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2014 STATE TECH AND SCIENCE INDEX

Enduring Lessons for the Intangible Economy

Kevin Klowden, Kristen Keough, and Jason Barrett

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ON THE WEB

Data for each state and indicator can be found on our interactive website, at **www.statetechandscience.org**.

ACKNOWLEDGMENTS

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ABOUT THE MILKEN INSTITUTE

A nonprofit, nonpartisan economic think tank, the Milken Institute works to improve lives around the world by advancing innovative economic and policy solutions that create jobs, widen access to capital, and enhance health. We produce rigorous, independent economic research—and maximize its impact by convening global leaders from the worlds of business, finance, government, and philanthropy. By fostering collaboration between the public and private sectors, we transform great ideas into action.

The Milken Institute California Center is focused on developing and implementing solutions to strengthen the business and workforce climate of the state and improve its ability to lead and compete on the global stage.

CONTENTS

EXECUTIVE SUMMARY

The 2014 State Technology and Science Index, a project of the Milken Institute's California Center, represents over a decade of tracking and examining the key factors behind technology-based economic development in the United States. Since its inception in 2002, the index has provided a means to examine the components that allowed leading states to build and maintain their preeminence in high technology and enabled others to develop their strengths in the field. Below are this year's key findings:

» The Top 3 states (Massachusetts, Maryland, and California) improved their scores for the third straight index and are returning to heights not seen since 2002. At the same time, the composition of the Top 10 leading states has become increasingly stable, cementing their success while frustrating up-and-coming states striving to become leaders in the tech-based economy.

» The impact of state budgetary instability and the consequent decline of investment in human capital have had a significant impact in many states. States that have continued to invest in innovation and education have emerged stronger from the recession.

» The importance of tech-based economic development is evident in 2014, as technology and science continue to develop a larger share of the U.S. economy while more traditional and lower-skilled sectors have been slower to regain their pre-recession levels.

» The 2014 index shows that technology and innovation are reaching ever-wider sectors of the economy, even those previously considered to be less exposed to innovation. The bottom 10 states all showed improvements in the rankings over the previous index.

The index is composed of five equally weighted composites that can be applied across all 50 states for comparison and analysis. Seventy-eight indicators comprise these five composites, which are listed below. Each indicator is computed and measured against the relevant statistic: population, gross state product (GSP), number of establishments, number of businesses, and so on. The 50 states are then ranked accordingly. Data sources include government agencies, foundations, and private sources.

» **Research and development inputs:** This composite examines a state's R&D capacity to determine if it has the facilities to attract funding and create innovations that can contribute to economic growth.

» **Risk capital and entrepreneurial infrastructure:** This measures a state's ability to convert research into commercially viable products and services.

» **Human capital investment:** This focuses on how much each state invests in developing its workforce, which is crucial to success and viability in the tech-based economy.

» **Technology and science workforce:** Measuring the current strength of a state's high-end technical talent, this composite is a key to a state's ability to staff tech-based businesses.

» **Technology concentration and dynamism**: This evaluates the actual current impact of efforts by policymakers and other stakeholders in strengthening and growing the tech-based economy within the state.

Overall Rankings

TABLE 1 **State Technology and Science Index:** State rankings, 2014

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Massachusetts	1	1	0	86.59
Maryland	2	2	0	81.48
California	3	3	0	76.64
Colorado	4	4	0	74.60
Utah	5	7	2	74.01
Washington	6	5	-1	72.71
Virginia	7	6	-1	71.58
New Hampshire	8	10	2	66.88
Connecticut	9	9	0	65.51
Delaware	10	8	-2	65.34
New York	11	13	2	64.99
Minnesota	12	12	0	64.35
Rhode Island	13	17	4	64.20
Pennsylvania	14	11	-3	63.06
North Carolina	15	21	6	62.04
New Jersey	16	15	-1	61.32
Oregon	17	20	3	59.55
Vermont	18	14	-4	58.99
Arizona	19	16	-3	58.96
Texas	20	19	-1	58.56
Illinois	21	18	-3	58.27
Michigan	22	23	1	57.10
Georgia	23	26	3	55.03
New Mexico	24	22	-2	54.91
Wisconsin	25	25	0	53.90

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Ohio	26	28	2	51.72
Indiana	27	27	0	50.40
Kansas	28	24	-4	49.47
North Dakota	29	32	3	48.72
Nebraska	30	33	3	48.15
Iowa	31	31	0	48.01
Alabama	32	30	-2	46.11
Idaho	33	34	1	45.44
Missouri	34	29	-5	44.62
Hawaii	35	36	1	44.37
Tennessee	36	35	-1	43.74
Florida	37	38	1	43.46
Alaska	38	41	3	43.22
Montana	39	37	-2	42.95
South Carolina	40	43	3	39.99
Maine	41	39	-2	36.65
South Dakota	42	42	0	35.06
Oklahoma	43	40	-3	34.86
Kentucky	44	45	1	32.65
Arkansas	45	49	4	32.45
Wyoming	46	46	0	32.13
West Virginia	47	48	1	32.11
Louisiana	48	44	-4	31.34
Mississippi	49	50	1	30.86
Nevada	50	47	-3	30.77

Top 10 States

Massachusetts is No. 1 again, nudging up its 2012 score of 86.40 to 86.59 in 2014. The state maintains its dominant position by ranking first in four of the five composites. Its near-perfect record is marred by its fourth-place finish in Technology Concentration and Dynamism, but even this ranking is its best since 2004.

