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Utah's Engineering and Computer Science Workforce: Higher Education and Economic Trends

Innovative engineering and computer science professionals—along with the higher education institutions that prepare many of them for the workforce—create vast economic and societal value for Utah.

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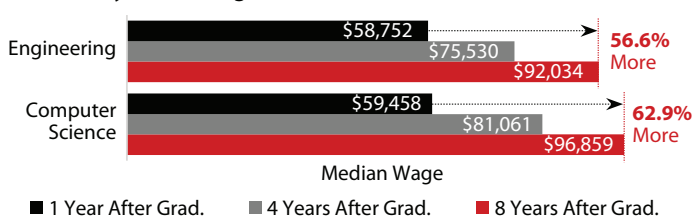
Analysis in Brief

Engineering and computer science professionals make substantial contributions to Utah and its economy. In 2020, Utah's engineering and computer science workforce generated 238,400 full- and part-time jobs, $19.1 billion in earnings, and $25.2 billion in gross domestic product (GDP). These amounts represent 12% to 15% of Utah's $200 billion economy. In every major industry, and in communities statewide, engineering and computer science professionals contribute to meaningful innovation, research, and entrepreneurship.

Key Findings

- **Student degree completions –** The number of new engineering and computer science graduates from Utah System of Higher Education (USHE) institutions increased from about 1,540 in 2000 to over 3,700 in 2020.
- **Specialization –** Engineering and computer science employment has more than doubled since 2000, with Utah employers adding over 46,000 full- and part-time jobs through 2020.
- **State comparison –** Since 2000, growth in Utah engineering employment outpaced growth in U.S. engineering employment by more than fivefold. The state's computer science employment over this same period outpaced the nation by more than double.
- **Future growth –** Projected growth rates in Utah's engineering and computer science employment exceed projected growth in other occupations through 2028, surpassing in-state labor availability.
- **Wages –** Utahns with engineering jobs made an average wage of $96,600 in 2020, and computer science workers earned $89,500—80% and 66% higher than the $53,800 state average, respectively.

- **Race and ethnicity –** Students in historically underrepresented groups elevated the minority share of Utah engineering and computer science degree completions from just over 7% in 2000 to over 17% in 2020.
- **Careers for women –** In 2020, women earned 583 engineering and computer science degrees at USHE institutions, far more than their 265 degrees in 2000 but still far below parity as a share of degrees awarded to students of all genders. In-state jobs in these fields pay women almost two or three times, respectively, the average earnings for women in other occupations.
- **Higher education graduates in the workforce –** Compared with their wages one year after degree completion, engineering and computer science graduates employed in Utah earn 31% more after four years and 59% more after eight years.

Utah Employment by Occupation, 2000–2020
(Index: 100 = Number of Jobs in 2000)

Note: Indices track growth paths for employee jobs beginning in 2000 with 9,420 engineering jobs, 28,370 computer science jobs, and 999,110 jobs in other occupations. Shaded areas indicate U.S. recessions.
Source: Kem C. Gardner Policy Institute analysis of sample data from the U.S. Bureau of Labor Statistics

Median Wages for USHE Graduates, 2012–2020
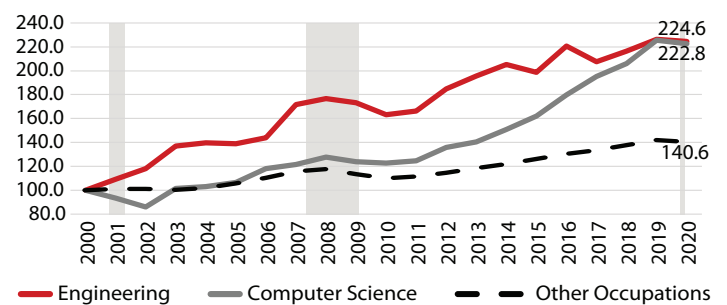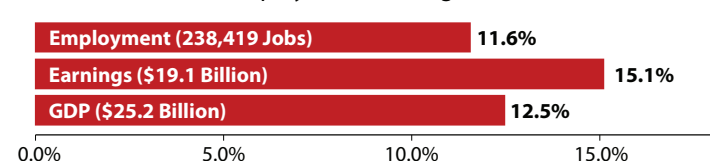(Annual Median in 2021 Dollars at Intervals After Graduation in the Utah System of Higher Education)

Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center

Engineering and Computer Science Workforce Economic Contributions, 2020
(Share of Total State Employment, Earnings, or GDP; 2021 Dollars)

Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services and U.S. Bureau of Economic Analysis data using the REMI PI+ model

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> *"The Legislature recognizes that a significant increase in the number of engineering, computer science, and related technology graduates from the state system of higher education is required over the next several years to advance the intellectual, cultural, social, and economic well-being of the state and its citizens."*

—Utah State Legislature in 2001, Senate Bill 61 [1]

Higher education programs in Utah support growth and specialization in engineering and computer science fields. Capable graduates and productive workers further economic development in many settings. Their ingenuity and the state's long-running Engineering and Computer Science Initiative have improved Utah's workforce since the turn of the century.

Utah's engineering and computer science professionals play an active role in Utah's economy and society (see Figure 1.1). They connect people and bridge gaps between scientific knowledge and human needs. These professionals implement practical innovations, for example, to streamline business processes or create and adapt platforms. Their work improves infrastructure throughout the state. Over the years, engineers and tech workers have helped set foundations that enable Utahns to address challenges such as rising housing costs, climate change, water shortages, poor air quality, and medical limitations. Other impactful applications from this strategic workforce segment are in communications, education, transportation, energy, and agriculture. People working in engineering and computer science often find high-quality careers in terms of pay, prestige, and purpose. Benefits from their work accrue to communities across the state as these fields become increasingly accessible and prolific.

From 2000 to 2020, engineering and computer science degree completion trends roughly matched job growth for the entire period.[2] Figure 1.2 shows that all four indices more than doubled. Over shorter periods, education-workforce alignment has been marked by some lagged education responses to workforce developments. In the past 10 years, completions surged to catch up with employment growth in these fields,

Figure 1.1: Engineering and Computer Science Contributions

Utah Economic Footprint		
Creating Value	**Economic Opportunity**	**Strategic Sectors**
- Product & process design - Devices & computing - Advanced manufacturing - Online platforms - Professional services	- Quality jobs - Business development - Investment - Contracting	- Tech (software/IT) - Life sciences - Defense & aerospace

Statewide Societal Benefits		
Learning	**Infrastructure**	**Innovation**
- K–12/Higher ed. programs - Technical & leadership experience at work - Research advances (R&D)	- Housing - Transportation - Financial services - Communications	- Health care - Sustainable energy - Clean air & water - Agricultural tech.

Note: This report's original results focus on aspects of economic opportunity and learning benefits. Lists are not comprehensive.
Source: Kem C. Gardner Policy Institute

Figure 1.2: Utah Degree Completion and Employment Indices, 2000–2020

(100 = Number of Jobs or Higher Education Degree Completions in 2000)
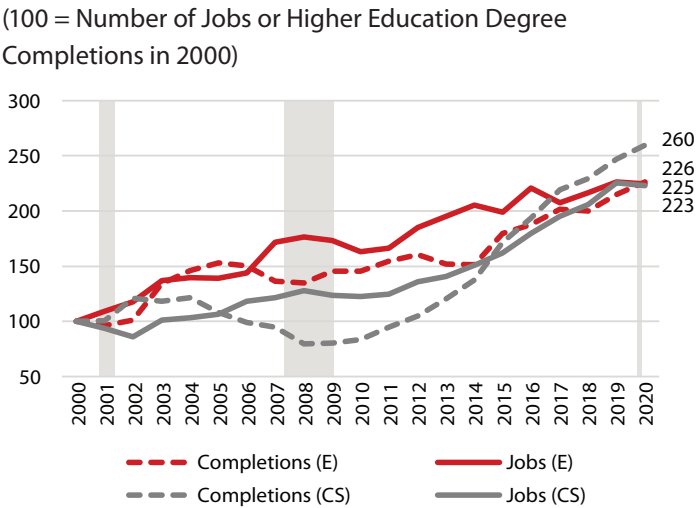
E = Engineering; CS = Computer Science
Note: Indices track growth paths beginning in 2000 with 9,420 jobs and 865 completions in engineering, and 28,370 jobs and 677 completions in computer science. Shaded areas indicate a U.S. recession. See Appendix B Table A1 for definitions of engineering and computer science degrees included here.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Bureau of Labor Statistics and the National Center for Education Statistics

particularly in computer science. Utah can build on its higher education successes and get ahead by anticipating future employment growth in these strategic sectors. Education is a long-term investment, and graduates need years after graduation to accumulate experience and prepare for key engineering and computer science roles.

Figure 1.3: Engineering and Computer Science Initiative Funding for USHE Institutions, FY 2002–2023

(Millions of Dollars; Share of Total for All Institutions)
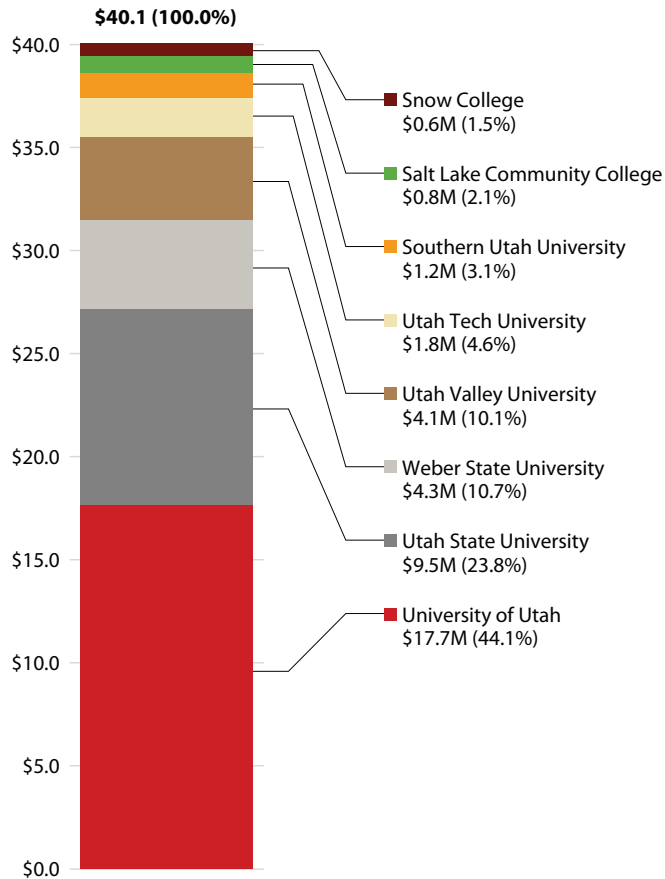
$40.1 (100.0%)

Snow College
$0.6M (1.5%)

Salt Lake Community College
$0.8M (2.1%)

Southern Utah University
$1.2M (3.1%)

Utah Tech University
$1.8M (4.6%)

Utah Valley University
$4.1M (10.1%)

Weber State University
$4.3M (10.7%)

Utah State University
$9.5M (23.8%)

University of Utah
$17.7M (44.1%)

FY = State fiscal year ending June 30
Note: Includes total ongoing and one-time funding to institutions in the Utah System of Higher Education (USHE). Utah State University amount includes funding to the College of Eastern Utah and later Utah State University–Eastern.
Source: Utah System of Higher Education, State Board of Regents, personal communication

In 2001, the Utah State Legislature and Governor Michael Leavitt established the Engineering and Computer Science Initiative through Senate Bill 61, Enhancements to the State Systems of Public and Higher Education. The principal goal of the initiative has been to double the number of engineering and computer science graduates from Utah's higher education system. With added state support, colleges and universities have responded to the challenge, which aligns with student interests and societal needs. For example, in 2013, the University of Utah awarded 2.1 times as many degrees in these fields as before the initiative, with 54% more faculty and elevated research and commercialization activity.[3] Public and private investments in the initiative have continued as high-tech labor demand in the Intermountain West has called for further expansion in postsecondary education programs in engineering and computer science.

Engineering degrees awarded by institutions participating in the initiative grew from 865 in fiscal year 2000 to 1,958 in fiscal year 2020, and computer science degrees awarded grew from 677 to 1,758.[4] Utah's progress exceeded or closely followed national trends. From fiscal years 2000 to 2019, the number of engineering graduates increased by 103% nationally and 115% in-state, and the number of computer science graduates increased by 155% nationally and 147% in-state.[5]

Over 22 years, the Engineering and Computer Science Initiative has allocated $40.1 million in ongoing and one-time funds to support its programs (see Figure 1.3). The initiative requires matching investments from colleges and universities.[6] With the highest engineering and computer science research and teaching volume, the University of Utah and Utah State University have been the largest recipients of initiative funding at 44.1% and 23.8% of total outlays, respectively. Utah Code

Figure 1.4: Engineering and Computer Science Initiative Funding for Higher Education in Utah, FY 2002–2023

(Millions of Dollars)
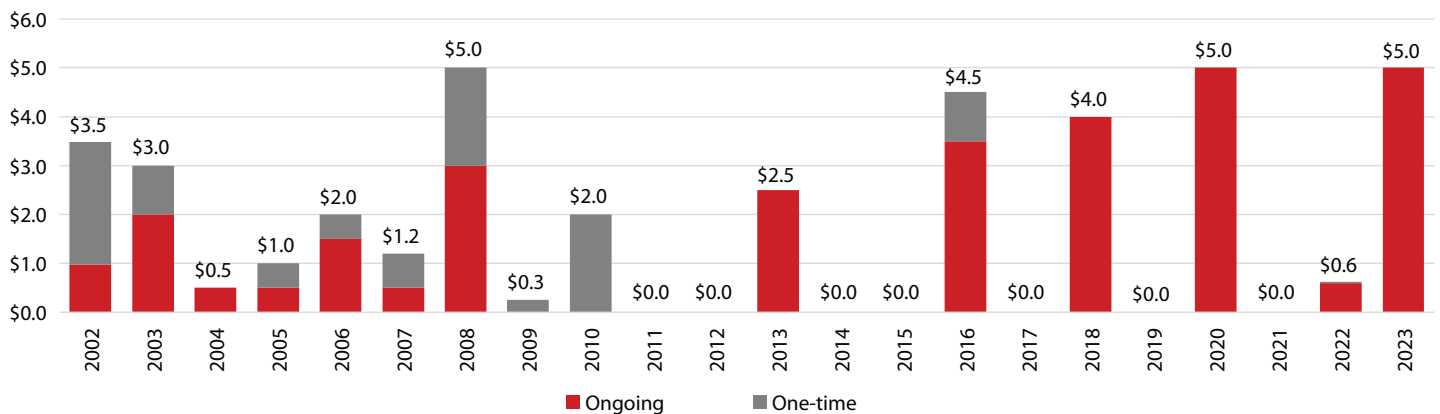
■ Ongoing   ■ One-time

FY = State fiscal year ending June 30
Note: Includes total ongoing and one-time funding to institutions in the Utah System of Higher Education.
Source: Utah System of Higher Education, State Board of Regents, personal communication

Utah Trends in Educational Attainment and Workforce Earnings

Higher education has become increasingly important for career success in Utah. Since 2000, Utahns have pursued more formal education. The share of the adult workforce with a bachelor's degree or higher rose from 24.9% in 2000 to 33.0% in 2019 (see Figure 1.5). Meanwhile, the percentage of Utah workers with less than a high school diploma fell 4.3 percentage points to 6.1% in 2019, and the percentage with some college or associate degree decreased by 3.5 percentage points to 37.6%. Engineering and computer science occupations are more likely than other occupations to attract Utah workers with higher education credentials. These results include employees and self-employed workers.

Completing a four-year degree is associated with higher earnings for Utah workers. The median annual earnings for adults in the workforce with a bachelor's degree was $63,500 in inflation-adjusted dollars (see Figure 1.6). Median earnings for workforce participants with less education ranged from $25,400 to $31,700. People with some college or associate degrees had similar median earnings to those with no postsecondary education.

Figure 1.5: Educational Attainment in Utah's Workforce, Selected Years 2000–2019

(Share of Adult Workforce)
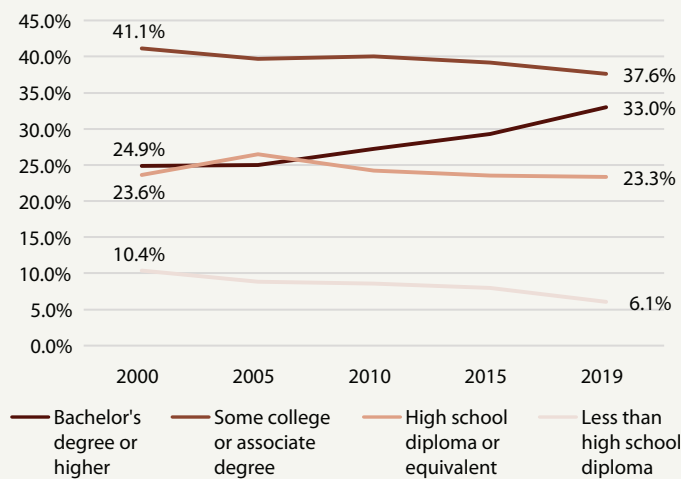
Note: The workforce includes people with jobs and people actively looking for work who were employed in the past five years. Depending on degree level and year, margins of error for these sample estimates range from 0.5 to 1.0 percentage points. Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figure 1.6: Utah Worker Earnings by Educational Attainment, 2019

(Median Annual Adult Earnings from Employment; 2021 Dollars)
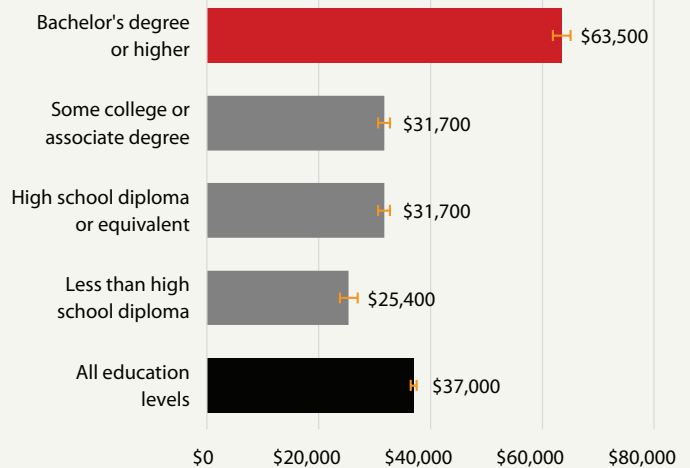
Note: Results include people with jobs and people actively looking for work who were employed in the past five years. Amounts rounded to the nearest $100 after adjusting for inflation using the U.S. Bureau of Labor Statistics nationwide consumer price index. Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

states that appropriations for this initiative "shall be used to hire, recruit, and retain outstanding faculty in engineering, computer science, and related technology fields..."[7]

From fiscal years 2002 to 2023, the cumulative $40.1 million in Utah's Engineering and Computer Science Initiative funding to public colleges and universities averaged $1.8 million per year (see Figure 1.4). Since 2002, both ongoing and one-time appropriations were inconsistent. Annual outlays ranged from $0 (during seven years since 2011) to a peak of $5.0 million (repeated in 2008, 2020, and 2023).

The Utah Legislature supports engineering and computer science programs across the state outside of the formal Engineering and Computer Science Initiative as well. The Legislature appropriated $2.51 billion to Utah's public, post-secondary education institutions for fiscal year 2023, $1.49 billion of which comes from the General Fund and Education Fund.[8] The difference (about $1 billion) largely comes from tuition payments. Higher education administrators may use much of the appropriated funds in a discretionary manner, thereby potentially benefiting engineering and computer science programs beyond the formal initiative. Total appropriations include the formal initiative funds as well as capital expenditures. At least $373 million in capital expenditures since fiscal year 2002 have gone towards buildings that benefit engineering and computer science programs, among other programs. See Table A9 in the Appendix for a list of such buildings.

Section 2. Economic Contributions*

> **" *Our state's economic sustainability required a greater abundance of engineering talent.*" [9] *The Engineering and Computer Science Initiative "started as a way to provide productive employment in the high tech industry for people statewide. It is the key to our economic future.* **"** [10]

—Michael Leavitt, Utah Governor in 2001

Utah's engineering and computer science professionals and the institutions where they work contribute substantially to Utah's diverse economy. While proponents and stakeholders of Utah's engineering and computer science fields have known its value, few studies provide quantitative data offering insight into how this unique and innovative population supports Utah's economy. This analysis will present the context of the total economic footprint of Utah's engineering and computer science workforce, showing the extent of economic activity supported and sustained by this workforce based on the current structure of Utah's economy.

Study Design

Total contributions are the sum of direct, indirect, and induced contributions generated by engineering and computer science employment. To estimate economic contributions, REMI PI+, a software package from Regional Economic Models, Inc., facilitates analysis based on integrated data on Utah's workforce, industries, and demographics. Direct effects are generated by activity at Utah companies that depends on people in engineering and computer science jobs. This activity produces indirect effects when these companies' in-state vendors hire employees and make purchases from other in-state vendors—commonly referred to as business-to-business activity. Finally, induced effects occur when engineering and computer science workers and the employees of supporting in-state vendors spend their wages in the Utah economy. Figure 2.1 provides a visual representation of the economic flows that produce "multiplier effects" beyond the engineering and computer workforce itself.

Figure 2.1: Economic Flows of Direct, Indirect, and Induced Economic Contributions
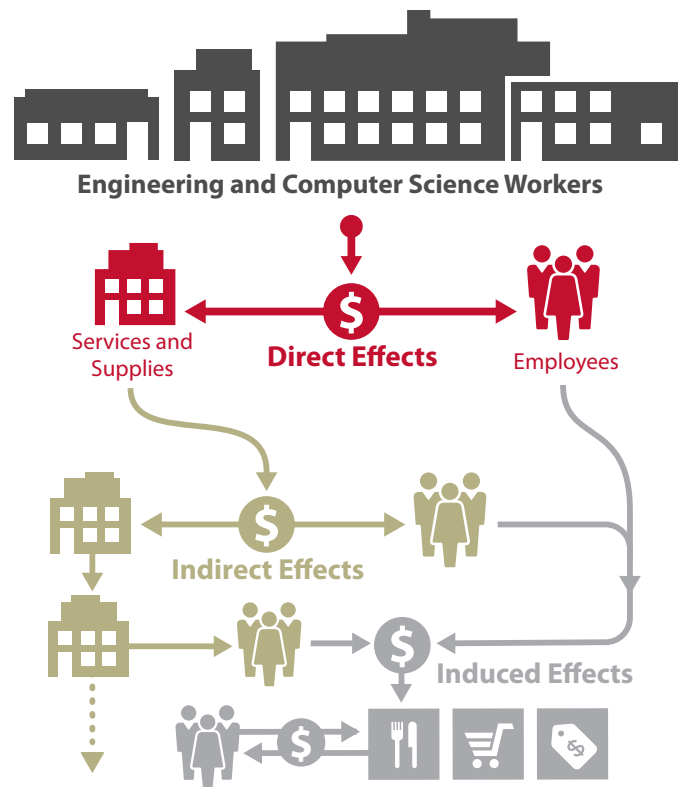
Note: Employees receiving income from direct effects include engineering and computer science workers.
Source: Kem C. Gardner Policy Institute

Economic effects are measured in three ways: jobs, earnings, and gross domestic product (GDP). GDP is a measure of the market-based value added in an economy, typically recorded quarterly and annually. In 2020, Utah's annual GDP was about $200 billion.

The Gardner Institute modeled the economic contribution of the engineering and computer science workforce by combining Utah data on employee and self-employment jobs from the U.S. Bureau of Labor Statistics, Utah Department of Workforce Services, and U.S. Bureau of Economic Analysis. In 2020, employees working in Utah held 21,160 engineering jobs and 63,210 computer science jobs (Table 2.1). In addition, the Gardner Institute estimates there were 25,583 self-employed individuals in an engineering or computer science occupation. The total 109,953 full- and part-time workers in all major industries represent the direct inputs for the economic contribution analysis.

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* Appendix A offers background and details on the results presented in this section.

Table 2.1: Utah Engineering and Computer Science Employment, 2020

(Economic Contribution Inputs—109,953 Jobs Total)

Engineering Occupations (21,160 Jobs)	Computer Science Occupations (63,210 Jobs)	Self-Employed E & CS Professionals (25,583 Jobs)
- Mechanical Engineers - Civil Engineers - Industrial Engineers - Architectural & Engineering Managers - Electrical Engineers - Plus 18 additional occupations	- Software Developers & Quality Assurance Analysts - Computer User Support Specialists - Computer Occupations, All Other - Computer & Information Systems Managers - Network & Computer Systems Administrators - Plus 12 additional occupations	- Self-employed professionals in an engineering and computer science occupations - Entrepreneurs in business partnerships or sole proprietorships

Note: See Tables 4.1 and 4.2 in Section 4 for complete occupation lists.
Source: U.S. Bureau of Labor Statistics, National Occupational Employment and Wage Estimates; Utah Department of Workforce Services, Staffing Patterns Dataset; and U.S. Bureau of Economic Analysis, Annual Personal Income and Employment by State

Analysis Results

In 2020, Utah's engineering and computer science workforce sustained and supported 238,419 jobs, $19.1 billion in earnings, and $25.2 billion in gross domestic product (GDP) for the state of Utah (see Figure 2.2). These estimates are the result of direct, indirect, and induced effects. The magnitude of these metrics is substantial, representing 11.6% of the state's employment, 15.1% of its earnings, and 12.5% of its GDP.

