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MILKEN INSTITUTE

State Technology and Science Index 2022

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EXECUTIVE SUMMARY

Over its 20-year history, the State Technology and Science Index has served as a benchmark for developing knowledge-based economies across the United States. Since the publication of the initial Index in 2002, the role of human capital development, research, innovation, and entrepreneurship connected to technology has become even more critical. This has not only been reflected in this year's Index but also in the dramatic shifts in the United States and global economies over the past two years. As the roles of tech-based supply chains, skilled worker shortages, and overseas competition repeatedly made the news, it has only served to reinforce the importance of the key indicators in the Index in signaling opportunities for higher wages, more diverse and competitive economies, and future growth both for the states and their residents.

The impact of the COVID-19 pandemic on the US economy, particularly concerning tech and science, has been widespread. In addition to the dramatic funding levels in seeking out new vaccines and therapeutics to combat the virus, states have also seen the rise of numerous technology companies and demand for tech workers as the economy shifted online and to new forms during the pandemic. As workers have moved out of traditional tech hubs, the opportunity for states not ranked as highly in the Index to advance their position has become more evident. The recently passed CHIPS and Science Act provides a real opportunity for states to invest in technology, particularly in underserved regions, and to be able to find themselves increasingly competitive.

Every two years, the Index provides an opportunity to examine how states rank against each other overall and directly relate to the five composite subindexes: Research and Development Inputs, Risk Capital and Entrepreneurial Infrastructure, Human Capital Investment, Technology and Science Workforce, and Technology Concentration and Dynamism. The Index scores states based on rankings in the five composites rather than on absolute numbers. These composites represent a state's current strengths in tech-based economic growth, skilled workforce, entrepreneurship, and future capacity, as reflected in investments in research and development and higher education.

For 2022, Massachusetts remains in first place, as it has done in every Index since 2002. Driven partly by the more significant role its tech sector played leading up to and during the pandemic, California saw its ranking rise to second place for the first time in more than a decade. The remaining top five consist of Colorado, Maryland, and Utah, which, along with Washington in sixth place, have remained at the top of the rankings for the past three Indexes. Oklahoma (46th), West Virginia (47th), Arkansas (48th), Louisiana (49th), and Mississippi (50th) make up the bottom five.

The most significant drop in this year's rankings is South Carolina, which fell by eight places from 35th to 43rd overall, driven by a 12-place decline in Tech Concentration and Dynamism and a seven-place fall in Risk Capital and Entrepreneurial Infrastructure. Ohio fell six places from 24th to 30th, mainly due to an eight-place fall in Research and Development Inputs. On the positive side, Wyoming made a remarkable jump of eight spots from 39th to 31st, mainly due to a dramatic 15-rank increase in Tech Concentration and Dynamism. Nevada also showed a strong upswing of seven places from 46th to 39th, as capital inflows from places such as Silicon Valley saw an astonishing jump in Risk Capital and Entrepreneurial Infrastructure, from 41st to fifth.

STATE TECHNOLOGY AND SCIENCE INDEX RESULTS

	2022 Rank	2020 Rank	Change	Score	Tier
Massachusetts	1	1	0	86.08	1
California	2	3	1	80.00	1
Colorado	3	2	-1	78.89	1
Maryland	4	4	0	77.67	1
Utah	5	6	1	76.84	1
Washington	6	5	-1	74.97	1
Delaware	7	9	2	74.83	1
Virginia	8	8	0	69.59	2
Connecticut	9	12	3	69.38	2
New Hampshire	10	7	-3	64.97	2
North Carolina	11	15	4	62.52	2
New Jersey	12	14	2	62.44	2
Minnesota	13	11	-2	61.72	2
Oregon	14	10	-4	59.74	2
Pennsylvania	15	13	-2	59.05	2
Arizona	16	17	1	57.15	3
Michigan	17	19	2	56.67	3
Texas	18	16	-2	56.12	3
New York	19	21	2	56.11	3
New Mexico	20	18	-2	54.46	3
Illinois	21	20	-1	52.60	3
Georgia	22	22	0	51.89	3
Rhode Island	23	23	0	50.77	3
Wisconsin	24	25	1	50.66	3
Idaho	25	26	1	50.42	3
Vermont	26	28	2	50.38	3

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	2022 Rank	2020 Rank	Change	Score	Tier
Alabama	27	32	5	48.30	3
Montana	28	29	1	48.03	3
Kansas	29	30	1	47.29	3
Ohio	30	24	-6	46.83	3
Wyoming	31	39	8	46.16	3
Indiana	32	27	-5	44.96	3
Iowa	33	34	1	44.52	4
Nebraska	34	38	4	44.46	4
Missouri	35	31	-4	42.02	4
Alaska	36	36	0	41.73	4
Hawaii	37	37	0	41.57	4
Florida	38	33	-5	40.99	4
Nevada	39	46	7	38.91	4
Tennessee	40	40	0	37.36	4
South Dakota	41	42	1	36.88	4
North Dakota	42	41	-1	34.65	4
South Carolina	43	35	-8	33.94	4
Maine	44	43	-1	32.61	4
Kentucky	45	44	-1	30.71	5
Oklahoma	46	45	-1	27.38	5
West Virginia	47	49	2	24.53	5
Arkansas	48	48	0	23.19	5
Louisiana	49	47	-2	22.34	5
Mississippi	50	50	0	17.49	5

INTRODUCTION

The Milken Institute's State Technology and Science Index (the Index) compares states' relative performances in critical areas of the knowledge economy. The Index provides insight into the component factors that drive economic growth and innovation in high-tech sectors and helps us understand why some states are more effective than others in this regard.

An enormous number of variables can influence a state's success in science and technology sectors, but there are several broad components without which a state cannot succeed. A state's economic success (in all areas, not just high-tech sectors) begins with a robust education system at all levels. Looked at through a high-tech lens, students and graduates in science, technology, engineering, and mathematics (STEM) are particularly important at all levels. In addition, strong private-sector research and technology-commercialization capabilities are essential to a robust knowledge economy.

The Index compares states on five essential components of the innovation ecosystem: research and development inputs; risk capital and entrepreneurial infrastructure; human capital investment; technology and science workforce; and technology concentration and dynamism.

OUTLINE OF THE INDEX

The Index compares states on the inputs necessary for a prosperous knowledge economy. The Index comprises five subindexes, each of which measures a different pillar essential to a state's science and technology economy. The overall rankings are calculated by using the average of a state's five subindex scores.

SUBINDEX COMPONENTS

- **RESEARCH AND DEVELOPMENT INPUTS (RDI):**

  This pillar measures a state's capacity to attract funding and create innovative technologies that can be commercialized. Indicators include academic, industry, and federal government R&D funding; National Science Foundation (NSF) activity; and Small Business Innovation Research (SBIR) awards.

- **RISK CAPITAL AND ENTREPRENEURIAL INFRASTRUCTURE (RCI):**

  This pillar evaluates components of a successful technology commercialization pipeline. Indicators include measures of venture capital, patents, business formation, and IPOs.

- **HUMAN CAPITAL INVESTMENT (HCI):**

  Education and training are crucial assets for any state to develop its knowledge economy. This pillar looks at the skill levels of a state's current and future workforce. Indicators include the number of bachelor's degrees, master's degrees, and doctorates in STEM fields; high school test scores; and access to computers and broadband.

- **TECHNOLOGY AND SCIENCE WORKFORCE (TSW):**

  This pillar measures the intensity of the technology and science workforce, which provides one indication of a state's depth of talent in the relevant fields. Indicators look at the share of workers in a particular field (across computer and information services, engineering, and life and physical sciences occupations) relative to total state employment.

- **TECHNOLOGY CONCENTRATION AND DYNAMISM (TCD):**

  This pillar examines high-tech industry growth. Indicators include proportions of establishments, employment, and payrolls in high-tech industries; and employment location quotient (LQ), which quantifies the concentration of a particular sector in a state relative to the entire country.

INDEX AND SUBINDEX RESULTS

	Overall Rank	RDI	RCI	HCI	TSW	TCD
Massachusetts	1	1	4	1	4	6
California	2	5	2	6	5	2
Colorado	3	6	6	8	2	3
Maryland	4	2	26	2	3	7
Utah	5	12	3	3	10	1
Washington	6	13	8	12	1	4
Delaware	7	4	1	9	9	10
Virginia	8	14	19	5	8	5
Connecticut	9	8	9	4	11	14
New Hampshire	10	3	24	14	16	13
North Carolina	11	11	7	24	18	16
New Jersey	12	19	10	18	11	14
Minnesota	13	25	17	7	7	22
Oregon	14	22	22	16	6	25
Pennsylvania	15	7	16	12	17	33
Arizona	16	18	14	29	31	8
Michigan	17	10	36	19	13	26
Texas	18	31	11	36	22	9
New York	19	15	12	10	38	21
New Mexico	20	16	38	30	14	19
Illinois	21	17	15	11	35	28
Georgia	22	32	21	26	33	11
Rhode Island	23	9	29	15	28	44
Wisconsin	24	20	33	27	19	29
Idaho	25	35	18	38	24	12
Vermont	26	27	32	17	29	22

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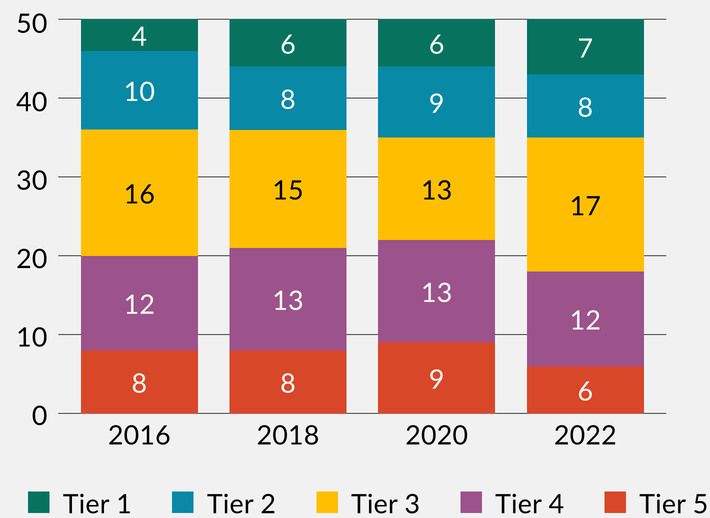
	Overall Rank	RDI	RCI	HCI	TSW	TCD
Alabama	27	24	41	35	21	24
Montana	28	26	25	32	22	37
Kansas	29	36	43	25	20	20
Ohio	30	23	28	33	25	39
Wyoming	31	30	23	34	29	30
Indiana	32	21	40	20	38	31
Iowa	33	29	35	23	26	45
Nebraska	34	38	20	21	32	38
Missouri	35	33	27	31	40	36
Alaska	36	34	50	37	15	27
Hawaii	37	28	42	39	27	33
Florida	38	41	13	42	46	17
Nevada	39	49	5	48	48	17
Tennessee	40	39	31	41	36	35
South Dakota	41	40	29	28	44	43
North Dakota	42	37	47	21	42	41
South Carolina	43	43	38	44	36	32
Maine	44	42	45	40	34	39
Kentucky	45	45	34	45	43	42
Oklahoma	46	44	44	50	41	45
West Virginia	47	47	49	43	45	48
Arkansas	48	50	37	49	50	45
Louisiana	49	46	46	46	47	49
Mississippi	50	48	48	46	49	50

METHODOLOGY AND ADJUSTMENTS

Each state's Index score is calculated using the average of its scores on the five subindexes. Subindex scores are calculated using a state's rankings on the indicators that comprise that subindex. Indicators are sourced from a wide variety of government and private sources. A comprehensive list is available in the Appendix. For each indicator, the state that ranks first receives a score of 100; the 50th state scores 2.