Maryland remains No. 2, moving its score closer to Massachusetts at 81.48, its highest score in the history of the index. Maryland's rising score is largely due to a rebound in Risk Capital and Entrepreneurial Infrastructure, up from 13th in 2012 to fifth in 2014.

California holds on to the No. 3 spot with a score of 76.64, nearly a full point higher than in 2012, but still well below its 2002 score of 80.37. California's principal weakness in the rankings remains Human Capital Investment, where it fell to 17th in 2014 after ranking an impressive second back in 2002. California's rankings are covered more fully in this report's supplemental section, California's Position in Technology and Science: A Comparative Benchmarking Assessment.

Colorado maintains the No. 4 spot, but its overall score dropped for the third straight index. Although Colorado continues to flourish in Research and Development Inputs, ranking third, it has declined in Technology and Concentration Dynamism, dropping from third place in 2012 to eighth in 2014.

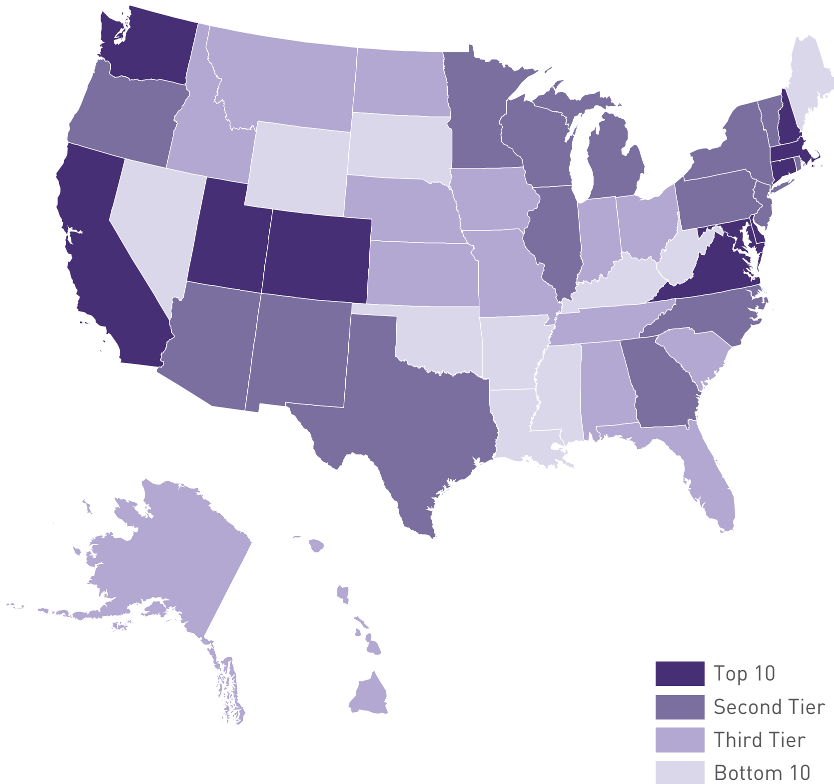
Utah climbs back two positions to No. 5, returning to its 2010 ranking with a 5-point boost to 74.01. In four of five composites, Utah posted gains and it continues to hold first place in Technology Concentration and Dynamism, a position it has maintained since 2008.

No. 6 through No. 10, in order, are **Washington, Virginia, New Hampshire, Connecticut,** and **Delaware**. These five states were also in the Top 10 in 2012, reflecting the increased stability at the top of the index. However, Delaware has fallen to No. 10 from No. 8 due to a decline in three of the five composites.

BIGGEST GAINERS

North Carolina made up for most of its eight-spot decline in 2012, regaining six places to move from 21st to 15th, thanks largely to a recovery in its Risk Capital and Entrepreneurial Infrastructure ranking. **Rhode Island** continued its gains from 2012, moving up four places, from 17th to 13th in 2014; it rose in Risk Capital and Entrepreneurial Infrastructure, from 31st to 22nd.

FIGURE 1 **How does your state stack up?** State Technology and Science Index 2014



INTRODUCTION

The Milken Institute's State Technology and Science Index looks at each state's technology and science capabilities and their impact on regional economic growth. It not only provides a method for comparing states' performance, but also aims to help states see the trends that will affect their future economies.

This year marks the sixth edition of the State Technology and Science Index since it was first released in 2002. Looking back, we see a few trends emerge:

- Competition has increased this year among the best performers. The Top 3 states—Maryland, Massachusetts, and California—improved their overall scores for the third index in a row. Overall, scores are slowly rising to the levels of 2002, the first year of our index. With the Top 10 states remaining relatively stable since 2010, it has been increasingly difficult for new states to enter the highest tier.