Nearly every major sector of Utah's economy benefitted from Utah's engineering and computer science professionals in 2020. Figure 2.3 presents sector shares of total economic contributions in terms of combined direct, indirect, and induced employment. The most-impacted sector was professional services, representing nearly a quarter (23.3%) of total employment contributions. Other notable sectors included business services (10.5%), retail trade (9.9%), and health and education (9.9%). Under 2.5% of jobs were concentrated in the construction and natural resources sectors.

Economic contribution results demonstrate the immense interconnectedness that Utah's engineering and computer science workforce has with the rest of the state's economy. The engineering and computer science sector had a strong multiplier effect on the economy. Gardner analysts estimate employment multipliers between 1.1 and 3.0, depending on the economic variable measured. This is consistent with the 1.8 to 3.0 range reported in similar studies measuring the economic contribution of engineers and STEM fields.[11] Refer to Appendix A for an in-depth discussion on model calibration and multipliers.

Figure 2.2: Engineering and Computer Science Workforce Economic Contributions, 2020

(Jobs; Billions of 2021 Dollars)
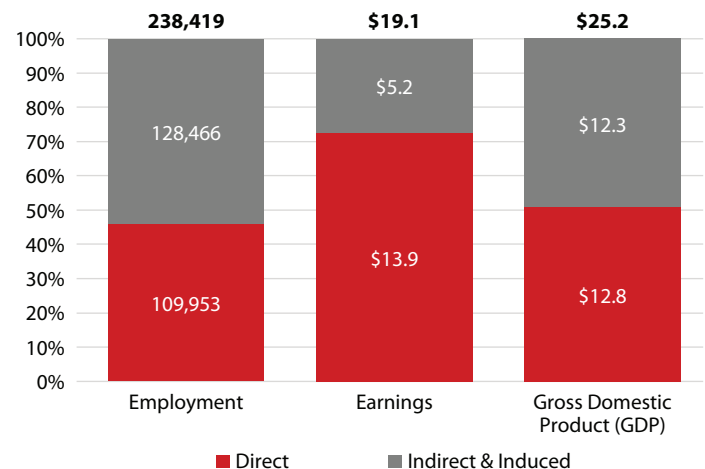
Note: Employment includes the number of full- and part-time jobs. Earnings include employee compensation (with benefits) and income from self-employment. Totals may not match exactly due to rounding.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services (personal communication, Staffing Patterns Matrix) and U.S. Bureau of Economic Analysis (Interactive Data Tables, Annual Personal Income and Employment by State) using the REMI PI+ model

Figure 2.3: Utah Employment Generated by Engineering and Computer Science Workforce, 2020

(Sector Share of 238,419 Jobs in Total Direct, Indirect, and Induced Economic Contributions)
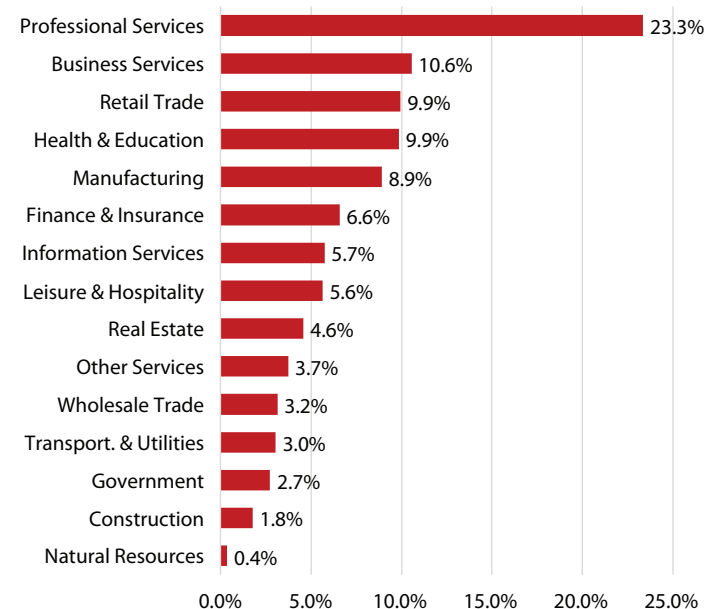
Note: Business services include management of companies and enterprises, administrative services, support, waste management, and remediation services. The health and education sector includes health care, social assistance, and private education. Public education is part of government. Leisure and hospitality include accommodation, food services, arts, entertainment, and recreation. Natural resources include agriculture, forestry, fishing, hunting, mining, oil, and gas.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services (personal communication, Staffing Patterns Matrix) and U.S. Bureau of Economic Analysis (Interactive Data Tables, Annual Personal Income and Employment by State) using the REMI PI+ model

Section 3. Higher Education Trends

"Computer science empowers students to create the world of tomorrow."

—**Satya Nadella, CEO, Microsoft**[12]

Utah colleges and universities are essential to the development of the state's engineering and computer science workforce. Many developed countries sustain their economies with the innovations and prosperity that their engineering and computer science workers generate. Engineers, tech workers, and professionals in related occupations are taking increasingly active roles in the economy and society. While they learn in a variety of settings, more than two-thirds of Utah's engineering and computer science workers earned a bachelor's degree or higher. Trends in degree completion demonstrate the growing importance of these programs to the state, as do patterns in grant funding for academic research. Representation across demographic groups remains uneven in higher education programs.

Degree Completions

Many colleges and universities in Utah offer degree programs in engineering and computer science.[13] Foremost, the Utah System of Higher Education (USHE) comprises eight public degree-granting institutions: two research universities, four regional universities, and two community colleges (see Table 3.1). Eight technical colleges within USHE offer a range of certifications.

Portions of this analysis address four private non-profit, degree-granting institutions: Brigham Young University, Westminster College, Ensign College, and Western Governors University. The study does not cover technical colleges or certificates awarded by other institutions.

Utah's promotion of STEM programs, specifically engineering and computer science, has helped increase degree completions in those disciplines. From 2000 to 2020, completions at USHE engineering and computer science programs more than doubled (see Figure 3.1). Degree completions in computer science increased from 677 in 2000 to 1,758 in 2020, with a temporary

Table 3.1: Utah System of Higher Education and Selected Utah Colleges and Universities

Public Institutions in the Utah System of Higher Education		
Research Universities	**Regional Universities**	**Community Colleges**
- University of Utah - Utah State University	- Weber State University - Southern Utah University - Utah Tech University - Utah Valley University	- Salt Lake Community College - Snow College

Selected Private Non-Profit Institutions		
Research University	**Colleges**	**Online University**
- Brigham Young University	- Westminster College - Ensign College	- Western Governors University

Source: Kem C. Gardner Policy Institute

Figure 3.1: Utah Degree Completions in Engineering and Computer Science by Institution, 2000–2020
(Utah System of Higher Education)
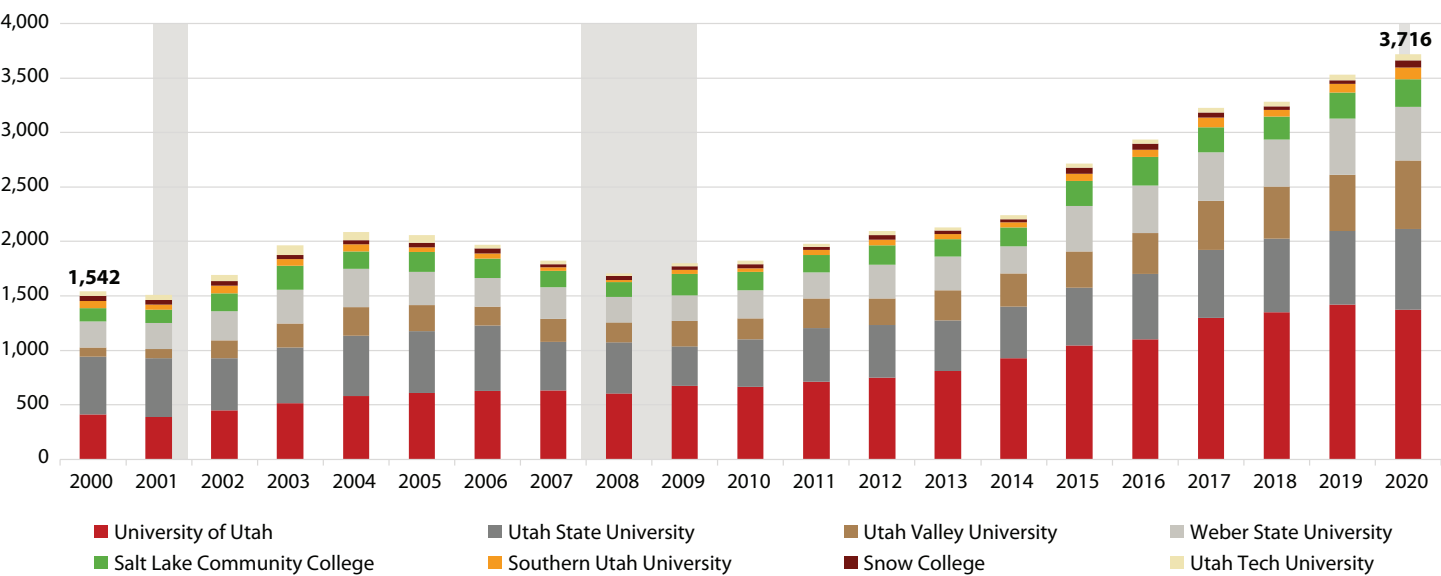
Note: Completions include associate, bachelor's, and graduate degrees awarded in years ending June 30. Shaded areas indicate a U.S. recession.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System

Graduation Trends Through Industry Setbacks and Economic Recessions

The dot-com bubble collapse at the turn of the century contributed to a pause in 2001 in the upward completion trend for computer science degrees in Utah, followed by marked declines from 2004 to 2008 (see Figure 3.2).[14] While the industry bounced back quickly, hiring at the pre-crash rate by 2004, graduation numbers at public higher education institutions did not begin to rise again until the Great Recession. Computer science's share of all degrees awarded in the Utah System of Higher Education followed similar trends, starting at 3.6% in 2000, declining to 2.2% in 2008, and reaching 4.8% in 2020 (see Figure 3.3). After the dot-com

collapse, skepticism surrounding the tech industry caused a downturn in student interest that persisted for several years after the industry had recovered.[15] At least in Utah, this skepticism appears to have dissipated over a decade ago as computer science completions increased more than three-fold from 2008 to 2020. Finally, the COVID-19 pandemic caused a sudden recession in the U.S. from February through April 2020, and a series of global economic disruptions with uneven impacts across communities. Utah completion data for 2020 reflects pandemic effects in the state, including public and private sector responses.

Figure 3.2: Degree Completions in Engineering and Computer Science, 2000–2020

(Utah System of Higher Education)
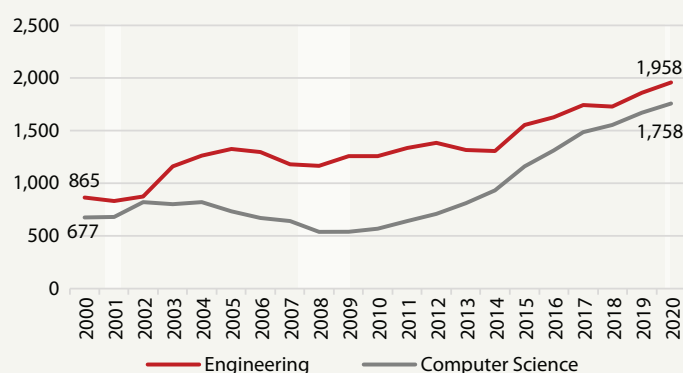
Note: Completions include associate, bachelor's, and graduate degrees. Completions are for years ending June 30. Shaded areas indicate a U.S. recession.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System

Figure 3.3: Engineering and Computer Science Share of Degree Completions, 2000–2020

(Percent of All-Program Total, Utah System of Higher Education)

Note: Completions include associate, bachelor's, and graduate degrees. Completions are for years ending June 30. Shaded areas indicate a U.S. recession.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System, and the Utah System of Higher Education, 2003–2004 Data Book

decrease preceding the financial crisis beginning in late 2007. Engineering completions increased from 865 in 2000 to 1,958 in 2020, with more year-to-year variability, but less large growth deviations than computer science completions. Computer science completions saw increases in 16 of the 20 years measured; engineering saw increases in 13 of the 20 years. Outside of USHE institutions, students from Brigham Young University, Western Governors University, Ensign College, and Westminster College accounted for an additional 1,443 engineering and computer science degree completions in 2020. These figures include completions ranging from associate to doctor's degrees.

In 2020, the University of Utah had the highest number of engineering degrees in the state at 805 completions, representing 41% of the USHE total (see Table 3.2). Utah State followed with 497 (25%). Most USHE engineering completions

were for bachelor's degrees (1,219, 62%), followed closely by associate and master's degrees (17% and 16%, respectively), and 4% of completions for doctor's degrees. Utah Valley University had the largest share of associate degrees, while the University of Utah and Utah State University claimed the highest total completions among the remaining degree paths. Brigham Young University—the only selected institution outside of USHE with engineering degree programs—had 629 graduates. Its 24% share of total engineering completions was second only to the University of Utah's 31% share.

The highest shares of USHE computer science completions in 2020 were from the University of Utah (571, 32%) and Utah Valley University (369, 21%). As with engineering programs, most computer science completions were for bachelor's degrees (57%), and only 1% of completions were for doctor's

Table 3.2: Higher Education Completions in Engineering and Computer Science by Institution and Degree Level, 2020
(Number of Degree Completions)

Program/Institution	Associate Degree	Bachelor's Degree	Master's Degree	Doctor's Degree	Total
USHE Institutions					
Engineering					
University of Utah	0	514	224	67	805
Utah State University	0	387	89	21	497
Utah Valley University	122	134	0	0	256
Weber State University	74	121	3	0	198
Salt Lake Community College	88	0	0	0	88
Southern Utah University	4	55	0	0	59
Snow College	44	8	0	0	52
Utah Tech University	3	0	0	0	3
Total	**335**	**1,219**	**316**	**88**	**1,958**
Computer Science					
University of Utah	0	286	267	18	571
Utah State University	0	203	37	3	243
Utah Valley University	94	259	16	0	369
Weber State University	128	168	0	0	296
Salt Lake Community College	165	0	0	0	165
Southern Utah University	2	35	14	0	51
Snow College	10	0	0	0	10
Utah Tech University	0	53	0	0	53
Total	**399**	**1,004**	**334**	**21**	**1,758**
USHE Total	**734**	**2,223**	**650**	**109**	**3,716**
Selected Private Institutions					
Engineering					
Brigham Young University	0	516	84	29	629
Computer Science					
Brigham Young University	0	378	96	5	479
Western Governors University	0	156	107	0	263
Ensign College	54	0	0	0	54
Westminster College	0	18	0	0	18
Total	**54**	**552**	**203**	**5**	**814**
Grand Total	**788**	**3,291**	**937**	**143**	**5,159**

Note: Utah System of Higher Education (USHE) and Western Governors University (WGU) completions were from July 1, 2019 to June 30, 2020. WGU, Westminster College, and Ensign College did not have degree completions in engineering. While WGU is a national university, their data above represent completions by Utah residents only.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System

degrees. Weber State University awarded the most associate degrees (128). The University of Utah and Utah Valley University awarded the most bachelor's degrees in computer science (286 and 259, respectively), and the University of Utah awarded the most master's and doctor's degrees (267 and 18).

At 629 completions, Brigham Young University awarded the second-most computer science degrees among the institutions analyzed, and awarded the most bachelor's degrees (378). Computer science programs garnered 263 bachelor's and master's degree completions at Western Governors University, 18 bachelor's degree completions at Westminster College, and 54 associate degree completions at Ensign College.[16]

Opportunity and Inclusion

Engineering and computer science programs at Utah colleges and universities often see distinct patterns in student outcomes based on demographic characteristics and economic opportunity. The number of women earning higher education degrees in both disciplines increased dramatically since 2010, yet three out of four graduates in the state are male. Meanwhile, Utah's minority groups collectively reflect national trends with degree completion rates closer to minority population shares. Completion rates are comparatively low, except for advanced degrees. While higher education success varies by racial and ethnic group, the number of engineering and computer science degree completions increased since 2000 for nearly every minority group.

Gender

As the 21st century progressed, more women completed engineering and computer science programs at Utah's public colleges and universities. In both fields, female degree completions rose from 2000 to 2020: the number of engineering degrees women received nearly tripled, and the computer science count rose by more than 75% (see Figure 3.4).

Recessions disrupted upward graduation trends for women, less in engineering than in computer science. While the number of computer science degrees awarded by USHE institutions declined during the first decade of the 2000s, the number of engineering degrees generally increased or held steady. In terms of graduates at all degree levels, USHE engineering programs outperformed computer science programs until 2019 when completions for the two fields intersected. In 2020, 297 women received engineering degrees from public higher education institutions, while 286 women received computer science degrees.

Female computer science completions dropped in all three recessions from 2000 to 2020, and the Great Recession was the lowest point during that period, followed by consistent growth until 2020. The number of degrees women earned increased four-fold from a low of 58 completions in 2008 to 286 completions in 2020.

In engineering and computer science programs, the vast majority of degree completions were male. Both disciplines had similar higher education gender gaps in completion shares. Of all completions at USHE institutions in 2020, degrees earned by women in engineering and computer science made up 15.2% and 16.3%, respectively (see Figure 3.5). Yet, women made up 48.9% of the state's college-age population (ages 18 to 29).[17] On the other hand, male graduates were overrepresented among graduates, accounting for 83.1% of engineering degrees and 82.3% of computer science degrees. The share of engineering degrees earned by women rose from 11.9% in 2000 to 15.2% in 2020, while the share of computer science degrees earned by women fell from 23.9% in 2000 to 16.3% in 2020.

In Utah engineering and computer science programs, women's representation among higher education degree earners varies by degree level, never approaching gender parity. With the exception of a bachelor's degree in computer science, both programs had progressively larger percentages of female completions in more advanced degrees (see Figure 3.6). In 2020, women had their highest completion shares at the doctor's level, claiming 20.5% and 23.1% of engineering and computer science degrees, respectively.

In both engineering and computer science programs, Utah women's participation was below the national average for women. Comparing USHE outcomes with data reported by the American Society for Engineering Education reveals an eight-

Figure 3.4: Women's USHE Degree Completions in Engineering and Computer Science, 2000–2020

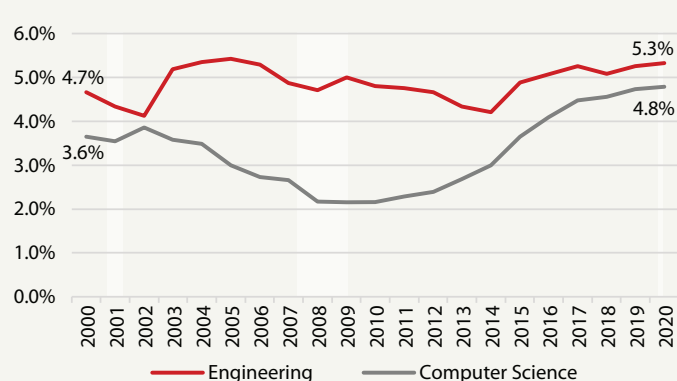(Number of Completions During Years Ending June 30)
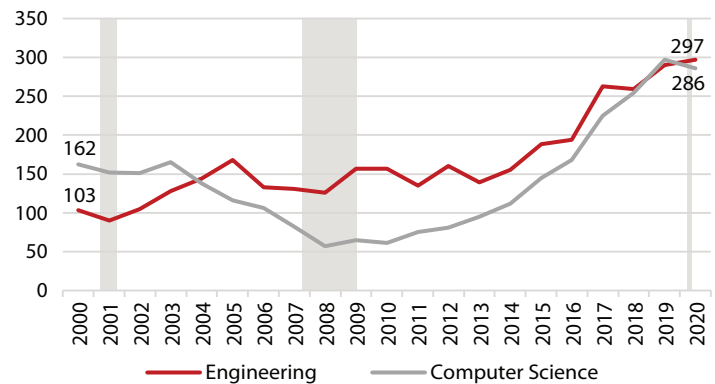
Note: Utah System of Higher Education (USHE) completions include associate, bachelor's, and graduate degrees. Completions are for years ending June 30. Shaded areas indicate a U.S. recession.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System, and the Utah System of Higher Education, 2002–2003 Data Book

Figure 3.5: Women's Share of USHE Degree Completions in Engineering and Computer Science, 2000–2020

(Percent of All Engineering and Computer Science Completions; Share of State Population Ages 18 to 29)

Note: Utah System of Higher Education (USHE) completions include associate, bachelor's, and graduate degrees awarded in years ending June 30. Population shares are for calendar years. Shaded areas indicate a U.S. recession. Labels are for 2000 and 2020.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System; Utah System of Higher Education, 2002–2003 Data Book; U.S. Census Bureau, American Community Survey, Integrated Public Use Microdata Series

percentage point disparity in bachelor's and master's degree attainment between Utah and U.S. females in 2020 (see Figure 3.7).[18] The gap decreased to within four percentage points at the doctor's level.

Future research on engineering and computer science students could explore gender differences by age group. Of USHE completions for all programs and genders in 2020, 93% of graduates were between the ages of 18 and 39, based on data from the National Center for Education Statistics, Integrated Postsec-

Figure 3.6: Women's Share of USHE Engineering and Computer Science Completions by Degree Level, 2020
(Share of Category, Utah System of Higher Education; Share of Statewide College-Age Population, Ages 18 to 29, Dashed Line)

Note: Completion shares include degrees awarded from July 1, 2019 to June 30, 2020. The population share is for calendar year 2020.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System, and the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figure 3.7: Women's Share of Engineering and Computer Science Completions by Degree Level and Location, 2020
(Share of Category, Utah System of Higher Education; Share of College-Age Population, Ages 18 to 29, Dashed Line)

Note: Women's share of the population ages 18 and above was 49.9% in Utah and 51.3% in the U.S. Utah completion shares are for the Utah System of Higher Education. Associate degree completions were not available for U.S. graduates. U.S. completions are for engineering and engineering technology, which includes computer science. Completions are for the year ending June 30, 2020, whereas population shares are for calendar year 2020.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System; American Society for Engineering Education, Engineering and Engineering Technology by the Numbers 2020; and U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

ondary Education Data System. Age-specific completion data by gender is lacking for engineering and computer science graduates. Across all higher education disciplines, Utah enrollment is characterized by a larger female share of students ages 35 and above, and a larger male share of students under 35.[19]

Race and Ethnicity

People in minority race and ethnicity groups are commonly underrepresented in higher education, and the engineering and computer science fields of study are no exception. In 2020, USHE institutions witnessed a total of 575 completions in these fields by students in racial or ethnic minority groups, representing 17.7% of all graduates. Hispanic or Latino graduates represented the largest minority share with 258 completions (44.9%); followed by Asians, Native Hawaiians, and Other Pacific Islanders (30.1%); and finally, graduates belonging to two or more races (18.8%) (see Figure 3.8). All three groups experienced notable growth following the Great Recession. Since 2000, minority completion counts improved in all groups except for American Indians or Alaska Natives, who went from 10 to eight completers in 2020. The COVID-19 pandemic had a negative impact on all groups in 2020. The already-dampened number of completions by international students in 2019 fell by 511 completions in 2020, a 57% drop.

Utah students in minority racial and ethnic groups are underrepresented among USHE graduates in engineering and computer science, but minority shares more than doubled from 2000 to 2020 (see Figure 3.9). As disparities narrowed, minority students made up 16.9% and 18.5% of engineering and computer

science completions by 2020. In the same year, minority groups made up 28.1% of the state's college-age population (ages 18 to 29). Compared with the distinct nationwide gender imbalance among engineering and computer science graduates, racial and ethnic minority representation in these programs' completions more closely reflected the diversity of the broader population in Utah and the U.S.

For USHE programs in engineering and computer science, racial and ethnic minority groups collectively claim higher shares of all completions at more advanced degree levels (see Figure 3.10). In 2020, minority engineering graduates accounted for nearly 17% of all associate, bachelor's, and master's degree completions. However, the minority share jumped to 31.8% for doctor's degrees, exceeding Utah's 28.1% minority share of the college-age population (ages 18 to 29).[20] In computer science, the minority share of completions was greater for associate degrees than bachelor's degrees. Graduate-level minority shares were progressively higher, with minority students representing 21.6% of master's degrees and 30.8% of doctor's degrees.

In Utah and nationwide, racial and ethnic minority groups in the college-age population are underrepresented in higher education completions. In 2020, U.S. racial and ethnic minority groups' collective share of bachelor's and master's degree completions was nearly 10% below the college-age population share of 47.7% (see Figure 3.11). Utah and U.S. minority shares for doctor's degrees are similar, perhaps because USHE institutions

Figure 3.8: Racial and Ethnic Minority USHE Degree Completions in Engineering and Computer Science, 2000–2020
(Number of Completions, Utah System of Higher Education)

Note: International students completed their degrees in the U.S. on a visa or temporary basis. International students may or may not be in racial or ethnic minority groups. The data source refers to them as nonreside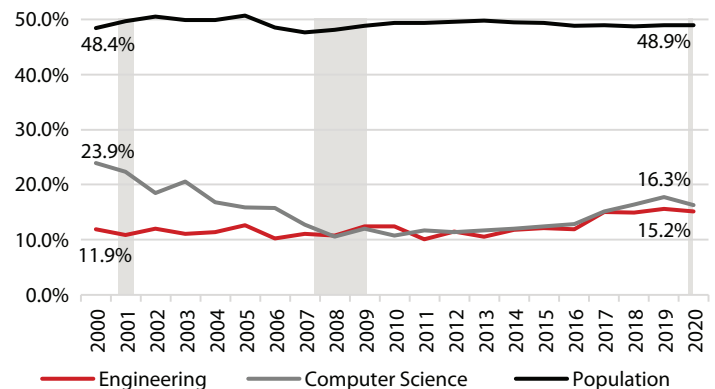nt aliens. Completions include associate, bachelor's, and graduate degrees. Completions are for years ending June 30. Shaded areas indicate a U.S. recession.
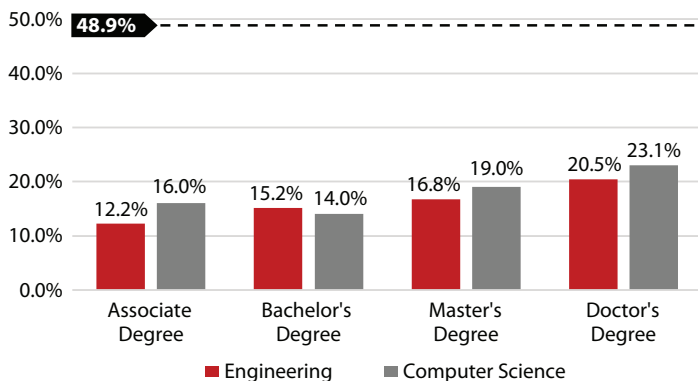Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System

and universities from other states draw from overlapping applicant pools.

