Utah's Tech Economy

Volume One: Economic Impacts, Industry Trends, Occupations, and Workers

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Kem C. Gardner
POLICY INSTITUTE
THE UNIVERSITY OF UTAH
DAVID ECCLES SCHOOL OF BUSINESS

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Utah's tech economy features a fascinating past, impressive present, and promising future. Researchers at the Kem C. Gardner Policy Institute have documented this history and transformation in a two-volume report on Utah's tech economy. Volume one shares research on the economic impacts, industry trends, occupations, and workers engaged in Utah's tech economy. Volume two presents an abbreviated four-decade history of Utah's tech economy. Together, the two volumes illuminate an evolving and rapidly growing innovation economy that has been transformed into a large and diverse collection of industries and companies that contributes significantly to the Utah economy.

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ANALYSIS IN BRIEF

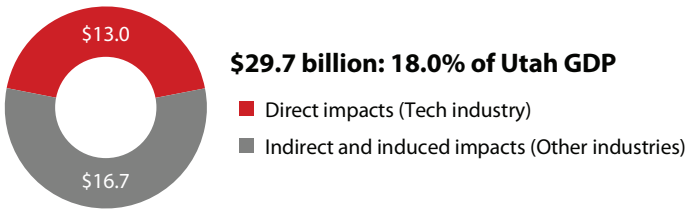
The tech industry, which provides information technology capabilities and support, made significant contributions to Utah's economy in 2018. Tech companies supported one in seven Utah jobs and one-sixth of worker earnings in the state. This economic activity generated over $2.5 billion in tax revenue to help fund schools and government services.

Tech companies employ a larger share of the workforce in Utah than nationwide. The industry's generous pay, compared with other industries, attracts workers. Even with Utah's strong wage growth in recent years, tech companies find labor costs in Utah well below the national average. Job growth in Utah's tech industry has been remarkable compared with other industries and states.

In addition to 118,600 Utah jobs in the tech industry itself, tech-related firms provided 50,100 jobs that overlapped with aerospace, defense, life sciences, and other industries. Another 43,800 employees worked in tech occupations for non-tech companies.

Salt Lake and Utah counties provide most of Utah's tech jobs, but the industry creates economic opportunity throughout the state. Going forward, homegrown and transplant tech innovators leverage decades of private and public investments in Utah's tech sector.

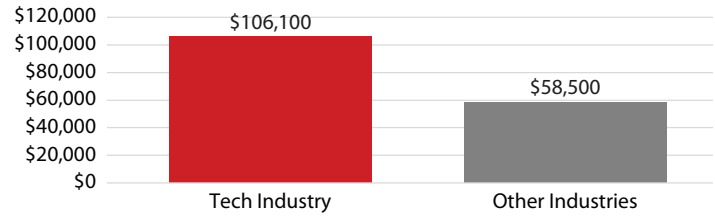
Utah Tech Industry Economic Impact, 2018 GDP



Note: Total economic impact of $29.7 billion is the sum of direct, indirect, and induced impacts of the tech industry itself, not tech-related industries or tech workers outside of tech companies.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services and U.S. Bureau of Economic Analysis using the REMI PI+ economic model.

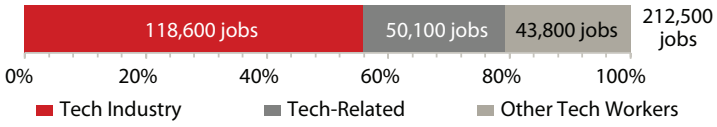
Utah Tech Industry Compensation Differential, 2018

(Average Compensation)



Note: Compensation includes employee wages and employer-paid benefits.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis.

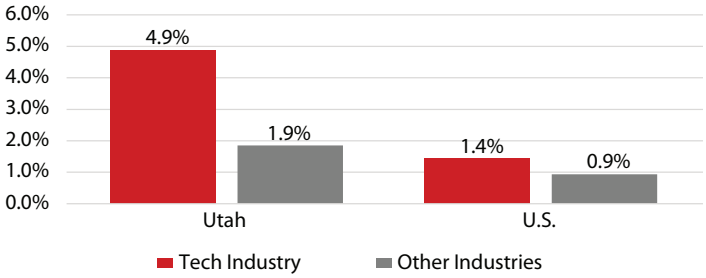
Utah Tech Employment Components, 2018



Note: The first two categories include employees, but "other tech workers" only includes self-employed workers. Does not include economic impacts.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics.

Tech Industry Job Growth, 2008–2018

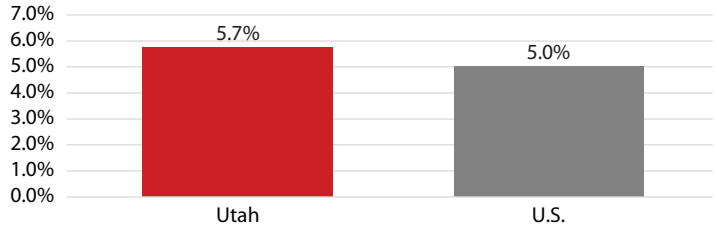
(Compound Annual Growth Rate for Employment)



Note: Does not include self-employment.
Source: U.S. Bureau of Labor Statistics.

Employment in Tech Occupations, 2018

(Share of All Jobs)



Note: Includes employees in tech and non-tech industries. Does not include self-employment.
Source: U.S. Bureau of Labor Statistics.

Overview

Utah's tech industry continues to grow and evolve rapidly. Researchers at the Kem C. Gardner Policy Institute engaged in a two-year research endeavor to measure this growth and change. In this capstone report, we provide statewide employment and earnings, economic impact results, historical trends, local detail, and state comparisons for the tech industry. We also highlight the characteristics of workers in tech occupations. This research builds upon preliminary and summary results released earlier by the Gardner Institute.[1]

A Tech Industry Advisory Council, with participation from three Utah trade associations—Silicon Slopes, Utah Technology Council, and Women Tech Council—as well as the Utah Governor's Office of Economic Development (GOED) and Economic Development Corporation of Utah (EDCUtah) contributed to this research by providing data, sharing expertise, and reviewing results. The Utah Legislature funded this research.

We take great care to explain how the components of Utah's tech industry fit together. While we focus on jobs and earnings of the tech industry itself, we also explore the workforce in tech occupations, regardless of the industry. This comprehensive approach results in a first of its kind and landmark report on Utah's tech economy.

Summary of Findings

Compiled below are Utah research findings for 2018 in six areas: employment at tech companies, geographic analysis by county and city, industry growth trends, statewide economic impacts, a tech occupation profile, and combined tech sector employment.

Employment at Tech Companies:

- Tech companies provided over 118,600 Utah jobs in the tech industry, and tech-related companies provided almost 50,100 additional jobs in the aerospace, defense, life sciences, and other industries (see Table 1).
- Average annual compensation was $106,100 in the tech industry, over 80 percent higher than the $58,500-per-job compensation in other industries.
- Among states, Utah had the fifth-highest share of private sector employee jobs in tech companies (6.4 percent), in spite of having the 25th highest average wage, 24.9 percent below the U.S. average.

Geographic Distribution:

- Salt Lake and Utah counties provided more than 80 percent of tech industry jobs and wages in Utah.
- Of Utah's 29 counties, 28 had at least one tech company; and 20 cities and towns had 50 or more tech industry establishments.

Industry Growth:

- In terms of total employment and wages in the private sector, no state with an economy of Utah's size had a larger tech industry.
- Since 2008, employment in Utah's tech industry grew at a rate of 4.9 percent per year, more than double the growth rate in other Utah industries and more than triple the growth rate in the U.S. tech industry.
- Utah had the second-highest 10-year tech industry job growth rate among all states and the third-fastest total wage growth.

Economic Impacts:

- In-state spending by tech companies and their workers supported over 191,900 Utah jobs outside the tech industry, 1.6 jobs for every job inside the industry.
- Total economic impacts exceeded 310,500 jobs at companies that paid $20.4 billion in earnings and generated $29.7 billion in GDP during 2018).
- Directly and indirectly, tech companies supported more than one in seven Utah jobs (15.2 percent) and almost one-fifth of worker earnings in the state (19.0 percent).
- Utah's tech industry generated an estimated $1.0 billion in state tax revenue and $0.7 billion in local tax revenue.

Tech Occupations:

- Across all industries, Utah employees filled over 83,600 jobs in tech occupations. They were more likely to be male, White or Asian, and mid-career than Utah employees in other occupations.
- Over 43,800 of these jobs in tech occupations were outside of the state's tech and tech-related companies (see Table 1).
- Utah's share of workers in tech occupations was 5.7 percent, which was well above the nationwide tech workforce concentration of 5.0 percent.

Combined Tech Sector Employment:

- Including all tech companies and tech occupations outside of tech companies, Utah's tech footprint exceeded 212,500 jobs that paid well above the state average (see Table 1).
- Excluding the tech-related jobs typically counted in other industries, Utah's combined tech footprint was 171,400 jobs.
- Table 1 results do not include a multiplier analysis for economic impacts in non-tech industries. We based our economic impact results only on our main tech industry definition (118,600 jobs).

Utah's tech sector is multifaceted. The first section of this report defines Utah's tech sector as a collection of companies that offer products related to information technology. We include workers in tech and non-tech roles at those companies, for example, programmers and accountants. Companies in every industry have integrated technology into their business processes. In Section 2, we address Utah tech workers irrespective of the industry in which they work.

Table 1: Utah Tech Sector Employment Footprint, 2018

Industry Definition	Jobs in Industry	Jobs Outside Industry in Tech Occupations	Total
Tech	118,600	52,800	171,400
Tech-Related	50,100	NA	NA
Total	**168,700**	**43,800**	**212,500**

Note: The tech-related definition includes tech companies in Utah's life sciences, aerospace, defense, and other industries outside our main definition (see Section 1.7). We include self-employment in industry jobs but not in jobs outside the industry in tech occupations. Employment rounded to the nearest 100 full- and part-time jobs.
Source: Utah Department of Workforce Services; U.S. Bureau of Labor Statistics.

Section 1. Utah Tech Industry

This section discusses how we identify tech companies in Utah and presents tech industry employment and earnings. These constitute the basis for our economy-wide economic impact results. Our coverage includes local details, an analysis of historical trends, and comparisons to other states.

This section follows the industry approach to studying the tech sector. The red circle with a bold outline in Figure 1.1 represents the economic value tech industry workers create in tech and non-tech occupations.

1.1 Definition

To establish criteria for selecting which companies make up Utah's tech sector, we reviewed best practices. After discussing our findings, we will introduce our tech industry definition.

1.1.1 What are the Leading Alternatives for Defining the Tech Industry?

The Gardner Institute reviewed tech industry definitions from prominent organizations in Utah and nationwide. We ended up closest to industry lists used by GOED, EDCUtah, and the Computing Industry Technology Association, a nationwide trade association. We also incorporated key aspects of definitions from the U.S. Bureau of Labor Statistics, U.S. Census Bureau, National Science Foundation, University of Utah, and Harvard University. The review process helped us develop conventions for the economic data and models incorporated in this study. Table 1.1 characterizes eight approaches and the ways they influenced our research.

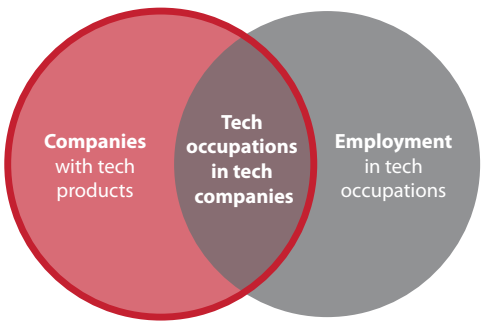
While they partially overlap, each definition in Table 1.1 provides unique insights. The first five point to industries that offer tech products. The remaining three definitions select industries based on operational characteristics: funding for research and development (R&D) and their use of tech-skilled workers. We created an amalgamated definition based on alignment among these eight sources. The industry employment and number of Utah establishments implied by our new definition fall within the range of preliminary estimates we made for the alternative approaches we reviewed.

All of the definitions rely on the North American Industry Classification System (NAICS) (U.S. Census Bureau 2018). Companies categorize themselves in this system based on the type of work they do primarily. State and federal agencies that provide key economic data—the Utah Department of Workforce Services and the U.S. Bureau of Labor Statistics, Bureau of Economic Analysis, and Census Bureau—have adhered to NAICS standards for more than two decades. Every five years, since 1997, the U.S. Office of Management and Budget has overseen a process to update NAICS categories so they align more closely with the contemporary economy. This study employs the 2017 version, except for earlier definitions and historical data, for which we use crosswalks between NAICS versions. The 2017 NAICS hierarchy devolves into 1,067 detailed industries represented by six-digit codes. These can be aggregated myriad ways. For example, a common set of distinct two- and three-digit codes represent 129 medium-level industry groupings, and a customary high-level aggregation has just 21 major sectors represented by two-digit codes.

To create Utah's legacy tech definition, GOED and EDCUtah reviewed all NAICS industries looking for products related to software or information technology (IT). "Software and IT" is among six strategic clusters to which the state directs its economic development efforts. One way GOED and EDCUtah check the resulting list is by looking up industry classifications for known tech companies. They have updated the list over the years as the tech industry and NAICS classifications evolved. GOED's Annual Report (2018, pp. 46-47) and EDCUtah's industry profile "Information Technology in Utah" (2018) use this definition.

The Computing Technology Industry Association's (CompTIA) definition aligns well with Utah's legacy definition and is somewhat more inclusive in three main areas: electronics repair and maintenance, technology research and development, and manufacturing of semiconductor machinery and electronic instruments (2019, p. 150). We added most of these additional industries either in our primary core definition or in an expanded tech-related definition we developed for industries that are also counted in other industry groupings, such as life sciences, aerospace, and defense. Of the 42 industries in our main industry definition, 39 are among CompTIA's 50 industries, as are 11 industries in our expanded tech-related definition of 16 industries.[2] CompTIA also integrated its industry-based tech definition with an occupation-based tech definition, which gave us the concept for Figure 1.1.

Figure 1.1: Diagram of Tech Industry and Tech Occupations



We compared the Utah and CompTIA lists to one from the U.S. Census Bureau, formulated over 20 years ago and updated for use with 2012 County Business Patterns data. This list corroborated our other sources for tech industry definitions and flagged one minor and one substantial area we were missing. The Census Bureau prompted us to include photographic and photocopying equipment manufacturing. More importantly, in terms of Utah employment, it helped us determine which aspects of e-commerce wholesale and retail to add to our definition.

Since the 1970s, the University of Utah's Bureau of Economic and Business Research, precursor to the Gardner Institute, sustained a research program on Utah's evolving software, electronics, computer systems, communications, and other high-tech industry segments. The Bureau incorporated various criteria in its definitions of high-tech: the concentration of technical, scientific, and engineering workers; the percent of revenue spent on research and development; and whether a company's product or service was technology-oriented, not merely created

Table 1.1: Description of Leading Tech Industry Definitions Contributing to this Report

Definition	Inclusion Criteria	Key Takeaways
1. Utah's legacy definition Utah Governor's Office of Economic Development (GOED) and the Economic Development Corporation of Utah (EDCUtah)	35 detailed industries for software and information technology	- This industry list was our starting point. - Consultation with GOED and EDCUtah staff about their approach
2. National trade association Computing Technology Industry Association	50 detailed industries that create, integrate, or support technology as a service or product (2019, p. 150)	- Inclusion of industries for electronics repair and maintenance, technology research and development, and anufacturing of semiconductor machinery and electronic instruments
3. U.S. Census Bureau	26 detailed industries that research, develop, manufacture, or distribute high-tech goods (2014)	- Inclusion of industries for e-commerce and manufacturing photographic and photocopying equipment
4. Multifaceted Utah definition University of Utah	49 detailed industries with tech products, a tech-skilled workforce, and high R&D spending; contacted Utah companies to refine the definition	- Preference for a definition based on multiple criteria - Company-specific review for part-tech industries, with input from Utah trade associations and our online research
5. Industry clusters framework Harvard University	23 detailed industries for information technology and analytical instruments; e-commerce grouped with distribution; 65 other industry clusters	- Considerations for parsing e-commerce from distribution cluster - Delineating boundaries between tech and neighboring industry groups
6. Research and development National Science Foundation	Seven high-level industries with R&D-spending-to-GDP ratios more than triple the economy-wide average	- List of innovative industries based on operations rather than their product type
7. STEM worker concentration U.S. Bureau of Labor Statistics (BLS)	31 medium-level industries with at least 2.5 times the economy-wide average share of employment in STEM occupations	- Addition of Section 2 on employment in STEM and tech occupations, in both tech and non-tech companies
8. STEM worker concentration—two tiers BLS Workforce Information Council	Same as previous with a "core" tier for 13 medium-level industries with at least five times the economy-wide average share of employment in STEM occupations	- Addition of Section 1.7 introducing an expanded tech-related definition outside our core tech industries

Note: Detailed industries are specified by six-digit NAICS codes, medium-level industries by three- or four-digit codes, and high-level industries by two- or three-digit NAICS codes.
Source: Kem C. Gardner Policy Institute.

by advanced technological processes (Crispin 1992; Crispin-Little 1996; and Perlich 2000). While definitions varied for reports focusing on different segments of the tech industry, we updated the Bureau's most expansive tech definition to 2018. Starting with the industry-level criteria mentioned, the Bureau's researchers surveyed and interviewed dozens of companies for a more nuanced, Utah-aware approach. For this report, we adopt an amalgamated definition and handpicked dozens of medium or large Utah establishments in industries where not all companies are tech.

Harvard University's Institute for Strategy and Competitiveness offers a system of 67 industry groupings, two of which were relevant: "information technology" and "distribution and e-commerce" (2018). The Institute's Cluster Mapping framework helped us delineate which tech-related industries belong partially or wholly in other clusters. The Institute's list of industries for IT is more limited than what GOED and EDCUtah use for IT and software. We also considered how to parse e-commerce from other retail and wholesale operations described by the 110 detailed industries in the "distribution and e-commerce" cluster.

The last three organizations in Table 1.1 define the tech industry by numerical measures of salient operational criteria (Paytas and Berglund 2004), which the University of Utah definition had incorporated. The National Science Foundation's definition focuses on research and development spending (2018). Industries identified as tech have R&D-spending-to-value-added ratios above 7.8 percent, triple the national average. As recently as 2015, the Business Research and Development and Innovation Survey provided U.S. R&D spending for 28 high-level industry categories, corresponding to 1,065 detailed industries.[3] Seven of the 28 industries have sufficiently high R&D ratios; these correspond to 167 detailed NAICS industries, not all of which have individually high levels of R&D. Observing which industries invest heavily in innovation made our definition more comprehensive.

Both occupation-based definitions focus on the concentration of STEM employment in each industry, which averaged 6.6 percent nationwide in 2018 (see Section 2.1, Figure 2.3). The first definition includes all industries with at least 2.5 times the average STEM percentage of employees (Wolf and Terrell 2016). The two-tier version adds a "core" category for industries with at least five times the average (Workforce Information Council 2015).[4] Data to support these approaches are available for some 129 medium-level industry groupings. We explored this definition and adaptations based on 2.5 times and five times the average share of workers in tech occupations, rather than in STEM occupations. The fairly broad industry categories that qualified corresponded to 187 detailed industries with at least 2.5 times the average tech employment concentration and 79 detailed industries with at least five times the average tech concentration.

1.1.2 What Do We Count as a Tech Company?

This analysis covers tech companies from 42 NAICS industries (see Table 1.2). The tech industry develops digital platforms that enable the ubiquitous information economy. Tech companies provide software for many applications. They manufacture and distribute computers and devices used by individuals and organizations. The industry encompasses e-commerce and technology support. We selected these industries based on multiple criteria: the type of service or product, research and development spending, and the share of jobs in tech occupations.

Women Tech Council, Utah Technology Council, and Silicon Slopes reviewed our approach and brought to our attention companies missing from our initial list because of their industry identification. Their input prompted our one-by-one review of companies in 11 industries that included both tech and non-tech companies. For 282 companies with at least 10 employees, we did online searches and visited company websites to learn more about their product and service offerings. For example, we found the following 10 tech companies in five industries: Ricoh and Xerox (office equipment); InMoment and Qualtrics (marketing research); Cerner and SAP (wholesale trade); Banyan and Ubiquiti Networks (marketing consulting); and PlanSource and Zenetex (management consulting).

Most companies, economy-wide, rely on information systems and innovative technology in their business processes. Besides using technology internally, companies in the tech industry distinguish themselves by providing tech capabilities for other companies and for personal use. Our industry definition does not include tech workers, such as in-house programmers and IT support specialists, at companies whose main product and service offerings are not among the functions in Table 1.2. For example, financial and health care organizations, among others, house substantial internal IT operations.

For this analysis, the Utah Department of Workforce Services (DWS) responded to our request for granular data on employment and payroll at tech companies. DWS manages Utah data from the Quarterly Census of Employment and Wages (QCEW). QCEW reporting requirements apply to almost every employer in the country. DWS provided aggregate 2018 data for 6,568 private-sector establishments with employees in Utah's tech industry.[5]

QCEW data do not include all tech companies. For example, this data set excludes self-employed owners (proprietors), who work in companies without employees. The U.S. Bureau of Economic Analysis (BEA) tracks proprietors and certain other workers missing from QCEW data. BEA provides information for multi-industry sectors in Utah's economy, but not for the detailed NAICS industries in our definition. The Gardner Institute estimated employment and income for companies not included in QCEW data by using BEA industry averages together with the detailed information from DWS.

Table 1.2: Utah Tech Industry Definition

Industry	NAICS Code
Manufacturing	
Instruments and devices	334512–5 and 334519
Electronic components and media	334400 and 334613–4
Communications equipment	334200 and 334310
Computer and peripheral equipment	333316 and 334100
Semiconductor machinery	333242
Trade	
E-commerce retail and wholesale	425110 and 454100
Software and device sales	423430
Information Services	
Software	511210
Telecommunications	517000
Data processing and hosting	518210
Internet publishing	519130
Technology Support	
Custom computer programming	541511
Computer systems design	541512
Systems management and support	541513 and 541519
Electronics repair and maintenance	811200
Software and computer training	611420

Note: Several of the higher-level industries with NAICS codes ending in zero include more than one of the 42 detailed industries within the broader tech industry. Apart from these complete industries, the definition includes 71 manually selected establishments similar to the companies in these industries.
Source: Kem C. Gardner Policy Institute.

1.2 Tech Companies

Companies in the various segments of Utah's tech industry include proprietorships with just one or a few owners, small and medium businesses, and over two dozen employers with at least 500 employees. We identify some of the largest employers and analyze spatial patterns for tech companies throughout the state.

The Utah Department of Workforce Services provides addresses for Utah companies with employees. While we have reliable, statewide estimates of self-employed workers and proprietors' income, we have not determined precisely where they are within the state.

1.2.1 How Large Are Most Tech Companies?

Six Utah tech establishments—any business or nonprofit location—provided at least 1,000 full-time or part-time jobs in 2018 (see Table 1.3). That year, 148 establishments had 100 to 999 jobs; 943 establishments had 10 to 99 jobs; and over 5,000 establishments had fewer than 10 jobs each. Compared with their statewide share of 6.4 percent of all establishments, tech companies were over-represented among the smallest establishments (fewer than five employees, 7.8 percent), and more so among large companies (500 or more employees, 11.3 percent).