Figure 1: Size of Index Tiers over Time



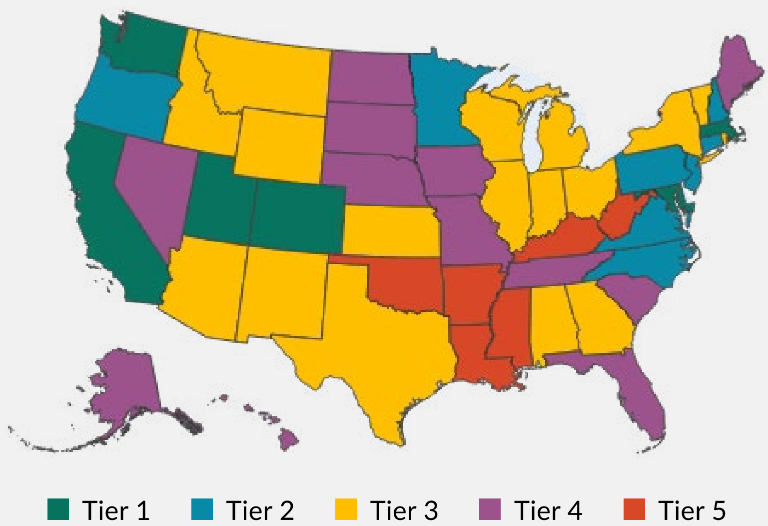
Source: Milken Institute (2022)

In general, we calculate scores for each subindex by averaging the rankings on the relevant indicators. On two occasions, we apply a weighted sum to better reflect the relative importance of different industries. The R&D rankings in the RDI subindex are weighted proportionally to the amount of R&D performed by industry, federal, and academic sources. Meanwhile, the TSW subindex measuring the prevalence of STEM occupations does not assign a ranking to each occupation code. Instead, it looks at the total employment across all occupation codes in three categories (Computer and Information Scientists, Engineers, and Life and Physical Scientists) and assigns a ranking for each category.

We divided the rankings on the overall Index and each subindex into five tiers to enable policymakers to benchmark their states' science and technology capabilities against peers. The range of scores on each ranking—or the difference between the top- and bottom-ranked states—determines the size of these tiers. After finding the top and bottom scores, the difference between these two scores is divided into five tiers, each of which spans an equal proportion of the range; for example, Tier One includes states that score between 73 and 86 points, while Tier Two includes states with scores between 59 and 72 points.

OVERALL RANKINGS

Figure 2: 2022 Overall Tiers by State



Source: Milken Institute (2022)

State	2022 Rank	2020 Rank	Change	Score
Massachusetts	1	1	0	86.08
California	2	3	1	80.00
Colorado	3	2	-1	78.89
Maryland	4	4	0	77.67
Utah	5	6	1	76.84
Washington	6	5	-1	74.97
Delaware	7	9	2	74.83

TIER ONE

States in Tier One were consistent with the top states in 2020's Index—with Delaware the only state to rise into the top tier. All Tier One states ranked first or second in at least one subindex and placed no lower than 13th in any subindex, except Maryland's 26th for RCI.

Massachusetts again placed first and ranked highly in all five subindexes: first in RDI and HCI, fourth in RCI and TSW, and sixth in TCD. **California** moved up from third to second overall. The Golden State was second in RCI and TCD, fifth in RDI and TSW, and sixth in HCI. **Colorado** dropped from second to third overall, placing second in TSW, third in TCD, sixth in RDI and RCI, and eighth in HCI. **Maryland** maintained its fourth place overall, placing second in RDI and HCI, third in TSW, seventh in TCD, and 26th in RCI. **Utah** moved up one spot from sixth to fifth overall. The Beehive State's result was bolstered by a first-place finish in TCD and third-place finishes in both RCI and HCI, but was held back by placing 10th in TSW and 12th in RDI. **Washington** dropped from fifth to sixth overall. Washington placed first in TSW, fourth in TCD, and eighth in RCI, but 12th in HCI and 13th in RDI. **Delaware** rounded out the top tier, moving up from ninth to seventh overall. Delaware placed first in RCI, fourth in RDI, ninth in both HCI and TSW, and 10th in TCD.

TIER TWO

State	2022 Rank	2020 Rank	Change	Score
Virginia	8	8	0	69.59
Connecticut	9	12	3	69.38
New Hampshire	10	7	-3	64.97
North Carolina	11	15	4	62.52
New Jersey	12	14	2	62.44
Minnesota	13	11	-2	61.72
Oregon	14	10	-4	59.74
Pennsylvania	15	13	-2	59.05

States in Tier Two demonstrated slightly more movement than those in Tier One, with most states moving up or down by two to four places. Their subindex results were also more varied than those in Tier One, with results ranging from third to 25th. Despite more variability, all states in Tier Two placed in the top half of states in all five subindexes.

Virginia maintained eighth place overall, scoring highly in HCI (fifth), TCD (fifth), and TSW (eighth). **Connecticut** improved three places to finish ninth overall, placing fourth in HCI. **New Hampshire** fell from seventh to 10th, held up by a third place in RDI. **North Carolina** moved up four spots, from 15th to 11th. The state's highest subindex result was seventh for RCI; the lowest was 24th for HCI. **New Jersey** improved two places to finish 12th, ranking between 10th and 19th in all five subindexes. **Minnesota** finished 13th, ranking seventh in both HCI and TSW but only 25th in RDI. **Oregon** dropped four places to 14th. The state finished sixth in TSW but between 16th and 25th in the other four subindexes. **Pennsylvania** finished 15th, with a high of seventh for RDI and a low of 33rd for TCD.

TIER THREE

State	2022 Rank	2020 Rank	Change	Score
Arizona	16	17	1	57.15
Michigan	17	19	2	56.67
Texas	18	16	-2	56.12
New York	19	21	2	56.11
New Mexico	20	18	-2	54.46
Illinois	21	20	-1	52.60
Georgia	22	22	0	51.89
Rhode Island	23	23	0	50.77
Wisconsin	24	25	1	50.66
Idaho	25	26	1	50.42
Vermont	26	28	2	50.38
Alabama	27	32	5	48.30
Montana	28	29	1	48.03
Kansas	29	30	1	47.29
Ohio	30	24	-6	46.83
Wyoming	31	39	8	46.16
Indiana	32	27	-5	44.96

States in Tier Three consistently placed in the middle of the rankings in the majority of their subindex results.

Georgia and **Rhode Island** maintained the same ranks as in 2020, finishing 22nd and 23rd, respectively. **Arizona, Wisconsin, Idaho, Montana,** and **Kansas** all rose one place; **Michigan, New York,** and **Vermont** climbed two places. **Illinois** fell by one place, while **Texas** and **New Mexico** declined by two places. The most notable changes in this tier, however, were **Alabama, Ohio, Wyoming,** and **Indiana**.

Alabama rose five places, from 32nd to 27th, and **Wyoming** rose eight spots, from 39th to 31st, which was the most significant climb in this year's Index. **Ohio** fell six places, from 24th to 30th, and **Indiana** fell five spots, from 27th to 32nd.

TIER FOUR

State	2022 Rank	2020 Rank	Change	Score
Iowa	33	34	1	44.52
Nebraska	34	38	4	44.46
Missouri	35	31	-4	42.02
Alaska	36	36	0	41.73
Hawaii	37	37	0	41.57
Florida	38	33	-5	40.99
Nevada	39	46	7	38.91
Tennessee	40	40	0	37.36
South Dakota	41	42	1	36.88
North Dakota	42	41	-1	34.65
South Carolina	43	35	-8	33.94
Maine	44	43	-1	32.61

States in Tier Four also demonstrated variability in their rankings, with several large jumps and falls. In the subindex results, these states consistently placed in the bottom half of states in most sections, with a handful of notable exceptions.

Alaska, Hawaii, and **Tennessee** all maintained the same rank as in 2020. Two states rose one place: **Iowa** from 34th to 33rd and **South Dakota** from 42nd to 41st. Two states fell one place: **North Dakota** from 41st to 42nd and **Maine** from 43rd to 44th.

Nevada rose an impressive seven places, from 46th to 39th, and had this tier's only top-five subindex result, placing fifth in RCI. The state was, however, held back by placing in the bottom three in three of the other subindexes. **Nebraska** rose four places, from 38th to 34th, but with no outstanding subindex results: All five were between 20th and 38th. Three states in this tier had notable falls in the rankings: **Missouri** fell four places, from 31st to 35th; **Florida** fell five spots, from 33rd to 38th; and **South Carolina** dropped eight places, from 35th to 43rd.

TIER FIVE

State	2022 Rank	2020 Rank	Change	Score
Kentucky	45	44	-1	30.71
Oklahoma	46	45	-1	27.38
West Virginia	47	49	2	24.53
Arkansas	48	48	0	23.19
Louisiana	49	47	-2	22.34
Mississippi	50	50	0	17.49

States in Tier Five were consistent with those in Tier Five in the previous edition of the Index, with no state moving by more than two places. States in this tier placed between 34th and 50th in all five subindexes.

Arkansas and **Mississippi** maintained their results of 48th and 50th; and **Kentucky** and **Oklahoma** both fell one place, to 45th and 46th, respectively. Kentucky had this section's best subindex result, placing 34th in RCI, but finished between 42nd and 45th in the other four subindexes. **West Virginia** rose two places, from 49th to 47th, and **Louisiana** fell two places, from 47th to 49th.

BIGGEST CHANGES

Rises	2022	2020	Change
Wyoming	31	39	+8
Nevada	39	46	+7
Alabama	27	32	+5

Falls	2022	2020	Change
South Carolina	43	35	-8
Ohio	30	24	-6
Indiana	32	27	-5
Florida	38	33	-5

Wyoming made this year's biggest improvement, up eight spots to finish 31st. This was driven by a seven-place jump in the RDI subindex, a seven-place jump in the RCI, and a 15-place increase in TCD. Wyoming fell two places in TSW and HCI. **Nevada** improved seven spots to finish 39th. This increase was driven by a dramatic improvement in RCI—up 36 places from 41st to fifth—and a seven-place rise in TCD. **Alabama** improved five places to finish 27th, jumping five spots in RCI and four in TCD.

The biggest fall in this year's Index was **South Carolina,** down eight places to finish in 43rd. The Palmetto State fell seven places in the RCI subindex, 12 in the TCD subindex, and three in the RDI subindex. **Ohio** dropped six places this year, primarily driven by an eight-place fall in the RDI subindex and a four-place fall in the RCI subindex. **Florida** fell by five places despite no significant drops in any individual subindex. Despite a seven-place improvement in RDI, **Indiana** dropped five places overall due to a 14-place drop in the RCI subindex.

