state's total employment, and about six percent of its establishments. However, the tech industry has a more substantial impact on the state economy when evaluating wages and sales. In 2020, the tech industry earned almost \$46 billion in sales revenue, accounting for 7.7 percent of all sales in the state.

The tech industry's economic impact extends beyond jobs. The industry also contributed to Missouri's economy through exports, tax revenue and gross state product (GSP). Looking at the 2020 data, the 95 industry groupings that make up the total tech sector accounted for 12 percent of all tax revenue and nearly 11 percent of GSP.

#### Missouri Total Tech Sector, 2020

ndicator	Technology Sector	State Total	Percentage of State Total
Employees	149,744	2,890,844	5.2%
Establishments	12,172	215,332	5.7%
Nages (millions)	\$15,719	\$175,412	9.0%
Sales (millions)	\$45,847	\$598,313	7.7%
Employees Establishments Nages (millions) Sales (millions)	149,744 12,172 \$15,719 \$45,847	2,890,844 215,332 \$175,412 \$598,313	5.2% 5.7% 9.0% 7.7%

#### Technology Percentage of State Total Indicator **State Total** Sector Taxes Paid (millions) \$16,931 12.0% \$2,037 Exports (millions) \$20,356 \$375,835 5.4% GSP (millions) \$291,976 10.9% \$31,965

#### **Missouri Total Tech Sector Contributions to Economy, 2020**

Source: EL calculations based on EMSI 2021.2

The presence of the tech industry also helps generate activity in other sectors of the economy. The tech sector in Missouri had a job multiplier of 2.75 in 2020. This means that for every job created in the tech sector, there were almost two additional jobs created or supported in the economy. Accounting for these multiplier effects increases the tech sector's impact on employment from 5 percent to 14 percent. In 2020, 411,950 workers in Missouri were directly or indirectly supported by the tech industry.





Tech Sector Percent Job Change, 2019-2020

The tech sector in Missouri was particularly resilient in a time of great change in the American economy. In 2020, the tech sector in Missouri grew jobs when the nation and nearby regions experienced some small net losses during the height of the COVID-19 pandemic.

 $\leftarrow$ 

The COVID-19 pandemic had an unequal effect on the Missouri economy. The industries in the tech sector were some of the few industries in Missouri that had net positive job growth in 2020.



#### Missouri Pandemic Impacts by Industry and Earnings

A large part of tech resiliency during the pandemic was the ability to work from home for many of its employees. Beyond the pandemic, the tech sector is also expected to be more resilient to the looming concern of automation in the future. Occupations that are associated with tech are the least likely to be automated in the future. These trends identify why the tech sector is so valuable to the state's economy and deserves investment.



#### Automation Risk and Ability to Work from Home by Occupation Group

Source: EL calculations based on EMSI 2021.2 and Dingel & Neiman (2020)

Online job postings show that while many tech jobs continued throughout the pandemic, companies slowed down their hiring for new positions compared to the previous year. In 2021 it appears that Missouri companies are more comfortable expanding, as unique tech occupation job postings have been at levels higher than 2019.





Investors are also taking notice of Missouri's growing presence in the tech space. Venture capital investment has grown sharply in the last nine years, outpacing the U.S. average. 2021 investment levels through the second quarter are as high as 2020 levels for the entire year.



Source: EL calculations based on NVCA (2021)

Talent is the most important locational factor for tech companies. Tech companies want to locate near pockets of concentrated skilled workers. In Missouri, most of the counties where the tech industry has the highest concentration (more than 5 percent of employment) are situated around Kansas City, St. Louis and the I-70 corridor. There are some higher concentrations of tech industries in the corners of the state as well.



### Tech Industry Employment as a Percentage of Total Employment by County, 2020

#### **Tech Sub-Sector Performance**

When looking at the four sub-categories that make up the tech industry, IT (Tech Core) accounts for about 58 percent of all tech jobs in Missouri with almost 86,500 employees. The Energy Tech grouping was the smallest sub-category with 10,830 employees. Even with a small decrease in job growth, Missouri's energy tech subsector still outperformed most states. In the past year, admittedly a challenging and unprecedented year, only two sub-categories saw moderate growth, with IT expanding during the pandemic at a rate of 1.3 percent. Looking at the five-year trends, three of the subsectors have seen strong, positive growth.

Category	Jobs, 2020	Job Change, 2019-2020	Job Change, 2019- 2020	Establishments, 2020	Sales, 2020 (millions)	National Location Quotient
Energy Tech	10,828	-1.1%	-1.3%	359	\$8,051	0.56
Environmental Tech	13,113	-1.4%	9.3%	996	\$2,547	0.92
Life Sciences	39,273	0.7%	4.1%	2,908	\$11,260	0.70
IT	86,530	1.3%	12.5%	7,909	\$23,988	0.91
TOTAL	149,744	0.7%	8.8%	12,172	\$45,847	0.81

#### Missouri Sub-Categories of Total Tech Sector, 2020

Source: EL calculations based on EMSI 2021.2

The tech sector can also be looked at by separating manufacturing and services. Tech manufacturing in Missouri has grown by nearly 18 percent in the last five years. The national rate of change for all manufacturing firms across the country was at a decline of 0.5 percent. Driving this growth in Missouri is the manufacturing of electronic components, automatic environmental controls, biopharmaceuticals, battery storage and pesticide products.

#### Missouri Total Tech Sector by Output, 2020

Output	Jobs, 2020	Job Change, 2019-2020	Job Change, 2015- 2020	Establishments, 2020	Sales, 2020 (millions)	National Location Quotient
Tech Services	124,074	0.8%	7.1%	11,634	\$37,085	0.83
Tech Manufacturing	25,670	0.7%	17.9%	538	\$8,761	0.72
TOTAL	149,744	0.7%	8.8%	12,172	\$45,847	0.81

#### **Tech Manufacturing Job Change, 2011-2031** 100 = 2011 levels



Source: EMSI 2021.2

One reason tech companies are coveted assets is the high wages they traditionally pay employees. In the tech industry, employees are often the largest company expense. This means that the money remains in the region, whereas a company in a different industry may spend more on equipment or raw materials that are acquired from outside the region. This study calculated the average annual earnings for the tech industry in Missouri. This metric of earnings includes all the wages, salaries and supplements received by a worker. Supplements include employee benefits and on average accounted for about \$20,340 of a tech worker's earnings in Missouri.