Among graduates across all disciplines at USHE institutions from 2016 to 2020, adult learners (ages 25 and above) displayed some differences from traditional students (under age 25) in terms of racial and ethnic diversity.[21] Minority shares were 21.1% for adult learners and 22.9% for traditional students. Utah shares for Black or African American, Native American or Alaskan Native, and Pacific Islander adult learners were slightly higher than the corresponding shares for younger students. Meanwhile, Asian, Hispanic or Latino, and Two or More Races shares were higher among Utah's traditional students. Future research on racial and demographic patterns by learner age group may address engineering and computer science graduates more thoroughly.

Figure 3.9: Racial and Ethnic Minority Share of USHE Completions in Engineering and Computer Science, 2000–2020
(Percent of All Engineering and Computer Science Degree Completions; Share of State Population Ages 18 to 29)
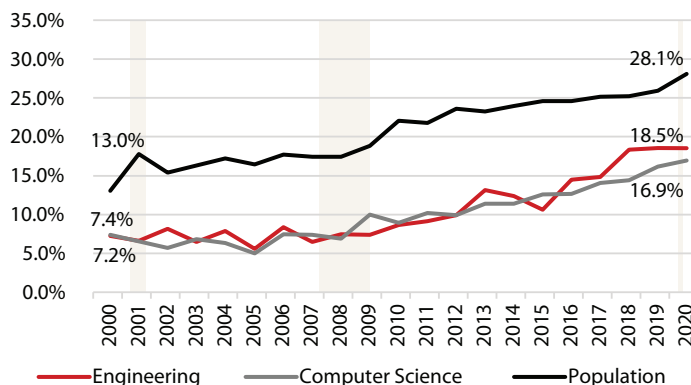
Note: Minority outcomes represent people who are Hispanic or Latino, or identify as any race other than white. Completions include associate, bachelor's, and graduate degrees awarded in the Utah System of Higher Education (USHE) in years ending June 30. Completion percentages do not include international students or other students whose race and ethnicity are not available in USHE data (combined 12.5% of USHE engineering and computer science graduates in 2020). Shaded areas indicate a U.S. recession. Population shares are for calendar years. Labels are for 2000 and 2020. The engineering minority share was lowest in 2000.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System, and the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figure 3.10: Racial and Ethnic Minority Share of USHE Engineering and Computer Science Completions by Degree Level, 2020

(Share of Utah System of Higher Education Completions; Share of Statewide College-Age Population, Ages 18 to 29, Dashed Line)
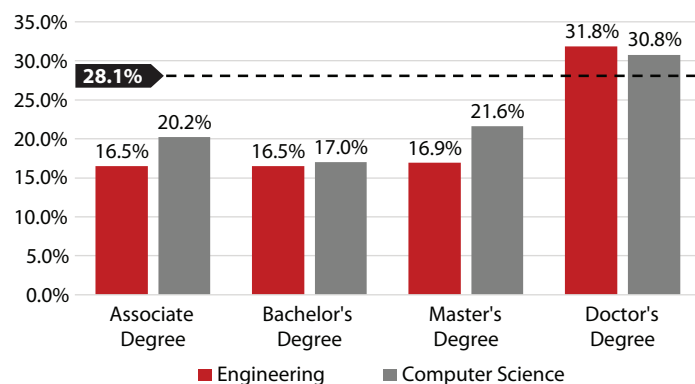
Note: Minority outcomes represent people who are Hispanic or Latino, or identify as any race other than white. Completion shares include degrees awarded from July 1, 2019 to June 30, 2020.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System, and the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figure 3.11: Minority Share of Engineering and Computer Science Completions by Degree Level and Location, 2020

(Racial and Ethnic Minority Share of Degree Completions; Share of College-Age Population, Ages 18 to 29, Dashed Lines)
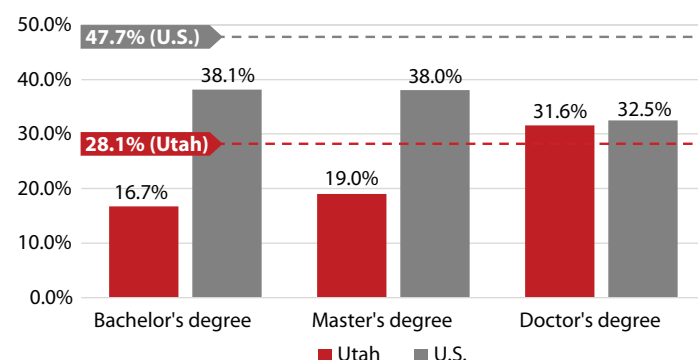
Note: "Minority" outcomes represent people who are Hispanic or Latino, or identify as any race other than white. Utah shares only include Utah System of Higher Education completions. Associate degree completions were not available for U.S. graduates. U.S. completions are for engineering and engineering technology, which includes computer science. Degree completions were from July 1, 2019 to June 30, 2020. Population shares are for calendar year 2020.
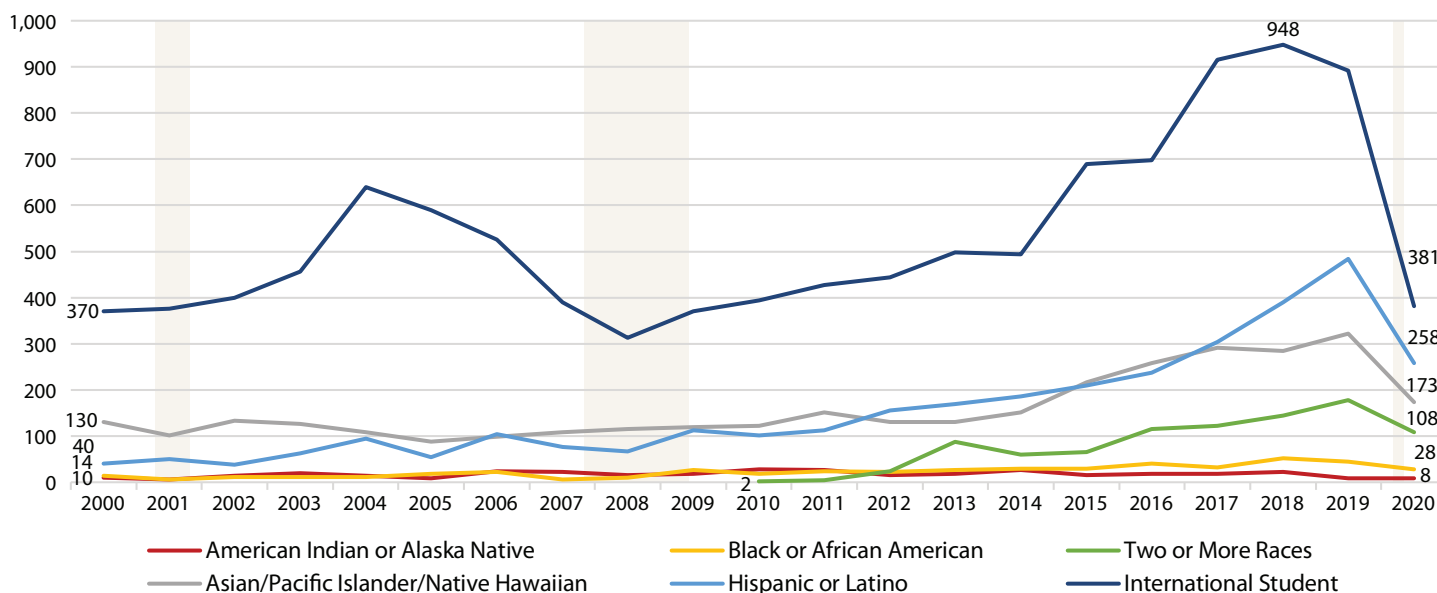Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System; American Society for Engineering Education, Engineering and Engineering Technology by the Numbers 2020; and U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Learning Engineering and Computer Science in Utah's K–12 Education System

In under-resourced Utah homes and among marginalized demographic groups, individual achievement in higher education depends heavily on childhood opportunities to learn. While documenting the success of college students and graduates in the world of science, technology, engineering, and math (STEM), it is worth exploring how Utah can prime future innovators for success, early and effectively. As the United States grew as an economic power during the 20th century, science and technology paved the path to prosperity.[22] However, by most metrics, the United States is losing its technological advantage relative to other developed countries. On average, K–12 students in the U.S. fare poorly in math and science relative to children and youth in other nations.

While the U.S. trails other nations in K–12 math and science achievement, Utah ranks highly compared with other states.[23] This may be due in part to ongoing initiatives such as the Utah STEM Action Center, established by the Utah Legislature in 2013 as a division of the Utah Department of Cultural and Community Engagement.[24] In collaboration with the Utah State Board of Education, the STEM Action Center supports teacher professional development and offers engaging learning tools for their K–12 classrooms. Additionally, the center provides programs such as Innovation Incubator grants, STEM Fest, best practices conferences, STEM school designations, and the K–8 STEM in Motion program. Public education and private industry partnerships further the center's goals for early STEM learning and equitable access across diverse populations.

STEM education can be a strong indicator of future success among students regardless of age, gender, race, or socio-economic background.[25] Researchers at the University of California – Irvine have found that early math skill levels accurately predicted K–5 students' academic progress.[26] Furthermore, early exposure to STEM is associated with engineers and computer scientists' success in postsecondary graduate-level studies and career accomplishments through age 35.[27]

While Utah's computer science and engineering sectors continue to grow, K–12 STEM education helps ensure the success of higher education STEM learning. Creating interest and literacy in these challenging fields among K–12 students could play a part in sustaining Utah's nation-leading economic growth.

Grant and Contract Research Funding

Utah higher education institutions receive significant funding for their engineering and computer science research and other activities. With a combined 96% of all grants and contracts in state fiscal year 2021, the University of Utah, Utah State University, and Brigham Young University accounted for $175.7 million of the $183.0 million total for eight universities and colleges. The University of Utah alone received grants and contracts worth $105.0 million for engineering and $26.5 million for computer science (see Figure 3.12 and Table 3.3).

Research expenditures do not all occur in the same year as institutions receive grant and contract funding. Utah's three research universities with engineering programs submit standardized research expenditure amounts to the American Society for Engineering Education. During the 2020–21 academic year, engineering colleges spent $84.7 million at the University of Utah, $24.7 million at Utah State University, and $17.9 million at Brigham Young University. Of the three institutions, only the University of Utah has a computer science program that is a part of the College of Engineering rather than the College of (Physical and Mathematical) Science(s).

The federal government creates significant grant programs and contracting opportunities for engineering and computer science at Utah colleges and universities. The National Science Foundation (NSF) is a primary source of higher education research funding in these fields. In FY 2021, Utah colleges and universities received $79.8 million in NSF federal grants for research and teaching (see Figure 3.13). Of this amount, funding for computer science and engineering research was $31.0 million, or 38.8% of the total. Another $17.4 million (21.9%) went to instruction in computer science, engineering, and other

sciences. Depending on how much of the instruction funding was for engineering and computer science, computer science and engineering departments received between $31.0 million and $48.4 million in NSF grants.

Of the $48.4 million in NSF grants to Utah colleges and universities in FY 2021, public institutions received $45.1 million (93.1%), and Brigham Young University received the remaining $3.4 million (6.9%) (see Table 3.4). Nine out of ten public and private institutions received NSF grants for instruction in computer science, engineering and other sciences. Three institutions received grants for computer science research, and four institutions received grants for engineering research. The

Figure 3.13: NSF Grants to Utah's Postsecondary Institutions, FY 2021

(Millions of Dollars, Federal Funding From the National Science Foundation)

Instruction $17.4 (21.9%)
Engineering $15.1 (18.9%)
$79.8
Other Sciences $31.4 (39.3%)
Computer Science $15.9 (19.9%)
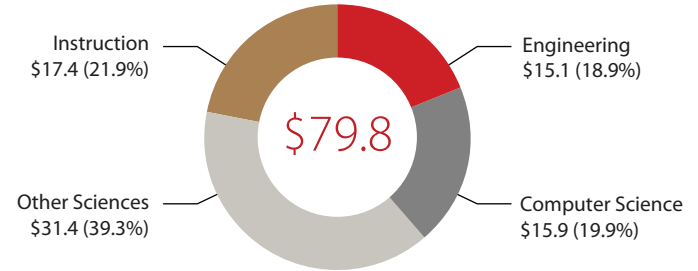
FY = Federal fiscal year ending October 31
Note: Except for Instruction grants, funding primarily supports academic research. Computer Science includes information sciences and computer engineering. Other Sciences include biological, mathematical, physical, earth, social and behavioral sciences. About 2% of the Other Sciences amount is for interdisciplinary research funding in computer science, engineering and other sciences. Instruction grants are primarily for undergraduate and graduate education. Besides engineering and computer science, they address teaching in other sciences.
Source: Kem C. Gardner Policy Institute analysis of data from USAspending.gov

Figure 3.12: Grants and Contracts for Engineering and Computer Science at Utah's Higher Education Institutions, FY 2021
(Millions of Dollars of Funding Received)
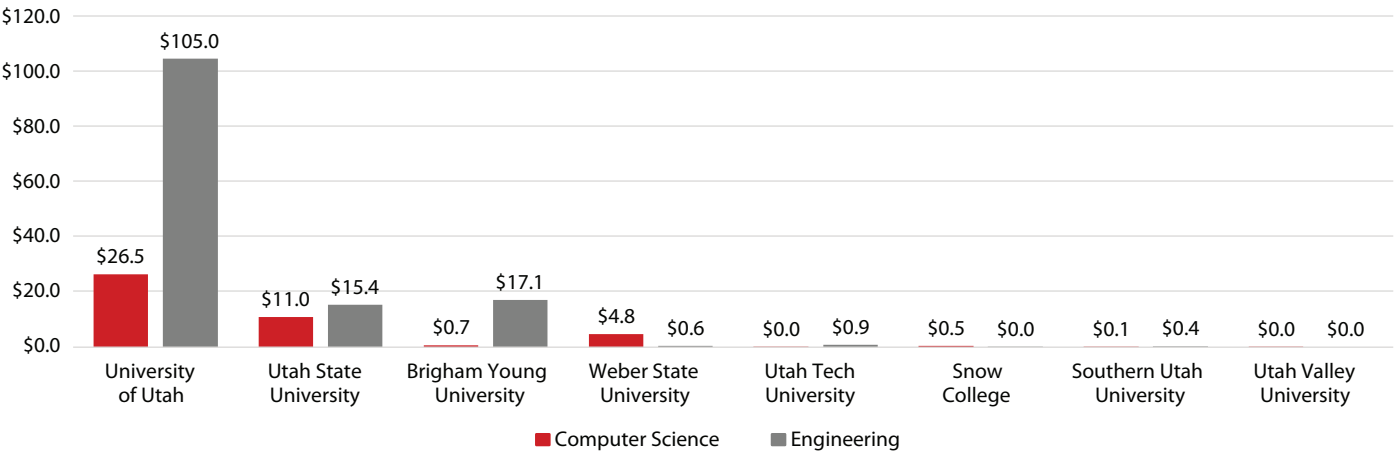
FY = State fiscal year ending June 30
Note: Computer science amounts were $18,000 for Utah Tech University and $11,730 for Utah Valley University. Engineering amounts were $37,826 for Snow College and $0 for Utah Valley University. Salt Lake Community College, Westminster College and Western Governors University could not report engineering or computer science amounts. See Table 3.3 for further details.
Source: Kem C. Gardner Policy Institute analysis of data from higher education institution responses to information requests

Table 3.3: Utah Higher Education Grants and Contracts, FY 2021

(Millions of Dollars in Funding Received)[1]

Institution	Engineering			Computer Science			All Colleges and Departments[2]		
	Amount	Share of All Institutions	Share of Institution	Amount	Share of All Institutions	Share of Institution	Amount	Share of All Institutions	Share of Institution
Public Institutions[3]									
University of Utah[4]	$105.0	75.3%	16.4%	$26.5	60.8%	4.1%	**$640.7**	**58.7%**	**100.0%**
Utah State University	$15.4	11.0%	5.3%	$11.0	25.3%	3.8%	**$290.7**	**26.6%**	**100.0%**
Weber State University	$0.6	0.4%	0.7%	$4.8	10.9%	5.9%	**$81.6**	**7.5%**	**100.0%**
Utah Tech University[5,6]	$0.9	0.7%	22.1%	$0.0	0.0%	0.4%	**$4.2**	**0.4%**	**100.0%**
Snow College[5,7]	$0.0	0.0%	NA	$0.5	1.2%	NA	**NA**	**NA**	**NA**
Southern Utah University	$0.4	0.3%	2.1%	$0.1	0.2%	0.4%	**$17.2**	**1.6%**	**100.0%**
Utah Valley University[5]	$0.0	0.0%	0.0%	$0.0	0.0%	0.1%	**$17.8**	**1.6%**	**100.0%**
Subtotal	**$122.2**	**87.7%**	**11.6%**	**$42.9**	**98.3%**	**4.1%**	**$1,052.2**	**96.5%**	**100.0%**
Private Institution[8]									
Brigham Young University[9]	$17.1	12.3%	44.4%	$0.7	1.7%	1.9%	**$38.5**	**3.5%**	**100.0%**
Total[2]	**$139.3**	**100.0%**	**12.8%**	**$43.6**	**100.0%**	**4.0%**	**$1,090.7**	**100.0%**	**100.0%**

FY = State fiscal year ending June 30

Notes:
1. While amounts primarily represent research awards, they may include any sponsored project or program for research, instruction, clinical, and public service.
2. Totals may not match exactly due to rounding.
3. Public institutions are in the Utah System of Higher Education. Salt Lake Community College could not report engineering or computer science amounts for this study.
4. University of Utah amounts include $62.0 million for the Energy and Geoscience Institute and $5.6 million for the Nora Eccles Harrison Cardiovascular Research and Training Institute under engineering, and $8.5 million for the Scientific Computing and Imaging Institute under computer science.
5. Three non-zero amounts rounded down to zero: computer science amounts of $18,000 at Utah Tech University and $11,730 at Utah Valley University, and Snow College's engineering amount of $37,826.
6. Utah Tech University's engineering amount represents a grant from the National Science Foundation for five years of STEM scholarships for instruction in engineering, computer science, mathematics and other sciences.
7. Snow College amounts do not include grant awards announced in June 2021 for funding to be received after FY 2021: $0.5 million related to engineering and $0.2 million in computer sciences.
8. Westminster College and Western Governors University could not report engineering or computer science amounts for this study.
9. Brigham Young University amounts are for the calendar year 2020, which has six months in FY 2020.

Source: Kem C. Gardner Policy Institute analysis of data from higher education institution responses to information requests

Table 3.4: NSF Grants for Engineering and Computer Science by Postsecondary Institution in Utah, FY 2021

(Millions of Dollars in Federal Funding for Research and Education From the National Science Foundation)

Institution[1]	Computer Science Research[2]		Engineering Research		Instruction[3]		Total	
	Amount	Share	Amount	Share	Amount	Share	Amount	Share
Public Institutions								
University of Utah	$13.9	87.6%	$7.0	46.6%	$6.8	39.0%	**$27.7**	**57.3%**
Utah State University	$1.1	7.2%	$6.6	43.7%	$2.7	15.5%	**$10.4**	**21.6%**
Utah Valley University	$0.0	0.0%	$0.0	0.0%	$2.5	14.4%	**$2.5**	**5.2%**
Weber State University	$0.0	0.0%	$0.0	0.0%	$1.2	6.7%	**$1.2**	**2.4%**
Salt Lake Community College	$0.0	0.0%	$0.0	0.0%	$1.0	5.7%	**$1.0**	**2.1%**
Utah Tech University	$0.0	0.0%	$0.0	0.0%	$0.9	5.4%	**$0.9**	**1.9%**
Bridgerland Technical College	$0.0	0.0%	$0.0	0.0%	$0.5	3.1%	**$0.5**	**1.1%**
Southern Utah University	$0.0	0.0%	$0.4	2.7%	$0.0	0.0%	**$0.4**	**0.9%**
Snow College	$0.0	0.0%	$0.0	0.0%	$0.3	1.7%	**$0.3**	**0.6%**
Subtotal	**$15.0**	**94.7%**	**$14.1**	**93.0%**	**$16.0**	**91.6%**	**$45.1**	**93.1%**
Private Institution								
Brigham Young University	$0.8	5.3%	$1.1	7.0%	$1.5	8.4%	**$3.4**	**6.9%**
Total	**$15.9**	**100.0%**	**$15.1**	**100.0%**	**$17.4**	**100.0%**	**$48.4**	**100.0%**

Note:
FY = Federal fiscal year ending October 31
1. Public institutions are in the Utah System of Higher Education.
2. Computer Science includes information sciences and computer engineering.
3. Instruction grants are primarily for undergraduate and graduate education. Besides engineering and computer science, they address teaching in other sciences.

Source: Kem C. Gardner Policy Institute analysis of data from USAspending.gov

Utah Science Technology and Research Initiative, 2006 to 2019

The Utah Science Technology and Research Initiative (USTAR), a technology-based economic development agency that operated from 2006 to 2019, facilitated research funding and technology commercialization.[28] USTAR received $175 million in one-time funds, intended to stimulate innovation in the biotechnology and bio manufacturing fields. General obligation capital bonds ($110 million) and federal funds ($50 million) provided $160 million of the $175 million investment and were used to finance the construction of facilities on the University of Utah and Utah State University campuses. Another $15 million from the General Fund was used to pay research teams and administrators.[29]

By 2012, Utah State University's Synthetic Biomanufacturing Facility and the University of Utah's James L. Sorenson Molecular Biotechnology Building were both operating, prompting an audit of USTAR by SRI International in 2014. SRI found that USTAR's resources would serve the state best by creating competitive grant funding for companies incubated through USTAR facilities.[30] These findings prompted the creation of the USTAR Innovation Center in Falcon Hill National Aerospace Research Park in 2017. SRI's report also spurred the creation of the Technology Acceleration Program Grant, the Industry Partnership Program Grant, and the University Technology Acceleration Grant, all of which provided capital for researchers and innovators in Utah.

In 2013, the Office of the Legislative Auditor General released a performance audit of USTAR. The audit found some of USTAR's reported revenues and jobs to be overstated and inaccurate.[31] In addition, the audit recommended improved oversight of research team funding, better oversight of research buildings, and improved administration and governance of operations. Other audits took place, including a follow-up audit by the Office of the Legislative Auditor General in 2016 which recommended improved data collection and reporting processes.[32]

From 2014 to 2018, the Legislature phased out USTAR's funding, transferring ownership of their facilities and principal research programs to the universities and research institutions where they resided. In 2019, USTAR's board was disbanded and the program dissolved. The University of Utah's James L. Sorenson Molecular Biotechnology Building continues to provide space for research and innovation in biotech and biosciences.[33] The USTAR Innovation Center near Hill Air Force Base came under Weber State University's ownership and is known today as the Northern Utah Accelerator.[34] Utah State University's Synthetic Biomanufacturing Facility is now owned and operated by Perfect Day, Inc., a California-based startup company.[35]

University of Utah, the state's Research I institution, received $27.7 million (57.3%), half of which was for computer science research. Meanwhile, Utah State University received $10.4 million (21.6%), nearly two-thirds of which funded engineering research. Finally, Utah Valley University received $2.5 million (5.2%) for instruction.

Federal defense agencies provide large amounts of engineering and computer science funding at Utah universities. In federal fiscal year 2021, the Department of Defense (DoD) and Department of Veterans Affairs (VA) awarded $34.5 million in grants and $313.1 million in contracts to three Utah universities (see Table 3.5). The University of Utah received the most grant funding at $27.9 million, and Utah State University received the most contract funding at $307.5 million. The DoD and VA awards were primarily for science and technology research with military applications. Amounts dedicated to engineering and computer science are not available independently from project funding in related fields, such as physics and social sciences.

Table 3.5: Defense Grants and Contracts to Postsecondary Institutions in Utah, FY 2021

(Millions of Dollars for Engineering, Computer Science, and Other Sciences)

Institution	Grants	Contracts	Total
Brigham Young University	$3.5	$0.6	**$4.1**
University of Utah	$27.9	$5.0	**$32.9**
Utah State University	$3.1	$307.5	**$310.6**
Total	**$34.5**	**$313.1**	**$347.6**

Note:
FY = Federal fiscal year ending October 31
Includes dollars obligated for prime awards and sub-awards from the U.S. Department of Defense and U.S. Department of Veterans Affairs. Grants and contracts primarily involve research in science and engineering. In addition, contracts include amounts for programming services and manufacturing related to information technology or advanced materials. Awards in the following categories were omitted because they were unlikely to include substantial engineering or computer science funding: grants for medical research, veterans services, and language programs; and contracts for tuition (largely not in STEM fields), chemical products, health care, lodging, and museums.
Source: Kem C. Gardner Policy Institute analysis of data from USAspending.gov

University Rankings, Diversity, and Social Mobility

USHE institutions strive to attract the brightest students from around the world and equip tomorrow's leaders in burgeoning fields. Understanding how Utah's higher education system compared with that of other states is necessary to improving key performance metrics. The most famous college comparison and ranking system in the United States is U.S. News and World Report's (USNWR) best colleges ranking. This ranking system is flawed, but influential. Because of their prominence, USNWR rankings are included in this report, but readers should interpret them with caution.