RESEARCH AND DEVELOPMENT INPUTS

BACKGROUND

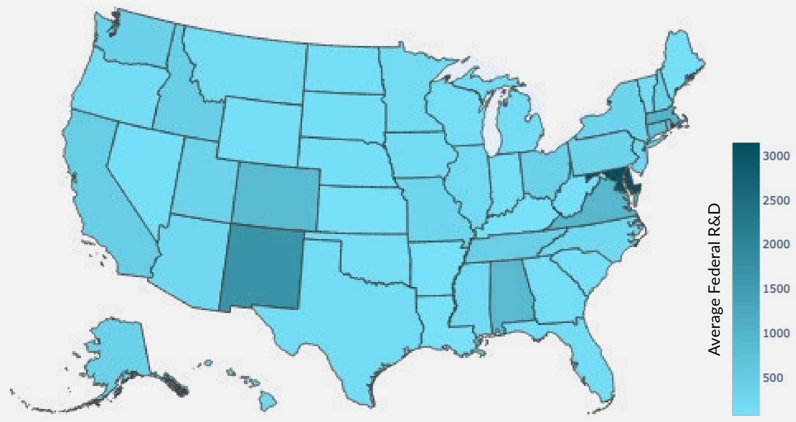
The Research and Development (R&D) Inputs subindex measures the generation of new knowledge, emphasizing science and technology that may have commercial value. Innovation is a cornerstone of knowledge-based economic development and can provide a key competitive advantage for states' long-term economic growth. Public and private R&D investments are essential for shaping a state's future capacity for economic growth.

After World War II, the United States became a global leader in R&D, accounting for more than two-thirds of annual global spending. But by 2019, faster growth in R&D spending in other nations—especially China—had reduced the US share of global R&D to roughly 30 percent.[1]

Vannevar Bush, who helped create the NSF, once called basic research "the pacemaker of technological progress."[2] If the US falls behind on basic research, it will lose its leadership in technological progress. However, basic research is also a public good that requires public-sector investments.

Partly in recognition of the importance of public support for R&D and partly to counteract supply-chain vulnerabilities exposed during the pandemic, Congress passed the $52 billion CHIPS and Science Act to revitalize domestic high-tech manufacturing and boost R&D in semiconductors, artificial intelligence, and biotechnology sectors, which are critical to both future economic competitiveness and national security.[3] This infusion of public investment dollars should benefit the private sector and accelerate the output of innovation and commercialization. Jointly, this robust R&D infrastructure in private and public sectors will translate into reduced costs, job creation, strengthening of the supply chain, and bolstering US competitiveness.

Figure 3: Federal R&D Performed ($/capita, 2018-2020)



Source: Milken Institute (2022)

- **Federal R&D expenditures:** This category captures investments in all basic and applied research in such areas as national defense, health, space research and technology, energy, and general science. As a principal source of nationwide R&D spending—just under 20 percent—state rankings in federal R&D receive additional weight when state scores are calculated.
- **Industry R&D expenditures:** This is the total that corporations spent on primary and applied research, including funds spent at federally funded R&D centers. Industry R&D rankings are heavily weighted when state scores are calculated on the subindex because industry represents by far the largest share of spending on R&D activities nationwide, at around 67 percent.
- **Academic R&D expenditures:** This is the total that a state's colleges and universities spent on R&D. All research, basic and applied, performed by colleges and universities is funded by a combination of federal, industrial, and academic sources, but more than 60 percent of R&D funding at universities originates from the federal government. Academic spending on R&D represents around 13 percent of national expenditures.
- **National Science Foundation funding:** The NSF supports research and education in science and engineering through grants, contracts, and cooperative agreements. Because the NSF is a critical funding source for R&D in higher education, we track the organization's support for research in the physical sciences, geosciences, computer science, life sciences, mathematics, and statistics. Rates of competitive NSF project proposals also measure R&D inputs.
- **Small business research funding:** Small Business Technology Transfer (STTR) and Small Business Innovation Research (SBIR) programs provide federal funding for innovation by small businesses. The STTR and SBIR programs support collaboration with nonprofit research institutes and research with commercial potential, respectively. Phase I programs provide six months of support for feasibility studies or prototypes, whereas Phase II programs offer two years of funding support for R&D.

State	Subindex Score	2022	2020	Change
Massachusetts	97.42	1	1	0
Maryland	86.99	2	2	0
New Hampshire	84.47	3	4	1

Massachusetts maintains its top spot on the Research and Development Inputs subindex. This is the seventh consecutive time Massachusetts has come out on top. The state ranks in the top five among 16 of the 18 variables that comprise the RDI subindex. According to the National Center for Science and Engineering Statistics (NCSES), Massachusetts ranks third in total R&D performance; measured as a share of the state's GDP, its 6.63 percent is double the national average of 3.1 percent (based on 2019 values).[4] In the fiscal year 2021, a total of $565.6 million in NSF grants were awarded to the state; the top NSF-funded academic institutions were the Woods Hole Oceanographic Institution ($141 million), Massachusetts Institute of Technology ($93.7 million), and Northeastern University ($57.1 million).[5]

Maryland maintains its second spot on the RDI subindex for the seventh consecutive time. The state ranks in the top five among 14 of the 18 variables that comprise the RDI subindex. According to the NCSES, Maryland ranks eighth in the nation for total R&D performance; its R&D makes up 5.38 percent of the state's GDP (based on 2019 values).[6] The state's lowest-ranked variable is Industry R&D Dollars per Capita at 19th. In FY2021, a total of $382.7 million in NSF grants were awarded to the state; the top NSF-funded academic institutions were the University of Maryland-College Park ($61.6 million), Johns Hopkins University ($44.2 million), and the University of Maryland-Baltimore County ($12.6 million).[7]

New Hampshire climbs from fourth to third on the RDI subindex. The state has consistently ranked fourth or fifth since 2015. In total, the state ranks in the top five in seven of the 18 variables. However, New Hampshire ranks only 32nd in the nation for Total R&D performance according to the NCSES; its R&D makes up 3.5 percent of the state's GDP, which is near the national average of 3.1 percent (based on 2019 values).[8] In the fiscal year 2021, a total of $33.3 million in NSF grants were awarded to the state; the top NSF-funded academic institutions were Dartmouth College ($18 million), University of New Hampshire ($13 million), and Keene State College ($648,000).[9]

State	Subindex Score	2022	2020	Change
Mississippi	17.52	48	45	-3
Nevada	17.32	49	47	-2
Arkansas	14.72	50	49	-1

Mississippi dropped three places to 48th on the overall RDI subindex in 2022. The state ranks last on four of the 18 variables that comprise the RDI subindex—including Industry R&D Dollars per Capita, a crucial driver of innovation for corporate America and many high-tech startups. In total, the state ranks in the bottom five in nine of the 18 variables. Notably, the state dropped 15 places in Higher-Ed R&D Expenditures on Computer and Information Science per Capita and 11 in Competitive NSF Proposal Funding Rate from the Index 2020. According to the NCSES, Mississippi ranks 41st in the nation for Total R&D performance; its R&D makes up 0.98 percent of the state's GDP, which trails the national average of 3.1 percent (based on 2019 values).[10] In the fiscal year 2021, a total of $31.3 million in NSF grants were awarded to the state; the top NSF-funded academic institutions were Mississippi State University ($17.4 million), Jackson State University ($6.7 million), and the University of Mississippi ($1.8 million).[11]

Nevada dropped two places to 49th on the overall RDI subindex in 2022. The state ranks last on five of the 18 variables that comprise the RDI subindex. Nevada ranks last on Academic R&D Dollars per Capita and National Science Foundation Funding. Compared to the Index 2020, the state climbed 14 places in Higher Ed R&D Expenditures on Math and Statistics per Capita but dropped 10 spots on STTR Awards per 10,000 Businesses (Phase I) and 13 places on STTR Awards per 10,000 Businesses (Phase II). According to the NCSES, Nevada ranks 40th in the nation for Total R&D performance; its R&D makes up just 0.74 percent of the state's GDP (based on 2019 values).[12] In the fiscal year 2021, a total of $29.9 million in NSF grants were awarded to the state; the top NSF-funded academic institutions were the University of Nevada-Reno ($17 million) and the University of Nevada-Las Vegas ($8.7 million).[13]

Arkansas dropped one place to 50th on the overall RDI subindex in 2022. The state ranks last on Higher Ed R&D Expenditures on Math and Statistics per Capita and ranks in the bottom five in another eight of the 18 variables. In the fiscal year 2021, a total of $33.8 million in NSF grants were awarded to the state; the top NSF-funded academic institutions were the University of Arkansas ($23.2 million), University of Arkansas-Pine Bluff ($2.5 million), and Arkansas State University ($706,000).[14]

BIGGEST GAINS

State	Subindex Score	2022	2020	Change
Utah	66.84	12	19	7
Indiana	57.26	21	28	7
Wyoming	47.67	30	37	7

Utah rose seven positions to 12th on the overall RDI subindex for 2022. The Beehive State climbed 11 places in SBIR Awards per 10,000 Businesses (Phase II) and 10 places in Higher Ed R&D Expenditures on Life Sciences per Capita from the Index 2020. However, it dropped 10 places in STTR Awards per 10,000 Businesses (Phase I). The state ranked highest in Higher Ed R&D Expenditures on Engineering per Capita at fourth and Higher Ed R&D Expenditures on Computer and Information Science per Capita at sixth. It ranked lowest in NSF Funding at 26th and Competitive NSF Proposal Funding Rate at 24th.

Indiana rose seven positions to 21st on the overall RDI subindex for 2022. The state climbed 13 places in STTR Awards per 10,000 Businesses (Phase II) and 11 places in Industry R&D Dollars per Capita from the Index 2020. However, it dropped 12 places in STTR Awards per 10,000 Businesses (Phase I). The state ranked highest in Higher Ed R&D Expenditures on Engineering per Capita and Higher Ed R&D Expenditures on Computer and Information Science per Capita, at seventh in the nation. It ranked lowest in Federal R&D Dollars per Capita and SBIR Award Dollars per $1 million GSP, both at 39th in the nation.

Wyoming rose seven positions to 30th on the overall RDI subindex for 2022. The state surged to the top third of the STTR Awards per 10,000 Businesses rankings after ranking in the bottom third in 2020. However, it dropped 13 places in NSF Funding and 12 places in Higher Ed R&D Expenditures on Engineering per Capita.

BIGGEST DROPS

State	Subindex Score	2022	2020	Change
Alaska	42.87	34	25	-9
Ohio	56.39	23	15	-8
Oregon	57.06	22	17	-5
Texas	46.96	31	26	-5

Oregon dropped five places to 22nd on the overall RDI subindex for 2022. The state climbed 15 places in NSF Funding but dropped 16 places in STTR Awards per 10,000 Businesses (Phase II) from the Index 2020. Overall, its rankings fell on 10 of the 18 variables. The state ranked highest on Competitive NSF Proposal Funding Rate at fifth and Industry R&D Dollars per Capita at eighth.

Texas dropped five places to 31st on the RDI subindex for 2022. The state dropped nine places in STTR Awards per 10,000 Businesses (Phase II) and six places in Federal R&D Dollars per Capita from the Index 2020. Overall, its rankings fell on 12 of the 18 variables. The state ranked highest in Higher Ed R&D Expenditures on Math and Statistics per Capita at 13th and lowest in NSF Research Funding at 39th.

Ohio dropped eight places to 23rd on the RDI subindex for 2022. The state dropped 14 places in Federal R&D Dollars per Capita and 13 places in Higher Ed R&D Expenditures on Life Sciences per Capita. Overall, its rankings fell on nine of the 18 variables. The state ranked highest in STTR Awards per 10,000 Businesses (Phase I) at ninth and lowest in Higher Ed R&D Expenditures on Environmental Sciences per Capita at 42nd and Competitive NSF Proposal Funding Rate at 37th.