Table 1.3: Utah Tech Companies by Size, 2018

	Establishments		
Employees	**Tech Industry**	**Any Industry**	**Tech Share**
4,000 or more	0	10	0.0%
3,000-3,999	1	9	11.1%
2,000-2,999	0	9	0.0%
1,000-1,999	5	50	10.0%
500-999	20	153	13.1%
250-499	25	419	6.0%
100-249	103	1,646	6.3%
50-99	134	3,223	4.2%
20-49	372	8,698	4.3%
10-19	437	12,037	3.6%
5-9	683	15,602	4.4%
Fewer than 5	4,931	63,288	7.8%
Total	**6,711**	**105,144**	**6.4%**

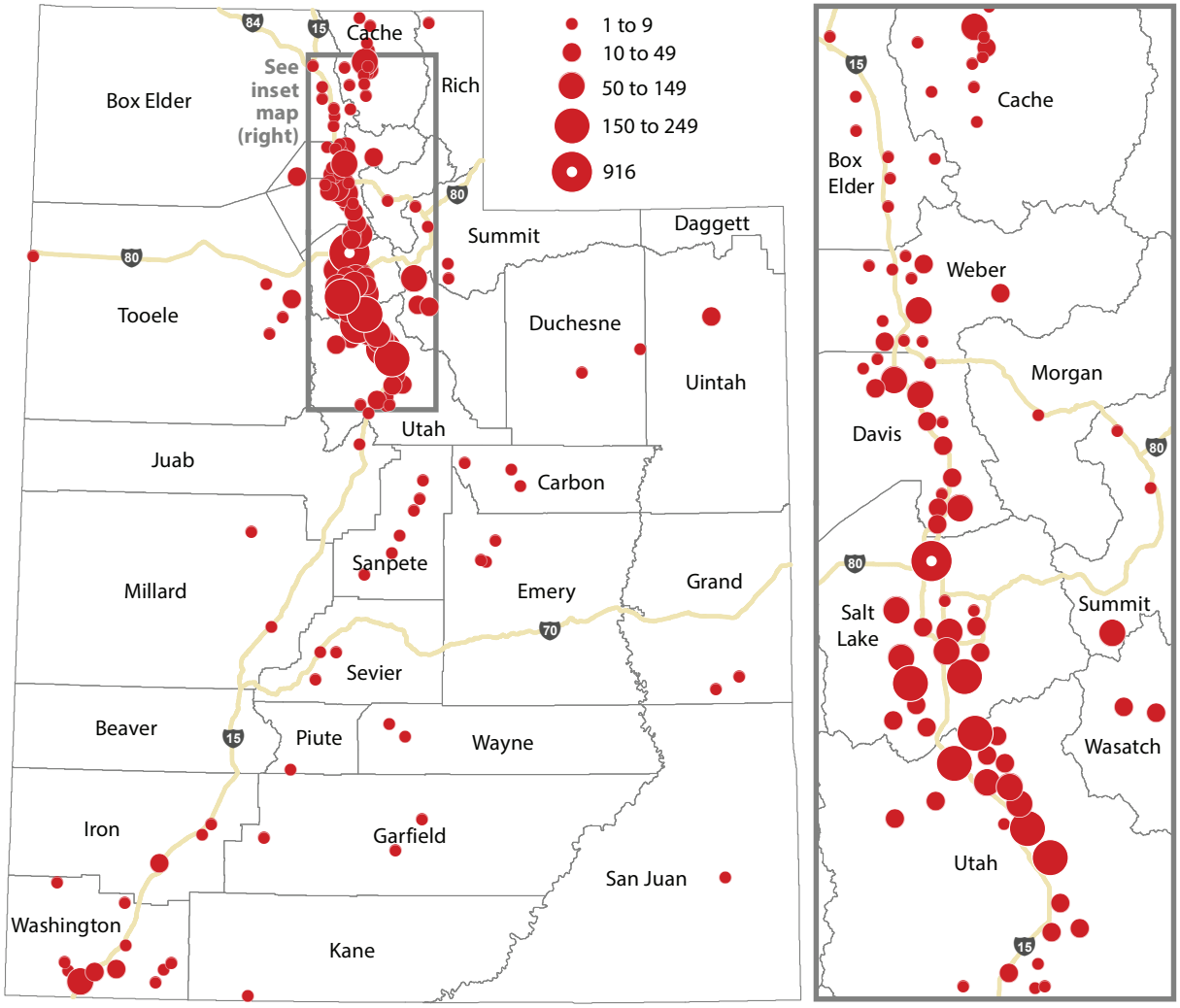
Note: Companies with more than one job site and those operating under more than one legal name count more than once, with their employment divided appropriately.
Source: Utah Department of Workforce Services.

Table 1.4: Largest Employers in Utah's Tech Industry, 2018
(Companies with at Least 500 Jobs)

Company	Description	Employment
L3 Technologies	Electronic instrument manufacturing	3,000 to 4,000
Adobe	Software	1,000 to 2,000
Clear Link	Telecommunications	1,000 to 2,000
eBay	E-commerce	1,000 to 2,000
IM Flash	Semiconductor manufacturing	1,000 to 2,000
Overstock	E-commerce	1,000 to 2,000
Ancestry	Internet publishing	600 to 1,300
1-800 Contacts	E-commerce	600 to 1,300
Instructure	Software	600 to 1,300
Dell EMC	Computer systems design	500 to 1,200
AdvancedMD	Custom computer programming	500 to 1,000
Autotrader	Custom computer programming	500 to 1,000
Domo	Software	500 to 1,000
Henry Schein	Software	500 to 1,000
Jet	E-commerce	500 to 1,000
NICE inContact	Telecommunications	500 to 1,000
Optum	Software	500 to 1,000
Pluralsight	Software and computer training	500 to 1,000
Qualtrics	Marketing research	500 to 1,000
Solutionreach	Custom computer programming	500 to 1,000
Verscend	Data processing and hosting	500 to 1,000
Wayfair	E-commerce	500 to 1,000
Workfront	Custom computer programming	500 to 1,000
Xactware	Computer systems design	500 to 1,000
Younique	E-commerce	500 to 1,000

Note: Federal disclosure guidelines permit broad employment ranges, not exact counts. We combined job counts for any company aliases. For companies with establishments in multiple industries, we only included jobs they reported in the tech industry. Industry descriptions are for the NAICS industry in which the company had the most jobs.
Source: Utah Department of Workforce Services.

Figure 1.2: Tech Company Locations in Utah, 2018
(Number of establishments in each municipality)



Note: A company may have more than one establishment (location). The map does not include self-employment in tech companies without employees. Locations available for 4,318 of Utah's 6,568 tech establishments, which provided at least 90 percent of the industry's employment in the state during 2018.
Source: Utah Department of Workforce Services; State of Utah, State Geographic Information Database.

1.2.2 Which Tech Companies Provide the Most Jobs in Utah?

Utah's 25 largest tech employers come from nearly every segment of the industry (see Table 1.4). Ten companies offer information services—half of them software companies and two of them telecommunications providers; another seven offer technology support—mostly computer programming; six are in e-commerce; and two are manufacturing firms. Each company provided at least 500 jobs to Utah employees in 2018. Those providing at least 1,000 jobs were L3, Adobe, Clear Link, eBay, IM Flash, and Overstock.

1.2.3 Where in Utah Do Tech Companies Cluster?

The Utah Department of Workforce Services provides location details for establishments representing at least 90 percent of Utah employment in 2018, excluding self-employment. Based on that coverage, tech companies operated in at least 143 cities and towns throughout the state (see Figure 1.2). Salt Lake City held the most tech establishments, over 900, which was 5.3 percent of private sector establishments in the city. Sandy followed with nearly 250 tech establishments. The next three cities, with over 200 tech establishments each, were in Utah County.

Twenty Utah municipalities had at least 50 establishments in the tech industry in 2018 (see Table 1.5). Seven of them were in Salt Lake County, six were in Utah County, and three were in Davis County. Four other counties—Washington, Weber, Summit, and Cache—had one city where at least 50 tech companies had clustered.

An even half of the municipalities with a tech nexus of at least 50 establishments were above the statewide average tech share of 6.4 percent of all establishments in any industry. In Lehi (a prominent tech hub) and Clearfield (gateway to Hill Air Force Base), 11.6 percent of establishments were part of the

Table 1.5: Utah Tech Establishments by City, 2018
(Municipalities with at Least 50 Establishments)

Municipality	Establishments in Tech Industry	Share of All Industries
Salt Lake City	916	5.3%
Sandy	246	7.0%
Orem	216	7.4%
Provo	212	8.1%
Lehi	203	11.6%
Draper	198	10.2%
South Jordan	167	9.3%
St. George	134	3.7%
Ogden	114	3.0%
American Fork	107	8.9%
Park City	102	4.7%
Clearfield	82	11.6%
Layton	78	4.4%
Midvale	76	5.8%
Logan	74	3.8%
West Jordan	73	3.6%
Pleasant Grove	72	7.9%
West Valley City	61	5.1%
Lindon	56	9.4%
Bountiful	55	4.3%

Note: Shares equal the number of tech establishments divided by total establishments for all industries in the municipality.
Source: Utah Department of Workforce Services.

Table 1.6: Utah Tech Establishments by County, 2018

County	Number	Percent of Total	Percent of County
Beaver	1	0.0%	0.4%
Box Elder	27	0.4%	2.0%
Cache	149	2.3%	4.1%
Carbon	8	0.1%	1.3%
Daggett	0	0.0%	0.0%
Davis	457	7.0%	5.3%
Duchesne	5	0.1%	0.6%
Emery	4	0.1%	1.5%
Garfield	2	0.0%	0.8%
Grand	9	0.1%	1.5%
Iron	56	0.9%	3.4%
Juab	3	0.0%	1.0%
Kane	6	0.1%	1.8%
Millard	3	0.0%	0.8%
Morgan	11	0.2%	3.1%
Piute	1	0.0%	2.1%
Rich	1	0.0%	0.8%
Salt Lake	3,738	56.9%	8.2%
San Juan	4	0.1%	1.2%
Sanpete	19	0.3%	3.0%
Sevier	8	0.1%	1.1%
Summit	131	2.0%	4.6%
Tooele	34	0.5%	2.9%
Uintah	17	0.3%	1.4%
Utah	1,335	20.3%	8.0%
Wasatch	44	0.7%	3.8%
Washington	238	3.6%	4.0%
Wayne	4	0.1%	2.8%
Weber	211	3.2%	3.4%
Not specified	42	0.6%	NA
Total	**6,568**	**100.0%**	**6.4%**

Note: Proprietor establishments not included. Percent of county equals the number of tech establishments divided by total establishments for all industries in the county.
Source: Utah Department of Workforce Services.

tech industry. Draper just exceeded 10 percent. The tech share of establishments was below 5.0 percent in seven cities, none of which fell below 3.0 percent.

Of Utah's 29 counties, 28 had at least one tech company in 2018 (see Table 1.6). Daggett County had none, and nine other counties, mostly in southern Utah, had fewer than five establishments. Eight counties had 5 to 19 tech establishments—three of them in eastern Utah, two in central Utah, two in southern Utah, and one near the Wasatch Front. Counties with 27 to 56 establishments were Iron, Wasatch, Tooele, and Box Elder counties, from most to least. In the next largest tier, Davis, Washington, Weber, Cache, and Summit counties each had between 100 and 500 tech establishments. Over 18 percent of Utah's tech establishments operated in those five counties. We previously noted the very large number of tech establishments in Salt Lake and Utah counties: 77.2 percent of the state total.

1.3 Employment and Earnings

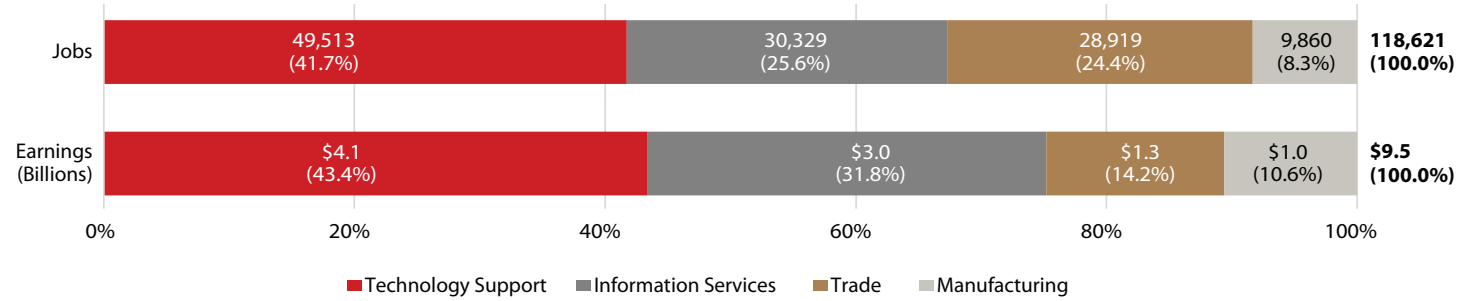
In this section, we present our findings for Utah employment and earnings from the tech companies identified in Section 1.2. We count jobs and earnings for employees and self-employed workers within the industry's four categories. We show which counties have the highest tech shares of county employment and wages. We also calculate average pay per job in the tech industry. In 2018, total employee compensation averaged $106,100 per Utah job, well above the state average.

1.3.1 How Many Jobs and How Much Pay Do Utah Tech Companies Provide?

In 2018, direct employment in Utah's tech industry was 118,621 jobs (see Figure 1.3). Tech industry employees and self-employed workers provided technology support, information services, wholesale and retail trade, and manufactured goods. They earned $9.5 billion in wages, benefits, and self-employment income.

Nearly 83,900 jobs in the tech industry (71 percent of the total) represented employees of companies, an average of almost 13 jobs per establishment (see Table 1.7). Self-employed workers in partnerships or sole proprietorships held over 34,700

Figure 1.3: Utah Tech Industry Employment and Earnings, 2018



Note: Includes full- and part-time jobs held by company employees and self-employed workers.
Source: Utah Department of Workforce Services; U.S. Bureau of Labor Statistics.

jobs (29 percent). Self-employed workers held nearly half of the 28,919 wholesale and retail trade jobs. In contrast, they filled just below 5 percent of 9,860 manufacturing jobs.

Tech companies provided $8.9 billion in employee compensation in Utah during 2018 (see Table 1.8). Compensation includes $7.5 billion in employee wages and an estimated $1.4 billion in employer-paid benefits, such as health insurance and retirement savings.[6] Companies with employees provided an even larger share of total earnings (94 percent) than their share of employment (71 percent) in the tech industry.

Self-employed Utahns in the tech industry earned $556.8 million, according to 2018 estimates.[7] Nearly $400 million of that income was from proprietorships offering technology support, and over $160 billion in earnings came from e-commerce and other trade proprietorships. These categories relied on self-employed workers for about 10 percent or more of total earnings. In contrast, proprietors that offered information services provided only 2 percent of industry earnings, and manufacturing proprietorships generated losses of $51.9 million. Perhaps the losses were due to design and setup costs before proprietors ramped up production and sales and brought on employees.

Of the four tech industry components, technology support provided the most Utah jobs, 41.7 percent of the industry total. Most of its more than 49,500 jobs were in computer programming and systems design, management, and support (see Table 1.9). Technology support also generated the most earnings of the four categories: $4.1 billion, 43.4 percent of the total, just above its share of jobs.

The information services and trade categories each accounted for about one-fourth of tech industry employment in the state, with a little over 30,300 and 28,900 jobs, respectively. However, earnings from information services were 31.8 percent

Table 1.7: Tech Industry Employment in Utah, 2018

	Companies with Employees		Self-Employment	Total Employment	
Category	**Establishments**	**Jobs**	**Jobs**	**Jobs**	**Share**
Technology support	3,578	32,567	16,946	49,513	41.7%
Information services	1,666	26,601	3,728	30,329	25.6%
Trade	1,103	15,335	13,584	28,919	24.4%
Manufacturing	221	9,389	471	9,860	8.3%
Total	**6,568**	**83,892**	**34,729**	**118,621**	**100.0%**

Note: Self-employment estimated from employee jobs by industry in 2018 and the 2017 ratio of employee jobs to self-employed jobs for each industry, since detailed self-employment data for 2018 had not yet been released at time of publication.
Source: Utah Department of Workforce Services; U.S. Bureau of Labor Statistics.

Table 1.8: Tech Industry Earnings in Utah, 2018
(Millions of Dollars)

Category	Employee Compensation	Proprietors' Income	Total	Share
Technology support	$3,703.4	$398.4	$4,101.8	43.4%
Information services	$2,960.3	$48.5	$3,008.8	31.8%
Trade	$1,179.4	$161.8	$1,341.1	14.2%
Manufacturing	$1,054.8	-$51.9	$1,002.9	10.6%
Total	**$8,897.9**	**$556.8**	**$9,454.6**	**100.0%**

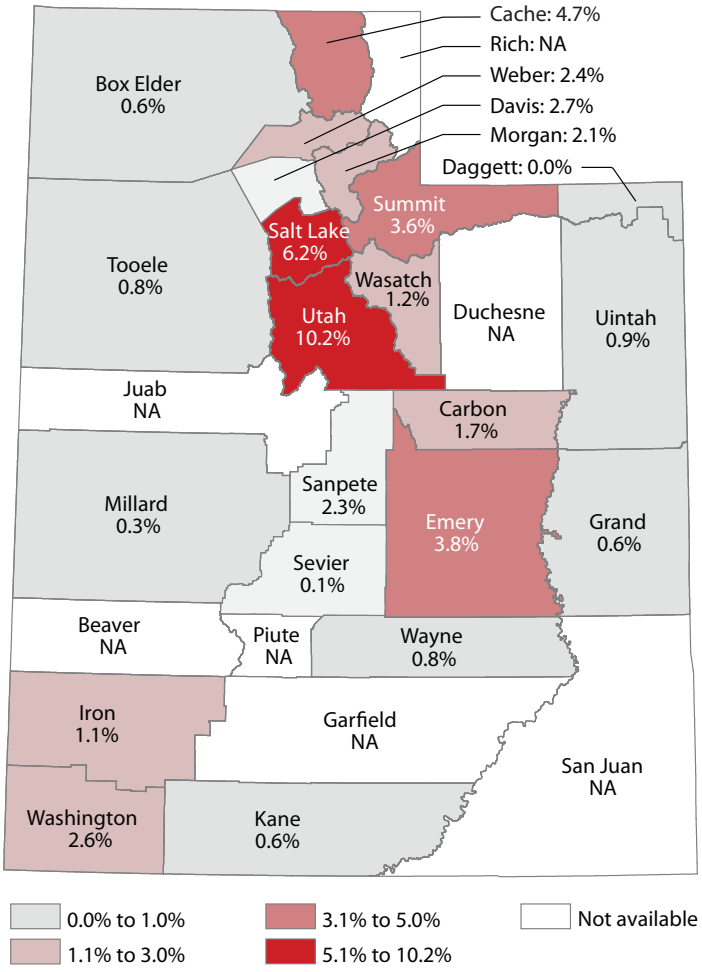
Note: Compensation includes wages and benefits. Proprietors' income is from self-employment.
Source: Utah Department of Workforce Services; U.S. Bureau of Labor Statistics.

Table 1.9: Employment and Earnings for Segments of Utah's Tech Industry, 2018
(Millions of Dollars)

	Employment		Aggregate Earnings	
Tech Industry Component	**Jobs**	**Share**	**$**	**Share**
Manufacturing				
Instruments and devices	4,436	3.7%	$521.6	5.5%
Electronic components and media	4,000	3.4%	$340.0	3.6%
Communications equipment	882	0.7%	$80.7	0.9%
Computer and peripheral equip.	542	0.5%	$60.6	0.6%
Subtotal	**9,860**	**8.3%**	**$1,002.9**	**10.6%**
Trade				
E-commerce retail and wholesale	26,187	22.1%	$1,019.7	10.8%
Software and device sales	2,732	2.3%	$321.4	3.4%
Subtotal	**28,919**	**24.4%**	**$1,341.1**	**14.2%**
Information Services				
Software	12,177	10.3%	$1,576.1	16.7%
Telecommunications	8,544	7.2%	$624.6	6.6%
Data processing and hosting	6,885	5.8%	$488.3	5.2%
Internet publishing	2,723	2.3%	$319.8	3.4%
Subtotal	**30,329**	**25.6%**	**$3,008.8**	**31.8%**
Technology Support				
Custom computer programming	27,129	22.9%	$2,233.3	23.6%
Computer systems design	9,877	8.3%	$801.6	8.5%
Systems management and support	8,411	7.1%	$756.0	8.0%
Electronics repair and maintenance	2,392	2.0%	$135.6	1.4%
Software and computer training	1,704	1.4%	$175.3	1.9%
Subtotal	**49,513**	**41.7%**	**$4,101.8**	**43.4%**
Total	**118,621**	**100.0%**	**$9,454.6**	**100.0%**

Note: Includes employees and self-employed workers. Employment and earnings for "semiconductor machinery" from Table 1.2 in Section 1.1 not available separately, included under "computer and peripheral equipment." Due to rounding, totals may not quite match.
Source: Utah Department of Workforce Services; U.S. Bureau of Labor Statistics.

Figure 1.4: Tech Industry Share of County Employment, 2018



Note: Map does not include self-employment. Employment not disclosed for counties with one to five tech establishments.
Source: Utah Department of Workforce Services; State of Utah, State Geographic Information Database.

of the tech industry total, well above its 25.6 percent employment share, while the earnings share for trade was only 14.2 percent of the total, well below its 24.4 employment share.

Finally, manufacturing made up 8.3 percent of tech employment and 10.6 percent of tech earnings from its 9,860 jobs. The largest manufacturing segments were instruments, devices, electronic components, and storage media.

1.3.2 Which Counties in Utah Rely Most on Tech Industry Jobs and Earnings?

Tech companies provide jobs throughout Utah. We will review county-level tech employment and wages and their relative importance in local economies. Our county-level data do not include self-employed workers or proprietor income.

An analysis by the Utah Department of Workforce Services for this study yielded tech industry employment for 22 of 29 counties in Utah (see Figure 1.4). In 2018, Utah County led the state in its tech share of county employment, 10.2 percent, and ranked second among counties for its employment level, over 25,300 jobs in the industry (see Table 1.10). At 6.2 percent, Salt Lake was the only other county with a tech industry share above the state average of 5.5 percent of employment.[8] Salt Lake County had the highest tech industry employment of any county, with over 42,400 jobs.

The next three counties for tech employment concentration were Cache County, with over 2,600 jobs and 4.7 percent of its employment in tech occupations; Emery County, with almost 120 tech jobs and a tech employment share of 3.8 percent; and Summit County, with nearly 950 jobs and 3.6 percent. Counties with the lowest levels of tech industry concentration, in terms of employment shares, were generally those farthest from the Wasatch Front, Logan, and St. George.