- Global competition in technology and science is more crucial than ever, in light of the increased daily reliance on all types of innovation. In 2012, the recession pushed the United States to 10th in the INSEAD Global Innovation Index, down from first in 2007. The United States has improved with the recovery, ranking sixth in 2014.[1]

- States that continued to invest in innovation and education are emerging stronger from the recession. Decision-makers should rethink the recessionary policies that led to cuts in spending and significant tuition increases at public universities. These universities are among the nation's greatest assets in innovation, and state leaders must be mindful of pricing the future generation of scientists and engineers out of the market.

- With each year of the index, a theme emerges. In 2008, it was the trend toward outsourcing. In 2010, it was the recession-driven pullback of the science and technology sectors. The 2012 index reflected the resurgence of these sectors coming out of the recession. Now, 2014 shows continued growth as technology and science further develop a larger share of the U.S. economy while more traditional sectors have been slower to recover.

- In 2014, competition increased among all states for high-technology jobs and innovation. In order to be a top performer in the index, states must encourage innovation, technology, and science. Whether their focus is on computer science, engineering, or life sciences, innovation clusters generate the highest scores. Innovation is becoming more important in every industry, not just those historically related to technology. The 2014 index shows that improvements are occurring everywhere, as the bottom 10 states all showed improved scores from 2012.

Technology and science are important to states and, by extension, the nation because innovation drives economic growth and bolsters the ability to compete in the global economy.

How a state fares in the index does not directly correlate to current economic performance and overall job creation, but it does clearly indicate whether or not the state is likely to create high-paying and future-proofed positions.

1. "Global Innovation Index - Home." Global Innovation Index. www.globalinnovationindex.org/gii/index.html (accessed November 22, 2012).

OVERALL FINDINGS

Outline of the Index

The State Technology and Science Index provides a benchmark for states to assess their science and technology capabilities as well as the broader environment that contributes to job and wealth creation. The index computes and measures 78 individual indicators relative to population, gross state product (GSP), number of establishments, percent change, and other factors. Data sources include government agencies, foundations, and private sources. The states are ranked in descending order with the top state being assigned a score of 100, the runner-up a score of 98, and the 50th state a score of 2. The indicators are then combined to create these five composite rankings:

Research and Development Inputs: We examine a state's R&D capacity to see if it has facilities that can attract funding and create innovations that can be commercialized. The category includes measures such as industrial, academic, and federal R&D; Small Business Innovation Research awards; and the Small Business Technology Transfer program, among others.

Risk Capital and Entrepreneurial Infrastructure: The entrepreneurial capacity and risk capital infrastructure of states are the ingredients that determine the success rate of converting research into commercially viable technology services and products. We include several measures of venture capital activity as well as entrepreneurial pursuits, including patenting activity, business formations, and initial public offerings.

Human Capital Investment: Human capital is the most important intangible asset of a regional or state economy. We look at indicators that suggest the skill levels of the current and future workforce. Examples include the number of bachelor's, master's and doctorate degrees relative to a state's population, and measures specific to science, engineering and technology degrees.

Technology and Science Workforce: The intensity of the technology and science workforce indicates whether states have sufficient depth of high-end technical talent. Intensity is derived from the share of employment in a particular field relative to total state employment. We look at 18 occupation categories in three main areas of employment: computer and information sciences, life and physical sciences, and engineering.

Technology Concentration and Dynamism: By measuring technology growth, we are able to assess how effective policymakers and other stakeholders have been at transforming regional assets into regional prosperity. This includes measures such as the percent of establishments, employment and payrolls that are in high-tech categories. It also measures growth in a number of technology categories.

At the Top

1. Massachusetts

The Top 4 states of 2012 return to their leading roles in the 2014 index. Massachusetts once again claims the No. 1 spot, improving its already dominant score of 86.40 in 2012 to 86.59 in 2014 (its highest since 2008). Massachusetts achieved this by ranking first in four of the five composites: Research and Development Inputs; Risk Capital and Entrepreneurial Infrastructure; Human Capital Investment; and Technology and Science Workforce. It also places fourth in Technology Concentration and Dynamism, continuing its rise in that category over the years. It had fallen to 11th in 2008, then steadily improved, moving to seventh in 2010, sixth in 2012, then fourth this year.