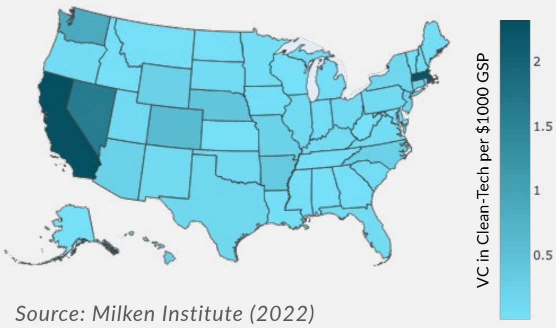
Alaska dropped nine places to 34th on the overall RDI subindex for 2022. The state dropped 33 places in STTR Awards per 10,000 Businesses (Phase II) and 23 places in STTR Award Dollars per $1 million GSP. Overall, its rankings fell on nine of the 18 variables. The state's performance in the RDI subindex was very mixed. It ranked first on four variables related to NSF funding and research in the physical sciences. But it also ranked in the bottom five on seven of the 19 variables, mostly due to its lack of STTR and SBIR recipients.

RISK CAPITAL AND ENTREPRENEURIAL INFRASTRUCTURE

BACKGROUND

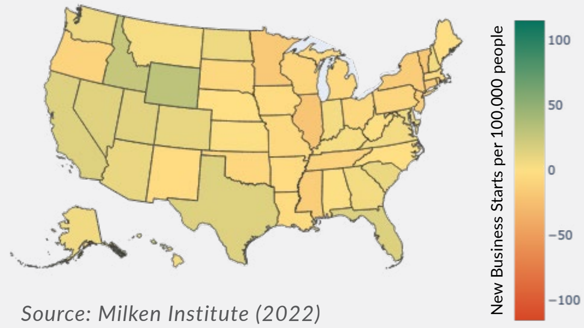
The Risk Capital and Entrepreneurial Infrastructure (RCI) subindex measures the environment for attracting capital investment to further business innovation. The ability of entrepreneurs to recognize the economic value of their ideas and commercialize them is a core asset to a state's knowledge economy. As such, venture capital plays a vital role in financing the innovation of American companies.

Figure 4a: Clean-Tech Venture Capital Investment per $1000 GSP 2019-2021



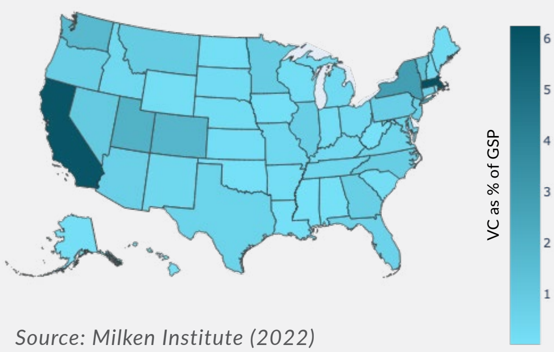
Source: Milken Institute (2022)

Figure 4b: Business Starts per 100,000 People 2018-2020



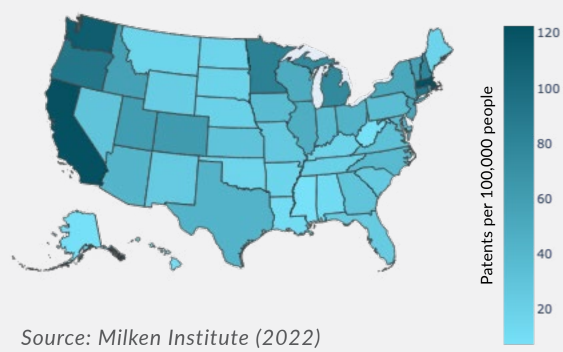
Source: Milken Institute (2022)

Figure 4c: Average Annual Venture Capital (as of GSP) 2019-2021



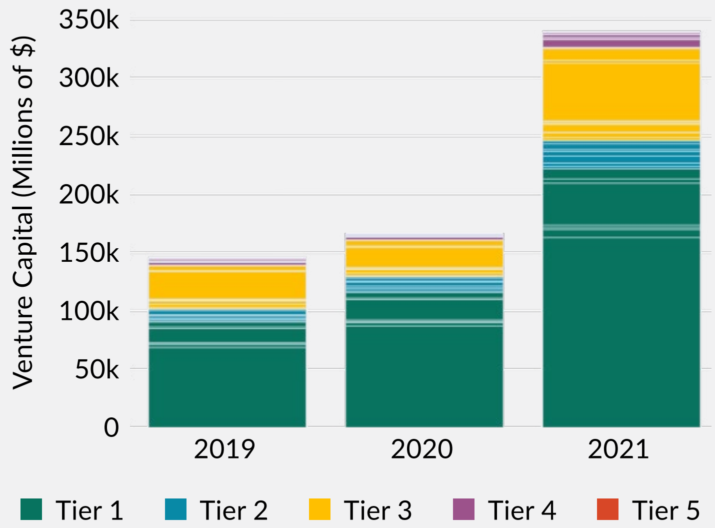
Source: Milken Institute (2022)

Figure 4d: Patents Issued per 100,000 People 2018-2020



Source: Milken Institute (2022)

Figure 5: Venture Capital Funding by Tier 2019-2021



Source: Milken Institute (2022)

- **Venture capital activity:** To assess a region's potential for entrepreneurship in science and technology, we look at indicators such as growth in total venture capital (VC) investment, the number of VC deals, the size of these investment flows as a percentage of the state's economy, and the proportion of deals to the number of businesses operating in the state.
- **Small Business Investment Company (SBIC) funding:** An SBIC is an incubator-type establishment that uses its capital, plus loans guaranteed by the US Small Business Administration, to make equity and debt investments in qualifying small businesses. Like venture capitalists, the SBIC identifies profit potential and makes funding decisions aiming for high returns on investment.
- **Patents:** Patents indicate a strong state-level culture of scientific inquiry and represent opportunities to commercialize new technologies. While the costs and time spent applying for a patent are significant, completing the process may offer enormous potential for long-term job creation and wage increases.
- **Business formation:** Business starts and initial public stock offerings (IPOs) reflect entrepreneurship and optimism. Often, companies that engage in IPOs have proven revenues.
- **Nanotechnology, clean technology, and biotechnology investments:** With three sectors at the forefront of technological innovation, investment in these fields represents a strong culture of entrepreneurship and measures investors' willingness to take risks in that state.

State	Subindex Score	2022	2020	Change
Delaware	87.45	1	12	11
California	82.36	2	1	-1
Utah	79.27	3	4	1

Delaware claimed the top spot in the RCI subindex in 2022, a significant gain from its previous 12th place. Delaware's rise was catalyzed by a surge from 39th to first in IPO Investment (largely due to a series of spinoffs affiliated with the asset-management firm BlackRock). The state also saw sizable improvements in SBIC funding and VC Investment (especially in Clean Technology).[15] It ranked first in three indicators: Venture Capital Deals and Business Establishments, Business Starts, and IPO Investments. Delaware also demonstrated a robust investment environment as evidenced by its placement among Total Venture Capital Investment Growth (ninth), Venture Capital Investment (fourth), Total Venture Capital Deal Growth (third), and Small Business Investment Company Funds (fifth).

California fell to second place on the RCI subindex in 2022, a one-place drop from its previous ranking. Still, the Golden State performed highly on several key indicators thanks to its diverse, strong, and innovative economy.[16] It is no surprise that the home state of Silicon Valley scored remarkably high in Venture Capital Investments (second), Venture Capital Deals (third), IPO Investments (third), and Patents Issued (second). California also demonstrated particularly strong results in investment in Clean Technology and Biotechnology, placing first and second, respectively. Its business ecosystem has allowed favorable growth, evidenced by its placement among business starts (10th) and SBIC Funds Disbursed (14th).

Utah moved up one ranking from 2020 to claim a third-place finish on the RCI subindex in 2022. In the past decade, Utah has emerged as one of the best states in the nation for capital investments. Indeed, the Beehive State placed fifth overall in Venture Capital Investment, seventh in Venture Capital Deals, and ninth in IPO Investments. In 2020 alone, Utah startups raised nearly $1 billion in VC funding.[17] Additionally, Utah's pro-business regulatory environment has produced high growth in the number of business starts (third overall). The Beehive State additionally had top 10 finishes in the following categories: SBIC Funds Disbursed (second), Patents Issued (10th), Investments in Nanotechnology (sixth), and Investments in Biotechnology (fourth).

BOTTOM STATES

State	Subindex Score	2022	2020	Change
Mississippi	22.36	48	48	0
West Virginia	22.00	49	50	1
Alaska	17.64	50	49	-1

Mississippi placed 48th on the 2022 RCI subindex for the second consecutive ranking. The state scored in the bottom tier in several components: Venture Capital Investment (49th), Total Venture Capital Deal Growth (50th), VC Deals (49th), Patents Issued (50th), IPO Investments (43rd), Venture Capital Investment in Clean Technology (42nd), and Venture Capital in Biotechnology (49th). However, Mississippi saw notable placements among Total Venture Capital Investment Growth (seventh) and Venture Capital Investment in Nanotechnology (18th).

West Virginia ranked 49th on the RCI subindex, a one-place improvement from its previous placement in 2020. However, the state saw marked improvements in several categories, from 49th to first in Total Venture Capital Deal Growth and 50th to first in Venture Capital Investment Growth.

Alaska came in last on the RCI subindex, dropping one spot from its ranking in 2020. The state ranked in the bottom 10 of the subindex on all indicators, with particularly weak performances in Patents Issued (49th), Venture Capital Deal Growth (47th), and Venture Capital Investment Growth (43rd). Notably, while Alaska's startup ecosystem is in its initial stages of growth, startups have been responsible for 89 percent of new employment growth in the private sector over the last decade. The state consistently added 4,000 to 6,000 jobs to the economy every year.[18]

BIGGEST GAINS

State	Subindex Score	2022	2020	Change
Nevada	73.27	5	41	36
Nebraska	55.45	20	42	22
Wyoming	53.45	23	40	17

Nevada recorded the most significant gain in this year's RCI subindex, advancing from 41st to fifth. The state saw marked improvements in several subcomponent categories: Total Venture Capital Investment Growth (44th to 10th), Venture Capital Investment (39th to ninth), Total Venture Capital Deal Growth (43rd to fifth), VC Deals (32nd to 13th), and Venture Capital Investment in Clean Technology (40th to third). A recent proposal by Nevada Governor Steve Sisolak would allow technology companies to form Innovation Zones,[19] where companies would have the ability to impose taxes, form school districts and courts, and provide government services, effectively allowing them to create a separate local government. This planned legislation, while not yet introduced to the state government, was introduced as a way to attract emerging tech industries to Nevada.