Category	Missouri Wages	Missouri Wages Adjusted for Purchasing Power	National Average
Energy Tech	\$146,400	\$164,900	\$158,300
Environmental Tech	\$71,100	\$80,100	\$85,100
Life Sciences	\$113,400	\$127,800	\$134,800
IT	\$113,500	\$127,800	\$158,300
Output	Missouri Wages	Missouri Wages Adjusted for Purchasing Power	National Average
<b>Output</b> High-Tech Services	Missouri Wages \$115,000	Missouri Wages Adjusted for Purchasing Power \$129,500	National Average \$145,900
<b>Output</b> High-Tech Services High-Tech Manufacturing	<b>Missouri Wages</b> \$115,000 \$98,100	Missouri Wages Adjusted for Purchasing Power \$129,500 \$110,500	National Average \$145,900 \$143,800

#### Wages of Tech Sector Workers, 2020

Source: EL calculations based on EMSI 2021.2

The average earnings for all jobs in Missouri was \$64,000 in 2020. The average earnings for a worker in the tech industry in the state are nearly double that at \$112,100 annually. While significantly higher than the average for all jobs, tech earnings in Missouri are \$33,000 lower than the national average for tech industry workers. However, Missouri tends to have lower costs for needs like housing and fuel compared to other tech hot spots in the country. When accounting for this purchasing power in Missouri, the average earnings increase to \$126,300.

Missouri Tech Sector Overview

## Missouri Tech Sector State Comparisons

To place Missouri's tech performance in context, the performance metrics for all fifty states, the nation and the District of Columbia were calculated. The rankings reflect Missouri's position across all states and the District of Columbia. The charts below lists the rankings for Missouri's tech sector. The top 15 rankings are highlighted in green and the bottom 15 are highlighted in red. In the appendix, detailed charts show Missouri's position and the position of all other states.

Missouri ranks in the top 15 for two of the six metrics for the tech sector. One of the highest rankings is for the percentage of women working for tech companies, where the state has the 10th highest percentage at 34.1 percent. The state also ranks 8th in the diversity of its tech sector workforce relative to the diversity of its general population. Missouri is well-positioned to continue to build an inclusive tech sector. Looking forward for the next five years, the Missouri tech sector is expected to grow its workforce by 7.5 percent.

#### State Comparisons for Total Tech Sector Metric Value Rank Tech Industry Diversity Index (2020) 92.0 8 Percentage of Women in the Technology Workforce (2020) 34.1% 10 Technology Sector Employment Growth (2015-2020) 8.8% 18 7.5% Expected Technology Sector Employment Growth (2020-2025) 21 Avg. Annual Wage for Technology Sector Employees with Purchasing Power (2020) \$126,273 25 Technology Sector Concentration (2020) 0.81 33

Source: EL calculations based on EMSI 2021.2

#### **State Comparisons for IT Industries**

Metric	Value	Rank
Expected IT Sector Employment Growth (2020-2025)	11.6%	12
IT (Tech Core) Employment Growth (2015-2020)	12.5%	15
IT Sector Concentration (2020)	0.91	18
Avg. Annual Wage for IT Sector Employees with Purchasing Power (2020)	\$127,767	20

This ranks the state in the top 25 for future growth.

Some of the same metrics used for ranking the tech sector across all states were then measured for each of the tech subsectors. The rankings for the Missouri IT subsector are very strong. Missouri ranked in the top 15 for both past job growth and predicted job growth for IT.

Life Sciences indicated as a stronger subsector in the 2018 report, but in 2020 the numbers were not as high for predicted future growth. It is likely that the relocation of a major life science employer out of Missouri affected these life science data points. Missouri did rank as the 16th highest in wages in Life Sciences among all states.

The number of jobs in Environmental Tech grew over 9 percent in the last five years. This ranks Missouri in the top 25 fastest growing states in this subsector. Environmental Tech is the subsector with the highest concentration of workers relative to the national average in this analysis. However, earnings are still low compared to other states, even after accounting for cost of living.

Missouri is not a large energy production state so, unsurprisingly, Energy Tech rankings score in the middle of the pack. The subsector has seen declines across the country, so while the subsector lost jobs in the last five years it did not lose them at the same rate as other states.

#### **State Comparisons for Life Sciences**

Metric	Value	Rank
Avg. Annual Wage for Life Science Sector Employees with Purchasing Power (2020)	\$127,752	16
Life Science Employment Growth (2015-2020)	4.1%	35
Life Science Sector Concentration (2020)	0.70	41
Expected Life Science Sector Employment Growth (2020-2025)	1.8%	43

Source: EL calculations based on EMSI 2021.2

#### **State Comparisons for Environmental Tech**

Metric	Value	Rank
Environmental Tech Employment Growth (2015-2020)	9.3%	23
Environmental Tech Sector Concentration (2020)	0.92	32
Expected Environmental Tech Job Change (2018-2023)	\$80,083	32
Avg. Annual Earnings for Environmental Tech Workers with Purchasing Power (2017)	5.7%	33

Source: EL calculations based on EMSI 2021.2

#### **State Comparisons for Energy Tech**

Metric	Value	Rank
Energy Tech Employment Growth (2015-2020)	-1.3%	9
Average Annual Wage for Energy Tech Employees with Purchasing Power (2020)	\$164,912	19
Energy Tech Sector Concentration (2020)	0.56	32
Expected Energy Tech Sector Employment Growth (2020-2025)	-3.1%	34

The tech industry can also be split into tech services and manufacturing. When these output categories are compared against the other states, tech manufacturing is a top state in terms of past and predicted job growth.

To provide a more comprehensive look at technology in Missouri the next two sections first examine specific advanced industries, and then a set of technology occupations. Both offer a different lens for examination.