The most comprehensive ranking system available is the American Society for Engineering Education's (ASEE's) annual *Engineering and Engineering Technology By the Numbers* report.[36] These rankings are not well known to students but are highly regarded among faculty. ASEE's findings provide clear statistical rankings in individual engineering fields by race, ethnicity, and gender. The *By the Numbers* report should provide direction as to where new funds and strategies can be put in place by USHE institutions.

ABET Accreditation

Six Utah institutions of higher learning have programs certified by ABET, formerly known as the Accreditation Board for Engineering and Technology. These institutions are Brigham Young University, Southern Utah University, Utah State University, Utah Valley University, the University of Utah, and Weber State University. Accreditation by ABET is based on outcomes rather than curriculum. Students graduating from ABET accredited programs will "meet the quality standards of the profession for which that program prepares graduates."[37] Regardless of ranking by any other organization, students graduating with engineering degrees from the six previously mentioned institutions are likely highly qualified to work in their respective fields.

U.S. News and World Report Rankings

Currently, only three Utah universities are ranked in USNWR's National University rankings: Brigham Young University, the University of Utah, and Utah State University (see Table 3.6).[38] These three schools are also the only Utah institutions in USNWR's engineering school rankings: the University of Utah at 57, Brigham Young University at 102, and Utah State University at 116.[39]

These rankings have been controversial since their inception in 1983. Multiple schools have refused to participate in the rankings, citing issues with methodology and data collection. Most recently, the University of Southern California, a top-30 school in USNWR's estimation, pulled the Rossier School of Education from the graduate school rankings after discovering "a history of inaccuracies" by the publication.[40]

Table 3.6: University Rankings in Utah, 2022
(Ranking Among U.S. Universities)

Institution	College of Engineering	Entire University
University of Utah	57	99
Brigham Young University	102	79
Utah State University	116	249

Note: Nationwide rankings included three higher education institutions in Utah. Computer science programs are part of the College of Engineering at the University of Utah. Computer science is in the College of Science at Utah State University and in the College of Physical and Mathematical Sciences at Brigham Young University. U.S. News produced these 2023 engineering rankings in 2022 and these 2022 university rankings in 2021.
Source: U.S. News and World Report, National Universities and Best Engineering Schools

USNWR's ranking factors weight funding and reputation as 50% of an institution's placement on their list. Schools with larger endowments and actively donating alumni automatically receive a boost, creating a cycle which keeps the same institutions at the top of the rankings year after year. The reputation factor is calculated by peer reviews of other schools conducted by presidents, deans, and other high-ranking officials from colleges across the country. These administrators do not have to go to the campus of other schools, sit in on classes, or speak with students and faculty to contribute to the reputation ranking. USNWR weights selectivity (7% of ranking score) more heavily than social mobility (5% of ranking score) when evaluating colleges. These rankings favor established, wealthy, exclusive schools over universities whose mission may be quite different from what the USNWR gives weight to.

Many prospective college students still consider rankings, especially when evaluating highly selective universities.[41] Rankings are one way to assess academic reputation, the most common reason for choosing an institution according to first-year students nationwide in 2019. A jump in the rankings can attract a more qualified applicant pool. The simplest way to climb the U.S. News rankings is investing more in higher education. Faculty and student resources account for 30% of USNWR's rankings; graduation and retention rates account for another 30%; social mobility accounts for 5%; and graduate indebtedness accounts for 5%.[42] The latter three categories are directly affected by institution funding. Greater investment leads to more graduates who are likely to stay in Utah and join the engineering and tech workforces. A stronger tech sector would boost USHE graduates, potentially affecting reputation rankings.

ASEE Diversity Rankings

Future investment can be targeted to meet the needs of Utah's students and workforce. ASEE's report *Engineering and Engineering Technology By the Numbers* provides rankings on degrees awarded by discipline, gender, race, ethnicity, and residency.[43] ASEE's metrics are concrete and verified. Moving up in these rankings would create a larger, more qualified, and more diverse engineering workforce in Utah.

ASEE considers all 462 American institutions with ABET accredited programs in its rankings. Its rankings are not calculated through a formula, but rather by raw completions and percentages. Many of ASEE's rankings do not provide ratios relative to the larger student body regarding graduation rates by race, ethnicity, and gender. These rankings also do not account for the demographic makeup of state populations where most public institutions draw largely from in-state application pools. Even with these caveats, only one of Utah's ABET accredited programs cracked the top 50 institutions in any rankings regarding race, ethnicity, or gender. Utah State University ranks 42nd in the percentage of doctor's degrees awarded to students from underrepresented minority groups (6.5%). Brigham Young University and the University of Utah both rank highly in total degrees awarded and in funding categories, but are in the middle of the pack or below in diversity rankings.

Investments in areas with underrepresented minority groups help bolster strategic workforce segments and prepare Utah for future opportunities. Utah has one of the largest gender pay gaps in the United States, and minority representation in STEM fields remains poor in Utah and across the country. Engineering and computer science have much higher average salaries than the median Utah worker and are prime areas to create social mobility as job offerings continue to outpace graduation numbers.

Pell Recipients and Social Mobility

Low-income enrollment at USHE institutions can provide insight into educational access to individuals who are economically disadvantaged. Low-income students are more likely to be Black and Latino, and those numbers bear out in Pell eligibility. In the 2015–16 academic year, 72% of Black students received Pell grants compared to 34% of white students across the country.[44] This metric highlights changes in low-income enrollment over time. Unfortunately, this information was only available from the University of Utah at the time of publication.

Pell-eligible students at the University of Utah have steadily declined as a percentage of enrollment over the last 10 years. In 2011, 37% of undergraduate students were Pell-eligible, while only 26% of students had that same status in 2021. The College of Engineering experienced a similar decline, from a high of 35% in 2012 to a low of 23% in 2021. It is not known how many Pell-eligible students simply did not fill out their Free Application for Federal Student Aid (FAFSA) during this time. Investment in low-income student opportunities can boost graduation rates, address labor shortages, and enable sustained growth in the engineering and computer science fields.

Section 4. Workforce Profile

> *"Scientists study the world as it is; engineers create the world that has never been."*

– Theodore von Karman, Hungarian-American mathematician, aerospace engineer, and physicist[45]

Software developer, computer specialist, engineer, and a host of related occupations feature prominently among Utah's in-demand workforce segments of the 2020s. Computer science and engineering professionals are integral to over a dozen significant industries—from advanced manufacturing to finance to health care—as well as basic government operations. With their specialized experience and advanced education, people in these occupations earn well above industry and state averages. Demographic patterns in representation and pay suggest that these opportunities are not yet similarly accessible to women and some minority racial and ethnic groups. The performance of engineers and tech workers and their availability to Utah enterprises defines the career outcomes for people in these fields. Their productivity also yields long-run societal benefits: infrastructure development in communications, transportation and housing; innovation and leadership in the knowledge economy; and public health and sustainability.

Utah Employment and Wages

Based on its 84,370 employee jobs in 2020, Utah's engineering and computer science workforce is comparable to the administrative and waste services, and finance and insurance sectors (see Figure 4.1).[46] The state's workforce included 21,160 engineering jobs and 63,210 computer science jobs, roughly a one to three ratio (see Figure 4.2). Average annual wages in Utah were $96,600 for engineering jobs and $89,500 for computer science jobs, higher than the statewide average in all other occupations by 81.6% and 71.1%, respectively (see Figure 4.3). Occupational categories are based on science, technology, engineering, and mathematics (STEM) definitions from the U.S. Bureau of Labor Statistics.

Figure 4.1: Engineering and Computer Science Workforce Industry Comparison, 2020

(Number of Employee Jobs, Selected Industries)

Industry	Jobs
Professional & Technical Services	113,883
Accommodations & Food Services	113,236
Administrative & Waste Services	91,985
Engineering & Computer Science	84,370
Finance & Insurance	76,044
Transportation & Warehousing	63,479
Educational Services	56,574
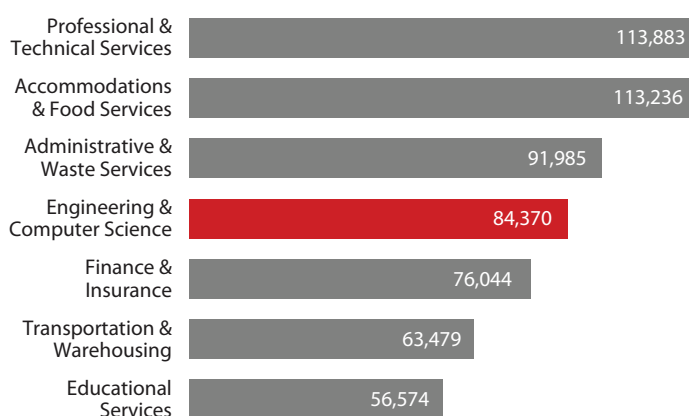
Note: Figure includes industries within 30,000 jobs of the engineering and computer science workforce selected from 22 sectors in the North American Industry Classification system, omitting "other services." Engineering and computer science workers are also present in industry sectors. Annual employment averages reflect COVID-19 pandemic employment effects. Self-employment is not included.
Source: U.S. Bureau of Economic Analysis, Full-Time and Part-Time Wage and Salary Employment by Industry

Figure 4.2: Utah Engineering and Computer Science Employment, May 2020

(Share of Statewide Total for Both Fields—84,370 Jobs)

25.1% Engineering (21,160 jobs)

74.9% Computer Science (63,210 jobs)
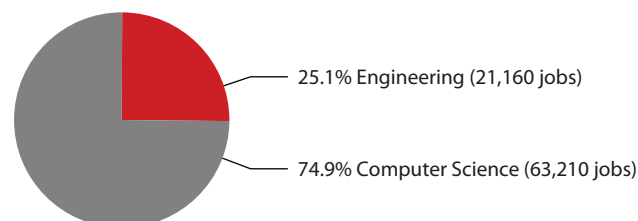
Note: Self-employment is not included (25,583 jobs). See Tables 4.1 and 4.2 for engineering and computer science definitions based on the Standard Occupation Classification System.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Bureau of Labor Statistics

Figure 4.3: Average Annual Wage Comparisons, May 2020

Occupation	Wage
Engineering	$96,600
Computer Science	$89,500
Other Occupations	$50,800
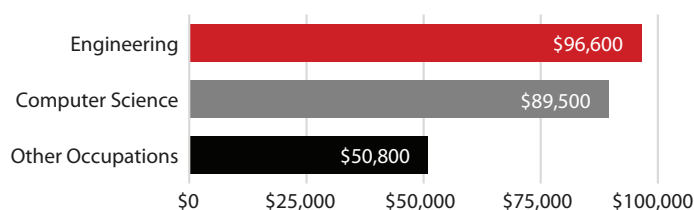
Note: The combined average for engineering and computer science occupations was $91,300.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Bureau of Labor Statistics

Table 4.1: Utah Employment and Wages in Engineering Occupations, May 2020

(2021 Dollars)

Code[1]	Occupation Title	Employment		Wages	
		Employee Jobs[2]	Share of Engineering Total	Average Annual Wage[3]	Percent Difference from State Average[4]
17-2141	Mechanical Engineers	3,260	15.4%	$94,200	+75.1%
17-2051	Civil Engineers	3,200	15.1%	$86,100	+60.0%
17-2112	Industrial Engineers	2,160	10.2%	$93,700	+74.2%
11-9041	Architectural and Engineering Managers	1,910	9.0%	$134,200	+149.4%
17-2071	Electrical Engineers	1,740	8.2%	$98,000	+82.2%
17-2199	Engineers, All Other	1,680	7.9%	$95,500	+77.5%
17-2072	Electronics Engineers, Except Computer	1,240	5.9%	$102,100	+89.8%
17-2061	Computer Hardware Engineers	900	4.3%	$115,700	+115.1%
17-3013	Mechanical Drafters	730	3.4%	$63,200	+17.5%
17-2111	Health and Safety Eng., Except Mining Safety Eng. and Inspectors	710	3.4%	$78,400	+45.7%
17-2081	Environmental Engineers	660	3.1%	$81,500	+51.5%
17-2011	Aerospace Engineers	580	2.7%	$106,000	+97.0%
17-2131	Materials Engineers	480	2.3%	$90,200	+67.7%
25-1032	Engineering Teachers, Postsecondary	430	2.0%	$114,000	+111.9%
17-2031	Bioengineers and Biomedical Engineers	400	1.9%	$81,600	+51.7%
41-9031	Sales Engineers	320	1.5%	$108,000	+100.7%
17-3012	Electrical and Electronics Drafters	220	1.0%	$69,200	+28.6%
17-2041	Chemical Engineers	180	0.9%	$80,500	+49.6%
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	180	0.9%	$86,200	+60.2%
17-2171	Petroleum Engineers	140	0.7%	$100,500	+86.8%
17-2161	Nuclear Engineers	40	0.2%	$145,500	+170.4%
Total	**All Engineering Occupations**	**21,160**	**100.0%**	**$96,600**	**+79.6%**

Notes:

1. Codes match the Standard Occupation Classification system. The Gardner Institute identified engineering occupations in the 2019 Science, Technology, Engineering, and Math (STEM) occupation definition from the U.S. Bureau of Labor Statistics.
2. Employee job totals do not include self-employment.
3. Wages are for employees and do not include benefits or self-employment income. Amounts rounded to the nearest $100 after adjusting for inflation using the nationwide consumer price index from the U.S. Bureau of Labor Statistics. Utah wage data is not available for two engineering occupations with no in-state employment reported in 2020: 17-2021 "Agricultural Engineers" and 17-2121 "Marine Engineers and Naval Architects."
4. State average for all occupations in Utah was $53,800.

Source: U.S. Bureau of Labor Statistics, National Occupational Employment and Wage Estimates

The federal 2018 Standard Occupation Classification (SOC) system includes 23 occupation titles for engineering and 20 occupation titles for computer science. In May 2020, mechanical and civil engineers were the most common engineering occupations. Utah employment in each was 3,200 or more jobs (see Table 4.1). The most common computer science jobs were software developers and software quality assurance analysts and testers, collectively 30.4% of the statewide total (see Table 4.2).

Utah wages vary considerably among engineering and computer science occupations. While earnings include benefits and self-employment income, most earnings are employee wages. In 2020, average engineering wages ranged from a low of $63,200 for mechanical drafters to a high of $145,500 for nuclear engineers, 17.5% to 170.4% higher than the statewide average for all occupations, respectively. These amounts are adjusted for inflation to 2021 dollars for comparability.

The range of average wages by occupation is wider for computer science than for engineering in Utah. In 2020, computer science ranged from a low of $40,800 for computer numerically controlled tool operators to a high of $142,800 for computer and information systems managers, 24.2% below to 165.4% above the statewide average for all occupations, respectively.

Table 4.2: Utah Employment and Wages in Computer Science Occupations, May 2020
(2021 Dollars)

Code[1]	Occupation Title	Employment		Wages	
		Employee Jobs[2]	Share of CS Total[3]	Average Annual Wage[4]	Percent Difference from State Average[5]
15-1252 & 15-1253	Software Developers and Quality Assurance Analysts and Testers	19,190	30.4%	$106,700	+98.3%
15-1232	Computer User Support Specialists	10,060	15.9%	$56,000	+4.1%
15-1299	Computer Occupations, All Other	7,590	12.0%	$82,700	+53.7%
11-3021	Computer and Information Systems Managers	4,790	7.6%	$142,800	+165.4%
15-1244	Network and Computer Systems Administrators	3,520	5.6%	$85,600	+59.1%
15-1211	Computer Systems Analysts	3,490	5.5%	$81,800	+52.0%
15-1254 & 15-1255	Web Developers and Digital Interface Designers	2,730	4.3%	$75,500	+40.3%
51-9161	Computer Numerically Controlled Tool Operators	2,340	3.7%	$40,800	-24.2%
15-1251	Computer Programmers	2,210	3.5%	$89,200	+65.8%
15-1242 & 15-1243	Database Administrators and Architects	1,920	3.0%	$97,300	+80.9%
15-1231	Computer Network Support Specialists	1,530	2.4%	$64,900	+20.6%
15-1241	Computer Network Architects	930	1.5%	$112,700	+109.5%
15-1212	Information Security Analysts	900	1.4%	$96,800	+79.9%
15-1221	Computer and Information Research Scientists	760	1.2%	$95,000	+76.6%
49-2011	Computer, Automated Teller, and Office Machine Repairers	550	0.9%	$64,100	+19.1%
25-1021	Computer Science Teachers, Postsecondary	430	0.7%	$116,000	+115.6%
51-9162	Computer Numerically Controlled Tool Programmers	270	0.4%	$63,800	+18.6%
Total	**All Computer Science Occupations**	**63,210**	**100.0%**	**$89,500**	**+66.4%**

Notes:
1. Codes match the federal Standard Occupation Classification (SOC) system. The Gardner Institute identified computer science occupations in the 2019 Science, Technology, Engineering, and Math (STEM) occupation definition from the U.S. Bureau of Labor Statistics. In 2020 data, employment and wages for three pairs of SOC codes were not available separately.
2. Employee job totals do not include self-employment.
3. CS = Computer science
4. Wages are for employees and do not include benefits or self-employment income. Amounts rounded to the nearest $100 after adjusting for inflation using the nationwide consumer price index from the U.S. Bureau of Labor Statistics.
5. State average for all occupations in Utah was $53,800.

Source: U.S. Bureau of Labor Statistics, National Occupational Employment and Wage Estimates

Employment Trends and Projections

From 2000 to 2020, Utah's engineering and computer science workforce doubled (see Figure 4.4). Employment in computer science occupations increased from 28,370 jobs in 2000 to 63,210 jobs in 2020, with temporary losses during recessions. Engineering employment also doubled, from 9,420 jobs to 21,160 jobs. These figures include employee jobs, not self-employment.

Utah's workforce has increasingly specialized in engineering and computer science occupations. Their combined share of employment rose from 3.6% in 2000 to 5.7% in 2020, with annual increases during 17 of those 20 years. In 2020, 4.2% of Utah employees were in computer science occupations, and 1.4% worked in engineering occupations (see Figures 4.5 and 4.6). Engineering's share in the state grew markedly from 2000 to 2008 and remained stable throughout, tracking closely with the U.S. share. Utah's computer science share, however, increased rapidly since 2011, departing from the moderate U.S. trend.

Figure 4.4: Utah Employment in Engineering and Computer Science Occupations, 2000–2020
(Number of Jobs in May)
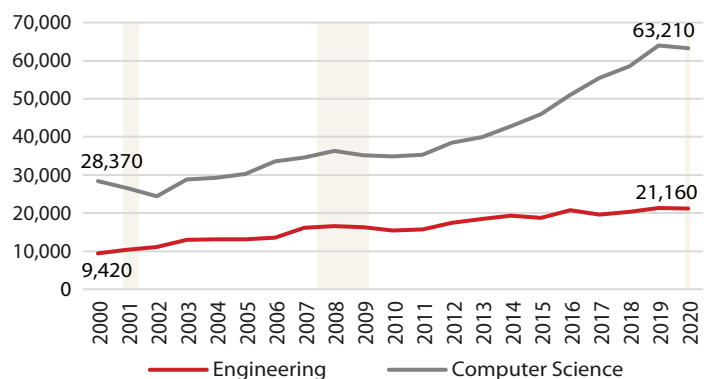
Note: Shaded areas indicate a U.S. recession. Employment labels are for 2000 and 2020.
Source: Kem C. Gardner Policy Institute analysis of sample data from the U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

Figure 4.5: Employment Shares for Engineering Occupations, 2000–2020

(Share of Statewide Employment in All Occupations)
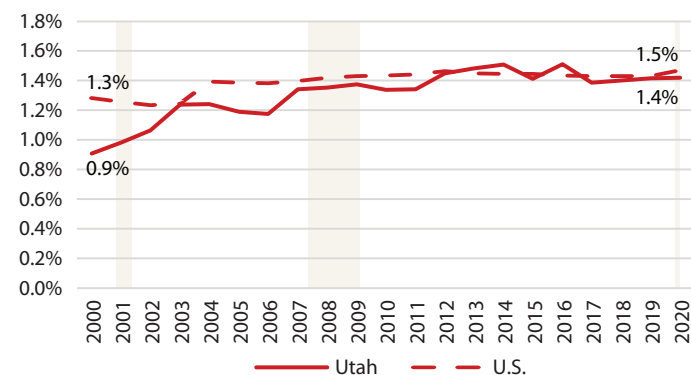
Note: Shaded areas indicate a U.S. recession. Labeled percentages are for 2000 and 2020.
Source: Kem C. Gardner Policy Institute analysis of sample data from the U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

Figure 4.6: Employment Shares for Computer Science Occupations, 2000–2020

(Share of Statewide Employment in All Occupations)
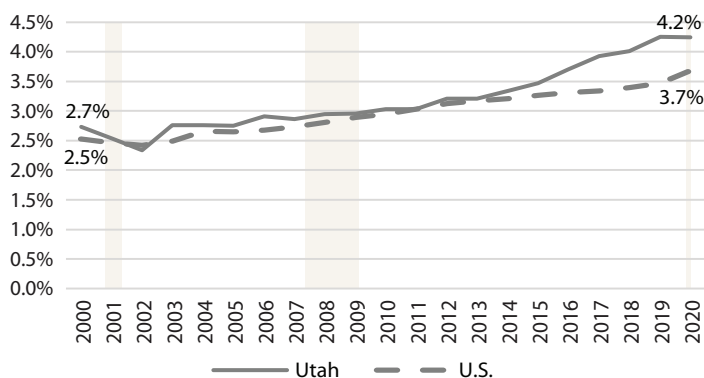
Note: Shaded areas indicate a U.S. recession. Employment labels are for 2000 and 2020.
Source: Kem C. Gardner Policy Institute analysis of sample data from the U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

A Utah employment index allows more direct trend comparisons between engineering, computer science, and other occupations. With U.S. and Utah employment levels in 2000 as a benchmark, engineering and computer science growth was comparable through 2020, each more than doubling. From 2000 to 2020, job growth in engineering occupations was a cumulative 124.6%, and computer science job growth reached a similar level at 122.8%, translating to index values above 220 (see Figure 4.7). Engineering employment rose fastest from the turn of the century to the onset of the Great Recession. During that period, the computer science employment trend was similar to that of other occupations, that is until tech growth accelerated in the 2010s.

Figure 4.7: Utah Employment Index, 2000–2020

(100 = Number of Jobs in 2000)
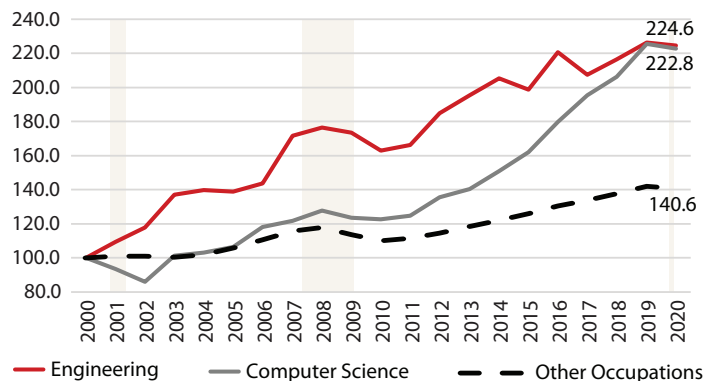
Note: Shaded areas indicate a U.S. recession. The indices track growth paths for employee jobs in May of each year, beginning in 2000 with 9,420 engineering jobs, 28,370 computer science jobs, and 999,110 jobs in other occupations.
Source: Kem C. Gardner Policy Institute analysis of sample data from the U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

Figure 4.8: Computer Science and Engineering Employment Indices, 2000–2020

(100 = Number of Jobs in 2000)
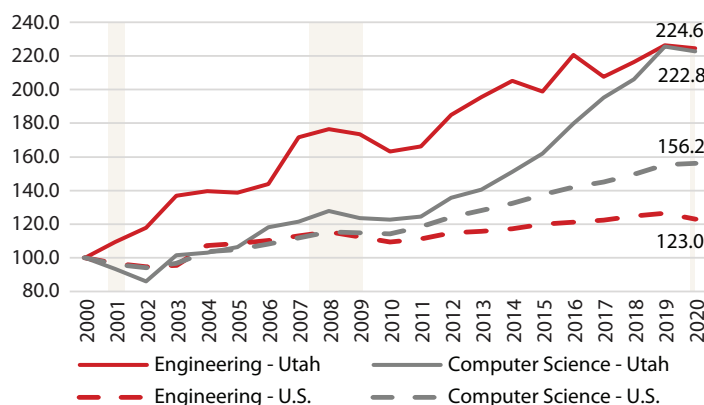
Note: Shaded areas indicate a U.S. recession. Indices track growth paths for employee jobs in May of each year, beginning in 2000 in Utah with 9,420 engineering jobs, 28,370 computer science jobs, and 999,110 jobs in other occupations. For the U.S., starting employment levels were 1.66 million engineering jobs, 3.28 million computer science jobs, and 124.79 million jobs in other occupations.
Source: Kem C. Gardner Policy Institute analysis of sample data from the U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

From 2001 to 2020, Utah employment in engineering and computer science occupations grew more quickly and more irregularly than average annual job growth. Average annual growth was 4.1% in both engineering and computer science jobs, well above the state's 1.7% average in other occupations. Combined, engineering and computer science job growth rates ranged from -3.6% to 17.9% per year, which compares favorably to the -3.7% to 4.7% range for other occupations.