Nebraska recorded a gain of 22, advancing from 42nd place in 2020 to 20th place in 2022. The state made significant improvements in Total Venture Capital Investment Growth (40th to eighth), Total Venture Capital Deal Growth (42nd to eighth), IPO Investments (41st to 35th), Venture Capital Investment in Nanotechnology (19th to seventh), Venture Capital Investment in Clean Technology (42nd to sixth), and Venture Capital Investment in Biotechnology (41st to 26th). In 2019, Nebraskan business leaders set out to grow the state's technology sector by adding 10,000 jobs by 2025. As of 2021, the state had met approximately 13 percent of its goal, advancing from 49,500 tech jobs in 2019 to 50,800 tech jobs in 2021.[20]

Wyoming advanced in RCI subindex rankings from 40th place in 2020 to 23rd place in 2022, a 17-rank increase. The state made notable improvements in the following subcategories: Venture Capital Investment (42nd to 36th), Total Venture Capital Deal Growth (34th to second), Venture Capital Deals (47th to 23rd), Business Starts (15th to eighth), and Venture Capital Investment in Clean Technology (37th to ninth). The state, particularly Cheyenne, is rapidly becoming a leader in blockchain innovation. The state legislature has passed approximately 24 crypto-friendly regulations in the last three years, most of which offer tax exemptions for businesses to lay down the foundations of their blockchain in Wyoming.[21]

BIGGEST DROPS

State	Subindex Score	2022	2020	Change
New Mexico	40.55	38	22	-16
Oregon	54.18	22	7	-15
Indiana	39.82	40	26	-14

New Mexico recorded the largest drop in this year's RCI subindex, falling 16 places from 22nd to 38th. The state's fall was primarily driven by declines in Total Venture Capital Investment Growth (from ninth to 41st) and Venture Capital Investment in Nanotechnology (16th to 42nd). The state also performed poorly in SBIC Funds Dispersed, coming in at 49th.

Oregon dropped 15 places in the 2022 RCI subindex to place 22nd. The state's poor placement was driven primarily by its subpar performance in Total Venture Capital Investment (14th to 38th), Venture Capital Investment (eighth to 16th), Total Venture Capital Deal Growth (14th to 35th), Number of Business Starts (8th to 21st), and Venture Capital Investment in Clean Technology (12th to 27th).

Indiana recorded a 14-place drop in this year's RCI subindex, moving from 26th place in 2020 to 40th place in 2022. The state ranked in the bottom tier for Total Venture Capital Investment Growth (45th) and Venture Capital Investment (39th) and had subpar performances in Total Venture Capital Deal Growth (15th to 40th), IPO Investments (18th to 33rd), and Venture Capital Investment in Nanotechnology (ninth to 39th). However, Indiana had notable improvements in two categories: Average Annual SBIC Funds Dispersed (33rd to 17th) and Number of Business Starts (26th to 22nd).

HUMAN CAPITAL INVESTMENT

BACKGROUND

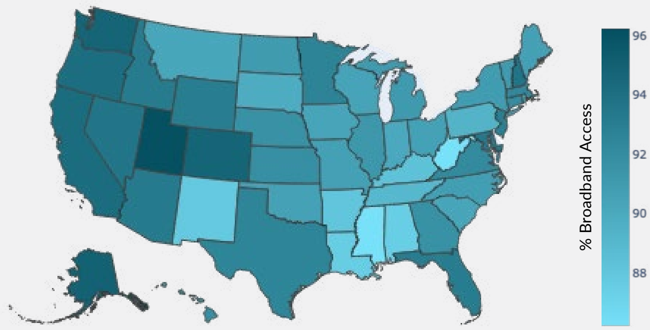
Human capital investment refers to the education and training made available to a state's population and the uptake of those opportunities. Training and talent development are essential to the knowledge economy's growth, perhaps more than the availability of any other resource. Higher levels of education often correlate with higher incomes, more stable and fulfilling job prospects, and greater potential for career growth.

In particular, education in science, technology, engineering, and mathematics (STEM) is essential for innovation and a region's ability to adapt to economic shifts. Investment in human capital not only takes place at the workforce level, but begins at all levels of education, all the way through to universities, and includes community colleges, vocational training, and other skill-development opportunities that increase a workforce's ability to take advantage of job opportunities, as well as raising a region's appeal to potential employers and investors.

The COVID-19 pandemic further highlighted the importance of education, as higher education levels correlated strongly with job security in the pandemic workplace[22]; workers without a college education were most vulnerable to the economic disruption wrought by the pandemic.

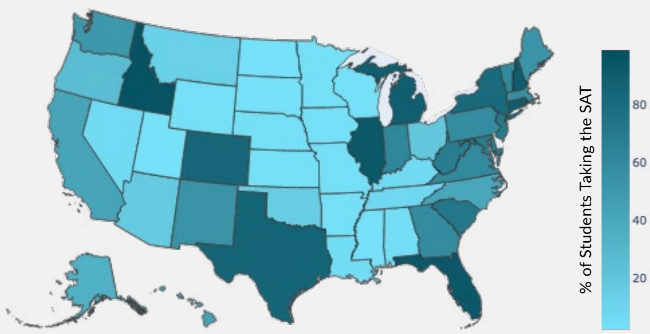
SUBINDEX COMPONENTS

Figure 6: Percentage of Households with Broadband Access 2017-2019 Average



Source: Milken Institute (2022)

Figure 7: Average SAT Participation Rate 2019-2021



Source: Milken Institute (2022)

- **Higher-education graduates:** The proportion of a state's population with university degrees. This is a key measure of skills and capacity for research and development, both within educational institutions and the private sector. Indicators focus specifically on degrees in science, engineering, and health (SEH), which affect a state's ability to attract federal grants and other research funding.
- **State spending on students:** Overall expenditures on student aid and changes in appropriations for higher education. This is an indication of the state's commitment to investing in the development of its workforce.
- **Computer penetration and broadband access:** Proportion of households with computers and broadband access. This illustrates technological connectivity across the state, which is an essential component of access to educational and work opportunities, especially in high-tech sectors.
- **Test scores:** Average scores on the Scholastic Aptitude Test (SAT) and American College Testing Assessment (ACT) among high school students. These test scores are one method of comparing the effectiveness of the state's curriculum in secondary schools.

TOP STATES

State	Subindex Score	2022	2020	Change
Massachusetts	84.4	1	1	0
Maryland	80	2	2	0
Utah	76.9	3	3	0

Massachusetts again ranked first in this subindex, with the top score in over half of the 20 indicators. Notably, Massachusetts ranked first in the percentage of residents with bachelor's degrees, master's degrees, and doctorates; doctoral scientists and doctoral engineers per capita; graduate students in SEH; and recent degrees in science and engineering per 1,000 workers. Success in this swath of indicators is representative of the state's successful higher education system, considered one of the best in the nation. The success of the state's higher education is not due simply to its strong network of universities but to its commitment to a strong education system at all levels.[23] Massachusetts has been ranked as having the top public school system in the country.[24]

The state's lowest scores in this subindex were in per capita state spending on student aid (35th) and state appropriations for higher education (30th). The lack of financing options for students in Massachusetts has already been identified as a problem that may pose a challenge in the future if the state is to maintain its reputation as the top state for education.[25]

Maryland again ranked second in this subindex, as it has in six of the last seven editions of the Index. Like Massachusetts, Maryland scored particularly well in the proportion of residents with bachelor's degrees, master's degrees, and doctorates; doctoral scientists and engineers per capita; and graduate students in SEH. Maryland also ranked highly for the proportion of households with broadband access (placing sixth). Maryland scored poorly on per capita state spending on student aid and both components of average SAT scores (verbal and math). Maryland has long been known for its strong tech and science industry, with many opportunities for highly educated workers to find career opportunities. Notably, Maryland's tech workforce grew faster than in any other state between 2021 and 2022, solidifying this reputation.[26]

Utah placed third in this subindex, the same as in the previous edition. The state ranked first in the nation for the proportion of households with a computer, recent bachelor's degrees in science and engineering per 1,000 workers, and proportion of bachelor's degrees awarded in science and engineering. Utah also ranked above the top two states in student aid, state appropriations for higher education, and average SAT scores. In recent years, Utah has become known for its thriving technology sector, which is helped significantly by top-quality higher-education institutions and their strong partnerships with the technology industry. Specifically, Utah's Industry Partnership Program[27] matches university research with industry expertise to promote innovation and tackle specific technology challenges.

BOTTOM STATES

State	Subindex Score	2022	2020	Change
Nevada	28.7	48	49	1
Arkansas	25.5	49	47	-2
Oklahoma	23.9	50	50	0

Nevada moved up one place to 48th in this subindex after placing 49th or 50th in the previous six editions. Despite placing last in a large number of indicators, the state was lifted by high scores in computer and broadband access, and growth in appropriations for higher education. Nevada placed last in the nation for average ACT scores, doctoral scientists per capita, SEH graduates, and recent degrees in science and engineering. Nevada also scores poorly for SEH doctorates per capita and recent master's degrees and doctorates in science and engineering. A recent study ranked Nevada last in the nation for school system funding,[28] which goes some way to explaining the state's poor result here.

Arkansas has consistently placed in the bottom five for this subindex. Notably, poor results were for computer and broadband access (45th and 49th) and the percentage of the population with bachelor's and master's degrees or doctorates (48th, 49th, and 48th, respectively). Arkansas's highest results are for state appropriations for higher education per capita and average verbal SAT scores, coming 16th in both indicators. Arkansas has one of the lowest rates in the nation of high school graduates continuing to college,[29] which not only holds Arkansas back in these particular rankings but has knock-on effects for the rest of the knowledge economy: Having one of the lowest rates of degree holders in the nation makes Arkansas an unlikely pick for high-tech investment from elsewhere.

Oklahoma placed last in this subindex for the third year running. Oklahoma did not place in the top half of the country in any of the measures making up this subindex, with the majority of its results falling between 39th and 45th. The state's best result in this section was 28th for recent SEH bachelor's degrees per 1,000 workers; its worst was 47th in average verbal SAT scores and number of doctoral scientists per capita. An analysis conducted by Education Week ranked Oklahoma schools 49th out of 50 states,[30] ranking Oklahoma below the national average on chance for success, school finance, and K-12 achievement.

BIGGEST GAINS

State	Subindex Score	2022	2020	Change
Michigan	55.5	19	29	10
Vermont	58.9	17	23	6

Michigan made the most significant improvement in the HCI subindex this year, jumping from 29th to 19th. This was driven by a huge leap in the growth of state appropriations for higher education, from 46th to 17th—with an average 3.9 percent annual growth from 2019 to 2021. Michigan also improved in the proportion of bachelor's degrees awarded in SEH fields, average SAT scores, and computer access.

Vermont also made a significant leap in the HCI subindex this year, from 23rd to 17th. This change was primarily driven by the state placing first for percentage change in state appropriations for higher education, up from 48th. Vermont also ranked well in recent science and engineering bachelor's degrees per 1,000 workers, doctoral scientists per capita, and percentage of the population with doctorates—placing third in all three.

BIGGEST DROPS

State	Subindex Score	2022	2020	Change
Missouri	47	31	20	-11
New Jersey	57.8	18	13	-5
Iowa	53.3	23	18	-5

Missouri dropped 11 places this year, from 20th to 31st in this subindex. This was driven by a fall from 28th to 45th in the growth of state appropriations for higher education, which was Missouri's lowest component result in this section. Missouri also fell by 11 places in recent bachelor's degrees in science and engineering per 1,000 workers. Placing 10th in verbal and math SAT scores was an impressive finish. However, only 2 percent of high-school graduates take the test,[31] which means that this is unlikely to present an accurate picture of the quality of the state's education. Additionally, these 10th-place rankings are a decline from 2020, when Missouri placed fifth and seventh in verbal and math scores, respectively. The most important driver of Missouri's fall in rankings, however, was from 28th to 45th in growth of state appropriations for higher education, where the state saw an average annual decline of just under 2 percent for the period analyzed.