#### **State Comparisons for Tech Services**

Metric		Rank
Average Annual Wage for Tech Services Employees with Purchasing Power (2020)	\$129,535	21
Tech Services Employment Growth (2015-2020)	7.1%	24
Tech Services Sector Concentration (2020)	0.83	26
Expected Tech Services Employment Growth (2020-2025)	6.7%	30

Source: EL calculations based on EMSI 2021.2

#### **State Comparisons for Tech Manufacturing**

Metric	Value	Rank
Tech Manufacturing Employment Growth (2015-2020)	17.9%	7
Expected Tech Manufacturing Sector Employment Growth (2020-2025)	11.1%	8
Tech Manufacturing Sector Concentration (2020)	0.72	29
Avg. Annual Wage for Tech Manufacturing Employees with Purchasing Power (2020)	\$110,506	30

Missouri Tech Sector State Comparisons

### Advanced Industries in Missouri

Increasingly, all companies are becoming tech focused. Many of the biggest technology advancements come out of other industries' adoption of new technologies. Having a thriving advanced industry economy can foster accelerated technology developments. In this report, "Advanced Industries" are industries that have high valueadded products and are conducting research and development to further their offerings, thus fostering tech growth as they continue to grow and evolve. A few years ago, The Brookings Institute developed a list of 49 specific industries they considered advanced industries. These industries were reviewed for their performance in Missouri. A full list of Brookings Advanced Industries is included in the appendix.

In 2020, there were 17,730 business establishments in advanced industries in the state. These companies employed almost 250,000 workers across the state, about 8.6 percent of all Missouri jobs. Job growth in advanced industries in the last five years was 6.1 percent (about 14,400 jobs), on par with the national average, and far outpacing Missouri's overall job growth. The top three advanced industries in Missouri in terms of employment are all service related. The top manufacturing advanced industry is the aerospace sector. Motor vehicle manufacturing is also a top advanced industry in the state. Many of the top advanced industries have seen positive job growth in the last five years. Many of the top growth advanced industries are those that are also classified in the tech sector in this report, such as semiconductor manufacturing.

In addition to strong job growth, the advanced industry sector contributes about \$53.8 billion to the Missouri economy, accounting for about 17 percent of Missouri's total GSP.



#### Advanced Industry GSP in Missouri, 2007-2020

#### Top Advanced Industries in Missouri, 2020

Description	2020 GSP (\$M)	2015-2020 Change (\$M)	2015-2020 Change (%)
Motor Vehicle Manufacturing	\$8,233	\$1,576	24%
Computer Systems Design and Related Services	\$5,928	\$1,520	34%
Wired and Wireless Telecommunications Carriers	\$5,141	(\$1,791)	-26%
Electric Power Generation, Transmission and Distribution	\$4,314	\$429	11%
Aerospace Product and Parts Manufacturing	\$4,314	(\$193)	-4%
Data Processing, Hosting and Related Services	\$3,709	\$807	28%
Architectural, Engineering and Related Services	\$2,964	\$257	9%
Management, Scientific and Technical Consulting Services	\$2,743	\$805	42%
Pharmaceutical and Medicine Manufacturing	\$1,927	\$235	14%
Basic Chemical Manufacturing	\$1,611	\$298	23%
Scientific Research and Development Services	\$1,182	\$128	12%
Semiconductor and Other Electronic Component Manufacturing	\$987	\$176	22%
Software Publishers	\$964	\$347	56%
Motor Vehicle Parts Manufacturing	\$812	\$5	1%
MISSOURI TOTAL ADVANCED INDUSTRIES	\$53.8B	\$5.3B	11%

#### Communications Equipment Manufacturing ● 120% 100% Other Telecommunications 80% Other Information Services Software Publishers 60%-2015-2020 GSP Change Management, Scientific and Technical Consulting Services 40% Cable and Other Subscription Programming Semiconductor and Electric Component Manufacturing 20% Industrial Machinery Manufacturing 0% Aerospace Product and Parts Manufacturing Foundries -20%· Wired and Wireless Telecommunications Carriers -40% Other Transportation Equipment Manufacturing -60% -10% -50% -20% 0% 10% 20% 30% 40% 50% 60% 70% 80% -40% -30% 2015-2020 Job Change

#### Advanced Industry Jobs and GSP in Missouri, 2015-2020

Source: EMSI 2021.2

Advanced industry annual wages averaged \$103,900 in 2020 and have increased 8.3 percent over the last five years. The average annual wage for all Missouri jobs in 2020 was \$64,000. The top advanced industries when considering wages are shown below.

Description	2020 Average Annual Wage	2015-2020 Change	2015-2020 Change (%)
Data Processing, Hosting, and Related Services	\$156,350	\$10,061	7%
Electric Power Generation, Transmission and Distribution	\$147,466	\$21,062	17%
Aerospace Product and Parts Manufacturing	\$130,208	(\$10,278)	(-7%)
Scientific Research and Development Services	\$127,657	\$15,248	14%
Software Publishers	\$124,818	(\$2,870)	(-2%)
Pharmaceutical and Medicine Manufacturing	\$120,021	\$9,942	9%
Motor Vehicle Manufacturing	\$117,172	\$7,188	7%
Iron and Steel Mills and Ferroalloy Manufacturing	\$112,460	\$64,207	133%
Oil and Gas Extraction	\$110,856	\$11,627	12%
Computer Systems Design and Related Services	\$110,728	\$6,767	7%
Architectural, Engineering and Related Services	\$108,998	\$13,148	14%
Wired and Wireless Telecommunications Carriers	\$103,589	\$8,309	9%
Pesticide, Fertilizer and Other Agricultural Chemical Manufacturing	\$102,762	(\$703)	(-1%)
Semiconductor and Other Electronic Component Manufacturing	\$102,666	\$1,342	1%
MISSOURI TOTAL ADVANCED INDUSTRIES	\$103,901	\$7,975	8%

#### Top Advanced Industries in Missouri, 2020

Source: EMSI 2021.2

# Missouri Tech Occupations

#### Missouri Tech Occupations as Percentage of All Workers by County, 2020



As technology has permeated every industry, a skilled technology workforce has become critical to company performance. This section of the analysis reviews 75 separate five-digit SOC codes across computer, science and engineering occupations to determine how many tech workers exist in Missouri across all industries. A complete list of occupations, and detailed data for the top 15 tech occupations, are included in the appendix.

#### Staffing Patterns of Tech Industries and Tech Occupations, 2020

### Tech Industry Jobs **149,740**

**33%** of tech occupation jobs are employed in tech industries

### Tech Occupation Jobs 203,135

Source: EL estimates based on EMSI 2021.2

There are approximately 203,135 tech workers throughout the Missouri economy. In the past five years jobs have grown at a rate of almost 11 percent. These tech positions offer about 21,100 annual job openings. Tech occupations are more concentrated in the urban and suburban counties of Missouri compared to tech industry employment. The southeastern and northeastern portions of the state have lower percentages of tech occupations. Twelve counties have tech occupations that account for more than five percent of total employment.