Massachusetts has many of the ingredients for success in the technology and science fields: world-class universities, cutting-edge firms, and a large pool of highly talented workers. Plus, the state strives for continued growth and improvement, pushing itself beyond its successes. For example, while Massachusetts has had a life-science super-cluster that already ranks first in almost every life-science indicator in the Technology and Science workforce composite since 2002, the state in 2008 launched the Massachusetts Life Sciences Initiative, investing $1 billion over 10 years for continued growth. Today the Massachusetts Life Sciences Center distributes the funding in ways that create jobs and advance good science.[2]

Massachusetts has programs in place to advance all aspects of science and technology. An advisory council created in 2009[3] has helped develop and oversee a plan for excellence in science, technology, engineering, and math (STEM) education.[4] The state's economic development efforts include a state STEM Plan that aligns with middle-skilled jobs, strengthening and supporting the state's innovative community, and building and retaining talent for the innovation economy.[5] Finally, the Massachusetts Technology Collaborative, a unique public economic development agency working to accelerate the creation and expansion of firms in the technology-growth sectors, is another sign that key players in Massachusetts understand the importance of technology and science.[6]

2. Maryland

For the first time since 2008, Maryland's average score tops 80, registering at 81.48 this year. It is the state's highest score since the 2002 inaugural index. Only four states have ever scored over 80 in the index: Massachusetts (every year except 2010), Maryland (2008), California (2002), and Colorado (2002). Both Massachusetts and Maryland scored over 80 in the 2014 index, exhibiting remarkable performances.

However, despite Maryland's strong second-place showing this year, the spread between the top two states remains steady, given Massachusetts' gains. Like Massachusetts, Maryland did well in all the composites, ranking second in Research and Development Inputs, Human Capital Investment, and Technology and Science Workforce. It placed third in Technology Concentration and Dynamism.

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2. The Massachusetts Life Science Center, 2013 Translating Good Science Into Good Business, http://www.masslifesciences.com/wp-content/uploads/MLSCBRO20111.pdf (accessed September 23, 2014).
3. "Governor's Science, Technology, Engineering & Math Advisory Council." Mass.Gov. http://www.mass.gov/governor/administration/councilscabinetsandcommissions/stem/ (accessed September 22, 2014).
4. Governor's STEM Advisory Council. "Massachusetts Plan for STEM Education." Mass.Gov.www.mass.gov/governor/administration/ltgov/lgcommittee/stem/ma-stem-plan.pdf (accessed September 17, 2012).
5. "Governor Patrick Signs Economic Development Bill." Mass.Gov. http://www.mass.gov/hed/economic/initiatives/compete/choosing-to-compete-2013-report-card.pdf (accessed September 22, 2014).
6. "Meet Mass Tech." Massachusetts Technology Collaborative. http://www.masstech.org/meet-masstech (accessed September 22, 2014).

In Risk Capital and Entrepreneurial Infrastructure, Maryland made spectacular gains, climbing eight spots to fifth in 2014 (from 13th in 2012). In 2010, it had fallen to an all-time low at 14th. The improvements show that the state is succeeding in its efforts to attract funding and streamline the commercialization of university research through InvestMaryland and the Maryland Venture Fund. InvestMaryland has raised close to $84 million by auctioning premium tax credits to insurance companies. This money is used to fund startups and help fill the existing gap in venture capital.7 Similarly, Innovate Maryland seeks to move discoveries from academia (Johns Hopkins University, Morgan State University, University of Maryland College Park, University of Maryland Baltimore, and University of Maryland Baltimore County) into the marketplace promoting the commercialization of research. Support is provided through TEDCO, Maryland's state-run technology transfer organization.[8]

Maryland's strongest performance is in the R&D, Technology and Science Workforce and Human Capital Investment composites (2nd). The state receives an enormous amount of federal R&D funding per capita, and its expenditures reflect that, especially in the life-science and engineering categories. This is hardly surprising given that the state is home to the National Institutes of Health and leading research universities such as Johns Hopkins.[9] Another factor in Maryland's performance in human capital: It has the most Ph.D. holders per capita. Further, the state's investment in human capital occurs at other levels. Recently, for example, Maryland Gov. Martin O'Malley announced that students across Maryland will have expanded access to new technology and resources in the classroom thanks to $4.9 million in grants.[10]

3. California

In third place, California maintains its 2012 ranking after having fallen to fourth in both the 2008 and 2010 national indexes. The state improved its score by nearly a full point this year, to 76.64, though this is still far below its highest score of 80.37 in 2002. California ranks in the Top 5 in Research and Development Inputs; Risk Capital and Entrepreneurial Infrastructure; Technology and Science Workforce; and Technology Concentration and Dynamism. However, California has fallen to 17th in Human Capital Investment, continuing its steady decline from second place in the 2002 index. This could create serious labor issues for the California science and technology sectors in the future.

For an in-depth California analysis, see our supplemental section: "California's Position in Technology and Science: A Comparative Benchmarking Assessment," starting on p. 39.

4. Colorado

Colorado retains its No. 4 position this year, but also posts its third consecutive drop in score. While the decline from 2012 is by only about half a point, to 74.60, any further small drops would put Colorado at risk of slipping down the index, especially since fifth-place Utah is only half a point behind. Previously, Colorado consistently ranked third (from 2002 through 2010) but fell to fourth in 2012. In terms of composites, the state ranks third in Research and Development Inputs and in the Top 10 in all other composites. Colorado's ranking fell in two composites: Risk Capital and Infrastructure (from fifth to seventh) and Technology Concentration and Dynamism (from third to eighth).