Figure 4.9: Utah Earnings Growth by Occupation, 2000–2019
(Average Annual Percentage Change in Inflation-Adjusted Median Adult Earnings from Employment)
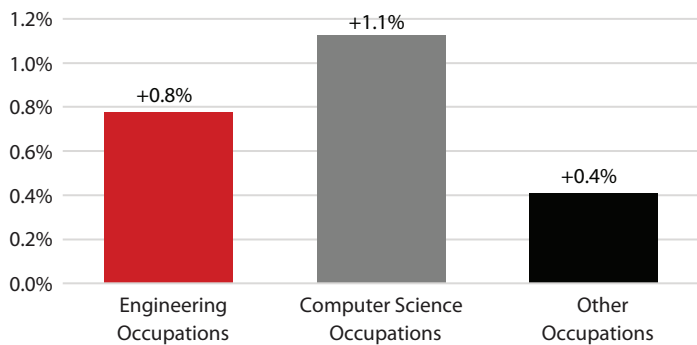
Note: Percent changes calculated as compound annual growth rates. Amounts adjusted for inflation using the nationwide consumer price index from the U.S. Bureau of Labor Statistics. See Figure A2 in Appendix B for median earnings during window years: 2000, 2005, 2010, 2015, and 2019.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figure 4.10: Growth Projections for Utah's Engineering and Computer Science Workforce, 2018 to 2028
(Average Annual Percent Change in Employment)
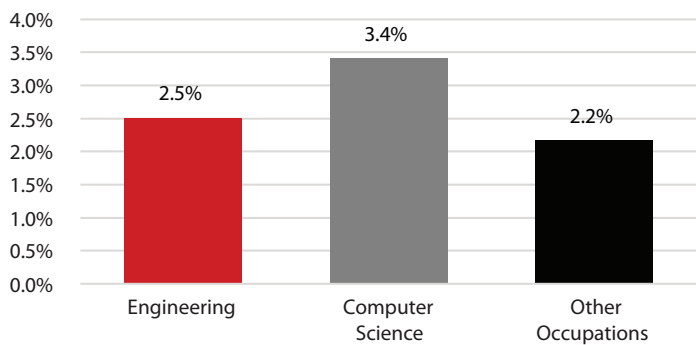
Note: Percent changes calculated as compound annual growth rates.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services, Utah Occupational Projections – Detailed Tables

Table 4.3: Projections for Utah's Engineering and Computer Science Workforce, 2018 to 2028

Occupation Group	Employment Level (Jobs)		Change from 2018 to 2028		
	2018 Actual	2028 Projected	Jobs	Cumulative Percent Change	Average Annual Percent Change
Engineering	22,510	28,830	6,320	28.1%	2.5%
Computer Science	42,290	59,130	16,840	39.8%	3.4%
Subtotal: Engineering and Computer Science	**64,800**	**87,960**	**23,160**	**35.7%**	**3.1%**
Other Occupations	1,513,620	1,875,390	361,770	23.9%	2.2%
Total: All Occupations	**1,578,420**	**1,963,350**	**384,930**	**24.4%**	**2.2%**

Note: Percent changes calculated as compound annual growth rates.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services, Utah Occupational Projections – Detailed Tables

Utah's growth in engineering and computer science professions surpasses national trends. From 2000 to 2020, cumulative Utah job growth in engineering occupations was more than five times the national average, and Utah job growth in computer science occupations more than doubled the national rate (see Figure 4.8). Engineering employment rose by 124.6% in Utah versus only 23.0% in the U.S., while computer science employment experienced a 122.8% increase in Utah compared with a 56.2% increase in the U.S.

Earnings for Utah workers in engineering and computer science have risen much more quickly than earnings for the adult workforce in other occupations. From 2000 to 2019, median annual earnings in engineering occupations increased by $12,400 in inflation-adjusted dollars, a 0.8% average annual increase from the $78,500 median in 2000 (see Figure 4.9). Computer science earnings rose even faster, increasing by $14,600 or 1.1% per year from $61,500. Meanwhile, adults in other occupations experienced a $2,700 or 0.4% increase in annual earnings.

Utah's 10-year workforce projections show strong demand continuing in engineering and computer science professions. Employers in the state may determine how much out-of-state hiring they require based on how much of their need for skilled workers can be met locally. Utah individuals and institutions have the opportunity to prepare for continued growth in hiring for these high-quality jobs.

The Utah Department of Workforce Services (DWS) projects the state's engineering and computer science workforce will grow at 3.1% per year through 2028, nearly one percentage point above Utah's average annual employment growth in other occupations (see Figure 4.10). At 3.4%, computer science growth is expected to exceed engineering growth of 2.5%.

DWS projections anticipate the creation of 23,160 jobs over 10 years, more than one-third of 2018 baseline employment levels in the two fields (see Table 4.3). New jobs include 6,320 in engineering and 16,840 in computer science. Projections are for employee jobs, not self-employment.

In 2020, USHE and selected private institutions awarded 2,587 engineering degrees and 2,309 computer science degrees. By 2028, more Utah graduates per year may be needed to fill jobs in these professions depending on variables such as out-of-state hiring, retirement and other attrition, and the share of Utah degree earners that work in-state after graduation.

The employment outlook for engineering, computer science, and related fields may have improved since 2018. In 2020, Utah had 35,035 job postings in tech occupations, an 18.8% increase from its 29,499 postings in 2018.[47] A noteworthy development for which the DWS projections do not specifically account is the $13.3 billion defense contract Northrop Grumman received in September of 2020.[48] The contract is expected to create 5,000 STEM jobs in Utah, half of them high-skill jobs.

From 2020 to 2030, the Computing Technology Industry Association (CompTIA) projects that Utah will have the highest tech occupation job growth rate of any state. Utah adding 27% to its tech employment would exceed the nationwide average growth rate of 15%.[49] CompTIA's analysis corroborates the DWS projection of 24.4%.

Industry Profile of Engineering and Computer Science Occupations

Strategic growth industries depend on Utah's growing engineering and computer sciences workforce, including all five industries the Governor's Office of Economic Opportunity targets: software and IT (tech), aerospace and defense, advanced manufacturing, life sciences and health care, and financial services. For example, computer science and engineering talent established Utah's tech industry, which provided 6.4% of the state's employment in 2018, a share that rose steadily since the early 2000s.[50] Job growth at tech companies, averaging 4.9% per year from 2008 to 2018, was more than double the average for other industries in the state (1.9%).[51] The industry is emerging from the COVID-19 pandemic with renewed job growth, during which many states experienced below-trend employment growth, while Utah's economy was less severely impacted.[52] On average, compensation at tech companies is 80% higher than at Utah companies in other industries. Tech-related business and worker spending generate an economic contribution of 18.0% of state GDP, nearly $30 billion in 2018, with benefits well beyond the tech industry. Over 80% of Utah employment in tech occupations is related to computer science or engineering.

The defense sector is another noteworthy strategic sector with a strong growth trajectory in Utah. Military installations, veteran services, and their suppliers are part of a statewide defense sector that provided 3.2% of Utah jobs in 2019.[53] Engineering and computer science professionals fill essential roles for federal contractors and the military.

Figure 4.11: Industry Profile of Utah's Engineering and Computer Science Workforce, 2020
(Share of Engineering or Computer Science Total Employment)
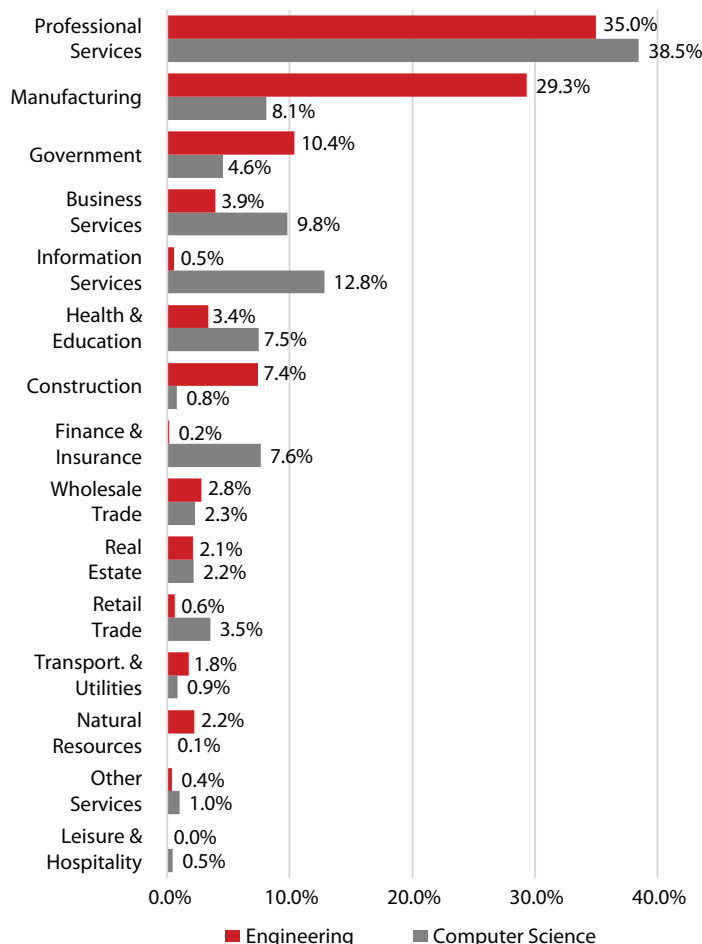
Note: Total employment was 25,863 engineering jobs and 84,090 computer science jobs for employees and self-employed workers. The note below Table 4.4 explains industry definitions.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services (Staffing Patterns Dataset)

In 2020, more than one-third of engineering jobs in Utah were in manufacturing (see Figure 4.11). Professional services and government were the next most common sectors for engineering employees, each comprising more than 10% of Utah's engineering workforce. The most common industries for computer science jobs were professional services, information services, and business services, which combined made up over 60% of Utah's computer science workforce. Results in this section include employees and self-employed workers.

The share of Utah's workforce in engineering occupations (1.3%) and computer science occupations (4.1%) varied widely by industry (see Table 4.4). Computer science workers held one in four information services jobs and nearly one in five professional services jobs in Utah during 2020. People in engineering occupations made up more than 2% of employment in three industries: professional services, manufacturing, and natural resources.

Table 4.4: Industry Profile of Utah's Engineering and Computer Science Workforce, 2020

Industry	Engineering Occupations			Computer Science Occupations		
	Jobs	Share of Engineering	Share of Industry	Jobs	Share of Computer Science	Share of Industry
Professional Services	9,042	35.0%	5.3%	32,362	38.5%	19.1%
Manufacturing	7,584	29.3%	5.2%	6,786	8.1%	4.7%
Government	2,680	10.4%	1.0%	3,840	4.6%	1.4%
Business Services	1,017	3.9%	0.7%	8,265	9.8%	5.6%
Information Services	141	0.5%	0.3%	10,767	12.8%	24.7%
Health & Education	868	3.4%	0.3%	6,289	7.5%	2.5%
Construction	1,922	7.4%	1.3%	673	0.8%	0.5%
Finance & Insurance	45	0.2%	0.0%	6,403	7.6%	4.6%
Wholesale Trade	718	2.8%	1.2%	1,907	2.3%	3.2%
Real Estate	540	2.1%	0.5%	1,814	2.2%	1.6%
Retail Trade	160	0.6%	0.1%	2,953	3.5%	1.4%
Transport. & Utilities	454	1.8%	0.5%	716	0.9%	0.8%
Natural Resources	576	2.2%	3.6%	61	0.1%	0.4%
Other Services	104	0.4%	0.1%	854	1.0%	0.8%
Leisure & Hospitality	12	0.0%	0.0%	399	0.5%	0.2%
Total	**25,863**	**100.0%**	**1.3%**	**84,090**	**100.0%**	**4.1%**

Note: Table includes employees and self-employed workers. Business services include management of companies and enterprises, administrative services, support, waste management, and remediation services. The health and education sector includes health care, social assistance, and private education. Public education is part of government. Leisure and hospitality include accommodation, food services, arts, entertainment, and recreation. Transportation and utilities also includes warehousing. Natural resources include agriculture, forestry, fishing, hunting, mining, oil, and gas.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services (Staffing Patterns Dataset)

Figure 4.12: Engineering and Computer Science Wages by Industry, 2020
(Average Employee Wage)
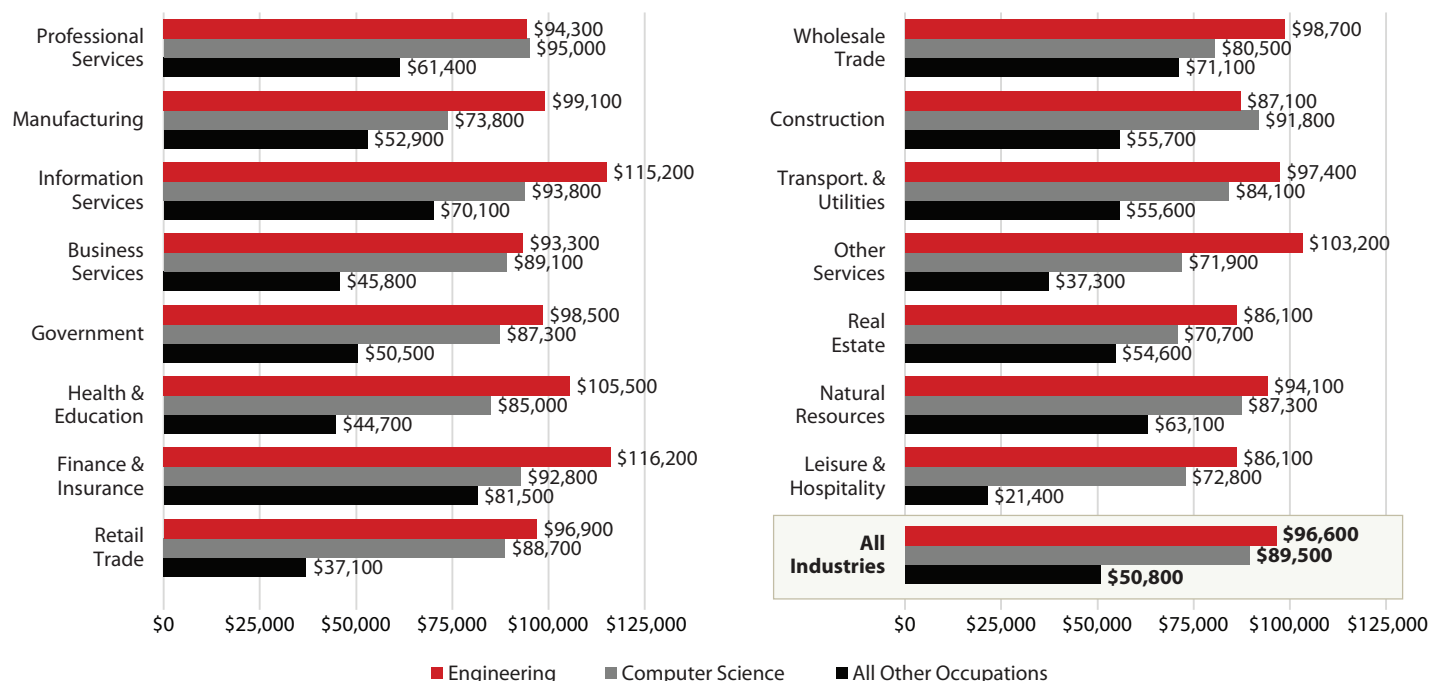
Note: Engineering and computer science wages are based on detailed occupation wages weighted by their Utah employment in an industry. The note below Table 4.4 explains industry definitions.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services (Staffing Patterns Dataset and Utah Economic Data Viewer)

Engineering and computer science jobs offered higher wages than other jobs in their respective industries (see Figure 4.12). In 2020, average wages across 15 Utah industries ranged from $86,100 to $116,200 for engineering occupations, $70,700 to $95,000, for computer science occupations, and $21,400 to $81,500 for all other occupations. The average engineering wage of $96,600 was nearly double the average wage for workers not in engineering or computer science occupations. The average computer science wage of $89,500 was 76.2% higher than for all other workers.

Educational Attainment

Utahns in engineering or computer science occupations are more highly educated than workers in other fields. More than two-thirds (67.5%) of people ages 25 and above working in computer science jobs have a bachelor's degree or higher, as do nearly four-fifths (79.9%) of the people ages 25 and above in the engineering workforce in the state (see Figure 4.13). These shares far exceed the 36.7% of Utah's workforce with a bachelor's degree or higher in occupations besides engineering and computer science.

In 2020, an estimated 84,370 Utah workers ages 25 and above worked in engineering or computer science occupations (see Table 4.5). About three-fourths (63,210 people) were in computer science, and the remaining one-fourth (21,160) were in engineering. The engineering workforce included over 1,000 people with a high school degree or less, over 3,200 people with some college or an associate degree, and nearly 17,000 people with a bachelor's degree or higher. Utah's computer science workforce included nearly 5,000 people with a high school degree or less, over 15,500 people with some college or an associate degree, and almost 42,700 people with a bachelor's degree or higher.

Workforce Demographics

Utah's engineering and computer science workforce includes many women and people of color, but gaps in representation and pay persist. In line with national trends, the diversity of Utah's population has steadily risen for decades, and the racial and ethnic minority share is projected to rise from 22% in 2020 to 35% in 2060 (see Figure 4.14).[54]

This section identifies job-related disparities by sex, race, and ethnicity without analyzing underlying causes. For example, employment shares and median earnings are not shown or adjusted here by demographic groups' occupational mix, job tenure, hours worked, educational background, age profile, or career breaks. The authors recognize that demographic patterns in individual outcomes may have causes both within

Figure 4.13: Educational Attainment of Utah's Engineering and Computer Science Workforce, 2020

(Share of Workers Ages 25 and Above)
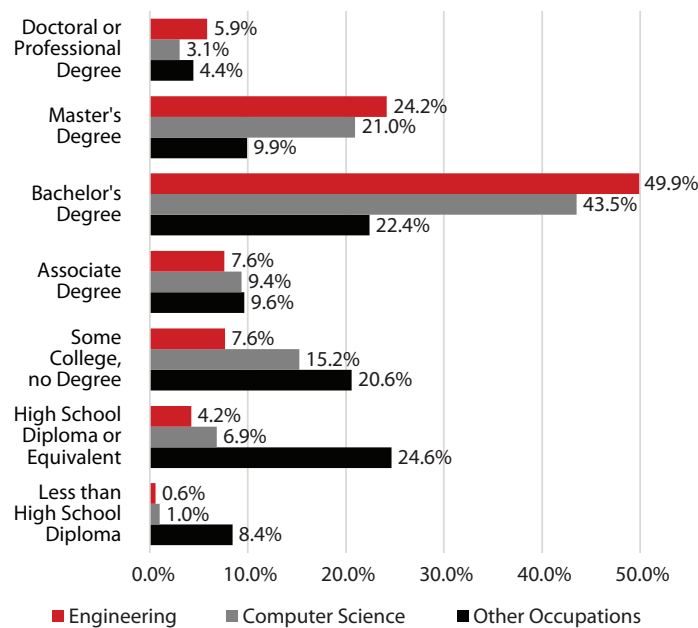
Note: For each occupation within a group, 2018–2019 shares for the U.S. applied to the Utah population reporting their primary occupation as of May 2020. Shares may not add to exactly 100% due to rounding.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Bureau of Labor Statistics (State Occupational Employment and Wage Estimates, May 2020; Table 5.3 Educational Attainment Distribution for Workers 25 Years and Older by Detailed Occupation, 2018–19)

and beyond engineering and computer science workplaces and classrooms. Career and life choices, circumstances, and opportunities contribute to observed Utah disparities in Census Bureau data on representation and pay.

Utah results for 2015 to 2019 in the workforce demographics section may poorly signal recent and ongoing progress with regards to diversity, inclusion, and equity. This section profiles Utah's workforce of all ages and backgrounds. Even the most recent cross-section reflects the aggregation of workers' individual experiences in the past, whether in Utah or outside the state. Meanwhile, emerging demographic shifts, economic

Table 4.5: Educational Attainment of Utah's Engineering and Computer Science Workforce, 2020

(Employed Individuals Ages 25 and Above)

Occupation Group	Less than High School Diploma	High School Diploma or Equivalent	Some College, no Degree	Associate Degree	Bachelor's Degree	Master's Degree	Doctoral or Professional Degree	Total
Engineering	126	893	1,617	1,610	10,561	5,114	1,238	**21,160**
Computer Science	634	4,334	9,634	5,911	27,519	13,248	1,931	**63,210**
Total	**760**	**5,227**	**11,251**	**7,521**	**38,080**	**18,361**	**3,169**	**84,370**
Share of Workforce	**0.6%**	**1.5%**	**3.7%**	**5.3%**	**10.8%**	**11.6%**	**4.8%**	**5.7%**

Note: For each occupation within a group, 2018–2019 shares for the U.S. applied to the Utah population reporting their primary occupation as of May 2020. Share of workforce equals the number of people ages 25 and above working in engineering or computer science occupations in Utah, divided by the Utah population with a given education level employed in any occupation.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Bureau of Labor Statistics (State Occupational Employment and Wage Estimates, May 2020; Table 5.3 Educational Attainment Distribution for Workers 25 Years and Older by Detailed Occupation, 2018–19)

Figure 4.14: Minority Population Shares, 1900–2060
(Population in a Racial or Ethnic Minority, All Ages)
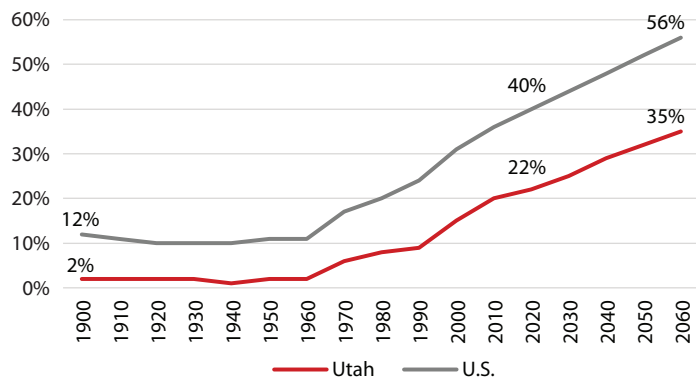
Note: Percentages after 2020 are projected. Minority shares include people identifying as Hispanic or Latino, or any race besides white.
Source: U.S. Census Bureau and Kem C. Gardner Policy Institute

Figure 4.15: Women in Utah's Engineering and Computer Science Workforce, 2015–2019
(Share of Adult Workers in Occupation Category)
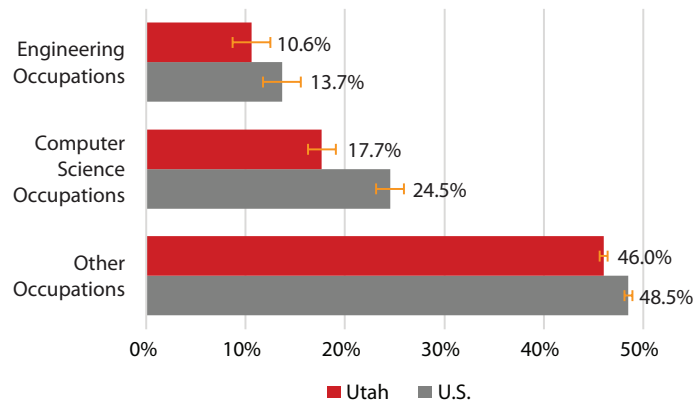
Note: Shares include employees and self-employed workers. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. Where orange-bar spans for two time periods or occupation groups do not overlap, we can say those values are different with 90% degree of confidence. For comparisons to the 2005–2009 period, see Figures A4 and A5 in Appendix B.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

trends, and policy decisions may depart from historical patterns. For example, significant investments in K–12 and higher education may improve participation and learning outcomes for girls, women, and students in minority racial and ethnic groups. However, only after decades will workforce employment shares and wage averages fully reveal the cumulative, long-term economic benefits to engineering and computer science workers and the broader economy from such educational investments.

Like women in other states, Utah women are underrepresented in engineering and computer science occupations. During the five years from 2015 to 2019, women made up only 10.6% of Utah's workforce in engineering occupations and 17.7% of its workforce in computer science occupations (see Figure 4.15). In contrast, women were 46.0% of the workforce in occupations

Figure 4.16: Racial and Ethnic Minority Groups in the Engineering and Computer Science Workforce, 2015–2019
(Share of Adult Workers in Occupation Category)
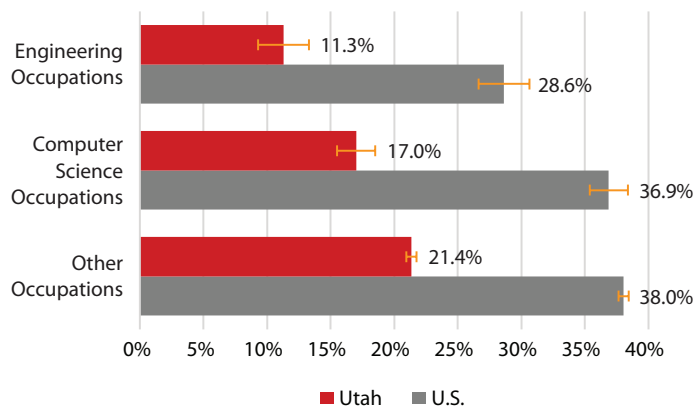
Note: Minority shares represent people who are Hispanic or Latino, or identify as any race other than white. Shares include employees and self-employed workers. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. For comparisons to the 2005–2009 period, see Figures A6 and A7 in Appendix B.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

besides engineering and computer science. Marked gender disparities were also prominent nationwide. Utah women's representation was 3.1 percentage points below U.S. women's 13.7% of the engineering workforce and 6.8 percentage points below the 24.5% U.S. share for computer science.[55] Outcomes for women and other demographic groups in this section represent both employees and self-employed workers.