Using data that matches occupations to their companies'

industries, this report maps the industries that employ the highest number of tech occupations. It was found that 33 percent of tech workers are employed by a tech sector company. The rest of the tech occupation workforce is spread across other industries. The IT subsector is the largest employer of tech occupations. Tech workers at IT companies account for 23 percent of all tech occupations. These are not the only workers at IT companies. At IT companies, 54 percent of all occupations are tech occupations. This means that IT companies, while tech focused, also have workforce demands in many positions including human resources, sales, legal, etc. Supporting an internet-based company in a region is not limited to the availability of computer programmers, but also a region's ability to staff a variety of skilled positions.

Other top employers of tech occupations include manufacturing, management, finance, life sciences and government employers. This shows how these occupations spread beyond innovative companies and become a crucial part of the whole economy.



#### **Top Industries Employing Tech Workers, 2020**

Source: EL estimates based on EMSI 2021.2

To understand if the benefits of tech jobs are distributed across the population, the demographics of tech occupations were compared to the demographics in the overall Missouri population. This creates an index where if the value is over 100 than the demographic is overrepresented in tech occupations. Tech has traditionally been dominated by men due to a myriad of societal factors.

In Missouri, men are overrepresented in tech occupations.

To spread the benefits of tech employment to more people in the state, potential workers need to have the skills needed for the job. In 2020, about 85 percent of the tech jobs required a bachelor's degree or higher for entry-level positions. In Missouri about 30 percent of the population has a bachelor's degree or higher.

Missouri tech occupations data was then compared to the other states and the nation. Tech occupation growth has not been quite as strong as tech industry job growth in Missouri, but the data still reflects an emerging market. Looking forward, Missouri is projected to be within the top 25 growing states in tech occupations. The state also scored well on tech occupation wages.

### Gender Distribution of Tech Occupations in Missouri, 2020

Metric	Tech Occupation	MO Population	Index
Women	34%	51%	67.2
Men	66%	49%	134.0

Source: EL calculations based on EMSI 2021.2

### Share of Missouri Tech Occupations by Entry-Level Education Requirements, 2020



Source: EL estimates based on EMSI 2021.2

#### **State Comparisons for Technology Occupations**

Metric	Value	Rank
Median Annual Earnings Adjusted for Purchasing Power (2020)	\$88,452	14
Expected Tech Occupations Growth (2020-2025)	7.1%	23
Tech Occupations Concentration (2020)	0.86	28
Tech Occupations Growth (2015-2020)	10.8%	35

### Missouri Tech Infrastructure

Similar to other industries, the technology sector needs a solid infrastructure to flourish. A strong technology infrastructure is often referred to as a "knowledge-based economy." The World Bank defines strong knowledge-based economies on four pillars (Tetra Tech, 2016):

- Entrepreneurship incentives,
- skilled and educated labor force,
- physical infrastructure access for technology and communications, and
- innovation ecosystem that fosters collaboration between academia, private sector and government.

Using this framework, Missouri's technology infrastructure was evaluated by collecting data on

factors such as funding access, patents, STEM education, and university technology transfer. The chart below compares Missouri's position on technology infrastructure indicators with the District of Columbia and all fifty states. Of the 16 technology infrastructure metrics, Missouri ranked in the top 15 states for two of the metrics. Missouri scored well in terms of businessfunded research and development and entrepreneurship metrics. The state ranked in the lower third of all states for four metrics. Opportunities exist to improve broadband, internet adoption, and start-up success. Detailed charts that show the tech infrastructure performance for each state and the national average are located in the appendix.
# State Comparisons - Tech Infrastructure Rankings

Technology Infrastructure			
Metric	Value	Rank	
Average Number of New Entrepreneurs (2020)	0.37%	15	
Business Performed R&D as a Percentage of Private Industry Output (2017)	2.0%	15	
Small Business Opening Rate vs. Closing Rate (2018)	0.98%	16	
Technology Licenses and Options Executed from Universities (2018)	204	16	
State Spending Per Student for Higher Education (2020)	\$8,819	17	
Start-Ups Early Job Creation Rate (2020)	5.06	19	
Average In-State Tuition Cost (2020-2021)	\$9,240	20	
Higher Education R&D in S&E Fields as a Percentage of GSP (2019)	0.39%	22	
Start-Ups from Universities (2019)	12	22	
Total R&D As a Percentage of GSP (2017)	2.1%	26	
Venture Capital Funding Per \$1 Million of GDP (2015-2020)	\$1,340	29	
SBIR and STTR Funding Per \$1 Million of GDP (2015-2020)	\$78	32	
Patents Issued per 1,000 Science & Engineering Workers (2019)	12.2	34	
Percentage of Population with High Speed Broadband Access (2018)	9.8%	37	
Percentage of Households Without an Internet Subscription (2019)	19.4%	40	
Start-Ups Early Survival Rate (2020)	76.0%	45	

# Conclusion

When the Missouri Chamber Foundation launched Missouri 2030: An Agenda to Lead in 2015, our goal was to provide a strong vision for economic growth, driven by Missouri's business community. The first Technology 2030 report, which followed, was designed to frame our technology strengths and provide a platform for securing smart policy and market-driven initiatives to grow our tech and innovation economy.

Little did we know how important that work would be when, as a result of COVID-19, our state and nation would face the biggest economic crisis of our generation. In March 2020 the world of business forever changed. That has brought hardship, but has also created opportunity, especially in the area of tech.

Missouri remains an emerging hub for the tech sector. The stability of the tech sector helped Missouri's economy get through the COVID-19 pandemic, and could continue to help Missouri adapt to a rapidly changing economy. Beyond being a lowercost alternative to the high prices of major coastal cities, the state has a particular competitive advantage in some sub-categories of the tech industry. Growth in IT is among the top in the nation. The state's resources show that Missouri could become a major player in the emerging tech subsectors, such as advanced manufacturing, agtech and fintech.

To fuel our growing tech economy, the reports shows that Missouri is producing a strong and diverse tech labor force. We are proud to be a leading state in the employment of women and people of color in technology. Initiatives such as the industry-driven IT Apprenticeship Grant Program will further shore up our labor force. Through a \$6 million grant provided by the U.S. Department of Labor, the Missouri Chamber Foundation is training 5,300 apprentices in high demand, technology jobs, for example.