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7. Department of Business and Economic Development, Maryland Ventura Fund. http://business.maryland.gov/mvf (accessed September 17, 2014).
8. TEDCO, The Maryland Innovation initiative (MII). http://tedco.md/program/the-maryland-innovation-initiative-mii/ (accessed September 17, 2014).
9. "S&E Indicators 2010 - Chapter 4. Research and Development: National Trends and International Linkages - Location of R&D Performance - US National Science Foundation (NSF)." nsf.gov - National Science Foundation - US National Science Foundation. http://www.nsf.gov/statistics/seind10/c4/c4s2.htm (accessed August 12, 2012).
10. Emily Kimball Pope, "Maryland delivers $4.9M in education, innovation grants," September 18, 2014. http://mdbiznews.business.maryland.gov/2014/09/18/maryland-delivers-4-9m-in-education-innovation-grants/#more-10052

Colorado's R&D strength can be attributed to the incredible amount of National Science Foundation (NSF) funding it receives. It ranked first in both NSF total funding and NSF research-specific funding—and has done well on these indicators since the first index in 2002. Maintaining its performance in the NSF indicators is important as the money provides tremendous benefits for the state's overall performance in science and technology. It ensures continued research for science-related projects that could be commercialized and contribute to job creation and quality of life in the state.

In November 2011, Gov. John Hickenlooper introduced the Colorado Innovation Network (COIN), which is designed to bring together leaders in the innovation environment and set an agenda for economic growth. COIN has committed to creating a yearly innovation index and hosting an annual innovation summit since 2011.[11] Thus far, however, these efforts have not resulted in improved numbers. In fact, since 2012, Colorado has declined in Risk Capital and Entrepreneurial Infrastructure (down two notches to seventh place) as well as in Technology Concentration and Dynamism. What's more, overall venture capital investment in the state has fallen since 2012, contrary to the national trend.[12] The state currently supports programs to assist technology startups through the Advanced Industries Accelerator grant program ($12.5 million per year) and the Advanced Industry Investment Tax Credit, but more innovative measures may be necessary if the state continues to decline.[13]

5. Utah

Returning to its 2010 ranking of fifth place, Utah rounds out the Top 5 states. Its score of 74.01 is its highest ever and reflects a five-point increase from 2012. The state once again placed first in Technology Concentration and Dynamism (for the third index in a row), and also improved its ranking in every other indicator. Utah's biggest improvements came in Research Development Inputs and in Technology and Science Workforce, jumping from 16th to 8th in both composites. Utah is among the four states, along with Massachusetts, Maryland, and Colorado, to place in the Top 10 in all composites.

Utah owes its top ranking in Technology Concentration and Dynamism to the impressive number of high-tech companies in the relatively small state. It has a strong life-sciences sector that receives support from the state-funded Utah Science and Technology and Research Initiative (USTAR). The organization has successfully recruited 50 star scientists to Utah's research universities from MIT, Harvard University, UCLA, Case Western, University of Arizona, and Oak Ridge National Laboratory.[14] Its main initiative is to create more technology-based start-ups in Utah and bring more high-paying jobs. This and other initiatives like the technology commercialization and innovation program[15] and STEM action center[16] appear to have been successful as Utah continues to improve its performance.

6. Washington

Utah's five-point gain bumped Washington from fifth to sixth place this year. Despite this drop in ranking, Washington actually improved its overall score by almost one full point since the 2012 index, finishing at 72.71. It posted composite gains in Research and Development Inputs (up to seventh from 10th) and Human Capital

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11. "About | Colorado Innovation Network." Colorado Innovation Network | Collaboration for Innovation. http://coloradoinnovationnetwork.com/about/ (accessed October 22, 2012).
12. Colorado Innovation Network, "The State of Innovation, Colorado 2014." http://www.coloradoinnovationnetwork.com/wp-content/themes/coin/assets/pdf/coii_2014.pdf
13. Ibid.
14. USTAR, about USTAR. http://www.innovationutah.com/about/ (accessed October 1, 2014).
15. Utah Governor's Office of Economic Development, Technology Commercialization and Innovation Program. http://business.utah.gov/programs/tcip/# (accessed September 23, 2014).
16. Utah Governor's Office of Economic Development, STEM Action Center. http://business.utah.gov/programs/stem/ (accessed September 21, 2014).

Investment (19th from 21st); these gains offset a decline in Risk Capital and Entrepreneurial Infrastructure (15th from 10th). Washington's best performance once again was in Technology Concentration (second place) and in Technology and Science Workforce (third place).

Home to Microsoft and its related suppliers, as well as Amazon, the state did well in numerous indicators, especially in Technology and Science Workforce. It ranked first in high-tech payroll and employment, a success it has repeated almost every year of the index. Not surprisingly, Washington has a high concentration of computer and information systems experts, finishing fourth in that indicator, and also ranks fifth in intensity of life and physical scientists, and third in intensity of engineers.