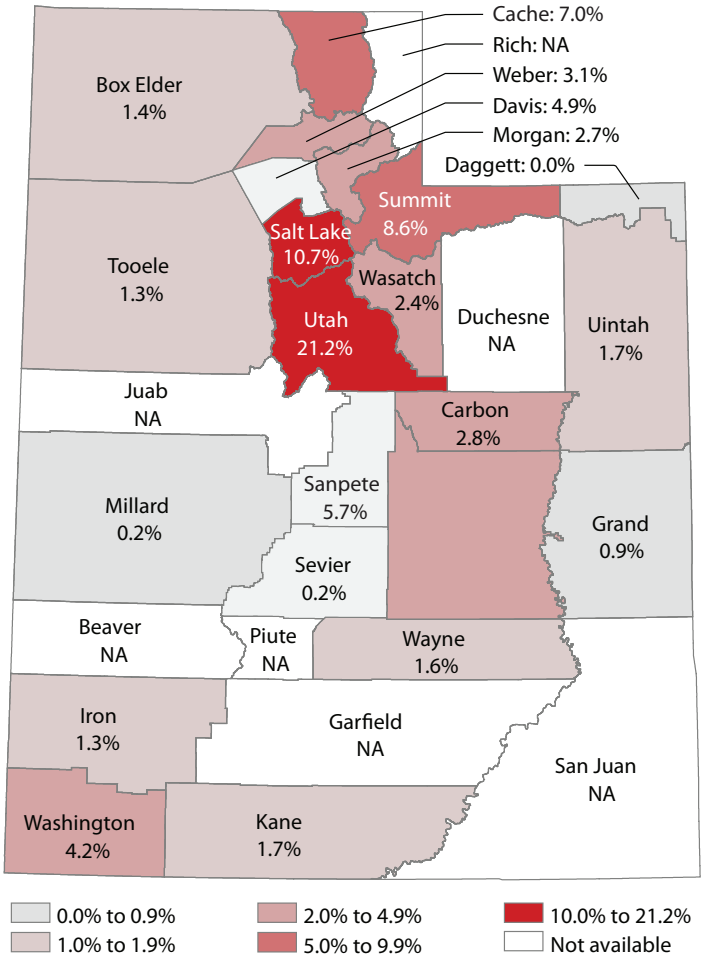
The average wage per tech industry job was much higher than the average wage in other industries in Utah. Thus,

Table 1.10: Tech Industry Employment by County, 2018

County	Jobs	Percent of Total	Percent of County
Box Elder	120	0.1%	0.6%
Cache	2,658	3.2%	4.7%
Carbon	144	0.2%	1.7%
Daggett	0	0.0%	0%
Davis	3,336	4.0%	2.7%
Emery	118	0.1%	3.8%
Grand	34	0.0%	0.6%
Iron	194	0.2%	1.1%
Kane	21	0.0%	0.6%
Millard	12	0.0%	0.3%
Morgan	50	0.1%	2.1%
Salt Lake	42,461	50.6%	6.2%
Sanpete	184	0.2%	2.3%
Sevier	10	0.0%	0.1%
Summit	949	1.1%	3.6%
Tooele	123	0.1%	0.8%
Uintah	114	0.1%	0.9%
Utah	25,366	30.2%	10.2%
Wasatch	106	0.1%	1.2%
Washington	1,670	2.0%	2.6%
Wayne	8	0.0%	0.8%
Weber	2,526	3.0%	2.4%
Not specified	3,688	4.4%	NA
Total	**83,892**	**100.0%**	**5.5%**

NA = not available
Note: Self-employment jobs not included. Tech employment not available for Beaver, Duchesne, Garfield, Juab, Piute, Rich, and San Juan counties.
Source: Utah Department of Workforce Services.

Figure 1.5: Tech Industry Share of County Wages, 2018



Note: Does not include proprietor income from self-employment. Wages not disclosed for counties with one to five tech establishments.
Source: Utah Department of Workforce Services; State of Utah, State Geographic Information Database.

wages reflect more fully than employment alone the effect of the tech industry on employees' household finances and the broader economy when workers spend their incomes in Utah communities. Like jobs, employee wages are reported by place of work, not place of residence, for people who commute across county lines. Wages do not include employer-paid benefits.

In all counties with more than five tech establishments in 2018, the industry contributed a larger share of county employee wages than its share of county employment (see Figure 1.5). For example, the tech industry paid 21.2 percent of all wages in Utah County, more than double the industry's 10.2 percent job share there. Workers in Salt Lake County's more diversified economy still earned 10.7 percent of their wages from tech companies, 4.5 percentage points above the industry's job share.

Tech industry workers in Salt Lake County received nearly $3.9 billion in 2018 wages, more than half of the industry's statewide total (see Table 1.11). With almost $2.3 billion, Utah County had the second-most employee wages, 30.5 percent of all tech wages in the state. In five other counties, the tech industry provided between $97.9 million and $274.6 million, collectively 10.0 percent of the state total. Workers in the remaining counties brought in almost 1.1 percent of Utah's tech industry wages.

1.3.3 How Much do Workers in Utah's Tech Industry Make on Average?

Tech companies in Utah reported paying $7.5 billion in employee wages and salaries during 2018, excluding benefits, an average of $89,000 per job, almost double the average wage in other industries in the state (see Figure 1.6).

Adding employer-paid benefits to wages and salaries, total tech industry employee compensation was $8.9 billion, 9.3 percent of all compensation in Utah in 2018. Average compensation per job was $106,100 in the tech industry, over 80 percent higher than other Utah industries, which averaged $58,500.

Turning to self-employed workers, proprietors' income in Utah's tech industry reached an estimated $556.8 million in

Table 1.11: Tech Industry Wages by County, 2018

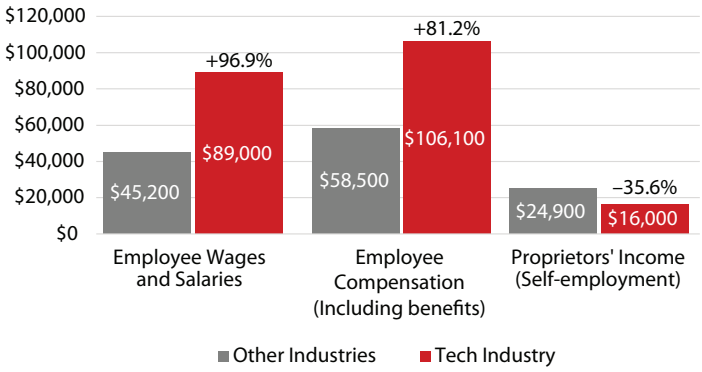
County	$ Millions	Percent of Total	Percent of County
Box Elder	$11.0	0.1%	1.4%
Cache	$140.2	1.9%	7.0%
Carbon	$9.4	0.1%	2.8%
Daggett	$0.0	0.0%	0.0%
Davis	$274.6	3.7%	4.9%
Emery	$6.1	0.1%	4.5%
Grand	$1.7	0.0%	0.9%
Iron	$7.6	0.1%	1.3%
Kane	$1.8	0.0%	1.7%
Millard	$0.4	0.0%	0.2%
Morgan	$2.6	0.0%	2.7%
Salt Lake	$3,893.2	52.1%	10.7%
Sanpete	$14.0	0.2%	5.7%
Sevier	$0.5	0.0%	0.2%
Summit	$102.1	1.4%	8.6%
Tooele	$7.9	0.1%	1.3%
Uintah	$9.3	0.1%	1.7%
Utah	$2,280.8	30.5%	21.2%
Wasatch	$8.4	0.1%	2.4%
Washington	$97.9	1.3%	4.2%
Wayne	$0.5	0.0%	1.6%
Weber	$131.8	1.8%	3.1%
Not specified	$464.5	6.2%	NA
Total	**$7,466.2**	**100.0%**	**10.3%**

NA = not available
Note: Employer-paid benefits and proprietor income not included. Tech wages not available for Beaver, Duchesne, Garfield, Juab, Piute, Rich, and San Juan counties.
Source: Utah Department of Workforce Services.

2018. The U.S. Bureau of Economic Analysis does not separate proprietors' benefits from self-paid wages and salaries. Average proprietors' income in the tech industry was $16,000, less than two-thirds of the average of other industries in the state. While proprietors' income was low, many self-employed workers were also employees in companies or had other sources of income. Many tech proprietorships were in an early growth phase where investments were high and revenue low. Later successes as established companies with employees may reward their strategic risk-taking as small entrepreneurs and compensate for temporarily low earnings and even losses.

Employee compensation varies for different types of Utah tech companies. Compensation averages in Figure 1.7 include a diverse mix of employee occupations, seniority, and pay within a given industry segment.[9] In 2018, software companies provided the highest average pay per job ($142,300), followed by companies offering software and computer training ($135,900) and instrument and device manufacturers ($129,000). Even the lower paying segments of the tech industry, such as electronics repair and maintenance ($62,800) and e-commerce retail ($66,800), paid above the Utah average for all non-tech industries ($58,500).

Figure 1.6: Average Annual Earnings per Job in Utah's Tech Industry, 2018



Note: Compensation equals employees' wages and salaries plus their benefits. Employee compensation and proprietors' income add up to total earnings.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis.

1.4 Industry Growth

Tech companies have created an enduring economic sector in Utah. After describing its size in 2018, we trace the industry's growth compared with other Utah industries going back to 2001. We conclude with comments about rising wages and out-of-state hiring as responses to the industry's growing demand for Utah workers. We find that Utah wages remain affordable compared with other U.S. tech hubs, and the state's tech workforce fills most job openings internally.

As tech companies occupy more of Utah's office space, whatever part of the industry's growth that does not merely displace other industries adds to the state's pressing housing, transportation, air quality, and workforce development needs. Tech growth also creates resources, such as income and innovative tools, that help individuals and governments make headway on public issues that other industries and non-economic factors also drive.

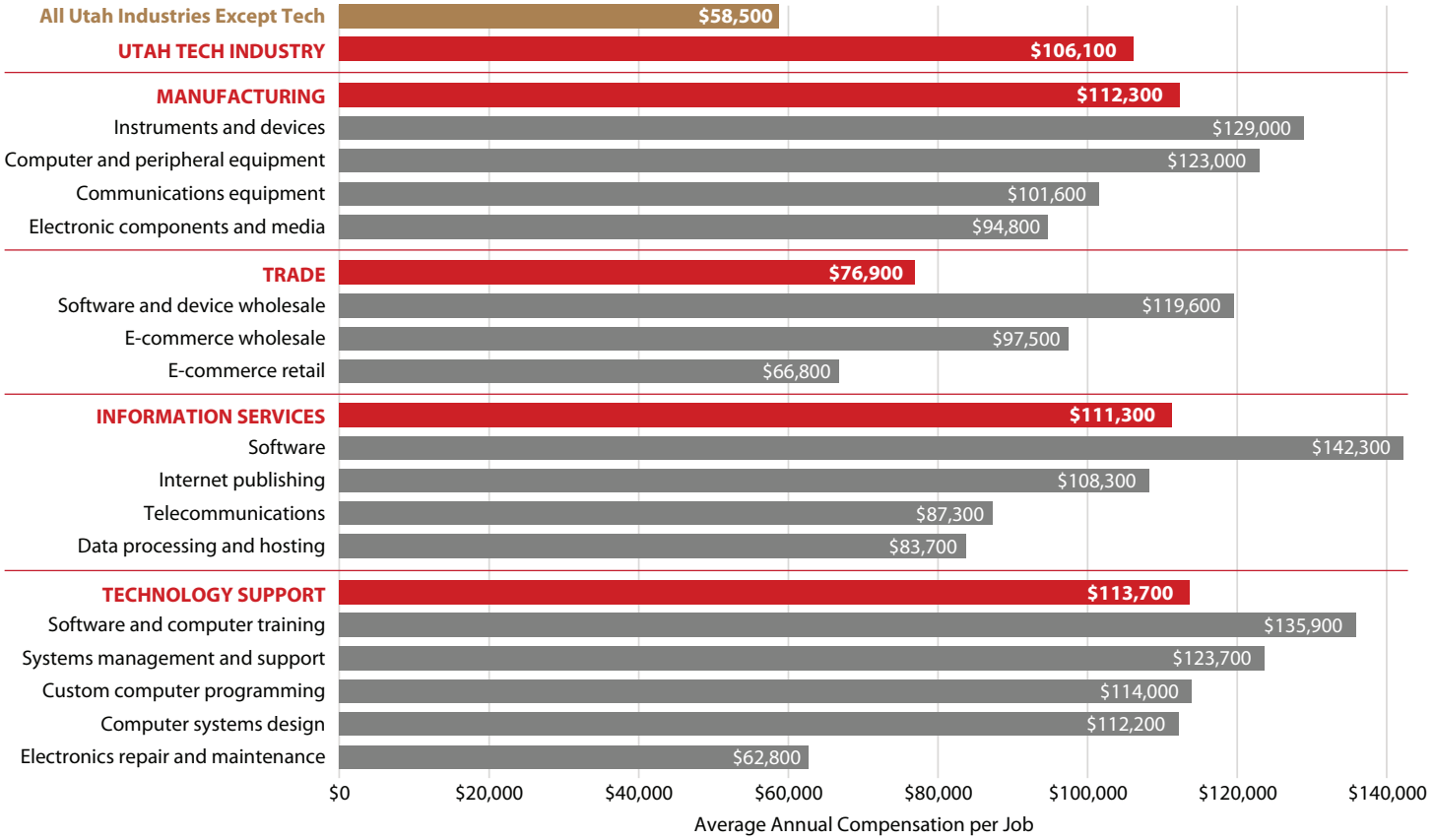
1.4.1 How Large Is Utah's Tech Industry Compared with Other Major Economic Sectors?

Placed alongside 21 major sectors in Utah's economy, nine of which partially overlap it, the tech industry had the ninth-highest direct employment. Figure 1.8 shows the seven sectors with employment levels closest to tech, those with 100,000 to 140,000 jobs.[10] At 118,621 jobs, tech was 3.3 percent larger than administrative services, 3.7 percent larger than real estate, and 9.0 percent smaller than construction.

1.4.2 How Does Tech Industry Job Growth in Utah Compare with Nationwide Trends?

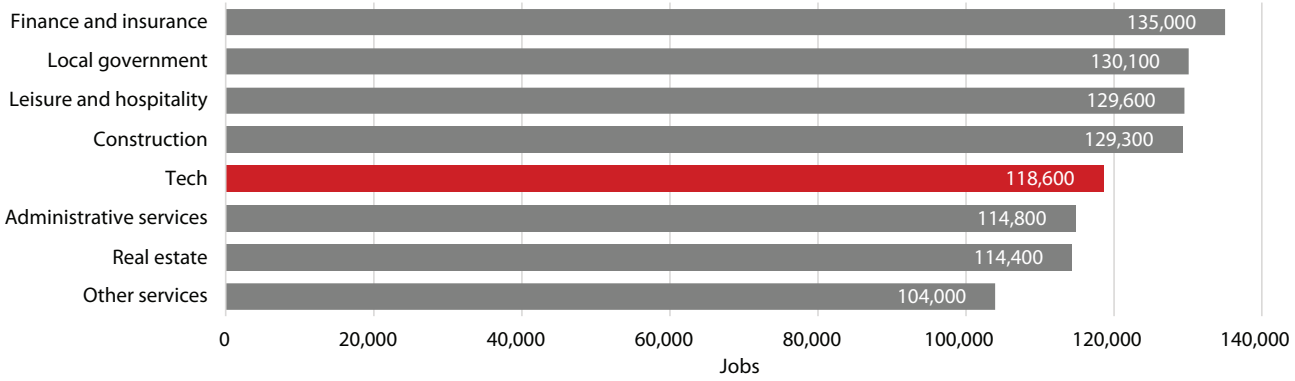
Over the past decade, Utah's tech industry has moved up through the ranks to reach its present standing among the major sectors in Utah's economy. Tech industry job growth averaged 4.9 percent per year from 2008 to 2018, more than

Figure 1.7: Average Compensation by Segment of Utah's Tech Industry, 2018



Note: Specific industry segments within the tech industry grouped under four categories denoted by red bars and bold text. Compensation equals employees' wages, salaries, and benefits.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis.

Figure 1.8: Utah Employment in Selected Industries, 2018



Note: Employment rounded to the nearest hundred for the tech industry and seven multi-industry sectors within 20,000 jobs of tech.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis; REMI PI+ economic model.

triple the industry's growth rate nationwide (see Figure 1.9). Utah's tech growth rate was more than double the 1.9 percent average for non-tech industries in the state. Historical data in this section cover companies with employees, not jobs from self-employment.

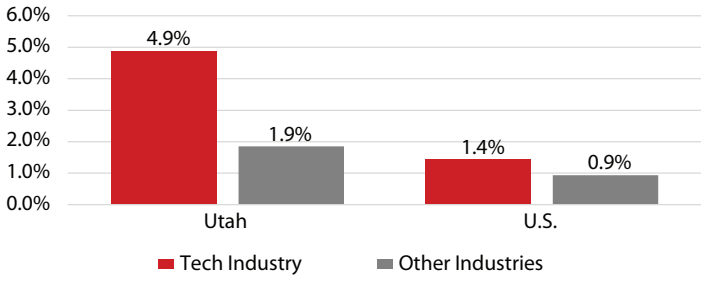
For the past 15 years, the tech industry has been a reliable job creator for Utah, even during the economic downturn from 2007 to 2009. The volatility and retrenchment the industry experienced in the first few years of the century have not recurred.

The tech industry's share of Utah's private sector employment was 5.8 percent in 2001, slightly above the U.S. average, when our time series begins (see Figure 1.10). The 2001 recession dampened industry prospects for several years, affecting high-tech companies nationwide more severely than companies in other industries. Utah's tech share of employment dropped a full percentage point as it shed over 9,400 jobs through 2003.

From 2004 to 2010, tech's job share was fairly steady in Utah, never dipping below 4.8 percent during years of sluggish

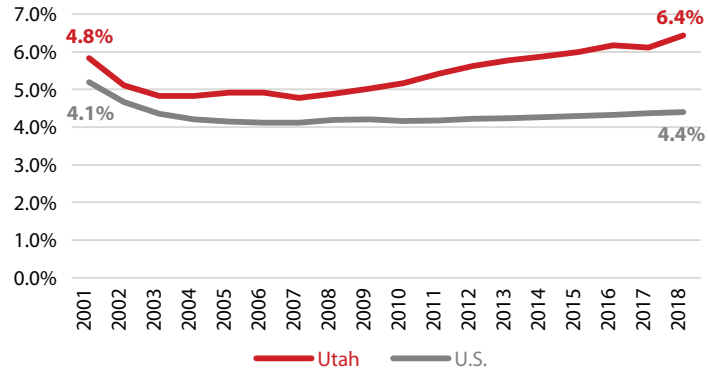
economic recovery followed by the recession from the mortgage crisis that began in 2007. The U.S. share fell to 4.1 percent and has not risen above 4.4 percent in the years since. In Utah from 2010 to 2018, the industry's job share jumped from almost 5.2 percent to over 6.4 percent of private sector employment.

Figure 1.9: Industry Job Growth, 2008–2018
(Compound Annual Growth Rate for Employment)



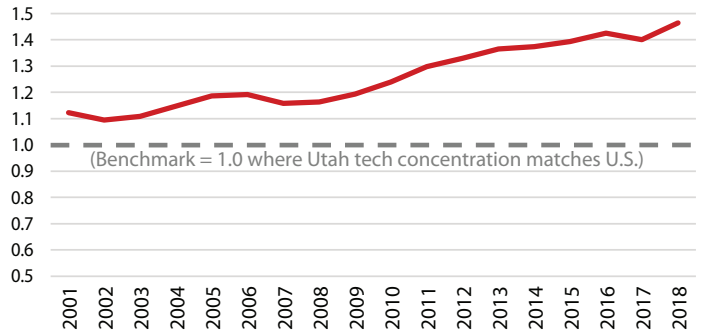
Note: Captures most tech industry employees, 95.7 percent of 2018 Utah tech jobs, excluding self-employment.
Source: U.S. Bureau of Labor Statistics.

Figure 1.10: Tech Industry's Rising Share of Private Sector Employment, 2001-2018



Note: Share equals tech industry employment divided by total employment for all industries in the private sector.
Source: U.S. Bureau of Labor Statistics.

Figure 1.11: Utah's Rising Location Quotient for Tech Industry Employment, 2001–2018



Note: Utah's tech industry location quotient equals the industry's share of economic activity in Utah's private sector divided by the industry's share nationwide.
Source: U.S. Bureau of Labor Statistics.

Utah's location quotient for the tech industry reflects the widening gap between Utah and U.S. tech industry employment shares since the early 2000s. This metric compares an industry's importance in a local or regional economy to its importance in a benchmark location, such as the U.S.

The tech industry's location quotient in Utah rose from 1.1 in 2001 to almost 1.5 in 2018 (see Figure 1.11). A value of one would mean the tech industry makes up the same percentage of the private sector in both Utah and the U.S. Values below one would imply an industry concentration in Utah below that of the U.S., and values above one indicate a comparatively high industry concentration in Utah.

The rising trend for the industry's location quotient in Utah stalled during the 2007–2009 economic recession. Since then, the upward trend in Utah's tech location quotient continued, except for an apparent one-year deviation in 2017.[11]

As they sustain relatively high job growth, Utah tech companies pay more every year to fill new positions and retain skilled employees. Since 2008, the average pay for tech company employees has grown faster than average pay at non-tech companies. Annual average wage growth for non-tech industries in Utah averaged 0.8 percent from 2008 to 2018, adjusted for inflation. Meanwhile, average wages in Utah's tech industry increased by an average of 2.0 percent annually. Ten-year average growth in employee wages was yet faster in the U.S. tech industry: 2.3 percent per year.

Higher wages result as tech companies compete for the best workers, including those from other states and industries. In Utah, residents supply most of the tech industry's internal employment demand. For two large segments of the tech industry, software publishing and computer systems design, an estimated 92.8 percent of new hires in Utah during 2016 were state residents, primarily people switching from other industries (Knold, Smith, and Stahle 2018). While Utah residents fill most of the Utah tech industry's workforce needs, companies also attract workers from other states and countries.

1.4.3 How Does the H-1B Visa Program Support Utah's Tech Job Growth?

Utah tech companies benefit from the international labor market. Many workers from abroad come through a U.S. visa program designed for industries like tech. The H-1B temporary worker program allows employers to access a global talent pool when the domestic workforce is inadequate. The specialized workers eligible for H-1B visas, which last up to six years, have U.S. bachelor's degrees or higher in their fields, or equivalent experience (U.S. Citizenship and Immigration Services 2019). In FY 2017, 76 percent of approved H-1B visa workers in the U.S. from were from India, 9 percent from China, and 1 percent or less from over 20 other countries (U.S. Citizenship and Immigration

Services 2018). For all national origins, these H-1B employees made up 0.2 percent of the U.S. civilian labor force, excluding self-employed workers.

H-1B application records show tech companies request H-1B visa holders as employees more often than do companies in other industries, but Utah's tech industry relies less on this labor source than tech industries in other states.[12] Companies in Utah's tech industry accounted for more than one-third (37.8 percent) of the positions opened to H-1B workers in 2018 (see Table 1.12). By comparison, an average of just above one-half (51.2 percent) of certified H-1B openings in other states came from tech companies. Perhaps Utah's labor force is more adequate than other states' in filling tech industry positions with local and other domestic applicants. H-1B program use by the tech industry is relatively high, considering the industry provided less than 7 percent of 2018 employment in Utah and the U.S. (see Figure 1.10 in Section 1.4.2).

In 2018, the U.S. Department of Labor certified H-1B applications for nearly 1,800 openings that tech companies sought to fill at Utah worksites. Companies provided detailed occupation descriptions based on the Standard Occupation Classification system by the U.S. Bureau of Labor Statistics. Over one-third (35.5 percent) of these positions were for software developers (see Table 1.13). Computer systems analysts, including information security analysts, filled one-fifth (20.1 percent) of the jobs identified in H-1B applications. Another 19.2 percent of the positions were for IT workers with computer occupations that did not fit in the other categories. The remaining fourth (25.2 percent) of job openings were for engineers (mostly electrical, mechanical, and electronic), computer programmers, workers in management and business support roles (mostly technical writers; IT managers; and management, financial, and market research analysts), and IT systems administrators (for databases, networks, and other systems).