To continue growth in the state, deficiencies will need to be addressed. The tech sector will likely continue to concentrate in the urban areas of the state until broadband access is available and adopted in the rural portions of the state. Rural broadband may help other parts of the state capitalize on the proliferation of remote work after the pandemic. Missouri must also address our lagging ranking in research and development funding. If we want to be home to the next life-changing innovation, we must invest in this critical foundation of innovation. Continued investment in our workforce is another crucial move. If we want tech companies to start, expand or relocate in Missouri, we have to provide them with the workforce to do so.

All of these deficiencies will require statewide policy to achieve. That is what makes the launch of the Missouri Technology Alliance so important. The Technology Alliance will work to advance and grow the innovation economy through advocacy, workforce development, branding and continued research.

### **APPENDIX I: METHODOLOGY**

Measurements of the tech industry are greatly influenced by how the sector is defined. Unlike sectors like health care or retail trade, the tech industry is not neatly categorized in the country's current economic North American Industry Classification System (NAICS). The knowledge economy exists across several of the broader industry groupings. Therefore, to measure the technology industry in Missouri, we identified 95 separate 6-digit NAICS code (highest-level of detail) sectors to characterize the total technology sector for the state and for comparison of other U.S. states. A full list of each 6-digit sector is available in the appendix of this report.

The total technology sector (hereby referred to as the 'tech sector') was divided into four sub-categories:

- Energy Technology
- Environmental Technology
- Life Sciences/ Health Care/Agtech
- IT (Tech Core)

These sectors were chosen based on several definitions of the technology industry. The primary source for defining the technology industry was based on TechAmerica Foundation's 2013 Technology Industry Classification. Other state and city industry reports were evaluated, and this report maintains a definition that is comparable to these reports.

### OCCUPATIONS VS. INDUSTRIES

A common critique when evaluating technology companies and technology jobs is the reality that within a tech company there are plenty of workers whose responsibilities are not necessarily tech related (for example, an accountant at Amazon) and vice versa; there are tech-focused positions embedded into many industries like finance and healthcare. To demonstrate both vantage points of technology in the state, we also evaluated the number of tech occupations that exist across all industries. For this section, we reviewed 75 separate 5-digit SOC codes across computer, science and engineering occupations in Economic Modeling Specialist International (EMSI) to determine how many tech workers exist in the Missouri across all industries. Using technology occupations data, we mapped those employees back to the industries where they are employed. These staffing patterns can help quantify some of the emerging tech subsectors.

### DATA COLLECTION

Once the parameters were established, data for employment, wages and establishments were collected. Economic Leadership used data developed by Economic EMSI, which is largely based on the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages. EMSI data fills in gaps from BLS' non-disclosure policy by amalgamating several economic data sources to provide the best estimates. EMSI data is calculated for the years 2001-2020 as well as predictive data for the upcoming ten years. Future estimates of growth in this report are determined by EMSI's predictive models.

Most of the technology sector data presented in this report are calculations based on EMSI data for the year 2020. Most trend data presented is for the 5-year period from 2015-2020. We also looked at the one-year change in the technology sector to evaluate the short-term trends in the industry. The input-output model used to determine the technology sector's overall economy impact for this study is also based on EMSI multiplier estimates.

Data for the technology infrastructure state comparisons comes directly from publicly available resources such as the National Science Foundation, Bureau of Economic Analysis and the U.S. Census Bureau. This ensures consistent and comparable data across all the states.

# **APPENDIX II: TOTAL TECH SECTOR STATE RANKINGS**

# Super Subsectors of the Total Technology

Super Sub-Sector	Jobs, 2020	Job Change, 2015-2020	Establishments, 2020	Sales, 2020 (\$M)
Software	48,850	27.8%	5,963	\$7,687
Internet & Telecommunications	27,724	-10.8%	1,783	\$14,079
R&D and Testing	22,795	5.8%	2,172	\$4,920
Agriculture Tech	7,646	-6.7%	514	\$2,519
Tech Hardware	7,570	28.4%	67	\$1,713
Remediation and Waste Management	7,061	12.6%	649	\$1,268
Fossil Fuels	4,895	1.6%	147	\$3,448
Electricity	4,798	-6.6%	178	\$3,413
Pharmaceuticals	4,714	11.7%	84	\$2,543
Medical Equipment	4,118	9.1%	138	\$1,279
Environmental Equipment	3,913	1.8%	51	\$940
Advanced Equipment	2,386	41.6%	96	\$509
Environmental Services	2,140	13.4%	296	\$339
Renewable Energy	1,135	12.2%	35	\$1,190
TOTAL TECH SECTOR	149,744	8.8%	12,172	\$45,847



### **Technology Sector Location Quotient (2020)**

### **Technology Sector Employment Growth (2015-2020)**

Nevada Washington Ŭtah Florida District of Columbia New Hampshire Massachusetts North Carolina Arizona Oregon Maine California Idaho Colorado South Carolina South Dakota Maryland Missouri New York Georgia Tennessee Virginia Wisconsin **United States** Alabama Nebraska Pennsylvania Ohio New Mexico Indiana New Jersey Texas Minnesota Vermont lowa Montana Michigan Illinois Kansas Hawaii Rhode Island Connecticut Arkansas Kentucky Mississippi Louisiana West Virginia North Dakota Delaware Oklahoma Wyoming Alaska



### Nevada Utah District of Columbia Arizona Washington Maryland South Dakota Florida North Carolina New York Texas Georgia Colorado Tennessee New Hampshire North Dakota California New Mexico Oregon South Carolina Missouri 7.5% Indiana Massachusetts **United States** 7.3% lowa Montana Idaho Arkansas Maine Virginia Wisconsin Pennsylvania Nebraska Ohio Kentucky Alabama Rhode Island Vermont Kansas New Jersey Louisiana Minnesota Mississippi Illinois Michigan **MO** Ranks Hawaii Alaska 21<sup>st</sup> West Virginia Connecticut Wyoming Delaware Oklahoma -10% -5% 0% 5% 10% 15% 20%