Innovate Washington, founded in 2011, is a public-private hybrid working to accelerate technology-based innovation, especially in the clean technology sector.[17] Nevertheless, the state has slipped to its lowest rank (15th) in Risk Capital and Entrepreneurial Infrastructure, continuing a steady decline in index after index (it had placed 10th in both 2012 and 2010, and fourth in 2008). And despite small improvements, the state performed worst in the Human Capital Investment composite, finishing 19th. Washington ranks low in indicators measuring science and engineering graduate degrees and state appropriations for higher education. It is likely that the state's high-tech companies hire a significant portion of their workers from out of state to help bridge this gap. This could present an area of opportunity for Washington.

7. Virginia

Virginia also fell a notch to No. 7 index-over-index due to Utah's large jump, as well as slight declines in three composites: Research and Development Inputs, Risk Capital and Infrastructure, and Human Capital Investment. Virginia improved in Technology Concentration and Dynamism, rising to sixth place in 2014 from ninth in 2012. It held on to fifth place in Technology and Science Workforce. Overall, Virginia is still better placed than it was in 2010, when it finished eighth overall.

The state has the opportunity to see improvements rather than declines in Research and Development Inputs, as well as Risk Capital and Infrastructure. In 2012, the Virginia Innovation Partnership was one of seven multi-institutes to win federal funding through the U.S. Department of Commerce i6 Challenge. The i6 Challenge gives financial support to the nation's best ideas for technology commercialization and entrepreneurship, with an emphasis in medical and bio sciences. The Virginia Innovation Partnership is distributing these funds in the state, working with universities, corporations, investment capital, and other resources to advance research in the economic realm.[18]

8. New Hampshire

New Hampshire strengthened its position this year, moving up to eighth place from 10th in 2012. In the composites, the state leapt at least five spots in both Research Development Inputs (11th to fourth) and Technology and Science Workforce (18th to 13th). The state fell in Risk Capital and Entrepreneurial Infrastructure (from third to ninth), but despite the drop, this ninth-place ranking is New Hampshire's second-highest composite performance.

New Hampshire swore in Gov. Maggie Hassan in January 2013.[19] The new governor has worked to double and permanently extend the state's R&D tax credit—which had been in place since 2007—thus creating more

17. Innovate Washington, About Innovate Washington. http://www.innovatewashington.org/about-us (accessed October 1, 2014).

18. University of Virginia, Virginia Innovation Partnership, U.S. Department of Commerce i6 Challenge. http://www.virginia.edu/vpr/i6/fact.html (accessed September 29, 2014).

19. New Hampshire government website, About Governor Hassan. http://www.governor.nh.gov/about/ (accessed September 30, 2014).

incentives and stability for research and development.[20] Results of these efforts should show more clearly in the next index. As well, since 2010, the state has had an Innovation Commercialization Center[21], which in 2014 merged with ABI Innovation Hub to better assist early-stage high-tech companies.[22] These changes have helped secure New Hampshire's position in the Top 10.

9. Connecticut

Connecticut remained in ninth place despite declining in all but one composite, Human Capital Investment, in which it has historically performed well. Still, the state ranked in the Top 25 for every composite, and its strong third-place finish in Human Capital Investment helped secure its spot in the Top 10.

Connecticut Gov. Dan Malloy recognizes the importance of science and technology. He launched a state "Innovation Ecosystem" in 2012 to create growth in technology with $5 million dedicated to starting up a public-private partnership.[23] It is no surprise that Connecticut performs well in small-business grants and loans, both STTR awards and SBIR awards.

10. Delaware

Like Connecticut, Delaware managed to remain in the overall Top 10 despite its weaker rankings in all but one composite. It rose to 19th place from 20th in Risk Capital and Entrepreneurial Infrastructure. Delaware's strongest composite finish was in Research and Development Inputs (sixth place), and the state also finished in the Top 20 for every composite. This year, there was stiffer competition from every state in all composites and this actually helped Delaware and Connecticut hold on to their overall positions, because the competition prevented any one single state from breaking into the Top 10 and unseating them.

Unlike in other Top 10 states, Delaware's leading innovation investment companies are private: First State Innovation and Innovation Capital Advisors LLC both work with entrepreneurs to commercialize high-tech innovations.[24][25] The University of Delaware also has an Office of Economic Innovation and Partnership to facilitate commercialization and entrepreneurship of innovations at the university.[26]

Biggest Gainers

North Carolina is the most improved state in the 2014 index. It rose six spots to 15th place, regaining much of the ground it lost in the 2012 index, when it fell eight spots to 21st. Its stronger performance this year was especially evident in the Risk Capital and Entrepreneurial Infrastructure composite, rising 13 places to 12th place after having dropped dramatically by 17 places to 25th in 2012. It also improved in Technology Concentration and Dynamism, climbing to seventh from 10th, and in Research and Development Inputs, jumping to 19th from 25th, thanks to academic R&D.