People in minority race and ethnicity groups are commonly underrepresented in engineering and computer science jobs in Utah and nationwide. In recent years, minority disparities narrowed, primarily in computer science fields. Adults belonging to a racial or ethnic minority group made up only 11.3% of Utah's engineering workforce and 17.0% of its computer science workforce. Both shares were significantly lower than the 21.4% share for all other occupations in the state (see Figure 4.16). While the U.S. workforce has more racial and ethnic diversity than Utah, workers in engineering and computer science occupations nationwide are similarly less diverse than those in other occupations collectively.[56]

In U.S. Census Bureau data, "Hispanic or Latino" is considered an ethnicity, while the other groups are considered races. Except for "White, not Hispanic or Latino," estimates in this section include anyone in a race category, regardless of their ethnicity. Except for "Two or More Races," race groups are not multiracial.

Figure 4.17: Utah's Engineering and Computer Science Workforce by Minority Racial or Ethnic Group, 2015–2019

(Share of Adult Workers in Occupation Category)

Figure 4.18: U.S. Engineering and Computer Science Workforce by Minority Racial or Ethnic Group, 2015–2019

(Share of Adult Workers in Occupation Category)
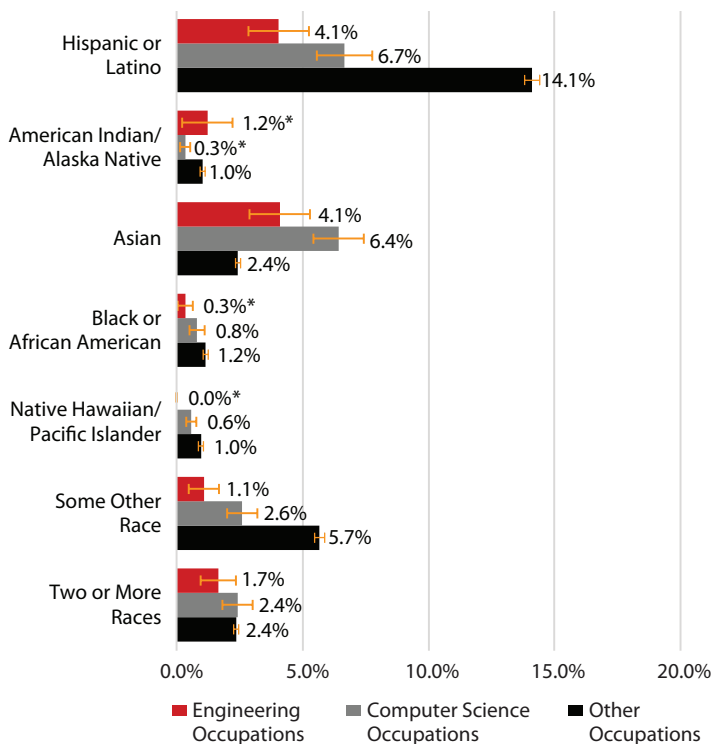
*Interpret results with added caution due to small sample size; fewer than 10 individuals from the subgroup in a sample of 72,659 Utah survey participants.
Note: Shares include employees and self-employed workers. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. "Some Other Race" includes people who identify as any race besides those shown or white.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

Note: Shares include employees and self-employed workers. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. "Some Other Race" includes people who identify as any race besides those shown or white.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

The participation of Utah workers from specific racial and ethnic groups in engineering and computer science jobs does not always match patterns observed for minority groups collectively. Most adult workforce percentages for a minority group shown in Figure 4.17 are lower for engineering and computer science than for other occupations. Most people in minority groups are collectively less likely than their peers to obtain relatively advanced, high-paying opportunities in engineering or computer science occupations. While small percentages and data limitations do not show significant differences for most groups, results for Hispanic or Latino workers are clear. Only 4.1% of adults with engineering occupations and 6.7% of adults in computer science occupations were Hispanic or Latino, less than half of the Hispanic or Latino share of the Utah workforce in all other occupations combined (14.1%). On the other hand, Asian workers were more likely to obtain engineering or computer science jobs than to enter

other occupations. Adult workforce shares for Asian workers were much higher in engineering (4.1%) and computer science (6.4%) than in other occupations (2.4%).

Utah is similar to the U.S. in Hispanic or Latino workers being less likely to find themselves in engineering and computer science jobs, with workforce shares less than half of their 17.7% nationwide share in other occupations from 2015 to 2019 (see Figure 4.18). Nationwide differences for three additional underrepresented minority racial and ethnic groups are statistically significant: American Indian or Alaska Native, Black or African American, and Some Other Race. For example, compared with Native American's 0.8% share of the workforce in other occupations, 0.4% of engineering workers and only 0.3% of computer science workers were Native American. Black workers made up 4.8% of workers in engineering jobs and 7.9% of computer science workers, well below the 12.5% in other occupations.

Figure 4.19. Utah Engineering and Computer Science Earnings by Demographic Group, 2015–2019

(Median Earnings for Adults; 2021 Dollars)

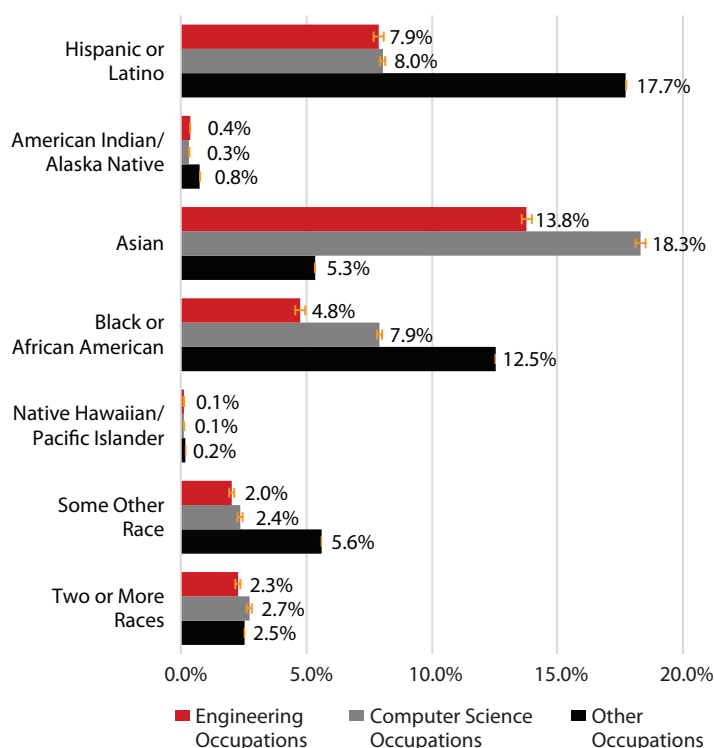Note: Earnings include employee wages and self-employment income. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. "Minority Race or Ethnicity" includes people who are Hispanic or Latino, or identify as any race other than white.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

Figure 4.20. U.S. Engineering and Computer Science Earnings by Demographic Group, 2015–2019

(Median Earnings for Adults; 2021 Dollars)

Note: Earnings include employee wages and self-employment income. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. "Minority Race or Ethnicity" includes people who are Hispanic or Latino, or identify as any race other than white.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series
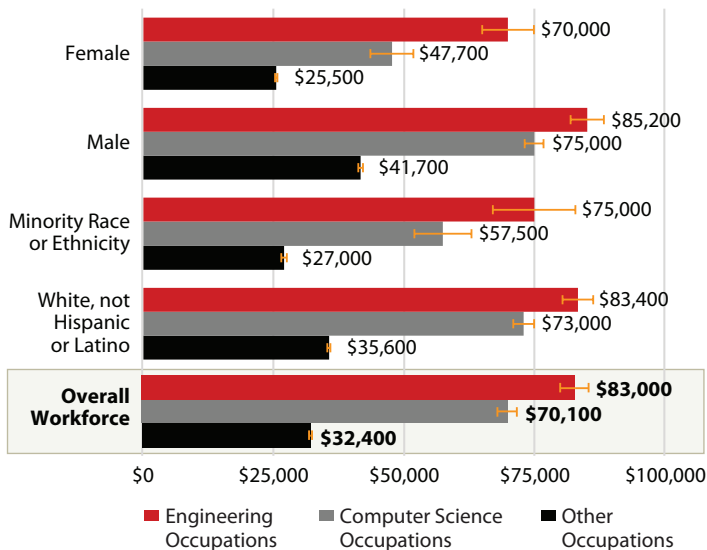
Besides occupational differences in workforce representation, Utah earnings also vary by demographic group. From 2015 to 2019, women in engineering jobs earned a median $70,000, 17.9% less than men ($85,200) (see Figure 4.19). The gender gap for computer science workers was more pronounced, with women earning 36.5% less than men ($47,700 versus $75,000). However, both percentage differences are smaller than the 39.0% gap for women in other occupations besides engineering and computer science.

Workers in a racial or ethnic minority group received median earnings of $75,000 in engineering and $57,500 in computer science, well below the $83,400 and $73,000 that white workers who are not Hispanic or Latino earned in the same

occupations, respectively. The U.S. engineering and computer science workforce also embodied significant median earnings disparities (see Figure 4.20). While disaggregated state-level data was limited, the highest-earning minority groups nationwide were Asian and white workers for both groups. In engineering, Black or African American workers had the lowest earnings of any distinct minority at 14.0% below the average for white workers. In computer science, American Indian and Alaska Native workers had the lowest earnings, 29.9% below the white average. Differentials were smaller for Native Hawaiians and Other Pacific Islanders. Compared with white workers, they earned 11.8% less in engineering jobs and 14.1% less in computer science jobs nationwide.

"Most of the major issues that face the country and the world, such as climate change, water availability, and energy security, need engineers to fix them."

– Philip Greenish, Former CEO, Royal Academy of Engineering[57]

To connect this study's higher education and workforce research, the Gardner Institute tracked the wages of engineering and computer science students after graduation. The results demonstrate the favorable returns on education investments in terms of personal income, both short- and long-term. However, this measure of the monetary value of engineering and computer science learning to someone in the field does not capture the broader economic benefits, let alone the accompanying technological and societal improvements.

For cohorts of graduates within the Utah System of Higher Education (USHE), the authors documented in-state wages for each individual working as an employee in Utah one, four, and eight years after earning their latest degree. The Utah Data Research Center (UDRC) made this methodology possible. The UDRC team, which was established by Utah legislation in 2017, has research expertise, privacy safeguards, and access to individual workforce, education, and health records.[58]

The period of wage analysis was from 2012 through 2020, beginning with cohorts of engineering and computer science students graduating during the 2011 calendar year. The authors tracked employee wages one year after graduation (2012 to 2020), four years after graduation (2015 to 2020), and eight years after graduation (2019 and 2020).

The data are complete based on the criteria, not a sample. However, they have other limitations. For example, self-employment income is not part of wages, and while time elapsed is a reasonable measure of work experience, outcomes were not adjusted for any time cohort members spent outside of the Utah labor force.

Utah Wages Post-Graduation

Figure 5.1 presents wages for graduates one, four, and eight years after graduation by their program of study. Unsurprisingly, more years of experience generally translates to higher wages in Utah. Even after adjusting for inflation, engineering and computer science graduates earned 31% more four years post-graduation than their first-year wages. Wages increased by 59% from the first year to eight years post-graduation. For all

Figure 5.1: Median Wages for Higher Education Graduates, 2012–2020

(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

Engineering
- 1 Year After Grad.: $58,752
- 4 Years After Grad.: $75,530
- 8 Years After Grad.: $92,034

Computer Science
- 1 Year After Grad.: $59,458
- 4 Years After Grad.: $81,061
- 8 Years After Grad.: $96,859

Engineering & Computer Science
- 1 Year After Grad.: $59,055
- 4 Years After Grad.: $77,504
- 8 Years After Grad.: $93,621

■ 1 Year After Grad. ■ 4 Years After Grad. ■ 8 Years After Grad.

Note: Students graduated from a public college or university in the Utah System of Higher Education (USHE). Combined results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Wages follow graduations that occurred from 2011 to 2019.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center, Utah System of Higher Education, and Utah Department of Workforce Services

Figure 5.2: Median Wages for Engineering and Computer Science Graduates by Degree Level, 2012–2020

(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

One Year After Graduation
- Associate: $40,407
- Bachelor's: $59,133
- Master's: $70,055
- Doctor's: $63,401

Four Years After Graduation
- Associate: $59,536
- Bachelor's: $76,998
- Master's: $90,389
- Doctor's: $96,930

Eight Years After Graduation
- Associate: $75,717
- Bachelor's: $93,710
- Master's: $104,508
- Doctor's: $108,616

Degree: ■ Associate ■ Bachelor's ■ Master's ■ Doctor's

Note: Students completed degrees at a public college or university in the Utah System of Higher Education (USHE). Combined results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Wages follow graduations that occurred from 2011 to 2019.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center, Utah System of Higher Education, and Utah Department of Workforce Services

three time periods, computer science jobs offered somewhat higher wages than engineering jobs. Engineering professionals one-year post-graduation earned nearly $20,000 more than the $38,875 median Utah wage for all occupations, education levels, and years of experience.[59] Meanwhile, computer science graduates started even higher at $59,458. Four and eight years after graduation, engineering and computer sciences graduates earned 1.9 to 2.5 times the state's median wage.

The expected pattern of higher wages rewarding more experience holds true for four higher education degree levels: associate, bachelor's, master's, and doctor's. Figure 5.2 presents the Utah wages of graduates with these engineering and computer science degrees one, four, and eight years after graduation. The earnings advantage of further education persisted over time. For example, the percentage difference in inflation-adjusted median wages post-graduation between

a bachelor's degree and an associate degree was 46.3% after one year, 29.3% after four years, and 23.8% after eight years. Master's degree holders earned 18.5% more than bachelor's degree holders one year after graduation and 11.5% more after eight years.

Table 5.1 presents wages for three time periods following graduation from a USHE engineering or computer science program. While some institutions had very low numbers of graduates with matching Utah employment and wage records, some general patterns are clear. Over any interval shown, those who graduated from the University of Utah and Utah State University make more at the median compared with other USHE institutions, in both engineering and computer science fields. Weber State University computer science graduates made above-average wages at all three intervals after graduation.

Table 5.1: Median Wages for Higher Education Graduates by Institution, 2012–2020
(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

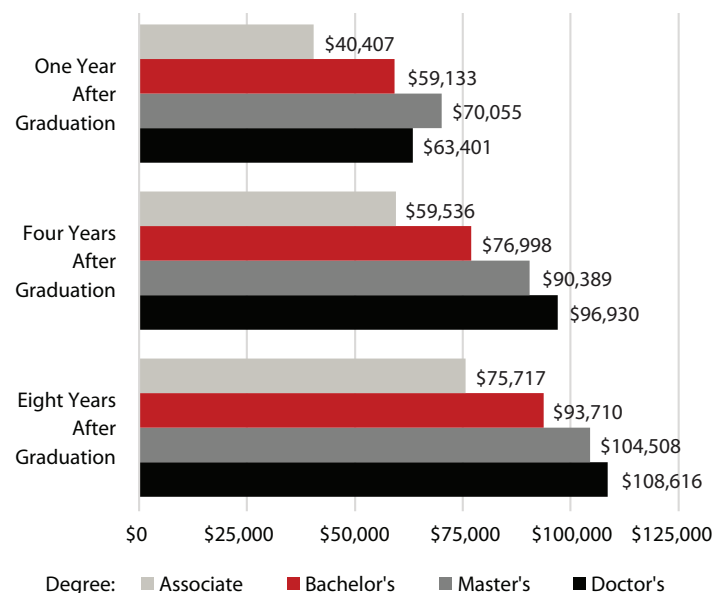| Program and Institution	One Year After Graduation		Four Years After Graduation		Eight Years After Graduation	
	Wage	Count	Wage	Count	Wage	Count
Engineering						
University of Utah	$63,456	2,674	$79,436	1,563	$101,374	487
Utah State University	$57,398	1,272	$74,456	743	$92,681	216
Utah Valley University	$55,646	563	$71,001	286	$80,451	69
Weber State University	$59,496	639	$75,277	414	$81,025	110
Salt Lake Community College	$40,747	283	$58,665	163	$72,138	58
Southern Utah University	$36,423	123	$56,933	89	$75,062	29
Utah Tech University	ND	4	ND	3	ND	1
Snow College	$14,038	50	$29,022	32	$3,213	5
All Institutions	*$58,715*	*5,608*	*$75,557*	*3,293*	*$92,133*	*975*
Computer Science						
University of Utah	$71,120	1,543	$98,207	831	$126,499	101
Utah State University	$59,257	939	$81,267	591	$103,577	155
Utah Valley University	$53,281	1,343	$70,987	842	$81,230	262
Weber State University	$60,813	820	$85,848	531	$102,310	177
Salt Lake Community College	$43,749	487	$62,451	273	$90,949	49
Southern Utah University	$52,163	110	$69,190	67	$81,974	21
Utah Tech University	$43,590	219	$62,030	147	$63,747	45
Snow College	$22,649	39	$46,044	26	ND	7
All Institutions	*$59,564*	*5,500*	*$81,108*	*3,308*	*$96,859*	*817*
Engineering and Computer Science, All Institutions	**$59,086**	**11,108**	**$77,531**	**6,601**	**$93,629**	**1,792**

ND = Not disclosed (fewer than 10 graduates)
Note: Combined results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual in the Utah System of Higher Education (USHE). Wages follow graduations that occurred from 2011 to 2019. Counts represent the number of graduates matched to a Utah employment record at some interval post-graduation. The total number of degrees USHE institutions during these years was higher than the number of matched graduate counts.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center, Utah System of Higher Education, and Utah Department of Workforce Services

Figure 5.3: Median Wages for Higher Education Graduates in Engineering and Computer Science by Gender, 2012–2020

(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

One Year After Graduation: Female $51,059, Male $59,816
Four Years After Graduation: Female $68,189, Male $78,517
Eight Years After Graduation: Female $71,170, Male $95,826

■ Female ■ Male

Note: Students graduated from a public college or university in the Utah System of Higher Education (USHE). Combined results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Wages follow graduations that occurred from 2011 to 2019.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center, Utah System of Higher Education, and Utah Department of Workforce Services

Demographic Patterns

The dataset UDRC created for this study includes demographic characteristics.[60] Women were vastly underrepresented among Utah employees who graduated from USHE institutions in engineering or computer science. One year after graduation, only 13% of Utah employees who completed academic programs in these fields were women. Figure 5.3 presents wages for Utah women in engineering and computer science jobs. Gardner Institute analysts identified a consistent gender wage gap that varied over graduates' careers. Women in engineering and computer science made 14.6% less than men one year after graduation. This gap narrowed to 13.2% after four years but widened to 25.7% after eight years. No accounting is available for time spent outside of Utah's employee workforce after graduation, which may vary by gender, race, and ethnicity.[61] Also, the occupation profiles for engineering and computer science graduates may have demographic patterns.[62]

Like women, people in racial and ethnic minority groups earned less than their peers with engineering and computer science degrees. While disparities for Utah minority workers collectively are smaller than for women, significant wage gaps remain for each time period compared with white graduates who are not Hispanic or Latino (see Figure 5.4). For example, four years after graduation, minority graduates earned 6.8% less than non-minority graduates. The spread is more significant for disaggregated minority groups (see Figure 5.5). For example, after four years, Native Hawaiian or Other Pacific Islander graduates earned 20.2% less than white graduates who are not Hispanic or Latino.

Figure 5.4: Median Wages for Engineering and Computer Science Graduates by Racial and Ethnic Minority Status, 2012–2020

(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

One Year After Graduation: Minority Race or Ethnicity $55,357, White and Not Hispanic or Latino $59,466
Four Years After Graduation: Minority Race or Ethnicity $72,455, White and Not Hispanic or Latino $77,709
Eight Years After Graduation: Minority Race or Ethnicity $85,169, White and Not Hispanic or Latino $93,836

■ Minority Race or Ethnicity ■ White and Not Hispanic or Latino

Note: Students completed engineering or computer science programs at a public college or university in the Utah System of Higher Education (USHE). Minority groups include people who are Hispanic or Latino, or identify as any race other than white. Combined results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Wages follow graduations that occurred from 2011 to 2019.
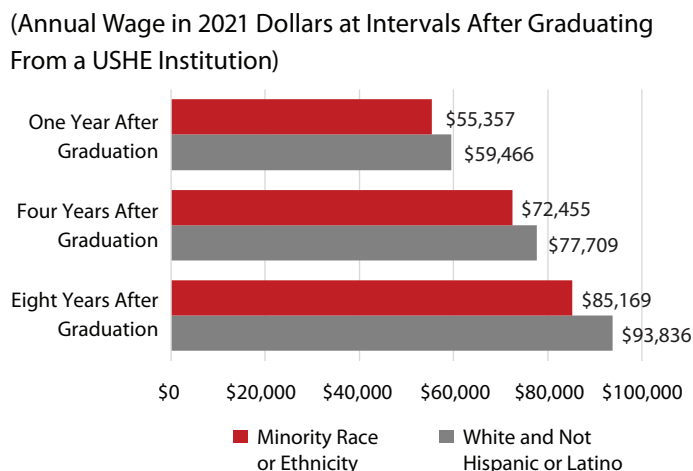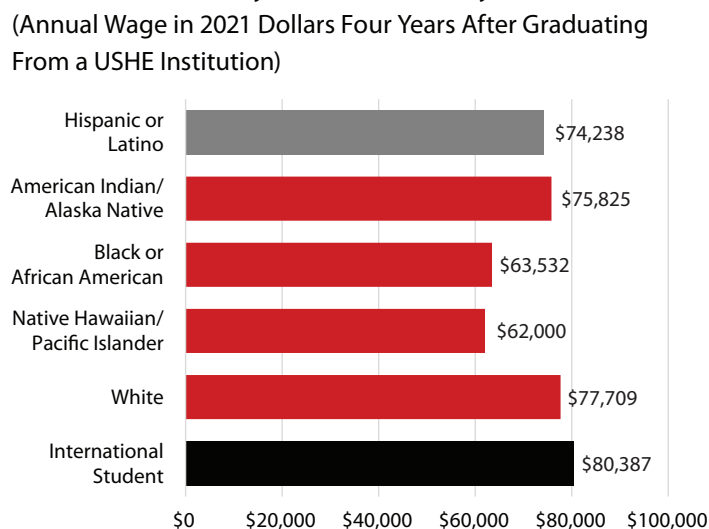Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center, Utah System of Higher Education, and Utah Department of Workforce Services

Figure 5.5: Median Wages for Engineering and Computer Science Graduates by Race and Ethnicity, 2015–2020

(Annual Wage in 2021 Dollars Four Years After Graduating From a USHE Institution)

Hispanic or Latino: $74,238
American Indian/Alaska Native: $75,825
Black or African American: $63,532
Native Hawaiian/Pacific Islander: $62,000
White: $77,709
International Student: $80,387

Note: Students completed engineering or computer science programs at a public college or university in the Utah System of Higher Education (USHE). In UDRC data, "Hispanic or Latino" is an ethnicity, and the following four bars are for race groups that do not include Hispanic or Latino graduates. International students completed their degrees in the U.S. on a visa or temporary basis. The data source refers to them as nonresident aliens. Combined results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Minority racial and ethnic groups each had 37 to 345 graduates, and there were 325 international students and 5,621 white non-minority students. Wages follow graduations that occurred from 2011 to 2016.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center, Utah System of Higher Education, and Utah Department of Workforce Services

Section 6. Potential Policy Options: Investing in the Utah Economy

Utah's innovative engineering and computer science workforce makes a substantial economic and societal impact on the state. This impact largely stems from the way Utah's public education system and institutions of higher learning support individual achievement over the long term. By continuing to invest in the training of talented engineering and computer science professionals, Utah leaders can build on the state's business advantages, bolster strategic industries, address societal needs, and expand people's economic horizons.

A variety of policy options to further Utah's engineering and computer science success are worthy of consideration by Utah policymakers, among them elected officials and those who administer public and higher education systems. Policy options include, but are not limited to, the following:

- **Higher education** – Continue to invest wisely in engineering and computer science workforce development at Utah's institutions of higher learning. Past investments have paid significant dividends to the state.

- **STEM in K–12** – Promote child and youth learning related to science, technology, engineering, and mathematics through increased investment in K–12 schools, industry partnerships, and public-higher education collaboration. Institutions of higher learning need Utah students to come to college ready for engineering and computer science classes.

- **Underrepresented groups** – Make targeted investments in the college and workplace success of people in underrepresented groups, particularly socio-economically disadvantaged Utahns. The data reveal there is still much progress to be made in this area.

- **Expand course offerings** – Appeal to more high school and college students by expanding course offerings to match students' academic and career goals. Invest in academic advising and applied learning programs beyond the classroom.

- **Adapt curricula** – Modify engineering and computer science curricula to accommodate a variety of learning styles and make stronger connections to real work. Give educators at all levels resources to better facilitate learner engagement, collaboration, and career readiness.

- **Family-friendly policies** – Support parents and children with policies that make it easier for parents to be in school and enter or re-enter engineering and computer science occupations.

Since Utah started its Engineering and Computer Science Initiative in 2001, the number of engineering and computer science college graduates in the state has more than doubled. Utah's current generation of leaders can build upon this success by adapting and augmenting ongoing efforts to invest in engineering and computer science workforce development.

Appendix A: Definitions and Research Methods

This section provides additional insight regarding how we conducted our analysis. We define key economic terms for conceptual clarity and then explain the additional context for education and workforce analysis and how we model economic contributions.