## Expected Total Tech Sector Growth (2020-2025)

# Tech Manufacturing Employment Change (2015-2020)



# **Expected Technology Sector Employment Growth (2020-2025)**

Hawaii South Carolina Virginia Montana Utah Missouri Georgia District of Columbia Maryland Tennessee Wyoming Oklahoma Louisiana Rhode Island Florida lowa Arizona Michigan Arkansas Ohio Kansas South Dakota North Dakota Mississippi Kentucky Maine Indiana Wisconsin Colorado Delaware **United States** North Carolina New Hampshire Minnesota Oregon New Mexico Texas Alabama New Jersey New York Pennsylvania California Nebraska Idaho Illinois Washington Connecticut Vermont Massachusetts West Virginia



### Average Annual Wage for Technology Sector Employees with Purchasing Power (2020)





### Percentage of Women in Technology Workforce



### **Tech Diversity Index**

# **Technology Occupations**

Missouri Top 15 Tech Occupations, 2020

Description	2020 Occupations	2015-2020 % Change	Median-Hourly Wageª	Annual Openings
Software Developers and Software Quality Assurance Analysts	24,546	28%	\$45.66	2,464
Project Management and Business Operations Specialists	24,241	47%	\$36.34	2,776
Computer User Support Specialists	14,788	11%	\$23.88	1,312
Management Analysts	12,822	87%	\$39.60	1,629
Computer Systems Analysts	10,923	-8%	\$39.74	909
Market Research Analysts and Marketing Specialists	10,699	17%	\$27.46	1,284
Financial and Investment Analysts	7,836	13%	\$38.53	737
Computer and Information Systems Managers	7,593	21%	\$62.99	718
Network and Computer Systems Administrators	7,331	-15%	\$38.91	543
Computer Occupations, All Other	6,378	-1%	\$41.48	669
Industrial Engineers	5,850	30%	\$40.61	564
Civil Engineers	5,372	9%	\$39.26	483
Computer Network Support Specialists	5,134	-8%	\$26.06	447
Electrical Engineers	3,805	6%	\$46.98	324
Computer Network Architects	3,611	12%	\$44.67	291
All Tech Occupations <sup>b</sup>	203,135	11%	\$37.76	21,111

Source: EL estimates based on EMSI 2018.4

<sup>a</sup> Wage estimate is different from the average annual wage values in the previous charts. The average annual wage value is calculated across all occupations in the technology sector and measures the average versus the median.

<sup>b</sup> This is a sum of the 78 SOC codes (see appendix) not only the 15 most common occupations displayed in the table above.

# Tech Sector Economic Impact Analysis

	Employees	Earnings (\$M)	Sales (\$M)
Direct Impact	149,740	\$15,700	\$45,800
Multiplier	2.75	1.87	1.82
Indirect & Induced Impact	262,210	\$13,700	\$37,400
TOTAL IMPACT	411,960	\$29,500	\$83,300
Percentage of MO Economy	14%	16%	14%



### Total R&D as a Percentage of GSP (2017)

## Business Driven R&D as a Percentage of Private Industry Output (2017)



Source: NSF (2020)

**Higher Education R&D in Science & Engineering Fields** as a percentage of GSP (2019) Maryland Massachusetts Rhode Island North Carolina Pennsylvania Michigan New Hampshire Montana Connecticut Alabama Utah Wisconsin North Dakota lowa Mississippi Nebraska Vermont District of Columbia Indiana Georgia Colorado 0.39% Missouri New York United States 0.37% Arizona Ohio Kansas New Mexico Tennessee California Oregon Hawaii Alaska Texas Virginia Illinois Delaware Louisiana Washington Kentucky Minnesota West Virginia Arkansas South Carolina **MO** Ranks Oklahoma 22<sup>nd</sup> Florida Maine South Dakota Wyoming New Jersey Idaho Nevada 0.0% 0.2% 0.4% 0.6% 0.8% 1.0% 1.2% Appendix

# Patents Issued per 1,000 Science & Engineering Workers (2019)



Source: NSF (2020)



### Venture Capital Invested Per \$1 Million of GSP (2015-2020)

Source: National Venture Capital Association (NVCA) [2021]



### Technology Licenses and Options Executed from Universities (2018)

Source: Association of University Technology Managers (AUTM) [2021]



# Startups from Universities (2019)

Source: Association of University Technology Managers (AUTM) [2021]



### SBIR and STTR Funding per \$1 Million of GSP (2015-2020)

Source: Small Business Innovation Research (SBIR) [2021] and BEA (2021)

#### Small Business Opening Rate vs. Closing Rate (2018) Idaho Utah Nevada Delaware Colorado Oregon Washington Florida South Carolina Texas Arizona North Carolina California Montana Georgia Missouri 0.98% Wyoming lowa District of Columbia **United States** 0.67% Tennessee Hawaii Arkansas New Hampshire New Hampshire Pennsylvania Mississippi Michigan Alaska Maine Massachusettes Virginia Indiana Maryland New York Oklahoma Wisconsin New Jersey Alabama Illinois Louisiana Kentucky Nebraska Ohio **MO Ranks** Rhode Island 16<sup>th</sup> Kansas Minnesota North Dakota Vermont New Mexico Connecticut West Virginia -1.0% -0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5%



**Rate of New Entrepreneurs (2020)** 

Source: Kauffman Foundation (2021)



### Startup Early Job Creation Rate (2020)

### California Louisiana Montana Massachusetts Idaho Minnesota New Mexico Mississippi lowa Texas Nebraska New Jersey Tennessee Alaska Kentucky Ohio Pennsylvania Oklahoma Wisconsin Maine Illinois North Dakota Vermont North Carolina United States 78.1% Indiana Arizona Nevada Connecticut Oregon Arkansas West Virginia District of Columbia South Dakota Alabama Wyoming New York Colorado New Hampshire Utah **MO** Ranks Maryland 45<sup>th</sup> Georgia Delaware Virginia South Carolina Missouri 76.0% Florida Rhode Island Hawaii Kansas Michigan Washington 0 20 40 60 80 100

### Startup Early Job Survival Rate (2020)

# **Completed STEM Education Programs per 1,000 Enrolled Students (2020)**





Source: College Board (2021)



### State Spending per Student for Higher Education (2020)

### Percentage of Population Without High Speed Broadband Access (2018)



Source: Federal Communications Commission (2020)