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20. New Hampshire government website, Innovate NH Jobs Plan. http://www.governor.nh.gov/innovate/ (accessed September 30, 2014).
21. Michael McCord, New Hampshire Business Review, "Innovation Commercialization Center 'pivots' to grow N.H.'s entrepreneurial ecosystem," November, 15, 2013. http://www.nhbr.com/November-15-2013/Innovation-Commercialization-Center-pivots-to-grow-NHs-entrepreneurial-ecosystem/
22. Madison Neveu, New Hampshire Business Review, "NH-ICC and abi Innovation Hub agree to merge," February 7, 2014. http://www.nhbr.com/February-7-2014/NH-ICC-and-abi-Innovation-Hub-agree-to-merge/
23. "Connecticut Governor Launches 'Innovation Ecosystem'," The New England Council Blog: Brett Briefing. http://newenglandcouncil.com/blog-post/connecticut-governor-launches-innovation-ecosystem/ (accessed September 30, 2014).
24. First State Innovation, Acceleration Delaware's Entrepreneurial Economy. http://www.firststateinnovation.org/ (accessed September 22, 2014).
25. Innovation Capital Advisors, LLC. http://innovationcapital.com/ (accessed September 22, 2014).
26. University of Delaware, Office of Economic Innovation & Partnership, What We Do. http://www.udel.edu/oeip/culture/ (accessed September 22, 2014).

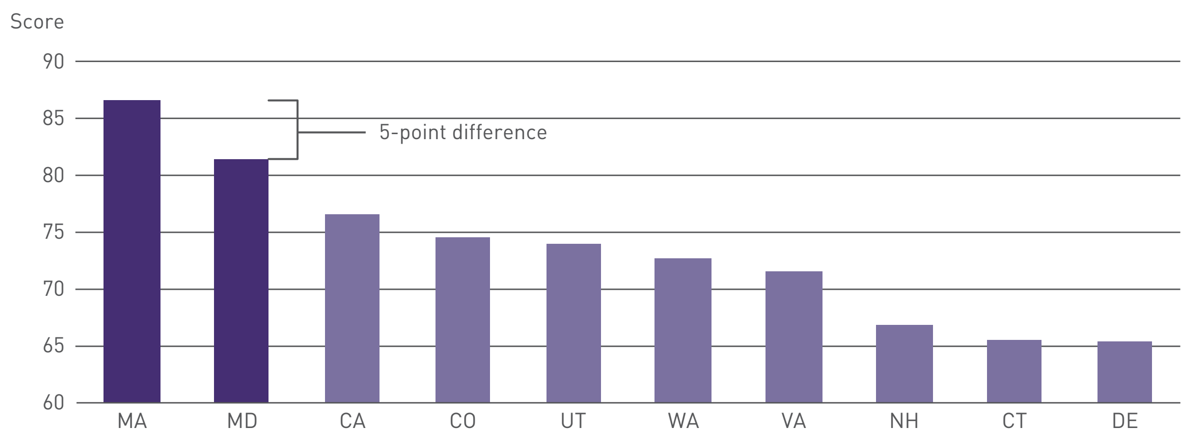
North Carolina's Department of Commerce has an Office of Science, Technology & Innovation, which works to expand technology infrastructure, enhance innovation, and create entrepreneurial activity.[27] It intermittently produces "Tracking Innovation: North Carolina Innovation Index," a report that helps the state identify its strengths and weaknesses to create long-term change.[28]

Rhode Island jumped higher for the second index in a row, placing 13th this year (in 2012, it had vaulted to 17th from 22nd in 2010). The state performed extremely well in the Risk Capital and Infrastructure composite, improving its ranking from 31st to 22nd. It also made drastic improvements in venture capital in clean/green technology and finished eighth in the New Venture Capital in Biotechnology indicator. And thanks to a jump in the net formation of high-tech establishments, Rhode Island also improved in the Technology Concentration and Dynamism Composite from 24th to 18th. **Tennessee,** which had been the biggest gainer in 2012, maintained most of its growth and dropped back only one spot to 36th in 2014. **Arkansas,** although still in the bottom tier, made enough improvements to move up to 45th from 49th, propelled by a 10-place gain in the Risk Capital and Entrepreneurial Infrastructure composite.

Struggling States

Three states saw significant declines. **Missouri** fell five places from 29th to 34th, pushed down by a seven-place fall in the Research and Development composite. Both **Kansas** and **Vermont** declined by four places. Kansas' decline (from 24th to 28th) was pushed by a 10-place fall in Technology Concentration and Dynamism, and could be linked to recent weakness in the state's economy. Vermont fell from 14th to 18th, with a 10-place decline in Research and Development and seven places in Technology Concentration and Dynamism.

FIGURE 2 **State Technology and Science Index:** Top 10 states, 2014



Source: Milken Institute

27. Science, Technology & Innovation, North Carolina Department of Commerce, About Us. http://www.nccommerce.com/sti/about-us (accessed September 30, 2014).

28. North Carolina Department of Commerce, "Tracking Innovation North Carolina Innovation Index 2013," November 2013. http://www.nccommerce.com/Portals/6/Documents/Resources/TI_NC_2013_Report.pdf (accessed September 30, 2014).

RESEARCH AND DEVELOPMENT INPUTS

The Research and Development Inputs Composite Index measures each state's ability to attract various types of federal, industry, and academic funding.