For these findings, we reviewed data from Labor Condition Applications companies submitted to the U.S. Department of Labor in 2018 to open jobs to visa workers. We included new, renewal, and transfer applications in the H-1B program and the similar E-3 program for Australia. Labor Condition Applications represent company intent to hire employees from abroad during 2018, pending approval for successful job candidates by U.S. Citizenship and Immigration Services. Applications indicate the number of positions for which H-1B visa holders are eligible, not the eligibility of specific individuals seeking work or the total number of H-1B visa workers employed. The statutory cap for new H-1B visas nationwide was 85,000 visas in FY2018 (U.S. Citizenship and Immigration Services 2019).

Table 1.12: H-1B Visa Job Openings, 2018

	Utah		Other States	
Industry	**Openings**	**Share**	**Openings**	**Share**
Tech	1,785	37.8%	578,141	51.2%
Other	2,932	62.2%	550,097	48.8%
Total	**4,717**	**100.0%**	**1,128,238**	**100.0%**

Note: Positions open to foreign workers through the H-1B program.
Source: U.S. Department of Labor, Office of Foreign Labor Certification.

Table 1.13: Occupations for H-1B Visa Workers in Utah's Tech Industry, 2018

Occupation	Job Openings	Share
Software developers	634	35.5%
Computer systems analysts	359	20.1%
Information technology, not specified	343	19.2%
Engineers	185	10.4%
Computer programmers	108	6.1%
Management and business support	83	4.6%
IT systems administrators	73	4.1%
Total	**1,785**	**100.0%**

Note: Positions open to foreign workers through the H-1B program.
Source: U.S. Department of Labor, Office of Foreign Labor Certification.

1.5 State Comparisons

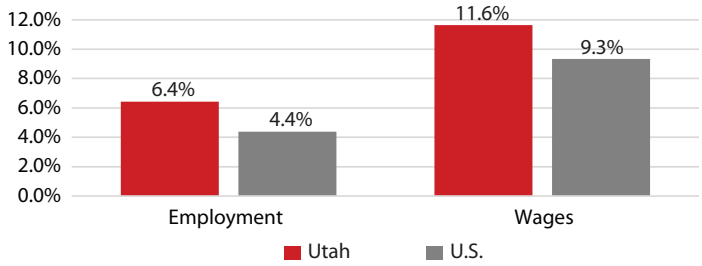
In the global tech industry, Utah primarily competes with other states for investment dollars and human talent. Utah's

Table 1.14: Tech Industry Employment and Wages in Utah and the U.S., 2018

	Employment			Wages		
Item	**U.S. Average**	**Utah**	**State Rank**	**U.S. Average**	**Utah**	**State Rank**
Growth, 2017 to 2018	2.5%	9.3%	3	5.4%	16.6%	1
Annual growth, 2008 to 2018	1.4%	4.9%	2	3.8%	6.9%	3
Concentration, share of total	4.4%	6.4%	5	9.3%	11.6%	7
Average wage	NA	NA	NA	$96,300	$72,300	25
Size, total jobs and wages	107,300 jobs	80,200 jobs	22	$13.0 billion	$7.0 billion	21
All industries, private sector	2,441,900 jobs	1,247,500 jobs	31	$139.7 billion	$60.6 billion	30

Note: Measures do not include the public sector, self-employment, employer-paid benefits, or proprietor income. Ten-year growth rates are compound annual growth rates. Tech concentration measures the tech industry's share of all private sector employee jobs and wages in the state or country. Our more complete analysis for Utah reported 83,892 employee jobs and $7.5 billion in wages (see Section 1.3). The lower estimates here follow a simplified analysis approach that we were able to apply consistently to all states.
Source: U.S. Bureau of Labor Statistics.

Figure 1.12: Tech Industry Share of Private Sector, 2018



Source: U.S. Bureau of Labor Statistics.

tech industry growth since 2008 places it among the top three states (see Table 1.14). No state with an economy Utah's size had a larger tech industry than Utah in 2018. Utah found itself in the middle of the pack for its level of tech employment in 2018, but the industry share of employment in the state was fifth-highest. Utah shares of private sector jobs (6.4 percent) and wages (11.6 percent) exceeded the U.S. averages by more than two percentage points (see Figure 1.12).

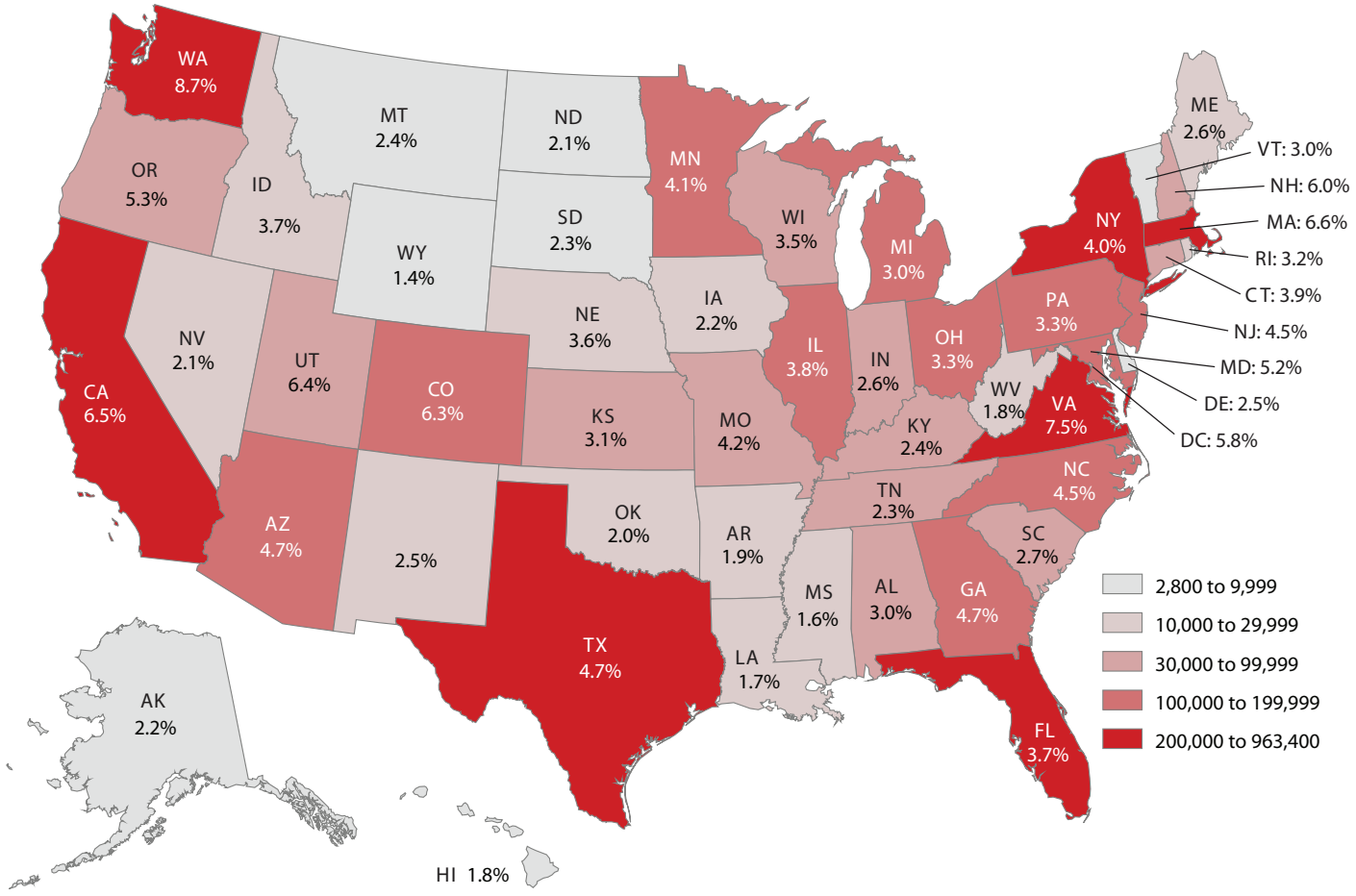
1.5.1 Where Are the Tech Jobs?

The U.S. tech industry clusters in certain large coastal states, in terms of both the total number of tech industry jobs and tech's share of private sector employment in all industries (see Figure 1.13). Several Great Lakes states have sizeable tech industries. In the Intermountain West region during 2018, only Arizona and Colorado surpassed Utah in tech industry employment. These three states also had the highest shares of tech industry employment in the region; in this category, Utah led its neighbors.

Among the 50 states and DC in 2018, Utah had the 22nd largest tech industry in terms of employment (see Table 1.15). The tech industry provided 80,200 jobs for Utah employees, out of nearly 5.5 million jobs nationwide. California had the most tech employment, almost 1 million jobs.[13] Texas provided almost 0.5 million tech jobs, and New York, Florida, Washington, Virginia, and Massachusetts each contributed over 0.2 million tech jobs. Utah had a higher level of tech industry employment than any state of its size, In terms of total employment in all industries. In 20 states, the tech industry provided less than 30,000 jobs.

Figure 1.13: Tech Industry Employment by State, 2018

(State colors and legend indicate the number of tech jobs. Percentage labels on states are tech's share of all private sector jobs.)



Note: Only includes employees, not proprietors. Alaska not shown to scale.
Source: U.S. Bureau of Labor Statistics.

From 2008 to 2018, the tech industry grew most quickly in the same coastal states where it has built up a critical mass of companies and workers: Washington, California, North Carolina, and New York (see Figure 1.14). Two other states with large tech industries, Texas and Florida, had somewhat slower growth. Utah—like Washington DC, South Carolina, and Missouri—had a medium-sized tech industry with a top 10 job growth rate. Utah's tech growth rate was a close second to Washington's.

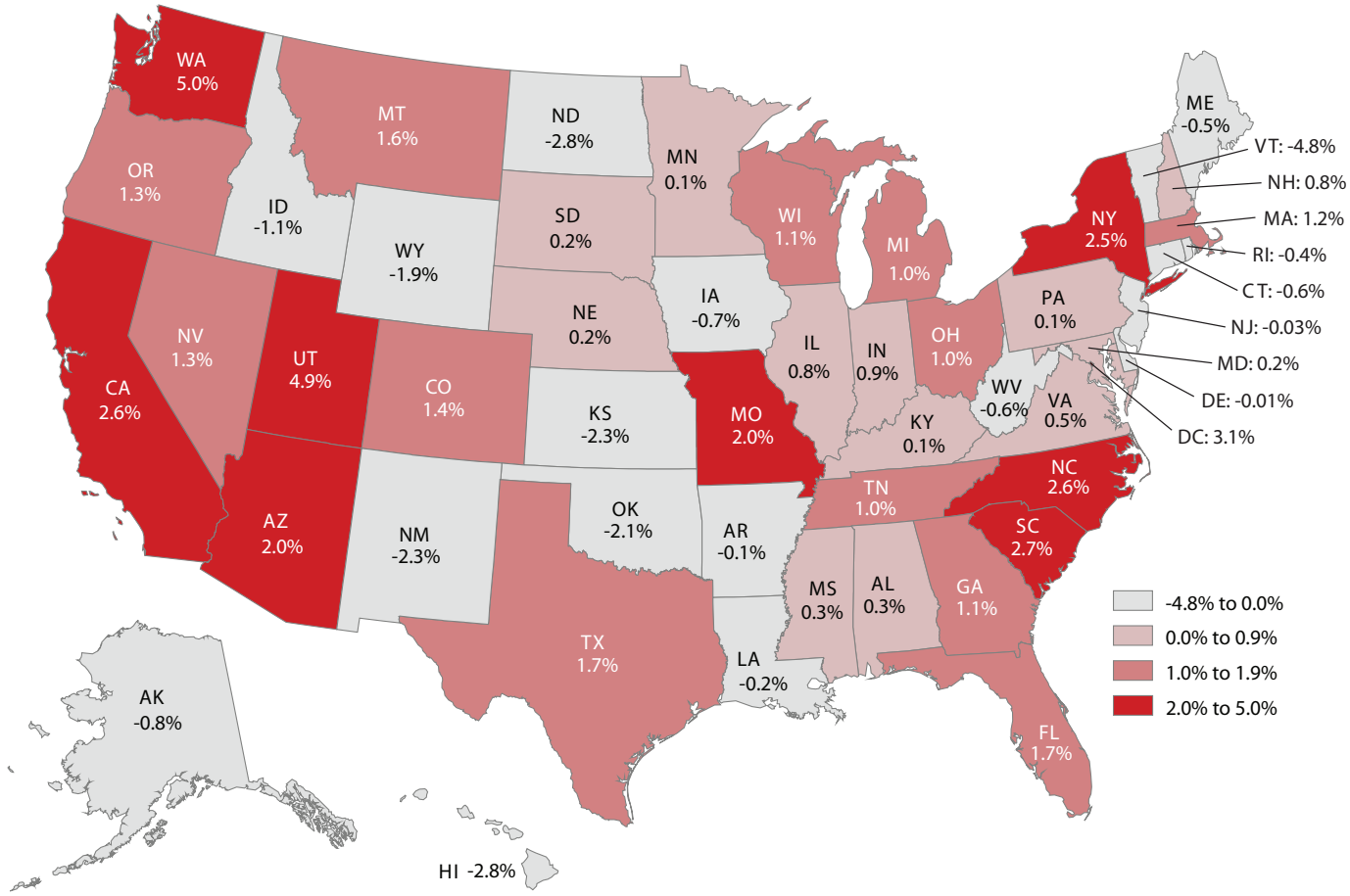
In the Intermountain West, Utah added tech jobs at an average annual rate of 4.9 percent, followed by Arizona at 2.0 percent. Montana, Colorado, and Nevada grew between 1.3 percent and 1.6 percent annually. Tech industry employment decreased in Idaho, Wyoming, and New Mexico from 2008 to 2018.

To evaluate employment concentration for the industry, we compared tech employment to the size of each state's private economy. Utah ranked fifth for its tech employment share, calculated as total employment in the tech industry divided by total employment in all industries, excluding self-employed workers and government employees (Table 1.15). In 2018, the tech industry provided 6.4 percent of private sector employment in Utah, well above the U.S. average of 4.4 percent. Washington had the highest tech employment concentration with 8.7 percent. Only 10 states' tech industries provided more than 5 percent of all employee jobs in the private sector.

Utah ranked third for its 10-year job growth rate. Employment at Utah tech companies increased by 30,400 jobs (61.0 percent) since 2008, which implies the previously noted 4.9 percent average annual growth rate. Only Washington had faster 10-year growth, with slightly higher annual job growth at 5.0 percent. The District of Columbia saw the third-fastest growth, at 3.1 percent per year. Not all states experienced growth in their tech sectors during the 10 years. Tech employment declined by more than 1 percent annually in seven states and by less than 1 percent annually in nine states.

We also reviewed one-year job growth rates. Utah's one-year growth (9.3 percent) was much faster than its 10-year growth (4.9 percent), but many other states also surged forward in 2018. Utah experienced the third-largest percent increase in tech industry employment from 2017 to 2018.

Figure 1.14: Tech Industry Employment Growth by State from 2008 to 2018
(Average Annual Percent Change in Employment)



Note: Compound annual growth rates include jobs held by employees, not proprietors. Alaska not shown to scale.
Source: U.S. Bureau of Labor Statistics.

Table 1.15: State Employment in Tech Industry, 2018

	2018 Tech Jobs		Share of All Industries		10-Year Annual Growth		One-Year Growth	
State	Number	Rank	Percent	Rank	Rate	Rank	Rate	Rank
Alabama	48,400	26	3.0%	30	0.3%	26	3.5%	15
Alaska	5,400	50	2.2%	42	-0.8%	44	-4.8%	46
Arizona	115,100	15	4.7%	11	2.0%	9	1.4%	31
Arkansas	19,300	38	1.9%	46	-0.1%	36	-7.2%	48
California	963,400	1	6.5%	4	2.6%	5	4.3%	11
Colorado	142,100	14	6.3%	6	1.4%	13	1.5%	29
Connecticut	56,400	25	3.9%	19	-0.6%	42	-0.7%	40
Delaware	9,600	45	2.5%	36	0.0%	34	1.6%	27
District of Columbia	31,200	31	5.8%	8	3.1%	3	4.7%	9
Florida	278,700	4	3.7%	22	1.7%	10	5.5%	5
Georgia	178,400	9	4.7%	12	1.1%	18	1.0%	34
Hawaii	9,800	44	1.8%	47	-0.3%	38	-1.0%	41
Idaho	22,400	37	3.7%	21	-1.1%	45	9.8%	1
Illinois	197,400	8	3.8%	20	0.8%	24	0.2%	38
Indiana	68,500	23	2.6%	33	0.9%	22	-10.2%	50
Iowa	28,700	33	2.2%	41	-0.7%	43	4.1%	12
Kansas	35,600	29	3.1%	28	-2.3%	49	2.7%	21
Kentucky	38,300	28	2.4%	37	0.1%	33	-4.8%	45
Louisiana	26,800	34	1.7%	49	-0.2%	37	1.1%	32
Maine	13,300	42	2.6%	34	-0.5%	40	9.7%	2
Maryland	114,400	16	5.2%	10	0.2%	29	3.3%	17
Massachusetts	207,100	7	6.6%	3	1.2%	16	1.8%	25
Michigan	112,000	17	3.0%	31	1.0%	19	-0.3%	39
Minnesota	103,400	18	4.1%	17	0.1%	32	0.9%	35
Mississippi	14,200	40	1.6%	50	0.3%	27	-3.0%	44
Missouri	99,800	19	4.2%	16	2.0%	8	3.1%	18
Montana	9,100	46	2.4%	38	1.6%	12	4.0%	13
Nebraska	29,500	32	3.6%	23	0.2%	30	2.0%	23
Nevada	25,000	36	2.1%	44	1.3%	14	8.8%	4
New Hampshire	34,500	30	6.0%	7	0.8%	23	0.7%	36
New Jersey	156,200	12	4.5%	14	0.0%	35	0.6%	37
New Mexico	16,300	39	2.5%	35	-2.3%	48	1.0%	33
New York	316,900	3	4.0%	18	2.5%	7	4.8%	7
North Carolina	165,300	11	4.5%	15	2.6%	6	3.1%	19
North Dakota	7,300	49	2.1%	43	-2.8%	50	-6.3%	47
Ohio	153,600	13	3.3%	26	1.0%	21	-2.4%	43
Oklahoma	26,300	35	2.0%	45	-2.1%	47	1.5%	30
Oregon	87,000	21	5.3%	9	1.3%	15	2.6%	22
Pennsylvania	170,600	10	3.3%	25	0.1%	31	1.8%	26
Rhode Island	13,700	41	3.2%	27	-0.4%	39	5.0%	6
South Carolina	47,000	27	2.7%	32	2.7%	4	3.8%	14
South Dakota	8,000	47	2.3%	40	0.2%	28	3.0%	20
Tennessee	59,600	24	2.3%	39	1.0%	20	3.4%	16
Texas	491,100	2	4.7%	13	1.7%	11	4.8%	8
Utah	**80,200**	**22**	**6.4%**	**5**	**4.9%**	**2**	**9.3%**	**3**

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Table 1.15: State Employment in Tech Industry, 2018 *(continued)*

	2018 Tech Jobs		Share of All Industries		10-Year Annual Growth		One-Year Growth	
State	**Number**	**Rank**	**Percent**	**Rank**	**Rate**	**Rank**	**Rate**	**Rank**
Vermont	7,800	48	3.0%	29	-4.8%	51	-29.3%	51
Virginia	237,600	6	7.5%	2	0.5%	25	1.8%	24
Washington	245,200	5	8.7%	1	5.0%	1	4.5%	10
West Virginia	10,200	43	1.8%	48	-0.6%	41	-1.4%	42
Wisconsin	88,300	20	3.5%	24	1.1%	17	1.5%	28
Wyoming	2,800	51	1.4%	51	-1.9%	46	-9.1%	49
Total	**5,470,300**	**NA**	**4.4%**	**NA**	**1.4%**	**NA**	**2.5%**	**NA**

Note: Share of all industries equals tech jobs divided by total private sector employment in the state. Ten-year growth calculated as a compound annual growth rate. Employment rounded to the nearest 100 jobs.
Source: U.S. Bureau of Labor Statistics.

1.5.2 How Do Aggregate Tech Wages Vary Among States?

With $7.0 billion in 2018 tech industry wages, Utah ranked 21st among U.S. states, a noteworthy outcome since the first 20 states all had larger economies in terms of total wages for all private industries (see Table 1.16).[14] The tech industry provided the most employee wages in California ($182.7 billion), where both tech employment and average wages per employee were also the highest in the country. Texas, Washington, and New York received between $40 billion and $55 billion in tech industry wages that year.

To measure industry concentration, we scaled tech wages to the size of each state's private sector. Utah ranked seventh by this measure, calculated as total employee wages in the tech industry divided by total employee wages for all industries outside of government. In 2018, the tech industry provided 11.6 percent of private sector wages in Utah, the second-highest share in the Intermountain West, after Colorado, and well above the U.S. average of 9.3 percent. Washington led all states in tech wage concentration, approaching one-fourth of wages for all industries. At the other end of the spectrum, 21 states received less than 5 percent of private sector wages from the tech industry.