### Percentage of Households Without an Internet Subscription (2019)

# **APPENDIX III: INDUSTRY AND OCCUPATION GROUPINGS**

# Tech Occupation Groupings

NAICS Code	NAICS Description	Sub-Category	Manufacturing or Service
211120	Crude Petroleum Extraction	Energy Tech	High-Tech Services
211130	Natural Gas Extraction	Energy Tech	High-Tech Services
212111	Bituminous Coal and Lignite Surface Mining	Energy Tech	High-Tech Services
212112	Bituminous Coal Underground Mining	Energy Tech	High-Tech Services
212113	Anthracite Mining	Energy Tech	High-Tech Services
213111	Drilling Oil and Gas Wells	Energy Tech	High-Tech Services
213112	Support Activities for Oil and Gas Operations	Energy Tech	High-Tech Services
213113	Support Activities for Coal Mining	Energy Tech	High-Tech Services
221111	Hydroelectric Power Generation	Energy Tech	High-Tech Services
221112	Fossil Fuel Electric Power Generation	Energy Tech	High-Tech Services
221113	Nuclear Electric Power Generation	Energy Tech	High-Tech Services
221114	Solar Electric Power Generation	Energy Tech	High-Tech Services
221115	Wind Electric Power Generation	Energy Tech	High-Tech Services
221116	Geothermal Electric Power Generation	Energy Tech	High-Tech Services
221117	Biomass Electric Power Generation	Energy Tech	High-Tech Services
221118	Other Electric Power Generation	Energy Tech	High-Tech Services
221121	Electric Bulk Power Transmission and Control	Energy Tech	High-Tech Services
221122	Electric Power Distribution	Energy Tech	High-Tech Services
221210	Natural Gas Distribution	Energy Tech	High-Tech Services
324110	Petroleum Refineries	Energy Tech	High-Tech Services
221310	Water Supply and Irrigation Systems	Environmental Tech	High-Tech Services
221320	Sewage Treatment Facilities	Environmental Tech	High-Tech Services
221330	Steam and Air-Conditioning Supply	Environmental Tech	High-Tech Services

NAICS Code	NAICS Description	Sub-Category	Manufacturing or Service
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	Environmental Tech	High-Tech Manufacturing
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	Environmental Tech	High-Tech Manufacturing
334514	Totalizing Fluid Meter and Counting Device Manufacturing	Environmental Tech	High-Tech Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	Environmental Tech	High-Tech Manufacturing
335911	Storage Battery Manufacturing	Environmental Tech	High-Tech Manufacturing
541620	Environmental Consulting Services	Environmental Tech	High-Tech Services
562111	Solid Waste Collection	Environmental Tech	High-Tech Services
562112	Hazardous Waste Collection	Environmental Tech	High-Tech Services
562119	Other Waste Collection	Environmental Tech	High-Tech Services
562211	Hazardous Waste Treatment and Disposal	Environmental Tech	High-Tech Services
562212	Solid Waste Landfill	Environmental Tech	High-Tech Services
562213	Solid Waste Combustors and Incinerators	Environmental Tech	High-Tech Services
562219	Other Nonhazardous Waste Treatment and Disposal	Environmental Tech	High-Tech Services
562910	Remediation Services	Environmental Tech	High-Tech Services
562920	Materials Recovery Facilities	Environmental Tech	High-Tech Services
562991	Septic Tank and Related Services	Environmental Tech	High-Tech Services
562998	All Other Miscellaneous Waste Management Services	Environmental Tech	High-Tech Services
333242	Semiconductor Machinery Manufacturing	IT	High-Tech Manufacturing
333314	Optical Instrument and Lens Manufacturing	IT	High-Tech Manufacturing
333316	Photographic and Photocopying Equipment Manufacturing	IT	High-Tech Manufacturing
334111	Electronic Computer Manufacturing	IT	High-Tech Manufacturing
334112	Computer Storage Device Manufacturing	IT	High-Tech Manufacturing
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing	IT	High-Tech Manufacturing
334210	Telephone Apparatus Manufacturing	IT	High-Tech Manufacturing

NAICS Code	NAICS Description	Sub-Category	Manufacturing or Service
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	IT	High-Tech Manufacturing
334290	Other Communications Equipment Manufacturing	IT	High-Tech Manufacturing
334310	Audio and Video Equipment Manufacturing	IT	High-Tech Manufacturing
334412	Bare Printed Circuit Board Manufacturing	IT	High-Tech Manufacturing
334413	Semiconductor and Related Device Manufacturing	IT	High-Tech Manufacturing
334416	Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing	IT	High-Tech Manufacturing
334417	Electronic Connector Manufacturing	IT	High-Tech Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	IT	High-Tech Manufacturing
334419	Other Electronic Component Manufacturing	IT	High-Tech Manufacturing
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	IT	High-Tech Manufacturing
334519	Other Measuring and Controlling Device Manufacturing	IT	High-Tech Manufacturing
335921	Fiber Optic Cable Manufacturing	IT	High-Tech Manufacturing
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing	IT	High-Tech Manufacturing
511210	Software Publishers	IT	High-Tech Services
517311	Wired Telecommunications Carriers	IT	High-Tech Services
517312	Wireless Telecommunications Carriers (except Satellite)	IT	High-Tech Services
517410	Satellite Telecommunications	IT	High-Tech Services
517911	Telecommunications Resellers	IT	High-Tech Services
517919	All Other Telecommunications	IT	High-Tech Services
518210	Data Processing, Hosting, and Related Services	IT	High-Tech Services
519130	Internet Publishing and Broadcasting and Web Search Portals	IT	High-Tech Services
541511	Custom Computer Programming Services	IT	High-Tech Services
541512	Computer Systems Design Services	IT	High-Tech Services
541513	Computer Facilities Management Services	IT	High-Tech Services
NAICS Code	NAICS Description	Sub-Category	Manufacturing or Service
---------------	--	---------------	-----------------------------
541519	Other Computer Related Services	IT	High-Tech Services
115116	Farm Management Services	Life Sciences	High-Tech Services
325311	Nitrogenous Fertilizer Manufacturing	Life Sciences	High-Tech Manufacturing
325312	Phosphatic Fertilizer Manufacturing	Life Sciences	High-Tech Manufacturing
325314	Fertilizer (Mixing Only) Manufacturing	Life Sciences	High-Tech Manufacturing
325320	Pesticide and Other Agricultural Chemical Manufacturing	Life Sciences	High-Tech Manufacturing
325411	Medicinal and Botanical Manufacturing	Life Sciences	High-Tech Manufacturing
325412	Pharmaceutical Preparation Manufacturing	Life Sciences	High-Tech Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing	Life Sciences	High-Tech Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing	Life Sciences	High-Tech Manufacturing
333111	Farm Machinery and Equipment Manufacturing	Life Sciences	High-Tech Manufacturing
333241	Food Product Machinery Manufacturing	Life Sciences	High-Tech Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	Life Sciences	High-Tech Manufacturing
334516	Analytical Laboratory Instrument Manufacturing	Life Sciences	High-Tech Manufacturing
334517	Irradiation Apparatus Manufacturing	Life Sciences	High-Tech Manufacturing
339112	Surgical and Medical Instrument Manufacturing	Life Sciences	High-Tech Manufacturing
339113	Surgical Appliance and Supplies Manufacturing	Life Sciences	High-Tech Manufacturing
339114	Dental Equipment and Supplies Manufacturing	Life Sciences	High-Tech Manufacturing
541330	Engineering Services	Life Sciences	High-Tech Services
541380	Testing Laboratories	Life Sciences	High-Tech Services
541690	Other Scientific and Technical Consulting Services	Life Sciences	High-Tech Services
541713	Research and Development in Nanotechnology	Life Sciences	High-Tech Services
541714	Research and Development in Biotechnology (except Nanobiotechnology)	Life Sciences	High-Tech Services
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	Life Sciences	High-Tech Services