New Jersey dropped five places in this subindex, from 13th to 18th, with the most substantial change being from fifth to 47th in percentage change in state appropriations for higher education, despite moving up 10 places in state appropriations for higher education per capita. New Jersey's state appropriations for higher education fell from $2.53 billion to $2.42 billion over the period analyzed (2019–2021), an average decline of just over 2 percent per annum. However, a new plan announced in 2022 introduces an increase in funding for New Jersey's education system,[32] so we may see the state improving in this section in the future. While New Jersey's results in this section's indicators are extremely varied, a top-10 finish in several indicators suggests New Jersey already has several of the necessary ingredients to move up in the rankings. In particular, New Jersey places third in the nation for the percentage of the population with bachelor's degrees, fifth for state spending on student aid, and seventh for the percentage of households with broadband access.

Iowa also dropped five places in this subindex, falling from 18th to 23rd, after placing 18th for several years in a row. Iowa's highest scores were in average math and verbal SAT scores, placing seventh and fifth, respectively. However, Iowa consistently has one of the lowest SAT participation rates, at around 3 percent of high school graduates,[33] which means that these test results are unlikely to present an accurate picture of the effectiveness of the state's curriculum or the readiness of its high school graduates. Iowa also moved down four places in the number of graduate students in SEH fields per capita. The state also moved down four spots in per capita state appropriations for higher education and, notably, moved down nine places in the percentage of bachelor's degrees awarded in SEH fields.

TECHNOLOGY AND SCIENCE WORKFORCE

BACKGROUND

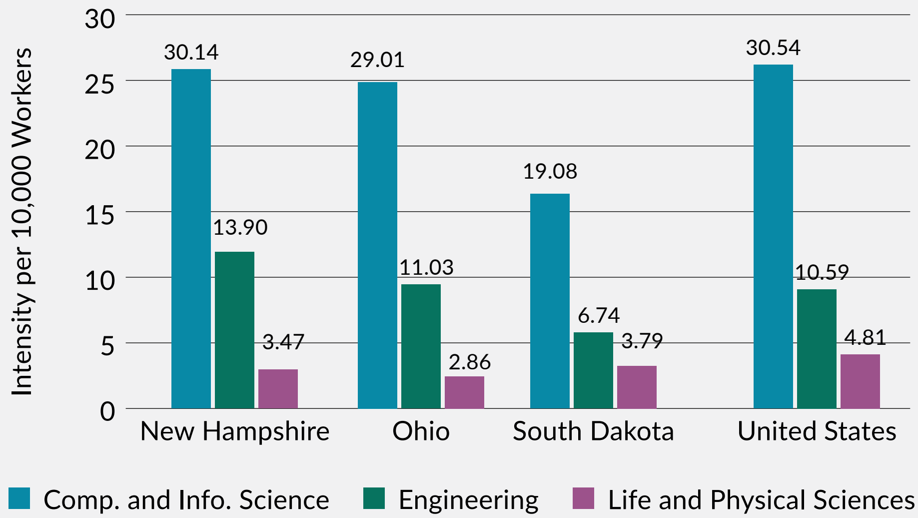
The Technology and Science Workforce (TSW) subindex shows how much each state's workforce is concentrated in scientific and engineering occupations. It measures employment in more than 40 occupations relative to total state employment.

The COVID-19 pandemic accelerated digitization and automation trends across the economy, which has fundamentally changed the labor market, leading to widespread unemployment and labor displacement. One of the big stories at the start of 2022 was the Great Resignation, with workers of all ages and occupations quitting work, leading in turn to worker shortages. The US currently has about 10 million jobs to fill (the most ever and more than double the historical average), including low-wage and high-wage jobs. Still, only 8.4 million Americans are actively looking for work.[34]

One way to tackle this labor shortage is to modernize workers through workforce development programs. Some states—such as New York, Tennessee, and Missouri—are experimenting with novel ways to bolster their tech and science workforce by training unemployed workers in data science and other high-demand fields. Some companies are designing online certificates to serve similar ends.[35] Streamlining the legal immigration system could also help strengthen the tech and science workforce. More than 9 million qualified immigrants are waiting for permanent residence in the US.[36] Meanwhile, research by economists Giovanni Peri and Reem Zaiour of the University of California, Davis showed that "sectors that are especially reliant on immigrant workers have had significantly higher rates of unfilled jobs in 2021."[37]

SUBINDEX COMPONENTS

Figure 8: Intensities by Occupational Category (2020)



Source: Milken Institute (2022)

- **Intensity of computer and information science experts:** This category includes the following jobs: Computer Systems Analysts, Information Security Analysts, Information Research Scientists, Network Support Specialists, User Support Specialists, Network Architects, Systems Administrators, Database Administrators, Computer Programmers, Software Developers, Web Developers, Operations Research Analysts, Statisticians, and other types of computer and information scientists.
- **Intensity of engineers:** This group includes the following occupations: Aerospace Engineers, Bioengineers and Biomedical Engineers, Chemical Engineers, Civil Engineers, Computer Hardware Engineers, Electrical Engineers, Environmental Engineers, Industrial Engineers, Materials Engineers, Mechanical Engineers, Mining and Geological Engineers, Nuclear Engineers, Petroleum Engineers, and other types of engineers.
- **Intensity of life scientists and physical scientists:** This category includes the following occupations: Soil and Plant Scientists, Biochemists and Biophysicists, Microbiologists, Zoologists and Wildlife Biologists, Medical Scientists, Epidemiologists, Physicists, Atmospheric and Space Scientists, Chemists, Materials Scientists, Environmental Scientists and Specialists, Geoscientists, Agricultural and Food Science Technicians, Biological Technicians, Chemical Technicians, Environmental Science and Protection Technicians, Nuclear Technicians, and other types of life scientists and physical scientists.

TOP STATES

State	Subindex Score	2022	2020	Change
Washington	93.33	1	1	0
Colorado	92.00	2	4	2
Maryland	91.33	3	1	-2

Washington maintains its first place in the Technology & Science Workforce (TSW) subindex. In total, 8.87 percent of Washington's workforce was employed in science and engineering occupations in 2020 (compared to 5.26 percent nationwide).[38] The state ranked second in the concentration of computer and information scientists; these workers made up 6.15 percent of its workforce, nearly double the national average of 3.21 percent. Washington also ranked fourth in the concentration of engineers and seventh in the concentration of life scientists and physical scientists.

Colorado rose to second place in the TSW subindex for the first time since reaching third place in 2016. The state ranked fourth in the concentration of computer and information scientists, third in the concentration of engineers, and eighth in the concentration of life and physical scientists. The percentage of computer and mathematical scientists in the state's workforce was 4.87 percent—far above the national average of 3.21 percent—and the percentage of engineers in the state's workforce was 1.89 percent compared with the national average of 1.28 percent (in 2020 values).[25] In total, 7.79 percent of Colorado's workforce was employed in science and engineering occupations, above the national average of 5.26 percent.[39]

Maryland drops to third place after maintaining first place for three consecutive years (2016, 2018, and 2020) in the TSW subindex. The state ranked third in the concentration of computer and information scientists, 10th in the concentration of engineers, and third in the concentration of life and physical scientists. In 2019, 0.64 percent of all occupations in Maryland were life scientists, which is also more than double the national average of 0.27 percent; 0.47 percent of all occupations in Maryland were physical scientists, which is more than double the national average of 0.22 percent.[40] In total, 8.31 percent of Maryland's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[41]

BOTTOM STATES

State	Subindex Score	2022	2020	Change
Nevada	16.00	48	50	2
Mississippi	10.00	49	48	-1
Arkansas	6.00	50	49	-1

Nevada rises two spots to 48th place, but more troubling is that it has stayed at the bottom of the TSW subindex ranking for at least the last 10 years. The state ranked 47th in the concentration of computer and information scientists (ranking remained unchanged), 48th in the concentration of engineers (up two places from 50th), and 34th in the concentration of life and physical scientists (up 14 spots from 48th). In 2019, the concentration of SEH doctorate holders among the state's workforce in Nevada was 0.22 percent, which is half the national average of 0.54 percent; life scientists as a percentage of all occupations in Nevada was 0.12 percent (less than half the national average of 0.27 percent); physical scientists as a percentage of all occupations in Nevada was 0.15 percent.[42] In total, only 2.75 percent of Nevada's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[43]

Mississippi drops one place to 49th; the highest it has ranked in the last 10 years was when it came out 44th in 2014. The state ranked 48th in the concentration of computer and information scientists (up one place from 49th), 45th in the concentration of engineers (down five places from 40th), and 45th in the concentration of life and physical scientists (down three places from 42nd). In 2019, the concentration of SEH doctorate holders among the state's workforce in Mississippi was 0.34 percent (the national average was 0.54 percent); life scientists as a percentage of all occupations in Mississippi was 0.28 percent (the national average was 0.27 percent); physical scientists as a percentage of all occupations in Mississippi was 0.15 percent (the national average was 0.22 percent).[44] In total, only 2.69 percent of Mississippi's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[45]

Arkansas comes out at the bottom of the 2022 edition's TSW subindex. The highest the state ranked in the last decade was 43rd place in 2014. The state ranked 44th in the concentration of computer and information scientists (down from 40th when compared to the Index 2020), 50th in the concentration of engineers (down one place from 49th), and 50th in the concentration of life and physical scientists (stayed put). In 2019, the concentration of SEH doctorate holders among the state's workforce in Arkansas was 0.32 percent (the national average was 0.54 percent); life scientists as a percentage of all occupations in Arkansas was 0.30 percent (the national average was 0.27 percent in 2020); physical scientists as a percentage of all occupations in Arkansas was 0.10 percent (the national average was 0.22 percent in 2020).[46] In total, 3.07 percent of Arkansas' workforce was employed in science and engineering occupations (the national average is 5.26 percent).[47]

BIGGEST GAINS

State	Subindex Score	2022	2020	Change
Hawaii	48.67	27	41	14
Connecticut	70.00	11	21	10
Tennessee	36.00	36	45	9

Hawaii climbed a remarkable 14 places to claim the 27th spot in the TSW subindex. This is a major improvement when one considers that the highest Hawaii ranked was 34th in 2018, and it has hovered around 40th place throughout the last decade.

The state ranked 34th in the concentration of computer and information scientists (up 10 places from 44th), 32nd in the concentration of engineers (up 10 places from 42nd), and 14th in the concentration of life and physical scientists (up six places from 20th). In 2019, the concentration of SEH doctorate holders among the state's workforce in Hawaii was 0.46 percent (the national average was 0.54 percent); life scientists as a percentage of all occupations in Hawaii was 0.25 percent (the national average was 0.27 percent in 2020); physical scientists as a percentage of all occupations in Hawaii was 0.26 percent (the national average was 0.22 percent in 2020).[48] In total, 3.83 percent of Hawaii's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[49]

Connecticut jumped 10 places to come out 11th in the TSW subindex. In the last decade, the state fluctuated considerably in rankings, with a high of 10th (2016) and a low of 21st (2020). The state ranked 23rd in the concentration of computer and information scientists (down two places from 21st), sixth in the concentration of engineers (ranking remained unchanged), and 19th in the concentration of life and physical scientists (up 16 places from 35th). The notable change is Connecticut's rise in the concentration of life and physical scientists.