Definitions

- **Jobs** measure the annual average of full- and part-time jobs (not workers) counted equally. Both wage and salary positions and self-employed individuals are included.

- **Earnings** are the sum of wages and salary disbursements, employer-paid benefits and payroll taxes, and self-employed income. Earnings are reported by place of work.

- **GDP** is the most commonly used measure of total economic activity in a region, reflecting the market value of all goods and services produced in Utah. GDP avoids double counting intermediate sales, and captures only the "value-added" to final products by capital and labor. GDP is equal to total output less the value of intermediate inputs purchased to produce that output. In 2020, Utah's GDP amounted to nearly $200 billion dollars.

- **Self-Employed** 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.

- **Economic Contribution** is a broad measure of a firm, industry, or development's economic footprint in a region. Contributions are based on the length of local supply chains and the extent of household spending in the local economy. Contributions include local money that recirculates or is redistributed within the region.

- **Direct Effects** are the changes in economic activity within the region during the first round of spending. This study includes the direct engineering and computer science employment in the region.

- **Indirect Effects** are the changes in sales, labor income and employment within the region in backward-linked industries that supply goods and services to the business or industry under study. For example, indirect employment impact might include a fraction of the jobs at an accounting firm that provides services to a construction company that employs engineers.

- **Induced Effects** are the increased sales within the region from household spending of the income earned from the business or industry under study and supporting businesses. These arise, for example, when engineering and computer science employees spend their earnings to buy groceries, movie tickets or car repairs from in-state establishments.

- An **occupation** is a category of jobs that are similar in work patterns, training requirements, pay, and other characteristics. Occupations can be represented in one or more industries. For example, engineers work in manufacturing, transportation, and many other Utah industries. This analysis follows the **Standard Occupation Classification (SOC)** system used in government sources of U.S. economic data. Refer to Tables 4.1 and 4.2 in Section 4 for detailed lists of engineering and computer science occupations.

- **Industries** represent categories for grouping similar types of business establishments, primarily based on their product and service offerings. Industries may also be conglomerates of multiple industries.

- A **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.

- The **North American Industry Classification System (NAICS)** was developed by U.S., Canadian and Mexican statistical agencies as a way to classify business establishments into sectors based on their production methods. NAICS numbers range from two digits at the highest level of aggregation to six digits for the most detail.[63]

- **CIP Code** refers to the Classification of Instructional Programs (CIP) taxonomy of academic programs developed by the U.S. Department of Education. Colleges and universities assign CIP codes to their academic programs as well as their degrees, certificates, and courses.

- **Completions** consist of data on undergraduate and graduate degrees and certificates awarded by field of study, level of award, race or ethnicity, and gender. Completion years are 12-month periods beginning July 1 of the previous calendar year and ending June 30 of the current calendar year.

- A **cohort** is a group of individuals established for tracking purposes over time. For Section 5, on the labor market outcomes of graduates, the first cohorts include people who completed their last degree studying engineering or computer science in 2011. Cohorts also began in subsequent years, and wage outcomes were observed at multiple intervals after graduation.

- **Fiscal Year** refers to the state of Utah's 12-month accounting period, which begins July 1 of the previous year and ends June 30 of the current year. Higher education data on completions and funding in Sections 1 and 3 often follow the fiscal year.

Research Methods

This section describes data sources and analysis methods for the education, workforce, cohort, and economic analyses in the report.

Higher Education Analysis

The Integrated Postsecondary Education Data System (IPEDS) relies on integrated surveys conducted annually by the U.S. Department of Education's National Center for Education Statistics (NCES). NCES gathers information from every college, university, and technical and vocational institution participating in federal student financial aid programs.

Completions are a primary component of education outcomes. Each year, IPEDS collects the number of degrees and certificates awarded by field of study, award level, race or ethnicity, and gender. The reporting period begins July 1 of the previous calendar year and ends June 30 of the current calendar year. The 2019-20 academic year was the latest period of consistent IPEDS data available during the research period for this report.

In 2007, the U.S. Department of Education provided new guidelines on reporting student race and ethnicity. In response, institutions' IPEDS reporting distinguished between nine race and ethnicity categories, instead of seven—adding "Native Hawaiian or Other Pacific Islander" and "two or more races" groups. The Gardner Institute applied the latest IPEDS categories to completion data for all years analyzed.

The Classification of Instructional Programs (CIP) is a taxonomy of academic programs that the U.S. Department of Education developed.[64] Colleges and universities assign CIP codes to their programs of study. The Gardner Institute analyzed CIP codes 11, 14 and 15 to include all engineering and computer science degree programs in accordance with Utah legislation S. B. 61 establishing Utah's Engineering and Computer Science Initiative. Table A1 presents academic programs that are common in Utah within each of the three CIP categories.

Table A1: Engineering and Computer Science Academic Programs

Code	Description	Selected Programs of Study
11	Computer and Information Sciences and Support Services	- Computer and Information Sciences, General - Computer Programming - Information Sciences - Computer Science - Digital, Multimedia, and Information Resources Design - Computer Software and Media Applications, Other - Computer Systems Networking and Telecommunications - Computer and Information Systems Security (Cybersecurity) - Multimedia Management and Webmaster
14	Engineering	- Pre-Engineering - Engineering, General - Biomedical Engineering - Chemical Engineering - Civil Engineering - Computer Engineering - Computer Software Engineering - Electrical, Electronics, and Communications Engineering - Materials Engineering - Mechanical Engineering - Metallurgical Engineering - Mining and Mineral Engineering - Nuclear Engineering - Petroleum Engineering - Geological Engineering - Mechatronics, Robotics, and Automation Engineering
15	Engineering Technologies/ Technicians	- Robotics Technology - Aerospace Engineering Technology - Surveying and Mapping - Drafting and Design Technology - Architectural Drafting and CAD/CADD - Mechanical Drafting and CAD/CADD - Structural Design Engineering Technology

CAD = computer-aided drafting; CADD = computer-aided design and drafting
Note: Codes are based on the Classification of Instructional Programs (CIP) taxonomy. Programs selected include all programs for which either the University of Utah or Utah Valley University awards degrees.
Source: U.S. Department of Education, National Center for Education Statistics; universities in the Utah System of Higher Education (USHE), personal communication

Award levels included in the analysis are degree-type awards corresponding to IPEDS levels 3, 5, 7, 17, 18, and 19. The analysis does not include certificates, postbaccalaureate certificates, or post-master's certificates. Six degree descriptions are itemized below with their IPEDS levels noted in parentheses.[65]

- **Associate degree (3)** – "An award that normally requires at least 2 but less than 4 years of full-time equivalent college work."

- **Bachelor's degree or equivalent (5)** – "An award (baccalaureate or equivalent degree…) that normally requires at least 4 but not more than 5 years of full-time equivalent college-level work."

- **Master's degree (7)** – An award for a program of study that typically requires "… at least the full-time equivalent of 1 but not more than 2 academic years of work beyond the bachelor's degree."

- **Doctor's degree-research/scholarship (17)** – "A Ph.D. or other doctor's degree that requires advanced work beyond the master's level, including the preparation and defense of a dissertation based on original research, or the planning and execution of an original project demonstrating substantial artistic or scholarly achievement. Some examples of this type of degree may include Ed.D., D.M.A., D.B.A., D.Sc., D.A., [D.M., or] others, as designated by the awarding institution."

- **Doctor's degree-professional practice (18)** – "A doctor's degree that is conferred upon completion of a program providing the knowledge and skills for the recognition, credential, or license required for professional practice. The degree is awarded after a period of study such that the total time to the degree, including both pre-professional and professional preparation, equals at least six full-time equivalent academic years. [T]hese degrees … may include: Chiropractic (D.C. or D.C.M.); Dentistry (D.D.S. or D.M.D.); Law (J.D.); Medicine (M.D.); Optometry (O.D.); Osteopathic Medicine (D.O.); Pharmacy (Pharm.D.); Podiatry (D.P.M., Pod.D., D.P.); or, Veterinary Medicine (D.V.M.), and others, as designated by the awarding institution."

- **Doctor's degree-Other (19)** – "A doctor's degree that does not meet the definition of a doctor's degree-research/scholarship or a doctor's degree-professional practice."

Workforce Analysis

Researchers classified engineering and computer science occupations, estimated self-employment, and analyzed demographics using a variety of data sources.

Identifying Engineering and Computer Science Occupations and Industries

The federal 2018 Standard Occupation Classification (SOC) system includes 23 occupation titles for engineering and 20 occupation titles for computer science (see Tables 4.1 and 4.2 in Section 4). Using the most detailed SOC categories, the Gardner Institute identified engineering and computer science occupations in the 2019 Science, Technology, Engineering, and Math (STEM) occupation definition from the U.S. Bureau of Labor Statistics.[66] Engineering occupations include all SOC codes in 17-2000 (engineers), as well as 11-9041, 17-3012, 17-3013, 25-1032 and 41-9031. Computer Science occupations include all SOC codes in 15-1200 (computer occupations) plus 11-3021, 49-2011, 51-9161 and 51-9162. For historical results in this report, the Gardner Institute tracked changes in occupation

definitions from the 2018 SOC system to the legacy 2010 and 2000 SOC systems. The U.S. Bureau of Labor Statistics and Utah Department of Workforce Services (DWS) provide employment and wage data by occupation for most Utah employees. The U.S. Census Bureau provides employment and wage data by occupation, industry, educational attainment, and demographic characteristics for a 1% sample of all Utahns, including self-employed workers.

Knowing the industries where engineering and computer science professionals work is important to economic modeling and helps describe workforce needs. Preparing the industry profile of Utah's engineering and computer science jobs required another DWS dataset. Each company belongs to one industry based on the services and products it provides, but a company usually has employees in multiple occupations. DWS provides a "staffing pattern" matrix showing the number and share of detailed occupation categories in each three-digit NAICS industry. This approach provides actual engineering and computer science employment by industry for most Utah employees, and reasonable self-employment estimates.

Estimating Self-Employment

Self-employed individuals work at a company that they own either alone or as a partner. Employment data from the U.S. Bureau of Labor Statistics and Utah's Department of Workforce Services does not include self-employed data. The Gardner Institute estimated the number of self-employed engineers and computer scientists through an analysis of Utah employment data from the U.S. Bureau of Economic Analysis (BEA) that included self-employed workers. Researchers subtracted wage and salary employment from total employment to calculate the number and share of self-employed workers by industry. We applied self-employment shares to the number of engineering and computer science jobs in each industry. The Gardner Institute similarly estimated self-employed income using industry-specific Utah compensation and earnings ratios from BEA.

Analyzing Workforce Demographics

The American Community Survey (ACS) asks participants about their educational attainment and employment status; the occupation and industry where they work; wages, benefits and other income they received; and their identities in terms of sex, race and ethnicity. Each year, about 1% of Utah and U.S. residents respond to the Census Bureau's ACS questionnaires. The University of Minnesota compiles deidentified individual responses in its Integrated Public Use Microdata Series database.[67] A statistical weighting procedure makes each state's sample representative of the entire population, with intentional oversampling of less common sociodemographic groups. The most recent data year available with standard reliability was 2019 due to COVID-19 pandemic disruptions to the survey.

The 2019 ACS sample included 32,371 Utah responses, including 23,128 adults and 15,474 adult labor force participants. Responses included 315 people in engineering occupations, 820 people in computer science occupations and 21,993 people in other occupations. Further segmentation by educational attainment or demographic group could result in Utah sample sizes that are too small to generate low-uncertainty results. For example, only 10 adult computer science workers in the Utah sample had less than a high school diploma. Most results in this study represent five years of pooled data for roughly a 5% population sample. The 2015–2019 ACS included 70,486 employed Utah adults, 31,417 of whom were women. The smallest sample size for a major racial or ethnic group was for Utahns who were Native Hawaiian or Pacific Islander: 266 employed adults.

To convey the confidence readers can attach to results from ACS data samples, charts in the report provide margins of error. Based on replicate weights for a 90% confidence level, margins of error give the range above and below an estimate wherein the central tendency (e.g., average or median) is 90% likely to fall.

Graduates in the Workforce

The Gardner Institute created cohorts to track outcomes for graduates who completed either an engineering or computer science degree. Degree completion data was linked to individuals' wages one, four, and eight years after earning their latest degree in the Utah System of Higher Education (USHE). Since the most recent wage data was for 2020, the last four-year outcomes were for 2016 graduates, and the last eight-year outcomes were for 2012 graduates (see Table A1). The authors requested this data from the Utah Data Research Center (UDRC), a state-created research platform with access to individual workforce, education, and health data. (Table A2)

Sorting graduates into cohorts based on the year and program of study for their last degree attained—rather than their first—allowed the Gardner Institute to focus on people who were most likely to end up in engineering or computer science professions. Subsequent wage outcomes are thus associated with a person's most recent degree, often their highest degree, with any prior postsecondary and even K–12 learning implied. UDRC wage data is not available by occupation.

Some results in the report aggregate more than one cohort year to produce a cumulative wage average adjusted for inflation. For example, average wages in Figure 5.1 in Section 5 combine four-year outcomes for all six years available wages. Aggregating cohorts reveals patterns by smoothing annual variation and augmenting samples of graduates from each institution, program, degree level, and demographic group.

In the panel dataset from UDRC, the Gardner Institute tracked individual outcomes over time. Table A3 shows the count of graduate cohorts by year. The wages of 11,108 graduates were tracked from 2012 through 2019. Of the 11,108 individuals, 5,608 were engineering graduates and 5,500 were computer science graduates. For nondisclosure compliance, UDRC did not report outcomes for 10 graduates.

From 2011 to 2019, USHE institutions awarded 24,136 engineering or computer science degrees. UDRC compiled de-identified records for 16,054 graduates receiving these awards. As expected, the number of graduates in the dataset is lower than 24,136, and a primary reason is that some graduates earned multiple USHE degrees during these years. The dataset has one record per individual.

Starting with 16,054 graduates, UDRC matched 11,108 individuals to a Utah employment record from 2012 to 2020, one year after their graduation. These outcomes represent 69.2% of graduates in the dataset. The remaining 30.8% of graduates not present in one-year wage results include graduates who:

Table A2: Cohorts by Graduation Year, 2011–2019

Interval After Graduation	Cohort									Count
	2011	2012	2013	2014	2015	2016	2017	2018	2019	
One Year	■	■	■	■	■	■	■	■	■	10
Four Years	■	■	■	■	■	■				6
Eight Years	■	■								2

Note: Cohorts are labeled by how long after graduation wages were tracked. The most recent wage data was for 2020. Graduation years end on June 30.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center

Table A3: Higher Education Graduates by Program and Last Graduation Year, 2011–2019
(Number of Graduates by Academic Year, Utah System of Higher Education)

Academic Program	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Engineering	181	475	491	497	570	731	799	854	1,010	5,608
Computer Science	152	383	420	573	628	729	814	835	966	5,500
Total	333	858	911	1,070	1,198	1,460	1,613	1,689	1,976	11,108

Note: Table includes people with Utah wages one year after graduation. Graduates are assigned to cohort years based on their most recent associate, bachelor's, or graduate degree award from a USHE institution in years ending on June 30.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center

- Moved out of state the year after graduation

- Worked for the federal government or were self-employed, which UDRC does not track

- Chose not to be in the labor force—for example, to attend a non-USHE institution or for personal reasons

- Experienced unemployment throughout the calendar year

- Did not appear due to data availability or matching issues

Table A4 presents the dataset's retention rates by year for USHE graduates in its cohort results one, four, and eight years post-graduation. For engineering and computer science graduates from 2011 to 2017, individually matched employment and wage data after four years included 60.7% of graduates, 8.5 percentage points below the one-year retention rate of 69.2% of graduates.

Table A4: USHE Graduate Retention in Utah Workforce, 2011–2019

(Share of Engineering and Computer Science Graduates with Matched Employment at Intervals After Graduation)

Year of Graduation	Count Graduating	Interval After Graduation		
		One Year	Four Years	Eight Years
2011	476	70.0%	60.1%	58.2%
2012	1,273	67.4%	59.0%	57.9%
2013	1,345	67.7%	59.3%	57.8%
2014	1,553	68.9%	59.8%	NA
2015	1,793	66.8%	60.7%	NA
2016	2,115	69.0%	60.6%	NA
2017	2,322	69.5%	63.2%	NA
2018	2,412	70.0%	NA	NA
2019	2,765	71.5%	NA	NA
Average Share	**100.0%**	**69.2%**	**60.7%**	**57.9%**
Total Count	**16,054**	**11,108**	**6,601**	**1,792**

NA = Not applicable (employment and wage data past 2020 not available)
Note: Average shares are cohort retention percentages calculated only for years where employment data is available (years not labeled "NA"). The denominators are 16,054 for one-year intervals (all years), 10,877 for four-year intervals (2011 to 2017), and 3,094 for eight-year intervals (2011 to 2013). The number of graduates in the record count column represents 100% of the UDRC dataset of individuals with engineering and computer science degrees. Graduation years end on June 30.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Data Research Center (UDRC)

Modeling Economic Contributions

Model Description

The Gardner Institute used the 70-sector REMI PI+ version 2.5.0 to analyze the Utah engineering and computer science workforce. Researchers entered state-level occupational inputs by industry from the Department of Workforce Services data. REMI PI+, developed by Regional Economic Models, Inc., is a dynamic, multiregional simulation model that forecasts economic, population, and labor market activity for many years into the future. REMI provides year-by-year estimates of the regional effects of specific economic or policy changes. The model incorporates input-output relationships, general equilibrium effects, econometric relationships, and economic geography effects.

Inputs and Model Calibration

The Gardner Institute tailored economic data inputs and REMI software to achieve research objectives. Primary inputs included Utah employment by industry in 2020 for engineering and computer science jobs, including most employees and self-employed workers. Industry employment data did not indicate whether federal employees were military personnel or civilians, but average wages and REMI impacts are different for the two types of employees. The authors assigned federal jobs to military and federal civilian categories based on Utah ratios of 70% and 30%, respectively, in 2020 data from the U.S. Bureau of Economic Analysis (BEA). This assumes engineering and computer science workers are distributed similarly to military personnel and federal civilians in other occupations. The authors modeled military employment as active duty.

Average wages in engineering and computer science occupations tend to be higher than average wages for the industries where these professionals work. The authors adjusted industry wages in REMI to reflect average Utah pay from the U.S. Bureau of Labor Statistics for specific engineering and computer science occupations present in each industry. Since comparable occupation-level data was not available for self-employment income, the authors used BEA industry averages for Utah. This understates engineering and computer science workers' self-employment income if they earned more than other self-employed workers in their three-digit NAICS industry.

REMI inputs and results were for the 2020 calendar year, while the model was based on Utah and U.S. data through 2019. Although later adjustments for pandemic effects were available, we did not apply them in order to make our analysis more representative of a typical year and more comparable to other research.

Multipliers

Economic contribution analysis provides context for how vast and interconnected Utah's engineering and computer science workforce is with the rest of the state's economy. This population's influence in Utah is multifaceted and nuanced, and multiplier estimates tend to be substantial and fairly accurate. Economists refer to economic multipliers to reference the additional economic activity generated and supported by the direct effects of an event, firm, or other variable—in this case, Utah's 109,953 engineering and computer science workers in 2020. The multiplier effect calculation is the ratio of direct effects to total economic contribution. Common units of analysis are jobs, earnings in dollars, or GDP in dollars.
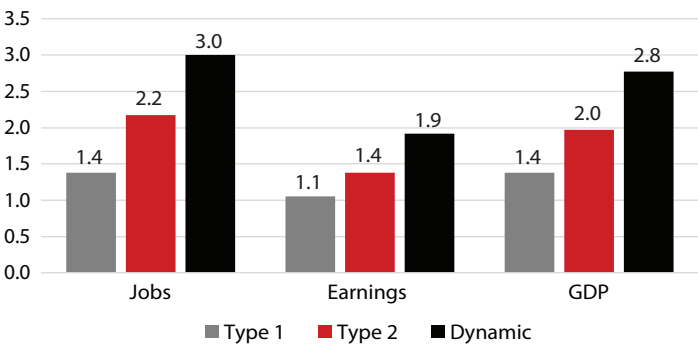
$$Multiplier \ Effect = \frac{Direct \ Effects}{Total \ Economic \ Contribution}$$

Several economic modeling packages are available to estimate multipliers, such as RIMS II, IMPLAN, and REMI. Even with the same inputs, the multiplier effect can vary based on analysis platform and modeling choices. There are three levels of economic modeling, each more comprehensive than the one before: Type 1 (direct and indirect effects), Type 2 (direct, indirect, and induced effects), and Dynamic (direct, indirect, induced, and dynamic effects). The Gardner Institute reviewed comparable economic contribution studies for engineering and STEM sectors and found that multipliers can range from 1.8 to 3.0.[68] The studies did not use Type 1 multipliers because they omit induced effects from household consumption. Type 2 modeling was most common in the literature, but dynamic modeling is the most comprehensive. Dynamic modeling includes population and demand changes from economic migration and other market effects beyond input-output connections.

REMI employment, earnings, and GDP multipliers for Utah's engineering and computer science workforce using these three types of models ranged from 1.1 to 3.0 (see Figure A1). Multipliers ranged from 1.4 to 3.0 for employment, 1.1 to 1.9 for earnings, and 1.4 to 2.8 for GDP, depending on the model. The Type 2 and Dynamic numbers are similar to multipliers in other contribution studies analyzing engineering and STEM sectors. The Gardner Institute used Type 2 results for the results in Section 2. Using the full REMI model with its dynamic capabilities increases the multiplier, for example, from 2.2 to 3.0 for employment. We chose the Type 2 approach to remain conservative and comparable to other studies.

Figure A1: Multiplier Effects of Utah's Engineering and Computer Science Workforce, 2020

Note: Multiplier effects are based on total economic contributions for employment.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah Department of Workforce Services (personal communication, Staffing Patterns Matrix) and U.S. Bureau of Economic Analysis (Interactive Data Tables, Annual Personal Income and Employment by State) using the REMI PI+ model

Contributions Versus Impacts

Economic impacts occur when new money enters a region from outside: for example, sales of locally manufactured goods to out-of-state customers or federal government contracts to conduct research at local universities. An economic impact is created when out-of-state firms relocate to Utah because of its engineering and computer science talent, and when this skilled workforce helps retain existing firms that otherwise would have left the state or gone out of business.

Economic contributions are a broader measure of a firm, industry, or development's economic footprint in a region. Both impacts and contributions are based on the length of local supply chains and the extent of household spending in the local economy. However, while impacts depend on new money entering a region, contributions include local money that recirculates or is redistributed within the region.

The economic impacts of the engineering and computer science workforce derive from the number of firms relocating to, or remaining in, Utah—and the ensuing jobs and investments—because of the existing engineering and computer science workforce. To the extent that firms employing engineering and computer science professionals move elsewhere within the state, economic activity is simply redistributed. However, to the extent that a highly educated engineering and computer science workforce provided by Utah higher education institutions attracts firms that otherwise would not have come to Utah—or retains companies who would have otherwise left—new economic activity and impacts are generated for the state.

The total economic contributions of the engineering and computer science workforce include 238,419 full- and part-time jobs, $19.1 billion in earnings, and $25.2 billion in GDP for the state of Utah. Within this contribution lies the economic impact (new dollars that enter the region); however, determining the size of the impact would require further data.

Appendix B: Supplemental Data

This section provides additional detail on engineering and computer science outcomes in Utah's higher education system and workforce.

Higher Education

Tables A5 and A6 show the annual number of degrees Utah colleges and universities awarded from 2000 to 2020, including eight institutions in the Utah System of Higher Education and up to four private institutions.

Workforce Profile

Figures A2 and A3 document changes over time in inflation-adjusted median earnings in Utah and the U.S. for engineering and computer science occupations. The U.S. Census Bureau's 1% sample of individuals in the workforce shows their earnings generally increased over time. The Great Recession affected wages in 2010. Non-overlapping confidence intervals indicate statistically significant differences.