Table 1.16: Employee Wages in the Tech Industry, 2008–2018
(2018 Dollars)

	2018 Tech Wages		Share of All Industries		10-Year Annual Growth		One-Year Growth	
State	**Billions**	**Rank**	**Percent**	**Rank**	**Percent**	**Rank**	**Percent**	**Rank**
Alabama	$3.9	26	5.3%	28	1.1%	36	2.9%	20
Alaska	$0.4	50	3.1%	47	-0.7%	47	-5.6%	48
Arizona	$11.1	16	8.8%	13	3.0%	13	5.6%	11
Arkansas	$1.5	38	3.3%	43	0.9%	41	-7.0%	49
California	$182.7	1	18.0%	2	7.1%	2	8.5%	7
Colorado	$16.4	13	12.3%	5	2.5%	17	1.7%	30
Connecticut	$6.2	23	6.3%	22	0.6%	44	0.3%	38
Delaware	$0.8	43	3.9%	37	1.4%	32	3.6%	17
District of Columbia	$3.8	27	8.2%	15	4.5%	5	-0.2%	40
Florida	$24.1	7	6.4%	21	2.7%	16	3.3%	18
Georgia	$18.1	9	8.8%	14	1.7%	24	-0.2%	41
Hawaii	$0.8	44	3.2%	44	0.4%	45	1.3%	33
Idaho	$2.3	32	8.9%	11	1.6%	26	8.3%	8
Illinois	$20.2	8	6.5%	20	2.3%	19	0.9%	35
Indiana	$5.3	24	4.1%	34	1.9%	22	-4.1%	46
Iowa	$2.2	34	3.5%	40	1.5%	27	4.2%	15
Kansas	$2.8	30	5.2%	29	-2.9%	50	2.3%	28
Kentucky	$2.6	31	3.5%	39	1.3%	34	-8.4%	50
Louisiana	$1.8	37	2.4%	50	1.2%	35	-0.6%	42
Maine	$1.0	41	4.4%	33	2.0%	20	9.8%	5

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Table 1.16: Employee Wages in the Tech Industry, 2008–2018 *(continued)*
(2018 Dollars)

	2018 Tech Wages		Share of All Industries		10-Year Annual Growth		One-Year Growth	
State	Billions	Rank	Percent	Rank	Percent	Rank	Percent	Rank
Maryland	$12.8	14	10.0%	9	1.1%	37	2.6%	23
Massachusetts	$29.1	5	12.6%	4	3.0%	11	2.9%	21
Michigan	$10.0	18	4.9%	31	1.6%	25	-1.2%	43
Minnesota	$9.8	19	6.7%	19	1.0%	38	1.5%	31
Mississippi	$0.9	42	2.6%	49	1.3%	33	-1.7%	45
Missouri	$8.8	20	7.5%	17	3.3%	10	7.1%	9
Montana	$0.7	47	4.1%	36	3.4%	9	6.1%	10
Nebraska	$2.3	33	6.0%	23	1.5%	30	2.3%	27
Nevada	$2.1	35	3.5%	41	2.8%	15	11.5%	3
New Hampshire	$3.6	29	10.9%	8	1.9%	21	2.5%	24
New Jersey	$18.0	10	7.9%	16	0.9%	39	2.5%	26
New Mexico	$1.2	40	4.1%	35	-1.9%	49	0.7%	36
New York	$40.8	4	6.9%	18	4.6%	4	9.1%	6
North Carolina	$17.3	11	9.2%	10	4.2%	6	10.5%	4
North Dakota	$0.6	48	3.2%	45	0.1%	46	-1.3%	44
Ohio	$12.2	15	5.2%	30	0.7%	42	0.1%	39
Oklahoma	$1.9	36	3.1%	46	-0.8%	48	0.9%	34
Oregon	$10.2	17	11.9%	6	3.4%	8	3.9%	16
Pennsylvania	$16.8	12	5.8%	24	1.5%	31	2.9%	22
Rhode Island	$1.2	39	5.5%	27	0.7%	43	5.5%	12
South Carolina	$3.7	28	4.8%	32	4.0%	7	2.1%	29
South Dakota	$0.5	49	3.3%	42	1.9%	23	4.5%	14
Tennessee	$4.8	25	3.7%	38	2.5%	18	2.9%	19
Texas	$54.3	2	8.9%	12	2.9%	14	5.5%	13
Utah	**$7.0**	**21**	**11.6%**	**7**	**6.9%**	**3**	**16.6%**	**1**
Vermont	$0.7	46	5.6%	26	-4.2%	51	-29.2%	51
Virginia	$28.2	6	15.3%	3	1.5%	29	1.3%	32
Washington	$45.2	3	24.1%	1	9.6%	1	15.7%	2
West Virginia	$0.7	45	2.8%	48	0.9%	40	0.6%	37
Wisconsin	$6.9	22	5.6%	25	3.0%	12	2.5%	25
Wyoming	$0.2	51	2.1%	51	1.5%	28	-4.6%	47
Total	**$664.4**	**NA**	**9.3%**	**NA**	**3.8%**	**NA**	**5.4%**	**NA**

Note: Percentages and dollar amounts based on aggregate wages adjusted for inflation to 2018 dollars using the U.S. consumer price index. Share of all industries equals tech wages divided by total wages in the state's private sector. Ten-year growth calculated as a compound annual growth rate.
Source: U.S. Bureau of Labor Statistics.

Almost as high as its ranking for 10-year job growth, Utah was third among states for its 10-year growth rate in total employee wages paid by tech companies, which nearly doubled between 2008 and 2018, increasing by 6.9 percent per year on average, from $3.6 billion to $7.0 billion in inflation-adjusted dollars. This aggregate wage growth reflects both job growth and rising wage rates per employee in the state. Utah trailed only California, which also nearly doubled its tech wages with 7.1 percent annualized growth, and Washington, where aggregate wages grew at the rate of 9.6 percent per year.

We also reviewed one-year growth rates. At 16.6 percent, Utah saw the largest percent increase in tech industry wages of any state from 2017 to 2018. Washington was a close second with 15.7 percent. Nevada, which ranked 35th in total tech industry employee wages, was third for one-year growth with 11.5 percent. These three Western states far exceeded the U.S. average of 5.4 percent.

1.5.3 What Do States Pay on Average per Tech Job?

After a decade of robust wage growth, Utah's average wage in the tech industry has risen to the median of all states. However, average tech wages in Utah remain lower and slower growing than the U.S. average.

The Utah-U.S. pay gap in the tech industry widened slightly from 2008 to 2018. In 2008, Utah's average tech wage was $72,300, 24.9 percent below the U.S. average of $96,300 (see Table 1.17). By 2018, the average employee wage in Utah's tech industry had risen to $87,800, but the national average rose even faster, and Utah found itself 27.7 percent below the U.S. average.

In 2018, the highest-paying tech jobs were in California, Washington, and Massachusetts. Utah's average wage in the industry rose 21.4 percent from 2008 to 2018, the 10th-largest percent increase among states. Still, average wages nationwide rose a notch faster at 26.1 percent per year, driven upward by California and Washington's very large tech sectors and 10-year average wage increases above 50 percent.

While Utah's tech industry did not quite keep pace with U.S. average wage growth, Utah employees experienced larger wage increases than employees in several states with roughly similar average pay. Utah's rank improved from 32nd in 2008 to 25th in 2018, just above the national median of $86,300.

Disparities in states' average tech employee wages increased from 2008 to 2018, as states drifted farther from the U.S. average in both directions. Among states like Utah with above-median tech industry employment in 2018, California paid the highest average wage at $189,700. Indiana ($76,700) and Ohio ($79,400) paid the lowest average wages among states with above-median tech employment.

Table 1.17: Average Wages, Selected States 2008–2018
(2018 Dollars)

	Annual Wage Tech Industry		Percent Change	
State	2008	2018	Tech Industry	All Industries
California	$123,500	$189,700	53.5%	15.3%
Georgia	$95,100	$101,300	6.5%	8.2%
Indiana	$69,300	$76,700	10.7%	6.7%
Massachusetts	$118,000	$140,700	19.2%	9.9%
Michigan	$83,900	$89,000	6.1%	4.9%
Ohio	$81,400	$79,400	-2.5%	6.6%
Oregon	$95,200	$117,400	23.3%	11.7%
Utah	**$72,300**	**$87,800**	**21.4%**	**11.0%**
Washington	$120,700	$184,300	52.7%	23.9%
Wisconsin	$64,700	$77,600	19.9%	8.3%
U.S.	**$96,300**	**$121,500**	**26.1%**	**8.1%**

Note: Among the 25 above-median states in 2018 tech employment, selected comparison states for Utah were either top three or bottom three for their 2018 average employee wage or 10-year percentage change in the average wage. We adjusted 2008 wages for inflation based on the U.S. consumer price index.
Source: U.S. Bureau of Labor Statistics.

Utah's low tech wages, compared with both the U.S. average and states with the largest tech sectors, may reflect the attractiveness of Utah's quality of life, cost of living, and labor affordability advantages to workers and employers. Utah's relatively low wages may also represent differences in the occupational mix within some segments of the state's tech workforce (Knold, Smith, and Stahle 2018). The rising cost of living on the Wasatch Front is among factors driving average wage growth in Utah's tech industry.

1.6 Economic Impacts

In economic systems, the success of one company depends on the vitality of other companies in both related and disparate industries. Industries that create value, earn customer revenue, and attract investment to a region synergistically strengthen other industries when those resources recirculate to pay suppliers, compensate employees, and reward business owners.

How do we model the effect of the tech industry on other Utah industries? In Sections 1.2 through 1.5, we focused on employment and earnings within the tech industry. In Section 1.6, we estimate economic activity the tech industry generates in other industries, guided by the counterfactual "What would Utah's economy look like without its tech industry?" We carefully estimate the multiplier effect of tech industry employment and earnings. We also estimate fiscal impacts, which include tax revenues and government expenditures. The economic activity that the tech industry sustains in Utah's private sector affects the state's public sector.

1.6.1 How Much Economic Activity in Utah Depends on the Tech Industry?

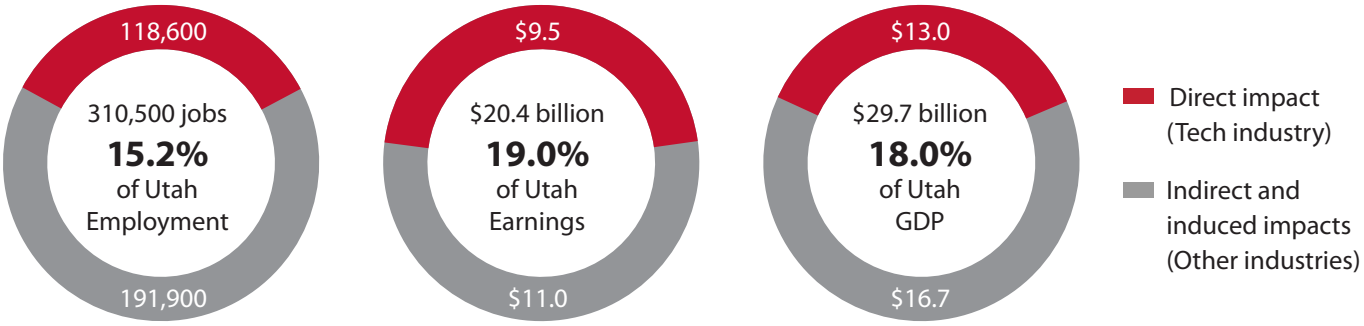
In 2018, economic impacts in Utah from the tech industry included 310,560 jobs, $20.4 billion in earnings, $18.5 billion in personal income, and $29.7 billion in GDP (see Table 1.18).[15] These results include direct economic activity within the industry, as well as indirect and induced activity that tech companies and workers generated in other industries.

Table 1.18: Tech Industry Economic Impacts in Utah, 2018
(Billions of Dollars)

Category	Direct	Indirect and Induced	Total	Share of Utah Economy
Employment	118,621	191,939	310,560	15.2%
Earnings	$9.5	$11.0	$20.4	19.0%
Personal income	NA	NA	$18.5	12.9%
GDP	$13.0	$16.7	$29.7	18.0%

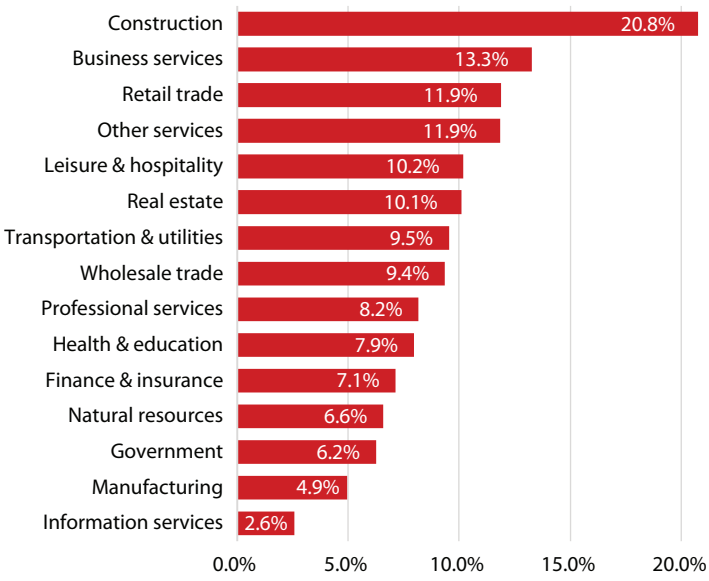
NA = not available
Note: Shares equal total economic impacts divided by total employment, earnings, personal income, and GDP in Utah.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services and U.S. Bureau of Economic Analysis using the REMI PI+ economic model.

Figure 1.15: Utah Tech Industry Economic Impacts, 2018



Note: Employment includes the number of full- and part-time jobs rounded to the nearest hundred. Earnings include employee compensation (with benefits) and income from self-employment. Totals may not match exactly due to rounding.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services and U.S. Bureau of Economic Analysis using the REMI PI+ economic model.

Figure 1.16: Tech Industry Indirect and Induced Employment, Share of Total Utah Jobs in Each Sector, 2018



Note: Indirect and induced employment represents tech industry economic impacts outside the industry itself.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services and U.S. Bureau of Economic Analysis using the REMI PI+ economic model.

Utah's tech industry contributed more than one-sixth of the state's earnings and GDP in 2018. Total direct, indirect, and induced impacts were 15.2 percent of Utah employment, 19.0 percent of earnings, 12.9 percent of personal income, and 18.0 percent of GDP (see Figure 1.15). For example, 19.0 percent of all earnings by Utah workers that year came either from tech companies or from other companies supported by purchases tech companies and workers made. For non-tech companies, we counted only whatever fraction of their jobs, earnings, and GDP depended on the tech industry.

1.6.2 Which Other Utah Industries Depend on the Tech Industry?

The economic impact of Utah's tech industry extends beyond the industry itself. Besides its direct economic activity, the tech industry supported indirect and induced activity outside the tech industry that amounted to 191,939 jobs, which contributed $11.0 billion in earnings and $16.7 billion in GDP in 2018 (see Table 1.18). We will explore indirect and induced impacts by sector for the first two measures, employment and earnings, both of which are more tangible than GDP for Utah residents.

Every major sector of Utah's economy benefitted from tech industry activity in 2018 (see Figure 1.16).[16] Of 15 sectors, construction depended the most on the tech industry. Just over one-fifth of construction jobs were supported by tech industry activity in Utah. The other 14 sectors fell between 2.6 percent (information services) and 13.3 percent (business services), in terms of the share of jobs from the tech industry's indirect and induced impacts.[17] Nine sectors were below the 9.7 percent state average, and six sectors were above the average.

The two sectors with the most indirect and induced employment from the tech industry in 2018 were retail trade and construction, which combined for over one-fourth of total indirect and induced jobs (see Table 1.19). The tech industry supported more than 26,000 Utah jobs in each sector. Three other sectors created or retained more than 17,000 Utah jobs each because of the tech industry: business services, health and education, and leisure and hospitality. The remaining ten sectors collectively received 42.6 percent of the indirect and induced employment from the tech industry.

For 13 of Utah's 15 economic sectors in 2018, earnings shares from tech industry indirect and induced impacts were larger than employment shares (see share of sector columns in Table 1.19). Among all sectors, an average of 10.3 percent of all worker earnings came from the industry's indirect and induced impacts, somewhat higher than the 9.7 percent average for employment outside the tech industry. Earnings include employee wages and benefits, as well as self-employment income.

Table 1.19: Tech Industry Indirect and Induced Economic Impacts, 2018

	Average Employment			Annual Earnings		
Industry Sector	**Jobs**	**Share of Total**	**Share of Sector**	**$ Millions**	**Share of Total**	**Share of Sector**
Retail trade	26,829	14.0%	11.9%	$1,334.0	12.1%	15.1%
Construction	26,616	13.9%	20.8%	$1,886.9	17.2%	22.3%
Business services	19,576	10.2%	13.3%	$975.5	8.9%	14.4%
Health and education	19,178	10.0%	7.9%	$1,047.3	9.5%	9.2%
Leisure and hospitality	17,992	9.4%	10.2%	$459.9	4.2%	11.3%
Government	12,781	6.7%	6.2%	$1,011.1	9.2%	5.8%
Other services	12,703	6.6%	11.9%	$551.6	5.0%	11.9%
Professional services	12,638	6.6%	8.2%	$892.5	8.1%	9.3%
Real estate	11,789	6.1%	10.1%	$351.4	3.2%	11.9%
Finance and insurance	9,330	4.9%	7.1%	$571.3	5.2%	8.7%
Manufacturing	6,996	3.6%	4.9%	$627.8	5.7%	6.0%
Transportation and utilities	6,972	3.6%	9.5%	$501.5	4.6%	10.0%
Wholesale trade	6,146	3.2%	9.4%	$594.6	5.4%	11.1%
Natural resources	1,241	0.6%	6.6%	$104.7	1.0%	7.8%
Information services	1,152	0.6%	2.6%	$76.9	0.7%	2.1%
Total	**191,939**	**100.0%**	**9.7%**	**$10,987.1**	**100.0%**	**10.3%**

Note: Indirect and induced employment and earnings represent economic impacts from the tech industry outside the industry itself.
Source: Kem C. Gardner Institute analysis of data from the Utah Department of Workforce Services and U.S. Bureau of Economic Analysis using REMI PI+ economic model.

During 2018, the tech industry generated almost $1.9 billion in earnings in the construction sector and over $1.3 billion in earnings in retail trade. Both the government and the health and education sectors also drew more than $1 billion of their earnings from tech. The government earnings impact derives from an increase in employment (almost two-thirds of it in local government, including schools, and the remainder in state government), as well as upward wage pressure for local, state, and federal government employees.

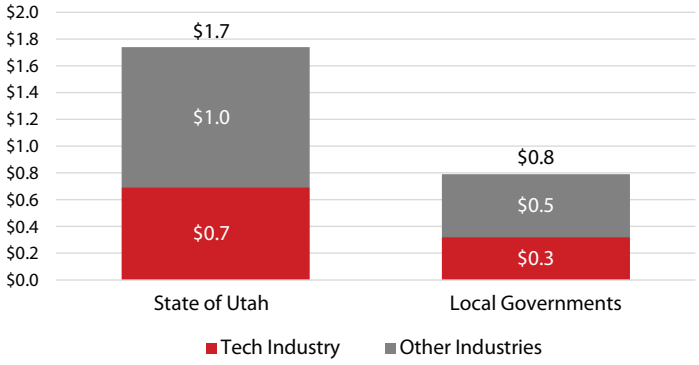
1.6.3 How Much Government Revenue Does the Tech Industry Generate?

Tech companies provided state and local governments with substantial funding to address public needs. We estimate that the tech industry's direct, indirect, and induced economic impact of $29.7 billion in economic activity (GDP) in 2018 (see Table 1.18) generated an estimated $2.5 billion in state and local tax revenue (see Figure 1.17). States received $1.7 billion of this amount, and local governments received $0.8 billion.

The $13.0 billion in direct GDP within the tech industry added an estimated $1.0 billion to state and local government budgets, and another $1.5 billion in tax revenue came from the $16.7 billion in indirect and induced economic activity outside the tech industry linked to tech industry jobs, pay, and purchases.

Additional government expenditures associated with Utah's tech industry partially offset the additional tax revenue it generated. Tech company operations in 2018 supported a net increase in state and local government revenue of $2,073.3 million (see Table 1.20). This amount includes $2,533.3 million in tax revenues paid or indirectly generated, noted previously, minus $460.0 million in additional demand for state, county, and school district expenditures.

Figure 1.17: Tax Revenue from Utah's Tech Industry, 2018
(Billions of Dollars)



Source: Kem C. Gardner Policy Institute fiscal model.

The net fiscal impact resulting from direct activity within the tech industry was $837.4 million. This includes taxes paid by workers and companies in the industry. Most fiscal impacts—60 percent of government revenues and almost 62 percent of expenditures—came from indirect and induced effects of the tech industry, as companies and individuals outside the tech industry paid taxes and utilized government services.

At the state level, most of the $1,741.3 million in estimated 2018 tax revenue associated with the tech industry's economic

Table 1.20: Utah Tech Industry State and Local Fiscal Impacts, 2018
(Millions of Dollars)

Impact	Direct	Indirect & Induced	Total
Tax revenues	$1,013.1	$1,520.2	$2,533.3
Government operating expenditures	$175.7	$284.3	$460.0
Net state and local revenue	**$837.4**	**$1,235.9**	**$2,073.3**

Note: Totals may not match exactly due to rounding. These impacts include total revenues and operating expenditures itemized in Table 1.21 and Table 1.22.
Source: Kem C. Gardner Policy Institute fiscal model.

Table 1.21: Tech Industry State Fiscal Impacts in Utah, 2018
(Millions of Dollars)

Impact	Direct	Indirect & Induced	Total
Sales tax revenues	$348.3	$527.6	$875.9
Personal income tax revenues	$315.2	$486.3	$801.5
Corporate income tax revenues	$30.0	$33.8	$63.9
Total State Revenues	**$693.6**	**$1,047.7**	**$1,741.3**
Non-Education expenditures	$73.9	$119.6	$193.5
Public education expenditures	$38.3	$61.9	$100.2
Higher education expenditures	$30.6	$49.5	$80.2
Total state operating expenditures	**$142.8**	**$231.1**	**$373.9**
Net state revenue	**$550.8**	**$816.6**	**$1,367.4**

Note: Not all totals and differences match exactly due to rounding.
Source: Kem C. Gardner Policy Institute fiscal model.

Table 1.22: Tech Industry Local Fiscal Impacts in Utah, 2018
(Millions of Dollars)

Impact	Direct	Indirect & Induced	Total
Property tax revenues	$258.2	$398.3	$656.5
Sales tax revenues	$61.3	$74.3	$135.6
Total local revenues	**$319.5**	**$472.5**	**$792.0**
Non-Education expenditures	$18.9	$30.6	$49.5
Public education expenditures	$14.0	$22.6	$36.6
Total local operating expenditures	**$32.9**	**$53.2**	**$86.1**
Net local revenue	**$286.6**	**$419.3**	**$705.9**

Note: Local revenues and operating expenditures include counties and school districts. We do not include cities and towns. Not all totals match exactly due to rounding.
Source: Kem C. Gardner Policy Institute fiscal model.

impact came from sales and personal income taxes (see Table 1.21). The state portion of additional sales tax revenue was $875.9 million. Personal income taxes totaling $801.5 million were paid by employees and proprietors in Utah's tech industry and by workers in other industries supported by tech company and worker spending. Finally, tech companies and other companies they supported paid $63.9 million in corporate income taxes.

Government expenditures provide services for the population of adults and children who live in Utah because of work opportunities the tech industry supports. We attribute $373.9 million in state government spending in 2018 to the tech industry. Public and higher education expenditures reached $180.4 million combined, nearly half of the state total. Non-education expenditures amounted to $193.5 million. Subtracting total state operating expenses from total state revenues yields net state revenue from the tech industry of $1,367.4 million.

We separated total state revenues and expenditures into portions associated with both the tech industry's direct economic impacts and its indirect and induced impacts. Direct economic impacts accounted for $550.8 million, 40 percent of the additional net state government revenue from the tech industry in 2018. The industry's indirect and induced effects generated over 60 percent of state tax revenues ($1,741.3 million) and state operating expenditures ($373.9 million).

Turning to local government, the net fiscal impact of Utah's tech industry was $705.9 million in 2018 (see Table 1.22). This includes an estimated $792.0 million in tax revenues and $86.1 million in operating expenditures for counties and school districts. Most local tax revenues came from the property tax, $656.5 million. The local portion of sales tax collections was $135.6 million. Expenditures for public K–12 programs totaled $36.6 million, and other county expenditures amounted to $49.5 million.

As with state fiscal impacts, we based these local revenues and expenditures on the direct, indirect, and induced economic impacts of the tech industry. Direct economic impacts accounted for $286.6 million, which was nearly 41 percent of the additional net local government revenue from the tech industry during the year. The industry's indirect and induced effects generated 60 percent of local tax revenues and 62 percent of local operating expenditures of counties and school districts.

1.7 Tech-Related Industries

To conclude Section 1, which addresses Utah's tech sector as a set of companies and industries, we move out to the sizeable periphery of our industry definition and identify tech companies in other industries.

Three of the industry definitions we reviewed in Section 1.1—from the Computer Technology Industry Association, University of Utah, and U.S. Bureau of Labor Statistics—drew our attention to companies that provide technological solutions for aerospace, defense, life sciences, and other applications.18 These qualify as tech companies in our tech manufacturing or technology support segments. We do not include them in our main tech industry definition to avoid undue overlap with Utah economic research on the non-tech industries to which they also belong (e.g., Downen 2018; Pace and Spolsdoff 2018).