In 2019, the concentration of SEH doctorate holders among the state's workforce in Connecticut was 0.69 percent (the national average was 0.54 percent); life scientists as a percentage of all occupations in Connecticut was 0.26 percent (the national average was 0.27 percent in 2020); physical scientists as a percentage of all occupations in Connecticut was 0.20 percent (the national average was 0.22 percent in 2020).[50] In total, 5.61 percent of Connecticut's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[51]

Tennessee climbed nine places and ranked 36th in this year's TSW subindex. Over the last decade, the state has ranked as high as 34th in 2013 and 2014, and as low as 45th in 2020. The state ranked 35th in the concentration of computer and information scientists (up four places from 39th), 38th in the concentration of engineers (up three spots from 41st), and 26th in the concentration of life and physical scientists (up eight places from 34th). In 2019, the concentration of SEH doctorate holders among the state's workforce in Tennessee was 0.36 percent (the national average was 0.54 percent); computer and mathematical scientists as a percentage of all occupations in Tennessee was 2.17 percent (the national average was 3.21 percent); engineers as a percentage of all occupations in Tennessee was 0.86 percent (the national average was 1.28 percent); life scientists as a percentage of all occupations in Tennessee was 0.20 percent (the national average was 0.27 percent in 2020); physical scientists as a percentage of all occupations in Tennessee was 0.23 percent (the national average was 0.22 percent in 2020).[52] In total, 3.6 percent of Tennessee's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[53]

BIGGEST DROPS

State	Subindex Score	2022	2020	Change
New Hampshire	64.00	16	6	-10
Ohio	50.67	25	17	-8
South Dakota	26.00	44	36	-8

New Hampshire dropped 10 places to take the 16th spot in the TSW subindex. The state ranked as low as 26th in 2016 and reached a high of sixth in 2020. The state ranked 17th in the concentration of computer and information scientists (down eight places from ninth), seventh in the concentration of engineers (ranking remained unchanged), and 33rd in the concentration of life and physical scientists (down three places from 30th). In total, 5.79 percent of New Hampshire's workforce was employed in science and engineering occupations, higher than the national average of 5.26 percent.[54]

Ohio dropped eight places to the 25th spot in the TSW subindex. The state ranked highest in 2020 at 17th and lowest in 2014 at 30th. The Buckeye state ranked 19th in the concentration of computer and information scientists (up four places from 23rd), 17th in the concentration of engineers (down three places from 14th), and 41st in the concentration of life and physical scientists (down 18 places from 23rd). The most notable change in Ohio is the drop in the concentration of life and physical scientists.

In 2019, the concentration of SEH doctorate holders among the state's workforce in Ohio was 0.44 percent, lower than the national average of 0.54 percent; computer and mathematical scientists as a percentage of all occupations in Ohio was 2.91 percent; life scientists as a percentage of all occupations in Ohio was 0.2 percent, and physical scientists as a percentage of all occupations was 0.17 percent, all of which were lower than the national averages. Engineers as a percentage of all occupations was 1.33 percent, higher than the national average of 1.25 percent.[55] In total, 4.83 percent of Ohio's workforce was employed in science and engineering occupations (the national average is 5.26 percent).[56]

South Dakota dropped eight places to 44th in the TSW subindex rankings. The state ranked highest in 2016 at 29th and lowest this year, coming out at 44th. The state ranked 39th in the concentration of computer and information scientists (down one place from 38th), 46th in the concentration of engineers (down one spot from 45th), and 29th in the concentration of life and physical scientists (down 15 places from 14th). The most notable change in South Dakota is the drop in the concentration of life and physical scientists. Life scientists as a percentage of all occupations in South Dakota was 0.51 percent, almost double the national average of 0.27 percent, while physical scientists as a percentage of all occupations in South Dakota was 0.18 percent, slightly below the national average of 0.22 percent.[57]

TECHNOLOGY CONCENTRATION AND DYNAMISM

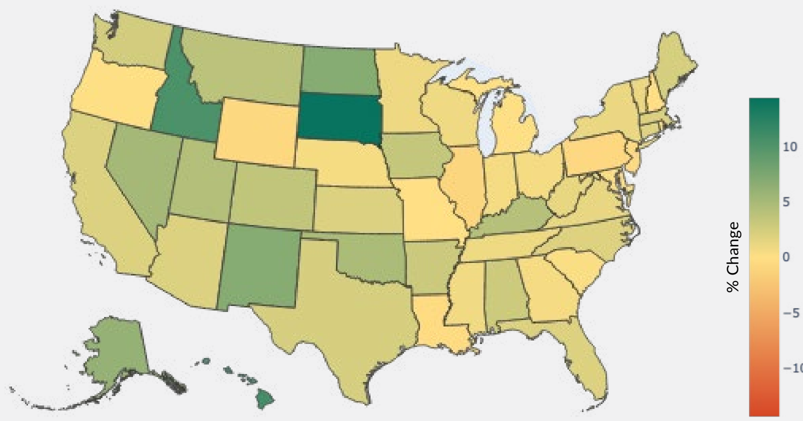
BACKGROUND

The Technology Concentration and Dynamism (TCD) subindex measures the intensity of high-tech business growth. It captures several critical components of a state's ability to transform small entrepreneurial firms into large, growing companies. Measures of high-tech dynamism, including high employment levels and payroll growth in high-tech industries, correlate with robust economies that are less vulnerable to external economic shocks or gradual obsolescence. Moreover, they often correlate with the development of high-tech clusters that generate positive spillover effects through the growth of supplier networks and local wages.[55]

By measuring outcomes—not just science and technology inputs—this subindex also captures other influences on the business climate that complement the Index's core analytical insights regarding factors that facilitate knowledge-based economic growth. These factors include taxes, regulations, growth in non-high-tech sectors, proximity to other dynamic regions, and overall quality of life. These influence not only where firms choose to locate but where their workers choose to live.

SUBINDEX COMPONENTS

Figure 9: Average High Tech Employment Growth 2018-2020



Source: Milken Institute (2022)

- **Industry concentration:** These industries are key drivers of both job creation and wage growth, so the subindex measures the concentration of establishments, employment, and payroll in high-tech sectors to determine the quality of new jobs in each state's economy. It also measures growth in high-tech startups and the number of high-tech jobs.
- **Geographic concentration:** The subindex counts the number of high-tech industries in each state with a location quotient (LQ) higher than 1.0, indicating that the industry's average concentration is higher than the national average. This indicator reveals which states have been most successful in stimulating the growth of particular industries and which sectors have been most successful in specific regions.
- **High-performing tech companies:** The number of companies named in Deloitte's Technology Fast 500—an index that identifies the fastest-growing private tech companies—reflects the level of growth in states' high-tech economies. We also consider the Inc. 500 rankings for a general snapshot of Technology Concentration and Dynamism among all companies. Taken together, they measure how well tech firms are performing against a wider field.

The following high-tech industries, defined at the four-digit industry group level by the North American Industry Classification System (NAICS), are measured by the indicators used for the TCD subindex: Pharmaceutical Manufacturing; Commercial and Service Industry Machinery Manufacturing; Computer Equipment Manufacturing; Communications Equipment Manufacturing; Audio and Video Equipment Manufacturing; Semiconductor and Electronic Component Manufacturing; Navigational and Control Instruments Manufacturing; Magnetic and Optical Media Manufacturing; Aerospace Manufacturing; Medical Equipment Manufacturing; Software Publication; Motion Picture, Video, and Sound Recording; Wired and Wireless Telecommunications; Satellite Communications; Data Processing, Hosting, and Related Services; Architectural and Engineering Services; Computer Systems Design; Scientific Research and Development; and Medical and Diagnostic Laboratories.

TOP STATES

State	Subindex Score	2022	2020	Change
Utah	90.50	1	1	0
California	90.25	2	3	1
Colorado	86.25	3	2	-1

Utah claimed the top spot in the TCD subindex for the third consecutive edition. Home to the Silicon Slopes, Utah has seen remarkable growth in its technology industry. In fact, in the Salt Lake City metro area alone, employment in high-tech sectors jumped by 30 percent—9,855 jobs—from 2015 to 2020.[58] Leading tech companies with a significant presence in Utah include Adobe, Overstock.com, Qualtrics, and eBay. Utah ranked within the top 10 in all eight of the subindex components. Notable performances include second in Number of Inc. 500 Companies, third in Number of High–Tech Industries, and fourth in Number of Technology Fast 500 Companies.[59]

California gained one spot from its 2020 ranking to achieve second in the TCD subindex. Once again, the state registered unprecedented diversity in its high-tech economy, ranking first for the third time in a row in the Number of High-Tech Industries with Employment LQ Higher than 1.0. The Golden State additionally scored first in the subcomponent Number of Technology Fast 500, an annual ranking of the fastest-growing North American companies in technology. Results showed that California's Silicon Valley leads regional representation: 21 percent of the companies included in the ranking were headquartered in the world's preeminent hub for technology.

Colorado ranked third in the TCD subindex, a one-place decrease from 2020. It ranked near the top of the subindex for Percent of Establishments in High-Tech Industries (fourth), Percent of Employment in High-Tech Industries (eighth), Net Formation of High-Tech Establishments (ninth), Number of High-Tech Industries (eighth), and Number of Inc. 500 Companies (fifth). The state has intentionally scaled its startup ecosystem by offering limited regulations, favorable local tax laws, and a robust regional transportation infrastructure to support and attract tech entrepreneurs.[60]

BOTTOM STATES

State	Subindex Score	2022	2020	Change
West Virginia	25.75	48	44	-4
Louisiana	20.50	49	46	-3
Mississippi	8.25	50	50	0

West Virginia ranked 48th in the 2022 TCD subindex, a four-place drop from its ranking in 2020. The state had subpar performances in Percent of Establishments in High-Tech Industries (46th), Percent of Employment in High-Tech Industries (45th), and Number of High-Tech Industries with Employment (46th). However, West Virginia placed within the middle tier of Net Formation of High-Tech Establishments (25th), Employment Growth of High-Tech Industries (27th), and Number of Inc. 500 Companies (20th). Recently, West Virginia has passed regulatory sandbox legislation, such as the FinTech Sandbox Bill, and is offering comprehensive developmental assistance through tax credits and exemptions to encourage startup activities and entrepreneurship within the state.[61]

Louisiana dropped three spots to claim the second-to-last ranking in this year's TCD subindex. The state recorded low scores in Employment Growth of High-Tech Industries (46th), Percent of Employment in High-Tech Industries (42nd), and Number of High-Tech Industries (40th). The state's subcomponent rankings fell in all categories but one: Net Formation of High-Tech Establishments. However, in 2021, the state saw notable tech milestones for its homegrown businesses: Shutterstock acquired the New Orleans-based 3D image marketplace, TurboSquid, for $75 million, California tech company Procore Technologies Inc. bought Levelset for $500 million, and the Swedish market research firm, Clint Group, purchased the New Orleans-based analytics company Lucid for approximately $1.1 billion, making it the state's first "unicorn" company, a significant victory for the region's startup scene.

Mississippi claimed the 50th spot in the TCD subindex for the second consecutive Index. The state ranked low in the following subcomponents: Percent of Establishments in High-Tech Industries (48th), Net Formation of High-Tech Establishments (44th), Percent of Employment in High-Tech Industries (50th), Number of High-Tech Industries (50th), and Number of Inc. 500 Companies (49th). However, Innovate Mississippi, the state's nonprofit angel network, has made strides to attract and fund startups to Mississippi, investing more than $17 million in nearly 40 companies in the past three years. Although Mississippi falls below the tech-scene radar, the state has immense potential: a supportive government, tax incentives, and a pipeline of well-educated graduates from four major universities—the University of Mississippi, Mississippi State, Jackson State, and Southern Mississippi.