Table A5: Engineering Degree Completions by Higher Education Institution, 2000–2020

Year	Univ. of Utah	Utah State Univ.	Utah Valley Univ.	Weber State Univ.	Salt Lake Community College	Southern Utah Univ.	Snow College	Utah Tech Univ.	USHE Total	Brigham Young University	Grand Total
2000	325	310	40	78	59	18	24	11	**865**	511	**1,376**
2001	311	272	39	101	63	15	21	10	**832**	569	**1,401**
2002	360	247	51	102	77	12	19	8	**876**	635	**1,511**
2003	414	332	97	133	124	17	23	21	**1,161**	579	**1,740**
2004	489	368	88	143	103	21	32	18	**1,262**	531	**1,793**
2005	510	390	98	139	117	23	29	19	**1,325**	532	**1,857**
2006	542	384	65	125	120	24	30	8	**1,298**	600	**1,898**
2007	516	318	53	129	108	20	25	10	**1,179**	549	**1,728**
2008	518	330	56	116	102	16	26	4	**1,168**	493	**1,661**
2009	568	279	77	112	165	27	24	6	**1,258**	512	**1,770**
2010	538	328	75	130	128	29	27	4	**1,259**	516	**1,775**
2011	577	366	96	122	118	34	23	2	**1,338**	552	**1,890**
2012	609	343	90	151	131	31	29	2	**1,386**	596	**1,982**
2013	645	313	83	126	95	29	23	1	**1,315**	593	**1,908**
2014	622	324	94	116	101	28	22	1	**1,308**	542	**1,850**
2015	700	354	80	225	122	35	37	1	**1,554**	616	**2,170**
2016	719	397	128	200	106	39	35	1	**1,625**	584	**2,209**
2017	801	415	150	199	97	48	32	1	**1,743**	551	**2,294**
2018	804	430	189	181	67	29	30	0	**1,730**	602	**2,332**
2019	837	458	175	225	97	43	23	0	**1,858**	635	**2,493**
2020	805	497	256	198	88	59	52	3	**1,958**	629	**2,587**

Note: Completions include associate, bachelor's, and graduate degrees awarded in years ending June 30. Western Governor's University, Ensign College, and Westminster College did not award engineering degrees.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System
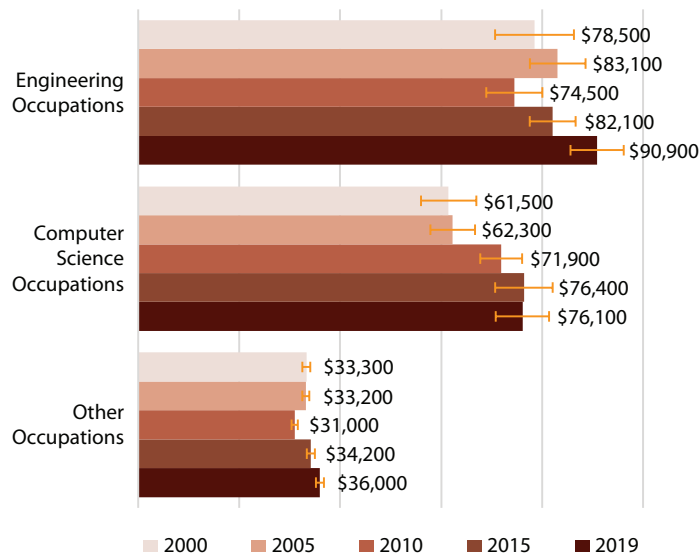
Table A6: Computer Science Degree Completions by Higher Education Institution, 2000–2020

| Year | Utah System of Higher Education (USHE) Institutions | | | | | | | | | Selected Private Institutions | | | | Grand Total |
	Univ. of Utah	Utah State Univ.	Utah Valley Univ.	Weber State Univ.	Salt Lake Comm. College	Southern Utah Univ.	Snow College	Utah Tech Univ.	USHE Total	Brigham Young Univ.	Western Governors Univ.	Ensign College	West-minster College	
2000	86	221	46	162	63	44	24	31	**677**	148	0	0	17	**842**
2001	80	265	44	142	55	34	20	40	**680**	147	0	0	11	**838**
2002	93	231	109	165	91	56	24	50	**819**	158	1	1	18	**997**
2003	102	180	121	178	96	44	13	68	**802**	206	1	15	17	**1,041**
2004	91	189	172	207	59	42	10	53	**823**	242	0	10	21	**1,096**
2005	98	179	143	165	63	22	11	51	**732**	208	5	11	14	**970**
2006	86	217	108	139	59	23	15	23	**670**	196	8	6	17	**897**
2007	116	128	161	159	43	11	6	19	**643**	181	16	9	10	**859**
2008	88	137	126	120	35	4	10	19	**539**	146	10	2	8	**705**
2009	109	82	158	120	32	11	9	21	**542**	188	15	2	9	**756**
2010	126	109	119	127	39	5	11	31	**567**	192	16	7	7	**789**
2011	135	129	172	120	40	13	6	27	**642**	189	33	4	4	**872**
2012	141	139	155	157	50	18	13	36	**709**	176	48	14	13	**960**
2013	166	150	194	185	66	15	10	28	**814**	228	61	19	15	**1,137**
2014	307	149	212	130	76	15	8	35	**932**	227	71	27	11	**1,268**
2015	348	175	252	192	107	31	21	36	**1,162**	247	83	22	12	**1,526**
2016	382	205	244	238	157	28	18	39	**1,311**	238	104	24	12	**1,689**
2017	498	210	299	244	134	40	16	43	**1,484**	290	81	22	14	**1,891**
2018	549	241	292	250	144	32	4	41	**1,553**	338	129	56	21	**2,097**
2019	584	219	339	290	144	35	12	49	**1,672**	470	187	43	15	**2,387**
2020	571	243	369	296	165	51	10	53	**1,758**	479	263	54	18	**2,572**

Note: Completions include associate, bachelor's, and graduate degrees awarded in years ending June 30. While WGU is a national university, their data above represent completions by Utah residents only.
Source: Kem C. Gardner Policy Institute analysis of data from the National Center for Education Statistics, Integrated Postsecondary Education Data System
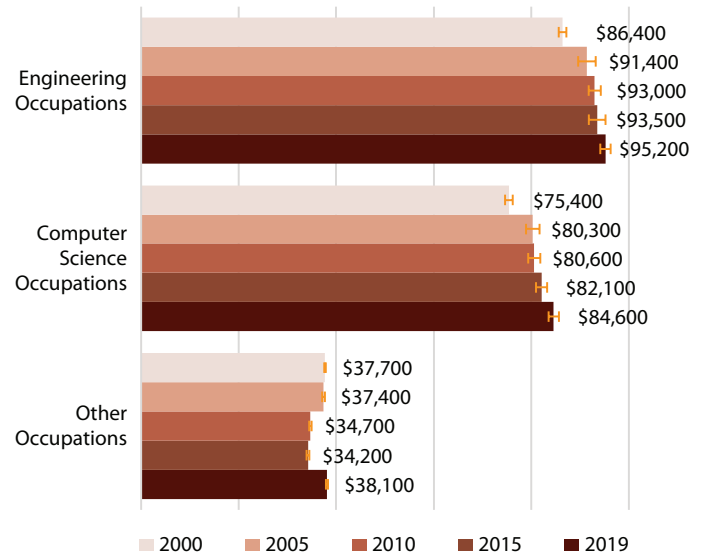
Figure A2: Utah Earnings in Engineering and Computer Science Occupations, Selected Years 2000–2019
(Median Annual Adult Earnings From Employment; 2021 Dollars)

Engineering Occupations: $78,500; $83,100; $74,500; $82,100; $90,900
Computer Science Occupations: $61,500; $62,300; $71,900; $76,400; $76,100
Other Occupations: $33,300; $33,200; $31,000; $34,200; $36,000

Legend: 2000 | 2005 | 2010 | 2015 | 2019

Note: Earnings include employee wages and self-employment income for people employed or actively looking for a job. Amounts rounded to the nearest $100 after adjusting for inflation using the nationwide consumer price index from the U.S. Bureau of Labor Statistics.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figure A3: U.S. Earnings in Engineering and Computer Science Occupations, Selected Years 2000–2019
(Median Annual Adult Earnings From Employment; 2021 Dollars)

Engineering Occupations: $86,400; $91,400; $93,000; $93,500; $95,200
Computer Science Occupations: $75,400; $80,300; $80,600; $82,100; $84,600
Other Occupations: $37,700; $37,400; $34,700; $34,200; $38,100

Legend: 2000 | 2005 | 2010 | 2015 | 2019

Note: Earnings include employee wages and self-employment income for people employed or actively looking for a job. Amounts rounded to the nearest $100 after adjusting for inflation using the nationwide consumer price index from the U.S. Bureau of Labor Statistics.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 1-Year American Community Survey, Integrated Public Use Microdata Series

Figures A4 and A5 address women's inclusion in engineering and computer science occupations over time with Utah comparisons between two five-year periods: 2005 to 2009 and 2015 to 2019. Non-overlapping confidence intervals indicate statistically significant differences.

Figures A6 and A7 address representation changes in engineering and computer science occupations by racial and ethnic minority status with Utah comparisons across two five-year periods: 2005 to 2009 and 2015 to 2019. Non-overlapping confidence intervals indicate statistically significant differences.

Graduates in the Workforce

Tables A7 and A8 provide demographic comparisons of average annual wages for Utah graduates disaggregated for engineering and computer science programs.

Additional Funding from the Utah Legislature

Table A9 provides a list of buildings funded partially or in whole by the state of Utah since 2002, all of which likely benefited at least one engineering or computer science program, among other academic programs. While not meant to be comprehensive, the list illustrates funding that benefits engineering and computer science programs beyond the formal Engineering and Computer Science Initiative.

Figure A4: Women in Utah's Engineering and Computer Science Workforce

(Share of Adult Workers in Occupation Category)
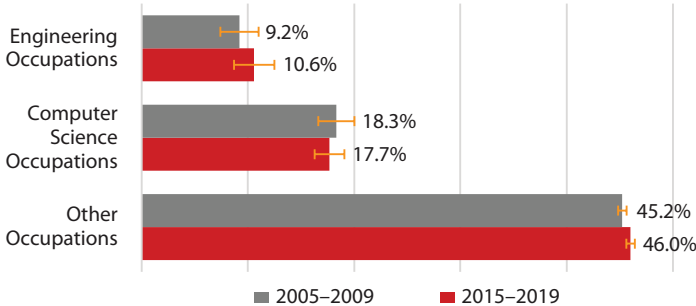
Note: Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data. Where orange-bar spans for two time periods or occupation groups do not overlap, we can say those values are different with a 90% degree of confidence.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

Figure A6: Racial and Ethnic Minority Groups in Utah's Engineering and Computer Science Workforce

(Share of Adult Workers in Occupation Category)
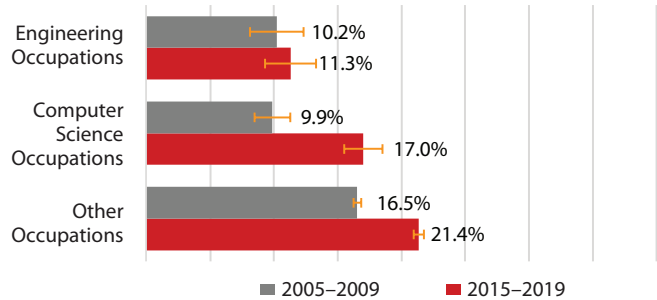
Note: Minority shares represent people who are Hispanic or Latino, or identify as any race other than white. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

Figure A5: Women in the U.S. Engineering and Computer Science Workforce

(Share of Adult Workers in Occupation Category)
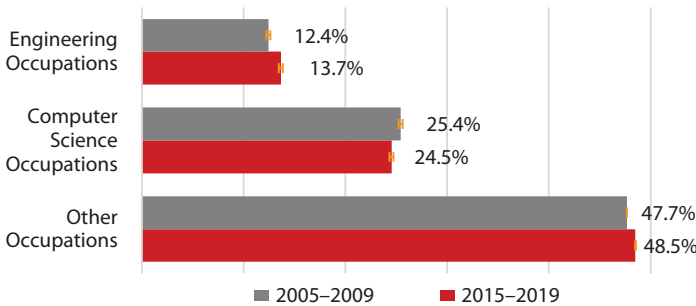
Note: Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

Figure A7: Racial and Ethnic Minority Groups in the U.S. Engineering and Computer Science Workforce

(Share of Adult Workers in Occupation Category)
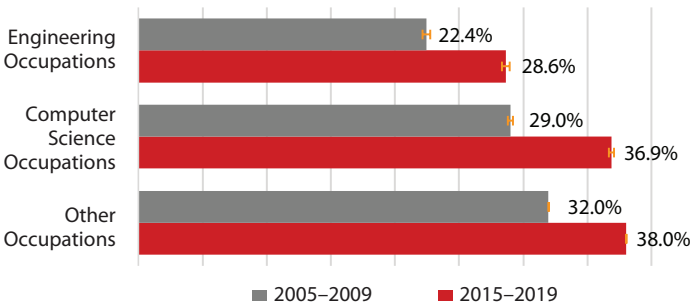
Note: Minority shares represent people who are Hispanic or Latino, or identify as any race other than white. Orange lines at the end of bars mark 90% confidence intervals around percentage estimates from sample data.
Source: Kem C. Gardner Policy Institute analysis of data from the U.S. Census Bureau, 5-Year American Community Survey, Integrated Public Use Microdata Series

Table A7: Median Wages for Engineering and Computer Science Graduates by Gender, 2012–2020

(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

Program and Post-Graduation Interval	Female		Male		Wage Gap
	Wages	Count	Wages	Count	
Engineering					
One Year	$50,570	732	$59,688	5,058	-15.3%
Four Years	$66,487	364	$76,125	3,057	-12.7%
Eight Years	$75,418	84	$92,763	943	-18.7%
Computer Science					
One Year	$52,920	760	$60,050	4,938	-11.9%
Four Years	$69,902	400	$82,562	3,032	-15.3%
Eight Years	$57,692	79	$99,460	771	-42.0%
Combined					
One Year	$51,059	1,492	$59,816	9,996	-14.6%
Four Years	$68,189	764	$78,517	6,089	-13.2%
Eight Years	$71,170	163	$95,826	1,714	-25.7%

Note: Wage gaps calculated as a percentage difference for women versus men. Combined section includes engineering and computer science graduates. Students attended eight public colleges and universities in the Utah System of Higher Education (USHE). Results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Wages are for calendar years 2012 to 2020, following graduations beginning in the 2011–12 academic year.
Source: Kem C. Gardner Policy Institute analysis of data from Utah Data Research Center.

Table A8: Median Wages for Engineering and Computer Science Graduates by Racial and Ethnic Minority Status, 2012–2020

(Annual Wage in 2021 Dollars at Intervals After Graduating From a USHE Institution)

Program and Post-Graduation Interval	Minority Race or Ethnicity		White and Not Hispanic or Latino		Wage Gap
	Wages	Count	Wages	Count	
Engineering					
One Year	$54,200	430	$59,806	4,784	-9.4%
Four Years	$71,095	220	$76,034	2,868	-6.5%
Eight Years	$86,682	53	$92,717	873	-6.5%
Computer Science					
One Year	$56,778	487	$59,062	4,440	-3.9%
Four Years	$74,036	255	$80,933	2,753	-8.5%
Eight Years	$83,618	51	$96,457	702	-13.3%
Combined					
One Year	$55,357	917	$59,466	9,224	-6.9%
Four Years	$72,455	475	$77,709	5,621	-6.8%
Eight Years	$85,169	104	$93,836	1,575	-9.2%

Note: Minority wage earners include people who identify as Hispanic or Latino (ethnicity) or American Indian or Alaska Native, Asian, Black or African American, or Native Hawaiian or Other Pacific Islander (races). Wage gaps calculated as a percentage difference for minority graduates versus other graduates. Combined section includes engineering and computer science graduates. Students attended eight public colleges and universities in the Utah System of Higher Education (USHE). Results for graduate cohorts are based on the most recent associate, bachelor's, or graduate degree awarded to each individual. Wages are for calendar years 2012 to 2020, following graduations beginning in the 2011–12 academic year.
Source: Kem C. Gardner Policy Institute analysis of data from Utah Data Research Center.

Table A9: State Capital Expenditures for Buildings Housing at Least One Engineering or Computer Science Program, 2002–2023

Institution	Fiscal Year	Building/Project	State-Funded Amount
Utah State University	2002	Engineering Initiative Building	$5,943,500
Utah State University	2002	Engineering Building	$16,151,200
University of Utah	2002	Engineering Remodel	$4,613,000
University of Utah	2002	Engineering Initiative Building	$15,000,000
Weber State University	2014	New Science Building - Design (Tracy Hall)	$3,500,000
Weber State University	2015	New Science Building - Construction (Tracy Hall)	$56,400,000
Snow College	2016	New Science Building (Graham Science Center)	$19,937,000
Snow College	2017	New Science Building (Graham Science Center)	$4,724,600
Utah Tech University	2020	Science Building (Science, Engineering, Technology)	$50,000,000
Weber State University	2020	Noorda Engineering and Applied Science Building	$50,000,000
Southern Utah University	2020	Technology, Engineering & Design Building (Design)	$2,000,000
University of Utah	2022	Applied Sciences Building (Remodel/Expansion)	$60,000,000
Utah Valley University	2023	Engineering Building	$80,000,000
University of Utah	2023	Interdisciplinary Computing Building	$4,800,000
Total			**$373,069,300**

Note: The table above may not be fully representative of all state-funded buildings and projects benefiting engineering and computer science programs.
Source: Kem C. Gardner Policy Institute analysis of data from the Utah System of Higher Education, personal communication

Endnotes

1. Utah General Session (2001). S.B. 61 Enhancements to the State Systems of Public and Higher Education. https://le.utah.gov/~2001/bills/sbillenr/SB0061.htm (see Utah Code § 53B-6-105(1) as of July 2001, later amended by H.B. 318 in 2021)

2. This study defines engineering and computer science degrees and occupations as follows. Degrees include three groups in the Classification of Instructional Programs (CIP) taxonomy for higher education: computer and information sciences and support services (CIP code 11), engineering (14), and engineering technologies/technicians (15). Occupations of interest in the Standard Occupation Classification (SOC) system include all 18 occupations under SOC code 17-2000 for engineering and five occupations outside of that group. Computer science occupations identified for this study encompass all 16 occupations under SOC code 15-1200 and four occupations outside of that group. Appendix B provides more details on these definitions.

3. University of Utah. (2014, February 12). U Doubles Engineering Grads. *UNews Archive*. https://archive.unews.utah.edu/news_releases/u-of-utah-doubles-engineering-grads

4. See Tables A5 and A6 in Appendix B.

5. For graduation counts for Utah percentage changes in the Utah System of Higher Education, see Tables A5 and A6 in Appendix B. For U.S. graduation data, not yet available for fiscal year 2020, see National Center for Education Statistics. (2020A). *Degrees in Engineering and Engineering Technologies Conferred by Postsecondary Institutions, by Level of Degree and Sex of Student: Selected Years, 1949–50 through 2018-19*. Digest of Education Statistics. https://nces.ed.gov/programs/digest/d20/tables/dt20_325.45.asp; National Center for Education Statistics. (2020B). *Degrees in Computer and Information Sciences Conferred by Postsecondary Institutions, by Level of Degree and Sex of Student: 1964–65 Through 2018–19*. Digest of Education Statistics. https://nces.ed.gov/programs/digest/d20/tables/dt20_325.35.asp

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7. See Utah Code Title 53B Chapter 6 Sections 105, 105.5, 105.7, and 105.9. https://le.utah.gov/xcode/Title53B/Chapter6/53B-6-S105.html

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13. For details on the engineering and computer science degrees included in Section 3, please see Appendix B Table A1.

14. Completion years for this analysis span from the 1999–20 academic year through 2019–20. In the data, completion years begin July 1st of the previous year and end June 30th of the year indicated.

15. Roberts, E. (2016, March 7). *A History of Capacity Challenges in Computer Science*. https://cs.stanford.edu/people/eroberts/CSCapacity.pdf

16. In fiscal year 2020, WGU's 263 computer science completions by Utah students made up 6.0% of its nationwide total of 4,353 computer sciences degrees earned primarily online.

17. In Utah from 2016 to 2020, 75.2% of students enrolled in higher education (undergraduate, graduate, or professional programs) were ages 18 to 29. However, a 1% population sample included higher education students ages 15 to 92. Kem C. Gardner Policy Institute analysis of U.S. Census Bureau data in the Integrated Public Use Microdata Series. The source for enrollment by age was the five-year American Community Survey (ACS), and the source for women's share of the college-age population was the one-year ACS. See Ruggles, S., Flood, S., Foster, S., Goeken, R., Pacas, J., Schouweiler, M., & Sobek, M. (2021). *IPUMS USA: Version 11.0 American Community Survey, 2020*. University of Minnesota. https://usa.ipums.org

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20. Far fewer students complete doctor's degrees—44 in engineering and 13 in computer science in 2020. Such low levels of completers could create notable variability in demographic shares from year to year.

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27. Wai et al. (2010)

28. Utah General Session (2018). S.B. 239. Utah Science Technology and Research Initiative Amendments. https://le.utah.gov/~2018/bills/static/SB0239.html

29. Utah General Session (2006). S.B. 75. U Star Initiative. https://le.utah.gov/~2006/bills/static/SB0075.html

30. Utah General Session (2016). S.B. 166. Utah Science, Technology, and Research Modifications. https://le.utah.gov/~2016/bills/static/SB0166.html

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41. The survey sample included 95,505 first-year full-time students at 148 baccalaureate institutions in the U.S. Weighted results suggest that 63.2% of all such students considered a college having a "very good academic reputation" to be "very important" to their decision to go there, and 15.2% considered "rankings in national magazines" a very important reason. The latter share rose to between 27.8% and 30.5% for full-time students entering public or private four-year universities with high or very high admissions selectivity. See Stolzenberg, E. B., Aragon, M.C., Romo, E., Couch, V., McLennan, D., Eagan, M. K., & Kang, N. (2020). *The American Freshman: National Norms Fall 2019.* https://www.heri.ucla.edu/monographs/TheAmericanFreshman2019-Expanded.pdf

42. The 30% weight for faculty and student resources in the U.S. New and World Report rankings is included as "funding" in the 50% weight mentioned in the previous paragraph. Reputation received a 20% weight.

43. Roy et al. (2021)

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54. Backlund, M., Bateman, M., Brandley, A., Christensen, M., Dean, P., Downen, J., Dejan, E., Gochnour, N., Hogue, M., Hollingshaus, M., Pace, L., Perlich, P. S., Robinson, J., Springer, P., Summers, L., & Wood, J. (2021, May 6). *Diversity in Utah: Race, Ethnicity, and Sex (Data Book).* Kem C. Gardner Policy Institute. https://gardner.utah.edu/diversity-in-utah-data-book/

55. Compared with 2005–2009 results, Utah women's representation appeared to increase somewhat in engineering and decrease somewhat in computer science over 10 years (see Tables A5 and A6 in Appendix B). Increases in these percentages were not statistically significant given available sample data. In contrast, increases nationwide over the same 10 years were statistically significant. Changes in representation for engineering and computer science occupations among women in the U.S. were similar in direction and magnitude to the changes observed among Utah women. Longer-term findings for the U.S. align with these results. From 1990 to 2016, women's nationwide share of the workforce in computer occupations declined from 32% to 25%, while women's share in engineering occupations rose from 12% to 14%. See Pew Research Center. (2018, January 8). *Women's Representation in Computer Jobs Has Declined Since 1990.* https://www.pewresearch.org/social-trends/2018/01/09/women-and-men-in-stem-often-at-odds-over-workplace-equity/ps_2018-01-09_stem_1-05/

56. Racial and ethnic diversity increased for all three occupation categories over a 10-year period beginning from 2005 to 2009 (see Tables A7 and A8 in Appendix B). For Utahns in computer science occupations, the minority share increased by a statistically significant 7.1 percentage points. Meanwhile, minority gains in the engineering workforce were 0.9 percentage points, which was within the margin of error for this survey data. Compared with other occupations from 2015 to 2019, U.S. minority shares were 9.4 percentage points lower for engineering (slightly larger than Utah's difference) and 1.1 percentage points lower for computer science (significantly smaller than Utah's difference).

57. McCormack, S. (2009, April 30). Engineers Will Play a Vital Role in Our Economic Recovery. *The Independent.* https://www.independent.co.uk/student/career-planning/getting-job/engineers-will-play-a-vital-role-in-our-economic-recovery-1676114.html

58. Utah Data Research Center. (n.d.). *About Us.* Retrieved May 10, 2022 from https://udrc.utah.gov/about.html

59. Following BLS conventions, median annual wage of $38,875 calculated from the median hourly wage of $18.69 assuming full-time year-round work (2,080 hours). See U.S. Bureau of Labor Statistics. (2022, March 31). *May 2021 State Occupational Employment and Wage Estimates: Utah.* https://www.bls.gov/oes/current/oes_ut.htm

60. Section 5 identifies earnings disparities by sex, race, and ethnicity without exploring data on underlying causes. For example, the authors did not present or adjust average earnings by demographic groups' occupational mix, job tenure, hours worked, or educational attainment profiles. Demographic patterns in individual outcomes have causes both within and beyond engineering and computer science workplaces. Personal, work, and academic choices and opportunities contribute to observed Utah pay disparities in UDRC data.

61. For example, Utah women and men with engineering or computer science degrees may have different rates of labor force participation, self-employment, and military employment. UDRC outcomes do not include income from self-employment or federal employment (military or civilian), and years elapsed since cohort graduation are not adjusted for career interruptions.

62. Record matching for this study classifies a graduate as engineering or computer science based on the degree program they completed, not based on their occupation after graduation. These occupation differences may partially account for wage differentials between demographic groups. For example, not everyone finds employment in their field of study, and some graduates may work in engineering or computer science occupations with lower pay than their peers' occupations. Besides differences in occupation profiles among demographics groups, graduates' full-time versus part-time status may also vary by group.

63. U.S. Census Bureau. (2022, May 10). *North American Industry Classification System: Introduction to NAICS.* https://www.census.gov/naics/

64. For a complete list of academic programs in CIP codes 11, 14, and 15, see U.S. Department of Education. (n.d.) *The Classification of Instructional Programs: Browse CIP Codes.* Retrieved June 7, 2022 from https://nces.ed.gov/ipeds/cipcode/browse.aspx?y=55.

65. National Center for Education Statistics. (n.d.) *IPEDS Survey Components: Completions (C) Glossary.* Retrieved May 10, 2022 from https://nces.ed.gov/ipeds/use-the-data/survey-components-glossary/7

66. U.S. Bureau of Labor Statistics. (2019, June.) *Options for Defining STEM (Science, Technology, Engineering, and Mathematics) Occupations Under the 2018 Standard Occupational Classification (SOC) System: SOC Policy Committee Recommendation to the Office of Management and Budget (OMB).* See Attachment A (https://www.bls.gov/soc/attachment_a_stem_2018.pdf) and Attachment B (www.bls.gov/soc/attachment_b_stem_2018.pdf)

67. Ruggles, S., Flood, S., Foster, S., Goeken, R., Pacas, J., Schouweiler, M., & Sobek, M. (2021). *IPUMS USA: Version 11.0 American Community Survey, 2000 to 2019.* University of Minnesota. https://usa.ipums.org

68. See FTI Consulting (2020); ACEC Research Institute (2021); and Center for Economics and Business Research (2015)

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