We refer to these companies as "tech-related" to differentiate them from the tech companies in the tech industry definition we used in Sections 1.2 through 1.6. In Section 1.7, we will briefly define Utah's tech-related industries, review their 2018 employment and earnings in the state, and identify some of the largest employers among them.

Tech-related companies include manufacturers of aircraft components and medical instruments, equipment, and supplies (see Table 1.23). They also include engineering services, research and development (R&D), and testing laboratories.

Tailored to this definition, the Utah Department of Workforce Services provided statewide employment and payroll data for 1,883 private sector establishments of tech-related companies with employees. We estimated self-employment jobs and earnings based on data from the U.S. Bureau of Economic Analysis.

In 2018, tech-related companies provided 37,594 jobs for company employees and an estimated 12,498 jobs for self-employed workers (see the tall gray rectangle to the right in Figure 1.18). These full-time and part-time jobs are in addition to the 118,621 jobs in the less ambiguous core of the tech industry.

Most of the 1,883 Utah establishments operated by tech-related companies in 2018 were small or average in size in terms of Utah employment, which is typical of most industries in the state. However, 49 establishments provided at least 100 tech jobs, and 13 advanced manufacturing or technology support companies provided at least 500 jobs. The largest tech-related company was aerospace manufacturer Northrop Grumman, which includes the Orbital ATK units it acquired in 2018 (see Table 1.24). The next six largest employers, each with more than 1,000 jobs, were in life sciences, including medical equipment and supplies manufacturing, as well as research and development in nanotech. Most of the other leading tech-related employers provide technology support, such as engineering services, testing laboratories, and engineering research and development.

Manufacturers of medical equipment and supplies generated over one-fourth of tech-related employment and earnings: 13,230 jobs for company employees and self-employed workers and over $1.0 billion in earnings, which include benefits (see Table 1.25). Over 7,500 additional jobs and $736 million in earnings came from companies that manufactured aircraft components and medical instruments.

Technology support services was the largest tech-related employment category in 2018. More than half of the jobs in this category, 31.6 percent of the tech-related total, came from engineering services firms, which provided over 15,800 jobs and $1.1 billion in earnings. Utah's chemical, civil, electrical, mechanical, and other engineering companies do work in aerospace and defense, as well as for construction, life sciences, transportation, and other industries. Research and development in biotech, nanotech, and other sciences provided nearly 10,600 jobs and $767.2 million in earnings in Utah. Nearly 3,000 tech-related jobs were at laboratories for chemical, electrical, environmental, industrial, and product testing.

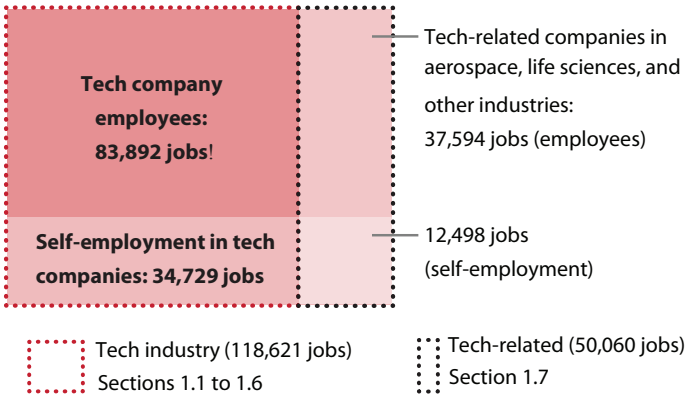
For additional insight on tech-related industries, a recent report from the Gardner Institute addresses historical and projected performance in Utah's life sciences, aerospace, and defense industries (Downen 2018). Another Gardner Institute report addresses the economic impacts of life sciences companies in Utah (Pace and Spolsdoff 2018). Tech companies are a substantial part of these industries.

Table 1.23: Utah Tech-Related Industries

Industry	NAICS Code
Manufacturing	
Medical equipment and supplies	339100
Aircraft components	334511, 336415, and 336419
Medical instruments	334510 and 334516–7
Technology Support	
Engineering services	541330
R&D in biotech, nanotech, and other sciences	541713–5
Testing laboratories	541380

Note: R&D also includes research and development in engineering. NAICS 339100 includes five of the 16 detailed tech-related industries. This expanded tech industry definition does not include any industry groups listed in the trade or information services categories.
Source: Kem C. Gardner Policy Institute.

Figure 1.18: Utah Tech Industry Footprint
(2018 Employment)



Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis.

Table 1.24: Largest Utah Employers in Tech-Related Companies, 2018

(Companies with at Least 500 Jobs)

Company	Description	Employment
Northrop Grumman	Aircraft component manufacturing	3,000 to 6,300
Biofire Diagnostics	Nanotechnology R&D	1,100 to 2,200
Becton, Dickinson and Company (BD)	Medical device manufacturing and diagnostics	1,000 to 2,000
Edwards Lifesciences	Medical device manufacturing	1,000 to 2,000
Fresenius Medical Care	Medical supplies manufacturing	1,000 to 2,000
Merit Medical	Medical supplies manufacturing	1,000 to 2,000
Ultradent Products	Dental equipment and supplies manufacturing	1,000 to 2,000
Myriad Genetic Laboratories	Biotechnology R&D	750 to 1,500
BAE Systems Technology Solutions and Services	Engineering services	500 to 1,000
Nelson Laboratories	Pharmaceutical and medical testing laboratories	500 to 1,000
Purple	Engineering R&D	500 to 1,000
Space Dynamics Laboratory	Engineering and physical sciences R&D	500 to 1,000
Varex Imaging Corporation	Medical instrument manufacturing	500 to 1,000

Note: Disclosure guidelines permit broad employment ranges, not exact counts. For companies with establishments in multiple industries, we only include jobs reported in the tech industry. Industry descriptions are for the NAICS industry in which the company had the most jobs. We attempted to combine job counts for any aliases.
Source: Utah Department of Workforce Services.

Table 1.25: Utah Employment and Earnings in Tech-Related Industries, 2018

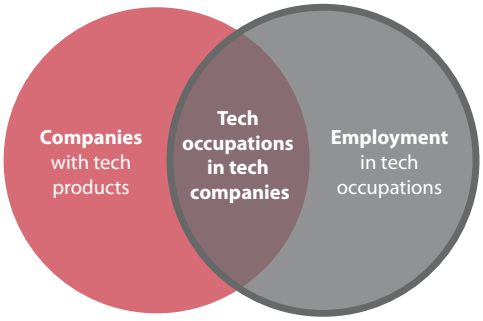
		Employment		Aggregate Earnings	
Tech Industry Component	Primary Industry	Jobs	Share	$ Millions	Share
Manufacturing					
Medical equipment and supplies	Life sciences	13,230	26.4%	$1,002.5	26.4%
Aircraft components	Aerospace and defense	5,041	10.1%	$515.1	13.6%
Medical instruments	Life sciences	2,476	4.9%	$220.9	5.8%
Subtotal		**20,715**	**41.4%**	**$1,738.5**	**45.9%**
Technology Support					
Engineering services	Aerospace, defense, other	15,805	31.6%	$1,128.1	29.8%
R&D in biotech, nanotech, and engineering	Life sciences	10,571	21.1%	$767.2	20.2%
Testing laboratories	Life sciences	2,969	5.9%	$157.0	4.1%
Subtotal		**29,345**	**58.6%**	**$2,052.3**	**54.1%**
Total		**50,092**	**100.0%**	**$3,790.8**	**100.0%**

Note: Includes employees and proprietors. "Primary industry" is the industry home besides tech for companies that provide technology solutions for a particular industry group.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis.

Section 2. Utah Tech Occupations and Workers

So far, we have analyzed the tech industry by looking at the economic activity of tech companies. Next, we describe workers in tech occupations, regardless of what industries their companies fall under. In Figure 2.1, the gray circle with a bold outline overlaps the red circle for companies in the tech industry and also covers considerable space outside the industry. The additional employment and earnings from tech jobs outside the industry are not part of our economic impact results, but they help us form a more complete picture of Utah's tech footprint.

Figure 2.1: Diagram of Tech Industry and Tech Occupations



Note: Section 2 covers employment and earnings from workers in tech occupations, represented by the circle to the right.

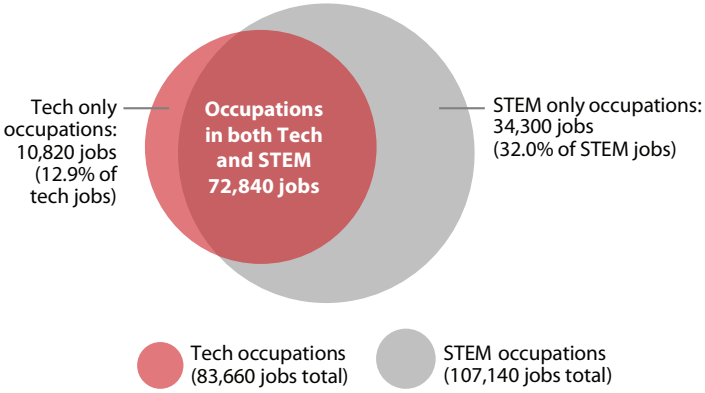
2.1 Definition: What Do We Count as a Tech Occupation?

To identify tech jobs, we reviewed a U.S. Bureau of Labor Statistics list of 120 science, technology, engineering, and mathematics (STEM) occupations (2012), which its researchers have used to define the tech industry (Wolf and Terrell 2016).[19] We compared the list of STEM occupations to a more tailored list of 50 occupations the Computing Technology Industry Association identified. The shorter list excludes many science, engineering, and mathematics occupations that are not closely related to information technology and electronics (2019).[20] Many Utahns in STEM or tech fields worked for tech companies, and many more worked outside the tech industry.

In 2018, Utah employees filled 107,140 jobs in STEM fields and 83,660 jobs in technology fields; 72,840 jobs fit both definitions (see Figure 2.2). The 32.0 percent of Utah jobs in STEM occupations that did not count as tech occupations include architecture and planning workers, civil and environmental engineers, chemical and natural resources engineers, life and physical scientists and their staff, social science professionals, postsecondary STEM teachers, and technical sales representatives.

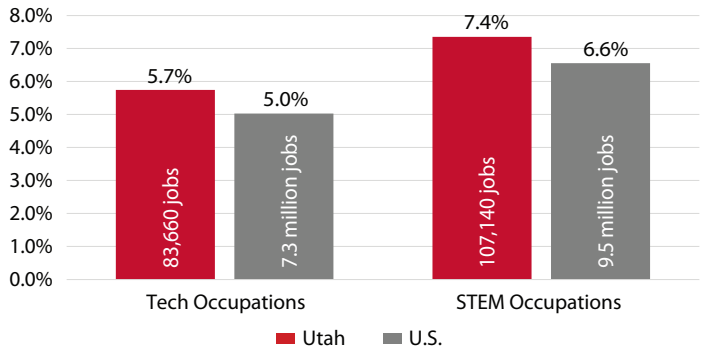
All but 12.9 percent of Utah jobs in tech occupations were in STEM fields. The jobs in tech occupations not considered STEM occupations primarily involved computer systems technicians, media or communication technicians, and electrical or electronics mechanics.

Figure 2.2: Utah Employment in STEM and Tech Occupations, 2018



Note: Includes Utah employees in tech and STEM job roles, regardless of the industry to which their company belongs. Does not include self-employed workers.
Source: U.S. Bureau of Labor Statistics.

Figure 2.3: Employment in Tech and STEM Occupations, 2018
(Share of Jobs in All Occupations)



Note: Utah employment in tech occupations rounded to the nearest 10 jobs.
Source: U.S. Bureau of Labor Statistics.

Utah's workforce has strong tech and STEM representation compared with the U.S. workforce. In 2018, 5.7 percent of Utah jobs were in tech occupations, 0.7 percentage points above the U.S. share (5.0 percent) (see Figure 2.3). Both Utah and the U.S. had fewer tech jobs than STEM jobs. STEM occupations accounted for almost 7.4 percent of Utah employment and 6.6 percent of U.S. employment.

The remainder of our analysis conforms to the tech occupation definition provided by the Computing Technology Industry Association. While all STEM roles support the innovation and education that drive the tech industry in some way, we focus on workers who provide services and tools for individuals and companies in the information economy.

Table 2.1 summarizes our 50 tech occupations in 15 categories. They have a variety of education and training requirements. Many workers with these types of jobs are highly skilled. In 2016, for

Table 2.1: Tech Occupations Definition

Category	Occupation Code
Computer systems	
Software developer	15-1132–3 (2)
Administrator	15-1140 (3)
Programmers and web developer	15-1111, 15-1131, and 15-1134
Analyst	15-1120 (2)
Technician	43-9011, 49-2011, 49-2020 (2), and 49-2091
Support specialist	15-1150 (2)
Other worker	15-1199
Engineering	
Electrical or electronics engineer	17-2061 and 17-2070 (2)
Mechanical or aerospace engineer	17-2011, 17-2131, and 17-2141
Industrial engineer	17-2112
Technician	17-3021, 17-3023–4 (2), and 17-3026–9 (3)
Other engineers	17-2031 and 17-2199
Electrical or electronics mechanic	49-2092–8 (7), 51-2020 (3), and 51-4010 (2)
Media or communication technician	27-4011–2 and 27-4014
Technical manager	11-3021 and 11-9041

Note: Category names and job titles are descriptive, not comprehensive of each occupation identified by the corresponding occupation codes, which follow the 2018 Standard Occupational Classification (SOC) system. The first hyphen follows conventional SOC formatting. A dash after six digits indicates a range of codes. A code ending in zero is a category including all occupations with the same five-digit prefix. For SOC code ranges and multi-occupation categories, the number of detailed occupations is in parentheses.
Source: U.S. Bureau of Labor Statistics.

Table 2.2: Utah Employment in Tech Occupations, 2018

Occupation Category	Jobs	Share
Computer Systems		
Software developer	16,730	20.0%
Support specialist	11,090	13.3%
Programmer or web developer	6,150	7.4%
Administrator	5,360	6.4%
Analyst	4,550	5.4%
Technician	3,000	3.6%
Other worker	6,470	7.7%
Subtotal	**53,350**	**63.8%**
Engineering		
Technician	4,930	5.9%
Mechanical or aerospace engineer	4,920	5.9%
Electrical or electronics engineer	3,210	3.8%
Industrial engineer	2,240	2.7%
Other engineer	1,750	2.1%
Subtotal	**17,050**	**20.4%**
Electrical or electronics mechanic	3,490	4.2%
Media or communication technician	2,100	2.5%
Technical manager	7,670	9.2%
Total	**83,660**	**100.0%**

Note: Occupation descriptions refer to precise occupation codes noted in Table 2.1. Employment rounded to the nearest 10 jobs. We count employees in all industries, not just employees in tech companies.
Source: U.S. Bureau of Labor Statistics.

example, about 57 percent of software developers, programmers, and computer systems analysts working in Utah's Wasatch Front had a bachelor's degree or higher, 80 percent of them in STEM fields (Knold, Smith, and Stahle 2018). Still, compared with other U.S. tech hubs, the state's urban core awards a much larger share of these particular tech jobs to people with less than a bachelor's degree.[21] Tech occupations present opportunities for Utahns with a variety of backgrounds and interests.

The findings in Sections 2.2 and 2.3 rely on data from the Utah Department of Workforce Services, which provided 2017 Utah employment figures for the 780 occupations within 238 industries based on the Quarterly Census of Employment and Wages (QCEW). This source includes virtually all employees in the private sector and most government employment outside of defense and education. QCEW does not include self-employed workers.

These data allowed us to identify industries for companies that provide 95 percent of all employee jobs in tech occupations. When our six-digit NAICS definition of the tech industry mapped to partial three- to five-digit NAICS industries in QCEW data, we multiplied by percentages based on industry employment for all occupations. We applied 2017 job shares for tech occupations to 2018 employment for 98 Utah industries that covered the same industries with a higher level of aggregation.[22] We reported tech and STEM employment totals for tech and non-tech industries in 2018.

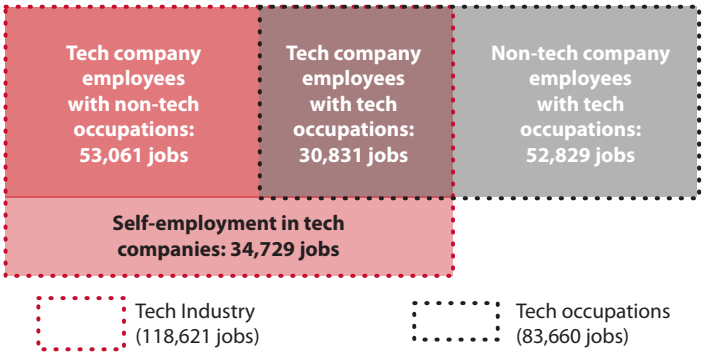
2.2 Employment: How Many Utah Jobs Are in Tech Fields?

In 2018, software developers made up the largest tech occupation category in Utah, with 16,730 jobs, one-fifth of the state's employment in tech occupations (see Table 2.2). Computer systems support specialists held 11,090 jobs, 13.3 percent. Programming, analysis, administrative, and other roles rounded out the substantial computer systems category.

Engineers and technicians held 17,050 Utah jobs, one-fifth of tech employment by occupation in 2018. These include electronics, electrical, mechanical, and industrial applications. Electrical or electronics mechanics, together with media or communication technicians, held another 5,590 jobs. Managers for most of the occupations in the table filled the remaining 7,670 jobs, 9.2 percent of the total.

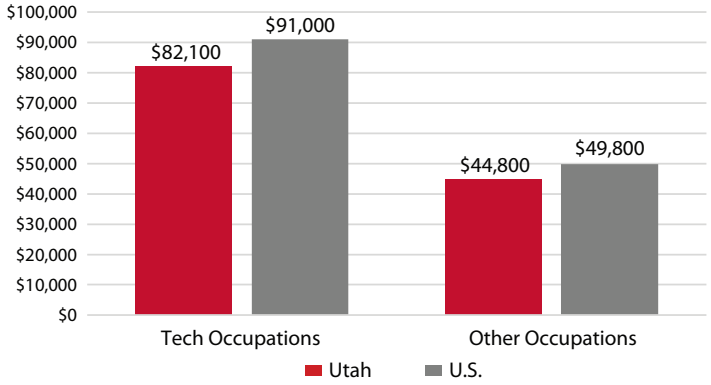
Utah's tech workers are employed both inside and outside the tech industry. For example, they work for software companies and online retailers, as well as hospitals and construction companies.

Figure 2.4: Utah Employment in Tech Occupations in Tech and Other Industries, 2018



Note: For tech industry definition, see Section 1.1.2. For tech occupation definition, see Section 2.1.
Source: Utah Department of Workforce Services; U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics.

Figure 2.5: Average Wages in Tech Occupations, 2018
(Average Annual Wage per Job)



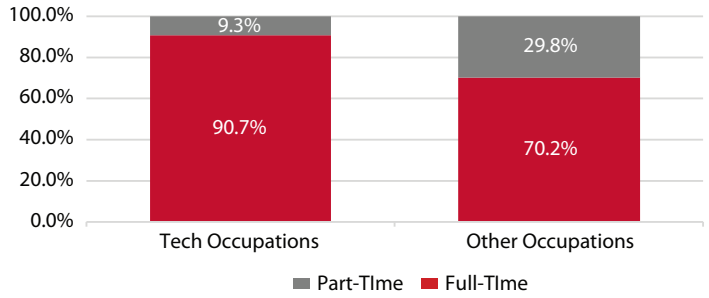
Note: Employee wages do not include benefits or self-employment income. Rounded to the nearest $100.
Source: U.S. Bureau of Labor Statistics.

Table 2.3: Utah Employment in Tech Occupations, 2018

Industry	Jobs	Share of Total	Share of Industry
Tech	30,831	36.9%	36.8%
Other	52,829	63.1%	3.9%
Total	**83,660**	**100.0%**	**5.7%**

Note: Does not include self-employment. "Other" includes government, agriculture, and all private sector employment outside the tech industry.
Source: Utah Department of Workforce Services; U.S. Bureau of Labor Statistics.

Figure 2.6: Full-Time Employment in Tech Jobs, Utah 2017
(Share of Workers)



Note: Includes most employees and self-employed workers. The American Community Survey defines full-time employment as usually working 35 or more hours per week over the past 12 months. Differences in shares are statistically significant at the 95 percent confidence level.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

In 2018, an estimated 30,831 jobs in tech occupations were inside the industry, while 52,829 jobs fell outside the industry (see Figure 2.4). Tech industry employment included 34,729 self-employed workers. We do not have reliable data for self-employed workers in tech occupations outside the tech industry.

Employment in tech occupations is far more concentrated in the tech industry than in other industries. While over one-third (36.8 percent) of tech industry employment was in a tech occupation in 2018, only 3.9 percent of employment in non-tech industries was in a tech occupation (see Table 2.3).[23,24] The statewide average was 5.7 percent.

2.3 Average Wages

Employees in tech occupations earn above-average wages for Utah jobs. After reviewing average wages in tech jobs collectively, we look at variations in pay within individual occupations.

2.3.1 What Do Tech Occupations Pay in Utah and the U.S.?

In 2018, tech occupations offered Utah workers an average of $82,100 in employee wages, 83.5 percent more than the average for other occupations in the state (see Figure 2.5).[25] Average Utah pay in tech occupations was 9.7 percent below the national average, representing a labor cost advantage for Utah companies.[26]

One reason for Utah's above-average pay in tech occupations is that more jobs are full-time in tech occupations than in other occupations in the state. Reliable state-level employment data that indicate full-time and part-time status are available as recently as 2017 from the U.S. Census Bureau (Ruggles et al. 2019). These data include self-employed workers, while the U.S. Bureau of Labor Statistics data we use elsewhere in Sections 2.2 and 2.3 include only employees.

Tech occupations favor full-time employment more than other occupations in Utah. In 2017, 90.7 percent of tech workers had full-time jobs, while the remaining 9.3 percent worked part-time (see Figure 2.6). Workers in non-tech occupations were far less likely to have full-time employment: only 70.2 percent of them did. High-quality jobs with benefits appear to be more common in tech than in other occupations. On the other hand, people seeking part-time work may have to search harder to find a good fit in the tech industry.

2.3.2 How Do Utah Wages Vary Within Specific Tech Occupations?

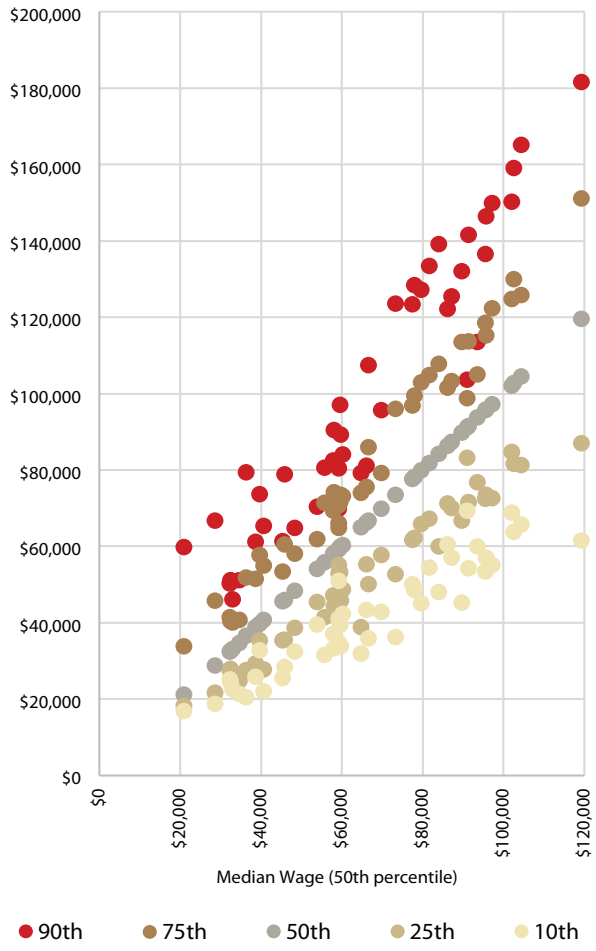
Wages varied widely by occupation. Median wages in 2018 ranged from a low of almost $21,100 for sound engineering technicians to a high just above $119,400 for computer and information systems managers. Figure 2.7 depicts the employee wage distribution for all 46 of the 50 tech occupations with any Utah employment that year.[27] Occupations with higher median wages generally have wider ranges of wages paid from the 10th to 90th percentiles.[28]

For further analysis, we selected 12 tech occupations, looking for varied types of work and pay ranges among occupations with at least 1,000 Utah jobs in 2018 (see Figure 2.8). Selected occupations represented 53.2 percent of tech employment in the state in 2018. Of the 12 occupations, web developers were near the middle in terms of wages at the 10th percentile ($35,800), median ($66,600), and 90th percentile ($107,400).