BIGGEST GAINS

State	Subindex Score	2022	2020	Change
Alaska	44.00	27	46	19
Wyoming	39.75	30	45	15

Alaska claimed the 27th spot in the TCD subindex, a 19-place improvement from its previous rank in 2020. This development can be attributed to the state's strong performance in the Net Formation of High-Tech Establishments (14th), for a 25-place rank difference from the previous Index, and in Employment Growth of High-Tech industries (sixth), for a significant 44-place improvement from its latest rank. Although Alaska is not historically known for its tech presence and innovation—due to the state's extreme climate, scattered population, limited transport infrastructure, and labor force—tech activity has begun to mount. A business accelerator, Launch Alaska, founded in 2016, has partnered with 28 climate-tech companies to deploy and invest in their projects in Alaska.[62] The CompTIA Cyberstates 2021 report also shows that Alaska is poised to accelerate its technology presence because demand for IT workers will increase as the state transitions from its current outdated infrastructure to one of emerging hardware and artificial intelligence technology, data, and next-gen cybersecurity.[63]

Wyoming recorded a 15-place gain in the 2022 TCD subindex to claim the 30th spot. Notable improvements were found in the Net Formation of High-Tech Establishments (third to second), Percent of Establishments in High-Tech industries (28th to 25th), and Number of Inc. 500 Companies (47th to 17th). While Wyoming's economy is dominated by mining, agriculture, and tourism, the state has become a ripe haven for cryptocurrency and blockchain innovation in recent years. Most recently, Wyoming has chartered special-purpose depository institutions—the first banking structures of this kind in the US—which allow for digital-asset–friendly banking. With this innovation, the state is creating a welcoming foundation and ecosystem for more crypto-related tech jobs in the years to come.[64]

BIGGEST DROPS

State	Subindex Score	2022	2020	Change
Oregon	48.50	25	11	-14
South Carolina	38.00	32	20	-12

Oregon dropped 14 positions in the 2022 TCD subindex to claim the 25th spot. The state experienced a sharp 32-place drop in the Net Formation of High-Tech Establishments (41st) and an even larger 34-place drop in the Employment Growth of High-Tech Industries (43rd). Oregon's poor performance can be attributed to stagnation. The state has not produced a major homegrown technology employer since Tektronix, which the Danaher Corporation acquired in 2007. It mainly serves as an outpost for major tech companies such as Intel, IBM, and Hewlett-Packard.[65] Indeed, Oregon placed 46th overall in the Number of Inc. 500 Companies, an index measuring the growth level in each state's high-tech economies.

South Carolina recorded a drop of 12 spots to place 32nd in the 2022 TCD subindex. The state ranked in the bottom tier for the following subcomponents: Percent of Establishments in High-Tech Industries (41st), Employment Growth of High-Tech Industries (41st), Number of Inc. 500 Companies (38th), and Number of Technology Fast 500 Companies (37th).

APPENDIX

RESEARCH AND DEVELOPMENT INPUTS

Indicator	Source	Year
Federal R&D Dollars per Capita	NSF, National Patterns of R&D Resources, Survey of Federal Funds for Research and Development	2018-20
Industry R&D Dollars per Capita	NSF, National Patterns of R&D Resources, Business Research and Development and Innovation Survey	2017-19
Academic R&D Dollars per Capita	NSF, National Patterns of R&D Resources, Higher Education Research and Development Survey	2018-20
National Science Foundation Funding per 100,000 of GSP	NSF, Budget Internet Information System	2019-21
National Science Foundation Research Funding per 100,000 of GSP	NSF, Budget Internet Information System	2019-21
R&D Expenditures on Engineering per Capita	NSF, Survey of Research and Development Expenditures at Universities and Colleges/Higher Education Research and Development Survey	2018-20
R&D Expenditures on Physical Sciences per Capita	NSF, Survey of Research and Development Expenditures at Universities and Colleges/Higher Education Research and Development Survey	2018-20
R&D Expenditures on Geological Sciences per Capita	NSF, Survey of Research and Development Expenditures at Universities and Colleges/Higher Education Research and Development Survey	2018-20
R&D Expenditures on Computer and Information Science per Capita	NSF, Survey of Research and Development Expenditures at Universities and Colleges/Higher Education Research and Development Survey	2018-20
R&D Expenditures on Life Sciences per Capita	NSF, Survey of Research and Development Expenditures at Universities and Colleges/Higher Education Research and Development Survey	2018-20
R&D Expenditures on Math and Statistics per Capita	NSF, Survey of Research and Development Expenditures at Universities and Colleges/Higher Education Research and Development Survey	2018-20
Average Annual Number of STTR Awards per 10,000 Business Establishments (Phase 1)	SBA, SBIR, STTR	2018-20

RESEARCH AND DEVELOPMENT INPUTS (CONT.)

Indicator	Source	Year
Average Annual Number of STTR Awards per 10,000 Business Establishments (Phase 2)	SBA, SBIR, STTR	2018-20
Average STTR Award Dollars per $1 Million of GSP	SBA, SBIR, STTR	2018-20
Average Annual Number of SBIR Awards per 10,000 Business Establishments (Phase 1)	SBA, SBIR, STTR	2018-20
Average Annual Number of SBIR Awards per 10,000 Business Establishments (Phase 2)	SBA, SBIR, STTR	2018-20
Average SBIR Award Dollars per $1 Million of GSP	SBA, SBIR, STTR	2018-20
Competitive NSF Proposal Funding Rate	NSF, Budget Internet Information System	2019-21

RISK CAPITAL AND ENTREPRENEURIAL INFRASTRUCTURE

Indicator	Source	Year
Total Venture Capital Investment Growth	Pitchbook, NVCA, Venture Monitor Report	2019-21
VC Deals per 10,000 Business Establishments	Pitchbook, NVCA, Venture Monitor Report	2019-21
Deal Growth of VC Investment	Pitchbook, NVCA, Venture Monitor Report	2019-21
Venture Capital Investment as Percent of GSP	Pitchbook, NVCA, Venture Monitor Report	2019-21
SBIC Funds Disbursed per $1,000 of GSP	SBA Small Business Investment Company Program (Financings to Businesses by State report)	2019-21
Patents Issued per 100,000 People	USPTO, Patent Technology Monitoring Team	2018-20
Business Starts per 100,000 People	US Census Bureau, County Business Patterns	2018-20
Average IPO Proceeds as Percent of GSP	Pitchbook	2019-21
Average VC Investment in Nanotechnology as Percent of GSP	Pitchbook	2019-21
Average VC Investment in Clean Technology/ Green Technology as Percent of GSP	Pitchbook	2019-21
Average VC Investment in Biotechnology per $1,000 of GSP	Pitchbook	2019-21

HUMAN CAPITAL INVESTMENT

Indicator	Source	Year
Percentage of Population with Bachelor's Degrees or Higher	American Community Survey 5-year estimates	2017-19
Percentage of Population with Advanced Degrees	American Community Survey 5-year estimates	2017-19
Percentage of Population with PhDs	American Community Survey 5-year estimates	2017-19
Graduate Students in Sci & Eng & Health per 1,000 people	NSF-NIH, Survey of Graduate Students & Postdoctorates in Science and Engineering	2018-20
Per Capita State Spending on Student Aid	National Association of State Student Grant & Aid Programs Annual Fiscal Report	2018-20

HUMAN CAPITAL INVESTMENT (CONT.)

Indicator	Source	Year
Average Evidence-Based Reading and Writing SAT Scores	College Board	2019-21
Average Math SAT Scores	College Board	2019-21
Average ACT Scores	ACT	2019-21
State Appropriations for Higher Education (per capita)	Illinois State University, SHEEO, Grapevine	2019-21
Percent Change in State Appropriations for Higher Education	Illinois State University, SHEEO, Grapevine	2019-21
Doctoral Scientists per 100,000 People	NSF, Survey of Doctorate Recipients	2019
Doctoral Engineers per 100,000 People	NSF, Survey of Doctorate Recipients	2019
Science, Engineering, and Health PhDs Awarded	NSF, Survey of Doctorate Recipients	2018-20
Percentage of Bachelor's Degrees in Science and Engineering per 100,000 People	IPEDS, Completions Survey	2019
Recent Bachelor's Degree in Science and Engineering per 100,000 People	IPEDS, Completions Survey	2017-19
Recent Master's Degree in Science and Engineering per 100,000 people	IPEDS, Completions Survey	2017-19
Recent PhD Degree in Science and Engineering per 100,000 People	NSF, Survey of Earned Doctorates	2018-20
Recent Degrees in Science and Engineering per 100,000 People	IPEDS, Completions Survey	2017-19
Percentage of Households with Computers	American Community Survey 5-year estimates	2017-19
Percentage of Households with Broadband Access	American Community Survey 5-year estimates	2017-19

TECHNOLOGY AND SCIENCE WORKFORCE

Indicator	Source	Year
Intensity of Computer and Information Research Scientists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Computer Systems Analysts per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Information Security Analysts per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Computer Programmers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Software Developers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Web Developers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Database Administrators per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Network and Computer Systems Administrators per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21

TECHNOLOGY AND SCIENCE WORKFORCE (CONT.)

Indicator	Source	Year
Intensity of Computer Network Architects per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Computer User Support Specialists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Computer Network Support Specialists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Computer Occupations, All Other per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Operations Research Analysts per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Statisticians per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Data Scientists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Aerospace Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Biomedical Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Chemical Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Civil Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Computer Hardware Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Electrical Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Environmental Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Industrial Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Materials Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Mechanical Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Mining and Geological Engineers, Including Mining Safety Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Nuclear Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Petroleum Engineers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Engineers, All Other per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Soil and Plant Scientists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Biochemists and Biophysicists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21

TECHNOLOGY AND SCIENCE WORKFORCE (CONT.)

Indicator	Source	Year
Intensity of Microbiologists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Zoologists and Wildlife Biologists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Biological Scientists, All Other per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Epidemiologists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Medical Scientists, Except Epidemiologists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Life Scientists, All Other per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Physicists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Atmospheric and Space Scientists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Chemists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Materials Scientists per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Environmental Scientists and Specialists, Including Health per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Geoscientists, Except Hydrologists and Geographers per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Physical Scientists, All Other per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Food Science Technicians per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Biological Technicians per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Chemical Technicians per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21
Intensity of Environmental Science and Protection Technicians, Including Health per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-22
Intensity of Nuclear Technicians per 100,000 Workers	Bureau of Labor Statistics, Occupational Employment Statistics	2019-21

TECHNOLOGY CONCENTRATION AND DYNAMISM

Indicator	Source	Year
Percent of Establishments in High-Tech NAICS Codes	US Census Bureau, County Business Patterns	2018-20
Percent of Employment in High-Tech NAICS Codes	US Census Bureau, County Business Patterns	2018-20
Percent of Payroll in High-Tech NAICS Codes	US Census Bureau, County Business Patterns	2018-20
Net Formation of High-Tech Establishments per 10,000 Establishments	US Census Bureau, County Business Patterns	2018-20
Number of Technology Fast 500 Companies per 10,000 Establishments	Deloitte Fast 500 Technology	2019-21
Average Yearly Employment Growth of High-Tech Industries	US Census Bureau, County Business Patterns	2017-20
Number of High-Tech Industries with LQs Higher Than 1.0	US Census Bureau, County Business Patterns	2018-20
Number of Inc. 500 Companies per 10,000 Establishments	Inc. Magazine	2019-21

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