## Advanced Industry Groupings

NAICS Code	NAICS Description
2111	Oil and Gas Extraction
2122	Metal Ore Mining
2211	Power Generation and Supply
3251	Basic Chemical Manufacturing
3252	Resin, Rubber, and Artificial Fibers Manufacturing
3253	Agricultural Chemical Manufacturing
3254	Pharmaceutical and Medicine Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
3271	Clay Product and Refractory Manufacturing
3279	Other Nonmetallic Mineral Products
3311	Iron and Steel Mills and Ferroalloy Manufacturing
3313	Alumina and Aluminum Production
3315	Foundries
3331	Ag, Construction, and Mining Machinery Manufacturing
3332	Industrial Machinery Manufacturing
3333	Commercial and Service Industry Machinery
3336	Turbine and Power Transmission Equipment Manufacturing
3339	Other General Purpose Machinery Manufacturing
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3343	Audio and Video Equipment Manufacturing
3344	Semiconductor and Electronic Component Manufacturing
3345	Electronic Instrument Manufacturing
3346	Magnetic Media Manufacturing and Reproducing
3351	Electric Lighting Equipment Manufacturing

NAICS Code	NAICS Description
3352	Household Appliance Manufacturing
3353	Electrical Equipment Manufacturing
3359	Other Electrical Equipment and Component Manufacturing
3361	Motor Vehicle Manufacturing
3362	Motor Vehicle Body and Trailer Manufacturing
3363	Motor Vehicle Parts Manufacturing
3364	Aerospace Product and Parts Manufacturing
3365	Railroad Rolling Stock Manufacturing
3366	Ship and Boat Building
3369	Other Transportation Equipment Manufacturing
3391	Medical Equipment and Supplies Manufacturing
3399	Other Miscellaneous Manufacturing
5112	Software Publishers
5152	Cable and Other Subscription Programming
5172	Wireless Telecommunications Carriers
5174	Satellite Telecommunications
5179	Other Telecommunications
5182	Data Processing, Hosting and Related Services
5191	Other Information Services
5413	Architectural and Engineering Services
5415	Computer Systems Design and Related Services
5416	Management and technical consulting services
5417	Scientific Research and Development Services
6215	Medical and Diagnostic Laboratories

Appendix

## Tech Occupation Groupings

SOC Code	Occupation Description
11-3021	Computer and Information Systems Managers
11-9041	Architectural and Engineering Managers
13-1081	Logisticians
13-1111	Management Analysts
13-1161	Market Research Analysts and Marketing Specialists
13-1198	Project Management Specialists and Business Operations Specialists, All Other
13-2031	Budget Analysts
13-2041	Credit Analysts
13-2098	Financial and Investment Analysts, Financial Risk Specialists, and Financial Specialists, All Other
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
15-2011	Actuaries
15-2021	Mathematicians
15-2031	Operations Research Analysts
15-2041	Statisticians
15-2098	Data Scientists and Mathematical Science Occupations, All Other
17-2011	Aerospace Engineers
17-2021	Agricultural Engineers
17-2031	Bioengineers and Biomedical Engineers

р
р
Ð
n
D
∠.
<u> </u>

SOC Code	Occupation Description
17-2041	Chemical Engineers
17-2051	Civil Engineers
17-2061	Computer Hardware Engineers
17-2071	Electrical Engineers
17-2072	Electronics Engineers, Except Computer
17-2081	Environmental Engineers
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
17-2112	Industrial Engineers
17-2121	Marine Engineers and Naval Architects
17-2131	Materials Engineers
17-2141	Mechanical Engineers
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers
17-2161	Nuclear Engineers
17-2171	Petroleum Engineers
17-2199	Engineers, All Other
17-3021	Aerospace Engineering and Operations Technologists and Technicians
17-3022	Civil Engineering Technologists and Technicians
17-3023	Electrical and Electronic Engineering Technologists and Technicians
17-3024	Electro-Mechanical and Mechatronics Technologists and Technicians
17-3025	Environmental Engineering 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
19-1011	Animal Scientists
19-1012	Food Scientists and Technologists
19-1013	Soil and Plant Scientists
19-1021	Biochemists and Biophysicists
19-1022	Microbiologists
19-1029	Biological Scientists, All Other

SOC Code	Occupation Description
19-1042	Medical Scientists, Except Epidemiologists
19-1099	Life Scientists, All Other
19-2021	Atmospheric and Space Scientists
19-2031	Chemists
19-2032	Materials Scientists
19-2041	Environmental Scientists and Specialists, Including Health
19-2042	Geoscientists, Except Hydrologists and Geographers
19-2043	Hydrologists
19-4011	Agricultural and Food Science Technicians
19-4021	Biological Technicians
19-4042	Environmental Science and Protection Technicians, Including Health
19-4045	Geological and Hydrologic Technicians
19-4051	Nuclear Technicians
19-4099	Life, Physical, and Social Science Technicians, All Other
25-9021	Farm and Home Management Educators
43-9111	Statistical Assistants
45-2011	Agricultural Inspectors

Appendix





428 East Capitol Avenue, P.O. Box 149 Jefferson City, MO 65102 573-634-3511 • mochamber.com