The highest wage reported was for computer and information systems managers, who earned $181,600 per year at the 90th percentile, nearly three times the 10th percentile manager. The lowest 10th percentile wage of the 12 occupations was $20,500 for audio and video equipment technicians. The top 10 percent of earners in the same occupation enjoyed wages at least 3.9 times that amount, at or above nearly $79,300. Computer-controlled machine tool operators had the smallest wage spread from the 10th to the 90th percentile, just under $26,800.

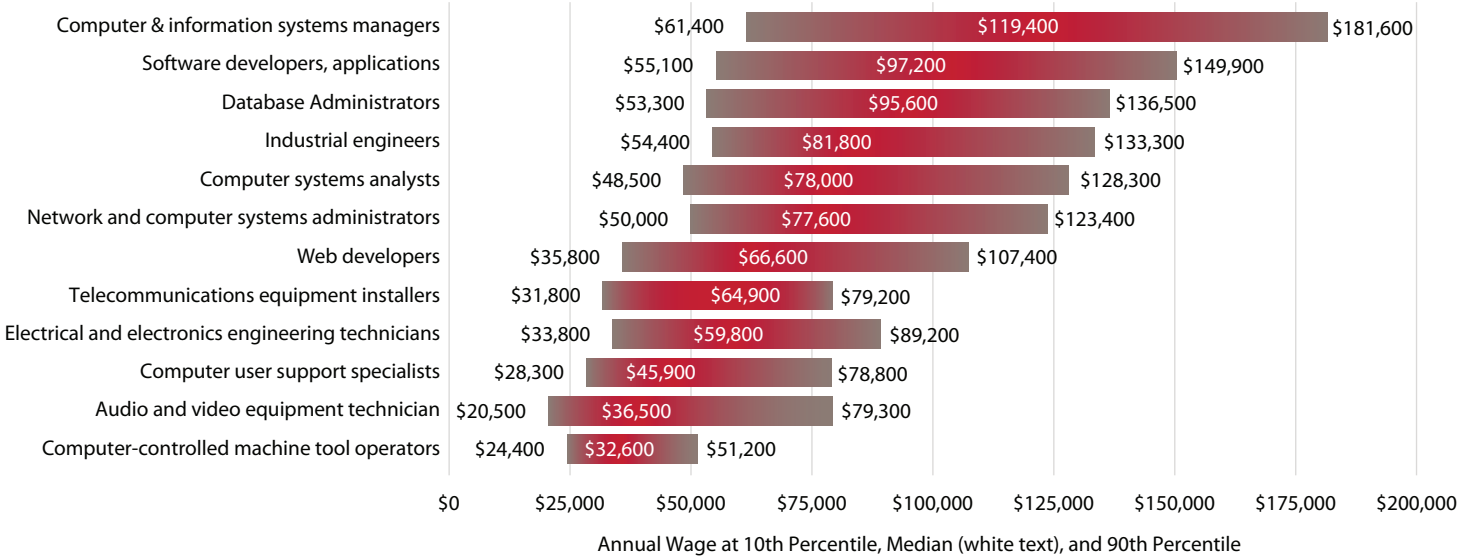
We compared the Utah wage spread for tech and non-tech occupations. Within a given occupation, the 10th to 90th percentile wage range was generally larger for tech occupations than other occupations. At least 63 percent of tech occupations

Figure 2.7: Wage Spread for Tech Occupations in Utah, 2018
(Selected Wage Percentiles)



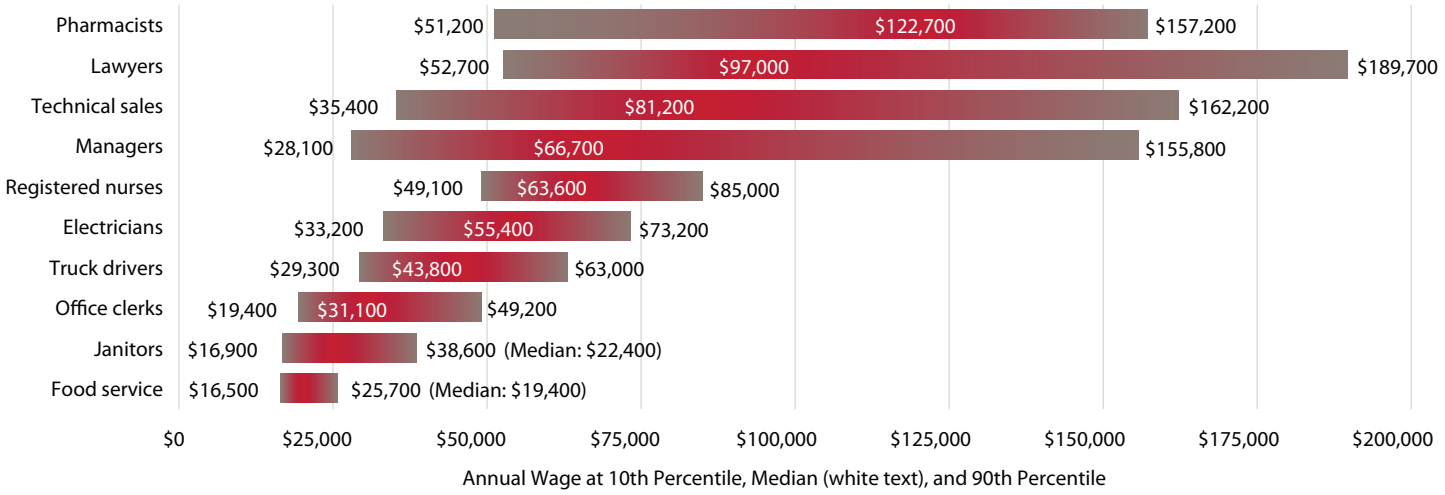
Note: Includes 46 tech occupations ordered by median wage from left to right.
Dots representing the five wage percentiles for a given occupation are aligned vertically.
Employee wages do not include benefits or self-employment income.
Source: U.S. Bureau of Labor Statistics.

Figure 2.8: Wage Spread for Selected Tech Occupations in Utah, 2018



Note: Bars represent the middle 80 percent of wages Utah employees received in each occupation. Full descriptions for two occupations shortened above: "computer-controlled machine tool operators, metals and plastics" and "telecommunications equipment installers and repairers, except line installers."
Source: U.S. Bureau of Labor Statistics.

Figure 2.9: Wage Spread for Selected Non-Tech Occupations in Utah, 2018



Note: Bands represent the middle 80 percent of wages for Utah employees in each occupation. Titles for six abbreviated occupation descriptions: "sales representatives, wholesale and manufacturing, technical and scientific products"; "general and operations managers"; "heavy and tractor-trailer truck drivers"; "office clerks, general"; "janitors and cleaners, except maids and housekeeping cleaners"; and "combined food preparation and serving workers, including fast food."
Source: U.S. Bureau of Labor Statistics.

(29 of 46) paid above the median wage for other occupations in Utah; parity would be 50 percent.

Figure 2.9 shows the wage distribution for 10 occupations that are not tech-related. The selected occupations each had between 2,500 and 45,000 Utah employees in 2018, collectively 15.3 percent of the state's 1.4 million non-tech jobs. In selecting non-tech occupations, we favored easily recognizable occupations with high employment from across the pay spectrum. Of these, the highest median wage in 2018 was for pharmacists, at $122,700 per year, comparable to computer and information system managers at the median, but lower at the 10th and 90th percentiles. The lowest median wage of the selected non-tech occupations was $19,400 for food service workers, 90 percent of whom earned $25,700 or less during the year.

2.4 Workforce Demographics

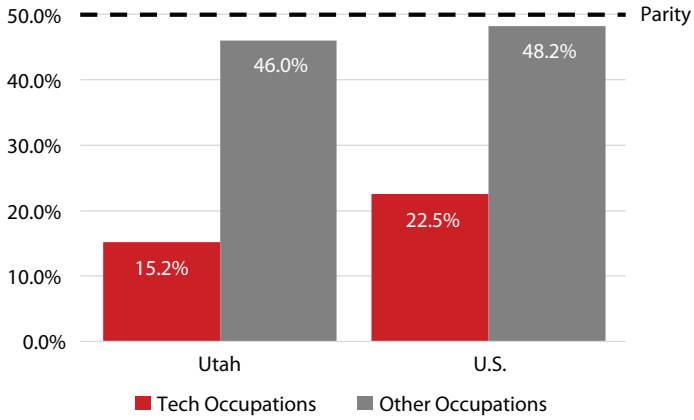
Who are the people in Utah's tech workforce? We address tech worker characteristics of sex, race, ethnicity, and age. Utah employees in tech occupations are more likely to be male, White or Asian, and mid-career than are Utah employees in other occupations. Utah's tech industry growth and its increasing population diversity (Hollingshaus, Harris, and Perlich, 2019) point to further economic opportunities from broader participation in the industry by the state's various demographic groups.

Our demographic results reflect all Utahns in tech occupations. Virtually every industry in the state hires people for tech roles, and 63.1 percent of them work in companies outside the tech industry (see Table 2.3 in Section 2.2). U.S. Census Bureau data from the 2017 American Community Survey in Utah and other states provide demographic information for a 1 percent sample of tech workers (Ruggles et al. 2019).[29] While occupation employment and wage findings thus far in Section 2 have been for company employees, our demographic results include employees and self-employed workers. Both sets of results use the Computing Technology Industry Association's list of tech occupations (see Table 2.1 in Section 2.1).

2.4.1 How High Is Female Participation in Utah's Tech Workforce?

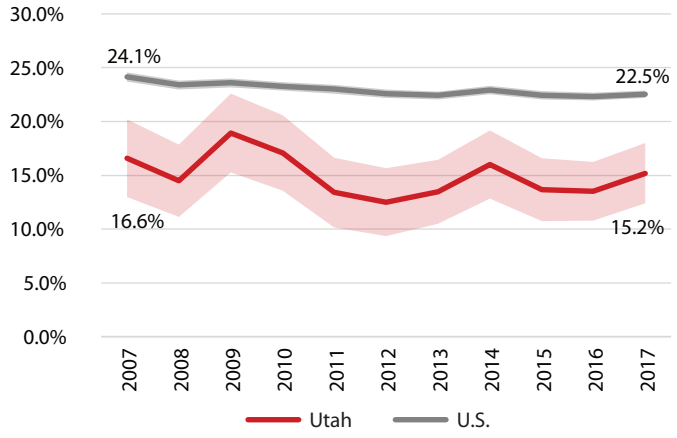
Tech occupations nationwide attract more than three times as many men as women. In 2017, 22.5 percent of U.S. tech workers were female (see Figure 2.10). In Utah, during the same year, women made up only 15.2 percent of Utah workers in tech occupations; 84.8 percent were male. The female share of

Figure 2.10: Women in Tech Occupations, 2017
(Female Share of Workers)



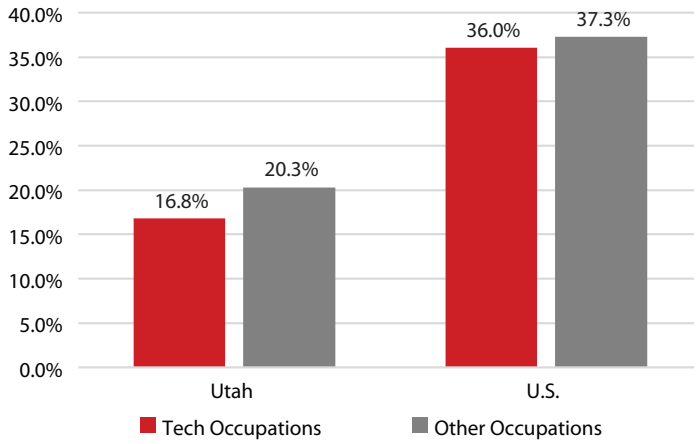
Note: All differences among the four female shares above are statistically significant at the 95 percent confidence level.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

Figure 2.11: Women in Tech Occupations, Utah 2007–2017
(Female Share of Tech Workers)



Note: Shaded bands represent the margin of error given a 95 percent confidence level. The error band is wider for Utah because of its smaller sample size.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

Figure 2.12: Racial and Ethnic Minorities in Tech Occupations, 2017



Note: Minorities include any race-ethnicity combination besides non-Hispanic White.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

tech workers was also far below that of non-tech workers in the state (46.0 percent female), which was much closer to parity (50 percent). While only 1.5 percent of employed women held tech jobs, 6.6 percent of employed men held tech jobs.

Since 2007, we do not see evidence of any increase in the female share of tech workers in Utah or the U.S. From 2007 to 2017, the female share of employees in tech jobs nationwide fell from 24.1 percent to 22.5 percent of all tech workers (see Figure 2.11). For Utah, year-to-year variability related to the state's relatively small sample size obscures any 10-year trend in female participation.[30]

2.4.2 Are Tech Occupations Accessible to Racial and Ethnic Minorities?

The next demographic traits for which we made estimates were race and ethnicity. In Utah, one in six workers in a tech occupation in 2017 identified as non-White or Hispanic (see Figure 2.12). Utah's minority share was somewhat lower in tech occupations (16.8 percent) than in non-tech occupations (20.3 percent), but the apparent difference of 3.5 percentage points is not statistically significant.

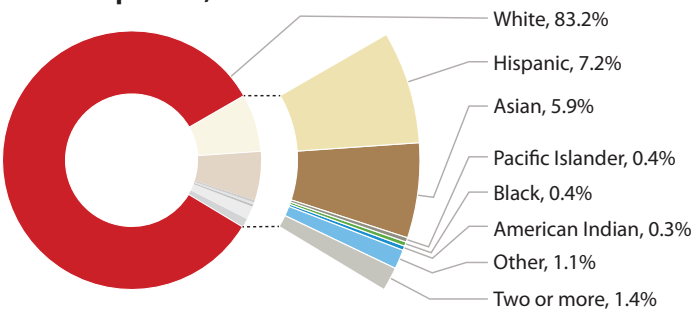
Reflecting the state's demographics, Utahns in tech occupations were less diverse in terms of standard race and ethnicity groups than were tech workers nationwide, based on an average of all states. Nationwide minority shares for tech workers were nearly as high as minority shares in other occupations. However, as in Utah, overall minority shares masked storylines regarding individual racial and ethnic groups, most of which were under-represented in tech jobs.

Following U.S. Census Bureau conventions, we use eight racial and ethnic groups. We count people with Hispanic, Latino, or Spanish origins as part of the "Hispanic" ethnic group, which includes people of any race. We count people not identifying as Hispanic in one of seven race groups: American Indian or Alaska Native ("American Indian"), Asian, Black or African American ("Black"), Native Hawaiian or Other Pacific Islander ("Pacific Islander"), White, "other," or "two or more." The "other" race group is for people whose race the Bureau was unable to classify, even after reviewing any write-in responses and the race and ethnicity responses of family members. To avoid double-counting, no race group includes people of Hispanic ethnicity, not even "other" or "two or more."

In 2017, 83.2 percent of Utahns in tech occupations were White, while 13.1 percent were either Hispanic or Asian (see Figure 2.13). Utahns who were Pacific Islander, Black, or American Indian made up 1.1 percent of the total. Finally, 2.5 percent of non-Hispanic Utah tech workers had two or more race identities or did not identify with any standard race or ethnicity group.

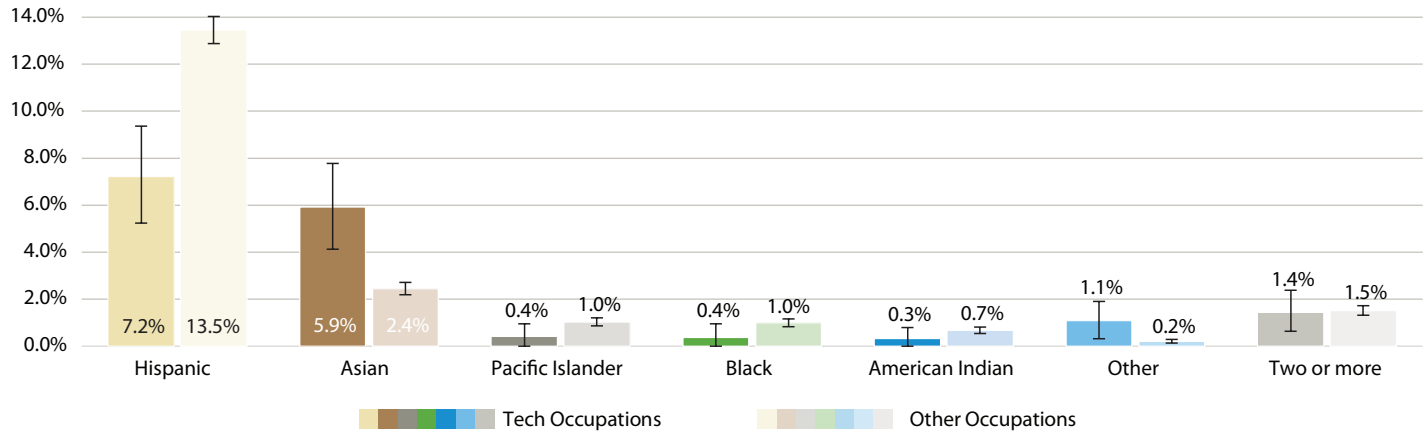
Next, we compare employment shares for Utah's racial and ethnic groups in tech and non-tech occupations. Tech and non-tech shares were fairly similar for White workers. Their share of

Figure 2.13: Race and Ethnicity Profile for Utah Workers in Tech Occupations, 2017



Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

Figure 2.14: Racial and Ethnic Groups among Workers in Tech and Other Occupations, Utah 2017
(Share of All Workers)



Note: Observed differences between workers in tech and non-tech occupations are statistically significant only for Hispanic, Asian, and "other" groups. Although placement varies, all labels are the percentage estimates represented by red and gray columns, not their margins of error. Vertical bars indicate margins of error, based on a 95 percent binomial proportion confidence interval following the Clopper-Pearson method.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

tech jobs was a few percentage points higher than their share of non-tech jobs (see Table 2.4 in Section 2.4.3). However, the apparent advantage fell just within the survey's margin of error.[31]

Representation in tech occupations for Utahns who identify as Hispanic is much lower than the group's representation in other occupations in the state. Of 68,000 people in tech jobs in 2017, only 7.2 percent were Hispanic, well below the 13.5 percent Hispanic share for all other jobs (see Figure 2.14). However, the gap is larger in other states: 7.8 percent in tech versus 17.5 percent in other industries (see Table 2.4). Hispanic workers are somewhat less under-represented in tech occupations in Utah than in the U.S.

Utah workers who are Asian have strong representation in tech occupations (see Figure 2.14). In 2017, 5.9 percent of tech workers were Asian, compared with only 2.4 percent of workers in other occupations. Asian workers' disproportionate participation was more pronounced in the U.S. than in Utah: nationwide, they filled 18.7 percent of tech jobs and only 5.5 percent of other jobs (see Table 2.4).

Utahns who identify as Pacific Islanders made up 1.0 percent of the state's workforce in non-tech occupations in 2017 (see Figure 2.14). Although only 0.4 percent of Pacific Islanders worked in tech occupations, the implied participation deficit for Utah was within the margin of error. However, nationwide, under-representation of Pacific Islanders in tech occupations compared with non-tech occupations was statistically significant.

Black or African American Utahns also appear to be under-represented in tech occupations. We estimate their participation was more than twice as high in other occupations (1.0 percent) as in tech occupations (0.4 percent), but the difference was not statistically significant. Although the U.S. gap was smaller than Utah's, Black representation in tech occupations was also much lower than in non-tech occupations nationwide, and the difference was statistically significant given the much larger U.S. sample (see Table 2.4).

Of the five distinct racial and ethnic groups in Figure 2.14, American Indians made up the smallest share of Utah workers in tech occupations in 2017, 0.3 percent, less than half of their 0.7 percent share for other occupations. Once again, the numbers are too low for a definitive comparison. The participation gap for American Indians was at least as large nationwide as in Utah.

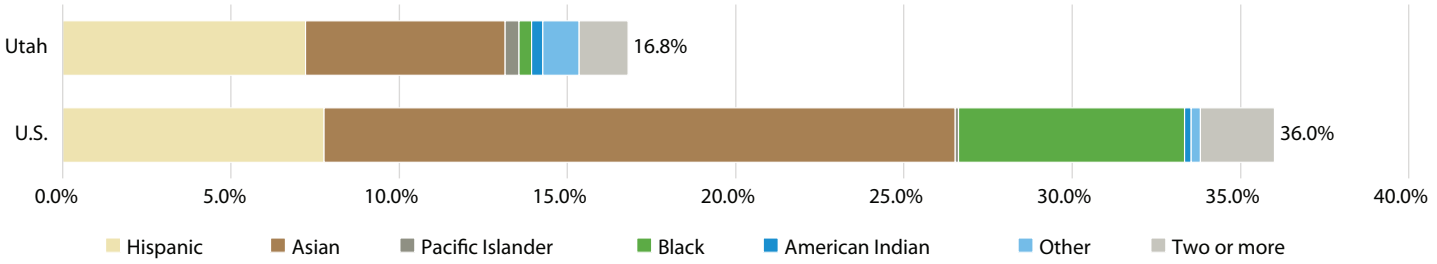
We do not have race information for 1.1 percent of Utah workers in tech occupations. Listed simply as "other race" in American Community Survey data, they do not identify as Hispanic or claim any standard race identity. The group's share of tech jobs was very high compared with its share of non-tech jobs (0.2 percent of Utah workers).

Another 1.4 percent of Utah workers in tech occupations had more than one non-Hispanic racial identity. Their participation in tech occupations was very similar to their participation in other occupations (1.5 percent). The "two or more" group's participation gap between tech and non-tech jobs was the smallest of any race-ethnicity group except White workers, who also had roughly proportional representation in tech and other occupations.

While we have explored participation in tech occupations for several race and ethnicity groups, our analysis does not address whether there is similar pay for people in minority groups in tech occupations. Perhaps by pooling several years of American Community Survey data, future research could address average pay for tech workers who are American Indian, Asian, Black, Hispanic, Pacific Islander, White, or of another race or ethnicity.

Besides comparing the race and ethnicity of Utah tech workers with that of workers in other occupations in the state, we briefly undertook nationwide comparisons. The racial and

Figure 2.15: Minority Racial and Ethnic Groups among Utah and U.S. Workers in Tech Occupations, 2017
(Share of All Tech Workers)



Note: The remaining 83.2 percent of Utah workers and 64.0 percent of U.S. workers not shown are non-Hispanic and White. Based on the survey's margin of error, observed Utah-U.S. differences are statistically significant at the 95 percent confidence level only for Asian and Black groups.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

ethnic profile of Utah's tech workforce differs most from the U.S. profile for people who identify as Asian or Black. Over one-fourth of U.S. employees in tech occupations belong to one of these groups, compared with only 6.3 percent in Utah (see Figure 2.15). Racial and ethnic workforce differences between Utah and the U.S. are a function of their population demographic differences. Equal access, job skills, individual preferences, and personal connections may also play a role.

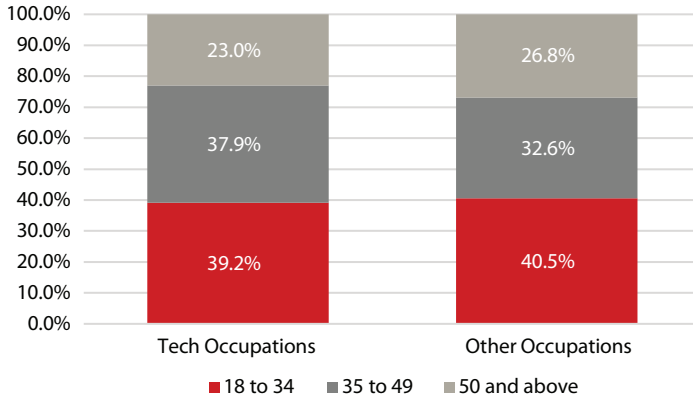
2.4.3 How Are Different Age Groups Represented in Tech Jobs?

Besides analyzing the demographic traits of sex, race, and ethnicity, we prepared a basic age profile for Utah employees in tech occupations. Utah tech workers are more likely to be mid-career than Utahns in other occupations.

In 2017, 37.9 percent of workers in tech occupations were 35 to 49 years old, compared with only 32.6 percent of workers in non-tech occupations, a 5.2 percentage point difference (see Figure 2.16). Shares of people younger than 35 or at least 50 years old were correspondingly lower for tech occupations than for other occupations, with a somewhat larger tech deficit among people 50 and above. The differences for both age groups lie within their margins of error.

U.S. age profiles for tech and other occupations were very similar to Utah profiles (see Table 2.4). However, with a larger nationwide survey sample, tech-versus-other occupation differences were statistically significant for U.S. workers in all three age groups. The middle category, ages 35 to 49, was over-represented in tech occupations by 6.4 percentage points, compared with non-tech occupations. The other two categories were each definitively under-represented in tech occupations, particularly people 50 and above, whose share of tech jobs was 4.4 percentage points lower than their share in other jobs.

Figure 2.16: Utah Worker Age Groups in Tech and Other Occupations, 2017
(Share of All Workers)



Note: Observed differences between workers in tech and non-tech occupations are statistically significant at the 95 percent confidence level only for the "35 to 49" age group.
Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

Table 2.4: Demographic Characteristics of Tech Workers, 2017

	Utah Occupations		U.S. Occupations	
Category	**Tech**	**Other**	**Tech**	**Other**
Sex				
Men	84.8%	54.0%	77.5%	51.8%
Women	15.2%	46.0%	22.5%	48.2%
Race/Ethnicity				
White	83.2%	79.7%	64.0%	62.7%
Hispanic	7.2%	13.5%	7.8%	17.5%
Asian	5.9%	2.4%	18.7%	5.5%
Pacific Islander	0.4%	1.0%	0.1%	0.2%
Black	0.4%	1.0%	6.7%	11.5%
American Indian	0.3%	0.7%	0.2%	0.5%
Other race/ethnicity	1.1%	0.2%	0.3%	0.2%
Two or more groups	1.4%	1.5%	2.2%	1.9%
Age				
18 to 34	39.2%	40.5%	32.4%	34.4%
35 to 49	37.9%	32.6%	38.3%	31.9%
50 or more	23.0%	26.8%	29.3%	33.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series.

Section 3. Research Methods

This section provides additional insight regarding how we conducted our analysis. We define key economic terms for conceptual clarity. Then, we explain how we model economic impacts and estimate tax revenues and government expenditures.

3.1 Terms

Employment is a measure of the average number of full-time and part-time jobs. Employment data from the Utah Department of Workforce Service and the U.S. Bureau of Labor Statistics include virtually all company and government employees. The U.S. Bureau of Economic Analysis and the U.S. Census Bureau's American Community Survey also include self-employed workers, but their Utah data are not quite so detailed and recent. Employment for the demographic analysis in Section 2.4 is by place of residence: we count the number of people employed based on where they live. In other sections of the report, we count jobs by place of work. For example, if a computer systems analyst commutes from Layton to work at an office in Sandy, we count her job in Salt Lake County, although she may spend much of her wages in Weber and Davis County. Also, we do not count under Utah employment an electrical engineer who lives in Logan and commutes to a tech company site in Idaho.

Compensation is the sum of wage and salary disbursements and supplements to wages and salaries, including, for example, contributions for health insurance policies and retirement accounts. Companies report their compensation by employees' place of work. Compensation does not include income from self-employment, personal investments, or government transfers. Earnings of self-employed tech workers are included in earnings and personal income as proprietors' income.

Earnings are the sum of wage and salary disbursements, supplements to wages and salaries, and proprietors' income. Earnings correspond to an individual's place of work.

Personal income includes earnings and all other income: wage and salary disbursements, supplements to wages and salaries, proprietors' income, rent, dividends, interest, and net transfer receipts. Transfer receipts include government transfers, such as Social Security payments to individuals, as well as certain payments from businesses to individuals and to nonprofit institutions that serve individuals. Individuals' personal income corresponds to their place of residence, rather than their place of work, and includes an adjustment for cross-region commuting.

Gross domestic product (GDP) is a measure of total economic activity in a region. "Products" refer to both services and tangible goods. GDP avoids double-counting intermediate sales and captures only the "value added" to final products by capital and labor in a region. Value added is the sum of total income and indirect business taxes. Alternatively, GDP equals total output or sales, less the value of intermediate inputs purchased to produce that output. Value added is equivalent to the GDP measure. For this study, we estimate GDP for the state of Utah.

Output equals the total sales value of products workers create. Output is not adjusted for the value of inputs coming into a company, so there is double-counting. Suppose, for example, a communications equipment manufacturer buys parts and supplies, creates a device, and sells it to a wholesale company that resells the device to a telecommunications service provider. Output counts all three sales—to the manufacturer, wholesaler, and service provider—not just the increments of value created at each stage of production and distribution.

Proprietor refers to a person who works at a company (proprietorship) that they own either alone or as a partner. For example, a web developer at a software company might work part-time as a business partner with a colleague devoted full-time to their e-commerce proprietorship. They may contract, rather than hire, to fill needs that arise beyond what they do themselves. The U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, and Utah Department of Workforce Services classify proprietorships that hire employees (workers who are not also owners) as companies with employees. Their owners do not count under proprietor jobs and income.

An industry is a category for grouping similar types of companies. For uniformity, government agencies and researchers in the U.S. follow the North American Industry Classification System (NAICS), which federal agencies periodically update as new types of companies become common enough to warrant a new category. Industries can be as specific as "bare printed circuit board manufacturing" (NAICS 334412) or as broad as "professional, scientific, and technical services" (NAICS 54). Industries may also be conglomerates of multiple industries, such as the tech industry as defined in Section 1.

An economic sector is a multi-industry category for grouping companies with some commonality. For example, the service sector includes all industries that primarily provide services, rather than tangible goods; and the defense sector includes

private contractors that belong to a variety of NAICS industries, along with military installations and their federal military and civilian workers. When we refer to the "tech sector," we imply a broader concept than our main tech industry definition for Sections 1.1 to 1.6; we leave room for tech companies in other industries and workers in tech occupations in non-tech companies.

An occupation is a category of jobs that are similar in terms of work patterns, training requirements, pay, and other characteristics. We follow the Standard Occupation Classification (SOC) system used in government sources of U.S. economic data. For instance, one of the 50 detailed tech occupations is "computer network architect" (SOC code 15-1143).

3.2 Modelling Economic Impacts

The tech industry supports individuals and organizations outside the industry itself. We wanted to know how much of Utah's economic activity would go away if the state did not have a tech industry. How do we model the effect of the industry on the rest of the state's economy?

Total economic impacts include direct, indirect, and induced impacts. Direct impacts are from companies within Utah's tech industry, while indirect and induced impacts are from companies outside the industry. Tech companies spend money on payroll for employees and purchases from suppliers.

Indirect economic impacts result from spending by the in-state companies from which tech companies purchase inputs. We estimate the portion of activity at non-tech companies that occurs because of tech company purchases.

Induced economic impacts result from in-state personal spending by workers who earn income from tech companies or tech companies' suppliers. We estimate the portion of activity at in-state companies that results from workers' consumer spending. Induced activity supports companies that are neither tech companies nor tech companies' suppliers.

Virtually all tech industry activity qualifies as a direct economic impact for one of two reasons. First, sales by Utah tech companies to buyers in other states and countries bring outside money into Utah's economy. Second, in-state sales are a direct substitute for tech goods and services that Utah buyers would otherwise purchase from outside the state; in-state sales prevent a loss of resources from Utah's economy.

Part of the tech industry's direct activity does not generate indirect or induced economic impacts. Neither of our two reasons apply to certain telecommunications companies based on fixed wired or wireless communications infrastructure. Their cable, telephone, and fiber optic lines are permanent installations serving local customers, as are their transmission and switching facilities. With some exceptions, such as near state borders, telecommunications services from Utah cannot be exported to subscribers in other states. Furthermore, in the absence of Utah's tech industry, most Utahns would be unable to import telecommunications services from other states.

We include all telecommunications operations in the tech industry's direct and total economic impacts, but we add indirect and induced impacts only for satellite telecommunications (NAICS 517410)—which primarily relies on mobile devices and untethered satellites that may not exclusively serve Utah. We do not estimate additional economic activity resulting from the operations of telecommunications carriers (NAICS 517311–2) or the telecommunications resellers that depend on those carriers (NAICS 517911). Regardless of their appropriate treatment in economic impact analyses, companies in all of these categories are indispensable for communication among tech companies, other organizations, and individuals.

To establish direct economic impacts, we used Utah Department of Workforce Services and U.S. Bureau of Economic Analysis data on 2018 tech company operations in Utah. To estimate the indirect and induced impacts that resulted from this direct activity, we customized an economic impact model for Utah. REMI PI+ version 2.2, developed by Regional Economic Models, Inc., is a dynamic, multiregional simulation software package that estimates the economic, population, and labor market impacts of specific economic changes. The analytical framework incorporates input-output relationships, general equilibrium effects, economic geography, and econometrics.

Aggregation in REMI's most detailed model for Utah yields 70 economic sectors with two- to four-digit NAICS codes made up of multiple six-digit industries. The 12 sectors that include tech companies (under the definition in Section 1.1) also contain companies outside the tech industry. These sectors are not 100 percent tech. In terms of the average profile of intermediate goods tech companies purchase, we assume they are similar to other companies in their sectors. Likewise, for our GDP estimates, we assume tech companies have similar value added per worker as other companies in their sectors. In terms of worker earnings, we calibrated the model to reflect pay for the specific tech companies in our definition without relying on sector averages. We applied in-house statewide employment numbers rather than the model's default estimates for 2018 (Kem C. Gardner Policy Institute 2017).

We adjust our model to avoid double-counting in cases where tech companies buy inputs from other tech companies. For example, software companies may buy computers from in-state vendors and contract with other Utah firms for custom programming. We subtract out the indirect and induced impacts of such activity, because our industry definition already counts all tech company activity in its direct impacts. For the 12 sectors that include tech companies, we assume the value of transactions between tech companies in different sectors is proportional to the tech industry's share of each sector.

3.3 Estimating Fiscal Impacts

The Gardner Policy Institute fiscal model uses effective tax rates and per capita government spending to estimate the fiscal impacts of tech industry operations in Utah during 2018. Inputs to the model are employment, personal income, output (sales), and population results from the REMI PI+ economic model for the tech industry's combined direct, indirect, and induced economic impact. Fiscal impacts generated in this report should be viewed as broad measures. The underlying analysis relies on historical data and assumes a linear relationship between taxes paid and personal income, earnings, industry output, and employment.

We estimated tax revenue impacts for personal and corporate income taxes, state and local sales taxes, and property taxes. We estimated additional spending by school districts and state and county governments. We did not include spending by cities and towns because we did not find recent and consistent compiled budget data for municipalities.

We also limited our model to state and local governments. Although the tech industry has a relatively large impact on state and local government entities in Utah, federal tax collections from the state have a relatively small impact on federal government receipts. Similarly, we assume federal spending in the state in a given year is largely independent of economic activity in Utah's tech and other industries.

Tax revenue impacts depend on myriad tax rates and policies. For example, specific tax rates apply to purchases of gasoline, groceries, and accommodations. Some services are not subject to sales tax. Residential property taxes depend on home value assessments and local levies for schools and other public services. Income tax rates for individuals and businesses are nuanced to accommodate different situations, such as caring for dependents and sustaining investment losses.

We calculated effective tax rates to avoid tenuous assumptions about applicable tax rates, spending patterns, asset values, and other matters. We started with annual, statewide collections in broad tax categories. Then, we divided total taxes paid in Utah by statewide economic variables for those years: output (sales), personal income, earnings, and employment. The denominators for our effective tax rates for state personal income tax, state and local sales tax, and residential and personal property taxes were personal income and earnings. For example, we assumed that a 5 percent increase in personal income would increase sales tax revenue by 5 percent. Our effective tax rate for corporate income taxes used output as its denominator. Finally, we used employment to estimate the change in commercial property taxes.

We estimated government expenditures on a per-capita basis using REMI's population impact results for the tech industry. Population impacts include workers and their households who would likely not be living in Utah were it not for employment opportunities in tech companies or in non-tech companies supported by tech industry activity. Expenditure estimates are multi-year averages of per capita budgeted amounts. We based non-education expenditures on total population impacts and included all state budget operating expenditures except those for higher education and public education. We based higher education expenditures on college-age population impacts, and we based public education expenditures on school-age population impacts.

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Endnotes

1 See Kem C. Gardner Policy Institute publications: *Summary of Economic Impacts of Utah's Tech Industry* Research Brief, February 2019 and *Utah's Tech Industry* Industry Snapshot, revised June 2019.

2. The Gardner Institute 42-industry definition in Table 1.2 yields 4.1 percent fewer establishments and 12.4 percent fewer employees of tech companies than the 50-industry definition from the Computing Technology Industry Association (CompTIA). CompTIA found 6,996 tech establishments and 95,646 jobs in Utah's tech industry during 2018 (2019, p. 61). Gardner Institute and CompTIA both include self-employed tech workers. CompTIA aggregates self-employment with employment in tech occupations, preventing direct comparison. Gardner Institute employment results may be higher since CompTIA does not include part-time self-employed workers, whereas the Gardner Institute includes them, but with correspondingly lower income than full-time workers.

3. The 2012 NAICS version contains 1,065 detailed industries, two fewer than the most recent 2017 NAICS version described above.

4. Until 2015, the Workforce Information Council operated as a research collaboration between the U.S. Bureau of Labor Statistics and state governments—in this case Idaho.

5. Since many companies have more than one establishment in Utah, there are fewer tech companies than tech establishments.

6. Estimated compensation equals employee wages from the Utah Department of Workforce Services for each of 37 industry categories times the corresponding industry-specific ratio of compensation to wages from REMI PI+ economic model.

7. Proprietors' income estimated from per-worker averages in 2016 and 2017, adjusted for inflation to 2018 dollars and applied to the number of self-employed workers in 2018.

8. In 2018, the tech industry directly provided 5.8 percent of Utah jobs, including company employees and self-employed workers (see Table 1.18 in Section 1.6.1). The somewhat lower 5.5 percent share from the bottom row of Table 1.10 in Section 1.3.2 represents employees but no self-employment. The difference suggests that the tech industry provided proportionately more self-employment opportunities than did other industries in Utah.

9. In Section 2.3, we examine Utah workers' wages at five different percentiles, but that level of insight is available by occupation, not industry.

10. For the analysis presented in Figure 1.8, we estimated employment for Utah's 21 economic sectors from 2017 U.S. Bureau of Economic Analysis data and the sectors' forecasted job growth rate from 2017 to 2018 in the REMI PI+ economic model. The tech industry, which spans many sectors, makes up less than 3 percent of employment in real estate, administration, and other services combined. Leisure and hospitality include accommodations and food services. Administrative services include support, waste management, and remediation services. Real estate includes rental and leasing. Other services include repair and maintenance, personal and laundry services, civic and professional organizations, and private households.

11. We have not analyzed how much of the tech industry's growth since 2001 displaced other presumably less efficient industries and how much of the growth purely added to the size of the state and national economies.

12. While H-1B visas are well suited to the tech industry, other temporary worker visas predominantly serve non-tech industries, such as the L-1 program for executives and managers transferred to the U.S. by international companies and the H-2A and H-2B programs for seasonal workers in agricultural and other occupations. As of FY 2013, H-1B visas covered about one-third of temporary foreign workers employed in the U.S. (Costa and Rosenbaum 2017).

13. Our more complete analysis for Utah reported 83,892 jobs (see Table 1.7 in Section 1.3). The similar but lower estimate in Table 1.15 (80,200 jobs) relies on a simplified analysis approach that we were able to apply consistently to all states, one that still captured 95.7 percent of Utah's employee jobs in the tech industry in 2018. Both results exclude self-employed workers.

14. Our more complete analysis for Utah gave the result of $7.5 billion in employee wages (see Section 1.3.1). The roughly similar but lower estimate in Table 1.16 ($7.0 billion) relies on a simplified analysis approach that we were able to apply consistently to all states, while still capturing wages from 95.7 percent of Utah's employee jobs in the tech industry in 2018. Both results excludes employer-paid benefits and self-employed workers.

15. Like earnings, personal income includes employee compensation and proprietors' income. Unlike earnings, personal income includes other sources of income and subtracts contributions for government social insurance. Personal income is reported by place of residence (for workers who live in Utah, even if they work in another state), whereas employment, earnings, and GDP are reported by place of work (where a company operates, even if some workers commute across state lines). See Section 3.1 for more a complete explanation of terms.

16. We grouped NAICS industries to create the 15 high-level industry sectors in Figure 1.15 and Table 1.19. Business services includes administrative and waste management services, as well as management of companies and enterprises. Other services do not include public administration. Leisure and hospitality includes accommodation and food services, arts, entertainment, and recreation. Real estate includes rental and leasing. Transportation and utilities include warehousing. Professional services include scientific and technical services. Health and education do not include public education, but they do include social services. Natural resources includes mining and farms, as well as forestry, fishing, and related activities.

17. One reason information services had the lowest sector share for tech industry indirect and induced impacts was that tech companies made up two-thirds (67.6 percent) of the sector's Utah employment in 2018. These tech company jobs counted only as direct economic impacts, while a portion of the remaining 32.4 percent of information services jobs was among the indirect and induced impacts. To a lesser extent, the tech industry made up a large part of professional services employment, 28.9 percent of the sector's jobs. Were so many professional service jobs not already counted in the tech industry, the sector's indirect and induced share would have been higher than 8.2 percent. The only other sector with more than 10 percent of its employment in the tech industry was retail trade, with 11.2 percent, owing to e-commerce. Most of the sectors with below-average shares simply had weaker economic ties to Utah's tech industry than did construction and business services, for example.

18. The life sciences industry offers products that apply biological research and technological solutions to health care.

19. Our treatment of STEM occupations follows the U.S. Bureau of Labor Statistics (BLS) definition. The 120 detailed occupations include everything BLS proposes in the "science, engineering, mathematics, and information technology domain" and only architecture and planning from the "science- and engineering-related domain," not health care practitioners and related staff.

20. Categories for STEM and tech occupations rely on the Standard Occupation Classification system. BLS and other government agencies use it to identify workers based on occupational characteristics. The 2018 classification hierarchy includes 459 detailed occupations.

21. The Utah Department of Workforce Services report compared the Salt Lake/Provo urban area to San Francisco/San Jose, Raleigh, Austin, Seattle, and New York (Knold, Smith, and Stahle 2018). The share of software developers, programmers, and computer systems analysts with educational attainment below a bachelor's degree for the six areas ranged from 7 percent in San Francisco/San Jose to 44 percent in Salt Lake/Provo, based on the 2016 American Community Survey.

22. Utah industry data for 98 industries were one year more recent than the occupation-industry matrix for 238 industries. The Utah Department of Workforce Services provided both QCEW data products.

23. For simplicity, Table 2.3 does not include tech-related industries. In 2018, Utah jobs in tech occupations made up 23.9 percent of all employees in the tech-related industries identified in Section 1.7. The tech-related industry share was much higher than the 5.7 percent average for all industries in Utah, yet somewhat lower than the 36.8 tech industry share. The tech-related calculation was 9,002 jobs in tech occupations in tech-related industries (included in Table 2.3 under the 52,829 jobs in other industries) divided by 37,594 total employee jobs in tech-related industries (see Figure 1.17 in Section 1.7). These tech occupation shares substantiate our industry definitions' suitability in Utah.

24. Our result of 36.8 percent of employees at Utah tech companies being in tech occupations is somewhat higher than the result of about 33 percent from the Computing Technology Industry Association, also for 2018. The difference is not surprising because, while we use the same tech occupation definition, our tech industry definition is slightly narrower than CompTIA's.

25. The average Utah wage in the tech industry of $89,000 per employee in Section 1.3.3 differs from the average wage of $82,100 per worker in Figure 2.5 for Utah employees in tech occupations. While the two results describe some of the same jobs, they also diverge. Section 1.3 addresses workers in all occupations only in the tech industry, and Figure 2.5 only addresses workers in tech occupations, irrespective of their companies' industries, whether it is tech or something else.

26. The Utah-U.S. pay gap was very similar for tech and non-tech occupations. Average wages in non-tech occupations in Utah were 10.2 percent below the U.S. average in 2018.

27. The U.S. Bureau of Labor Statistics generally does not disclose employment or wages for occupations with fewer than 25 jobs.

28. The 90th percentile wage represents the highest pay among employees in 90 percent of jobs, excluding the highest-paying 10 percent of jobs. The 10th percentile equals the highest wage paid to the bottom 10 percent of wage earners. Outliers—pay arrangements that are not representative of the occupation—do not distort percentile measures, unlike averages.

29. The American Community Survey includes 630 Utahns with tech occupations who were employed in 2017. The single-year sample size for other occupations in Utah was 13,519 workers. In the U.S., 53,724 people in tech occupations and 1,407,609 people in non-tech occupations responded to the survey. The Census Bureau weights survey observations to make the data more representative of the entire population. For any results that have non-negligible margins of error, we provide an estimate of the 95 percent confidence interval.

30. Between 409 and 630 Utahns employed in tech occupations responded to the American Community Survey each year from 2007 to 2017. Corresponding U.S. sample sizes ranged from 39,985 to 53,724 people.

31. In other words, while it appears White Utahns are over-represented in tech occupations (relative to their share of the entire workforce), if the U.S. Census Bureau were to survey more Utah tech workers, there is more than a remote possibility that the results would not bear out the apparent participation advantage observed. Based on the existing sample size, the probability of Utah workers in tech jobs having a White share different from workers in non-tech jobs is less than 95 percent, subject to statistical assumptions, such as normality.

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