R&D funding supports and strengthens the research labs, universities, and innovative companies that educate the workforce and lead to new technologies. It encourages the commercialization that takes inventive new products from minds to markets. And the resulting exchange of ideas and innovations draws new companies, especially technology-intensive firms.[29] World-renowned innovators such as Microsoft, Apple, Google, Genentech, and Amgen were launched from the springboard of the country's R&D landscape. Largely because of its advocacy and support of cutting-edge R&D, the United States is a world leader in science and engineering.[30]

Composite Index Components

In general, R&D funds come from three sources: the federal government, private industry, and academia. We rank each state on 18 R&D indicators that fall under the following categories.

Federal R&D expenditures: This captures investments in all basic and applied research in such areas as national defense, health, space research and technology, energy, and general science.

Industry R&D expenditures: This is the total that corporations spent on basic and applied research, including funds spent at federally funded R&D centers. Industry R&D receives greater weight in the composite index because of its large share of overall R&D. All research, basic and applied, performed by colleges and universities is funded by a combination of federal, industry, and academic sources, but more than 60 percent of R&D funding at universities comes from the federal government.[31]

National Science Foundation (NSF) funding: The National Science Foundation, an independent federal agency, funds research and education in science and engineering through grants, contracts, and cooperative agreements. Its R&D expenditures on engineering are a key source of funding at doctorate-granting institutions, but we also include indicators that track NSF support of the physical sciences, environmental sciences, math, computer sciences, and life sciences. Finally, the funding rates of competitive NSF project proposals for basic research are also used to judge the success and research capabilities of a region.

Small Business Technology Transfer (STTR) awards: These federally funded research grants go to innovative small businesses and nonprofit research institutes to support technology commercialization efforts.

Small Business Innovation Research program (SBIR): This program funds the often costly startup and development stages, and encourages commercialization of research findings. To be eligible, firms must be for-profit, American-owned, and independently operated, and employ a principal researcher and fewer than 500 workers.

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29. Dirk Engel and Andreas Fier, "Does R&D-Infrastructure Attract High-Tech Start-Ups?," ZEW Discussion Paper 00-30 (2000).

30. Crescenzi, Riccardo, Andre Rodriguez-Pose, and Michael Storper. "The Territorial Dynamics of Innovation: A Europe-United States Comparative Analysis." Journal of Economic Geography 7, no. 6 (2007): 673-709.

31. "Science Coalition - Success Stories." Welcome to the Science Coalition. http://www.sciencecoalition.org/successstories/ (accessed February 13, 2013).

State Rankings

Changes in this year's Research and Development Inputs were driven more by performance in STTR and SBIR awards than in the other indicators due to new grants and changes in recipients.

AT THE TOP

Massachusetts has dominated this category since the inception of the State Technology and Science Index. This year, it is stronger than ever with its highest score of 94.82. It outpaces second-place Maryland by more than 6 points. Massachusetts' strong showing in this composite is due largely to its first-place performance in all SBIR and STTR indicators. It also ranks fifth or higher in all but three of the 18 indicators. Its lowest finish was 24th in R&D expenditures in agricultural sciences.

Maryland holds steady in second place with an improved score of 88.28, up from 86.52. The state ranks first in federal and academic R&D and a number of R&D expenditures categories including engineering, physical sciences, math and computer sciences, and biomedical and life sciences. It also ranks in the Top 5 for number of STTR and SBIR grants.

Colorado remains in third place after gaining two spots in 2012, and increased its score by more than one point. It performance is due to substantial funding from the NSF.

New Hampshire jumped up seven places and 12 points to land in fourth place. It had marked improvements by nine or more spots in industry R&D per capita, and R&D expenditures in engineering, math and computer sciences, and agriculture. New Hampshire also performed well in STTR & SBIR awards. New Hampshire's large jump pushed California down to fifth place on the R&D composite list despite a slightly improved score.

Rounding out the Top 10 in this composite are **Delaware, Washington, Utah, Rhode Island,** and **Connecticut**. Delaware and Connecticut both lost ground this year but were able to stay in the Top 10. Utah made the biggest improvement of any state in Research and Development, shooting up eight spots, thanks to significant improvements in NSF funding and NSF research funding. The scores suggest competition for R&D funding was tougher at the bottom of the Top 10 than in the upper tier—states that ranked seventh to 10th scored within half a point of each other.

AT THE BOTTOM

Nevada, Arkansas, and **Louisiana** ranked 48th, 49th, and 50th, respectively, in the R&D composite index. Arkansas plunged four spots to 49th because its ranking in STTR awards per 10,000 businesses plummeted from 22nd to 45th. The bottom three states all scored below 20, resulting in an increase in spread as Massachusetts posted its highest score, but this is the first index with three states scoring less than 20.

BIGGEST GAINERS

Two of the top gainers moved into the Top 10, having previously been in the second tier. **Utah** improved from 16th to eighth (eight places), while **New Hampshire** improved from 11th to fourth (seven places). **Illinois** also improved seven places, from 23rd to 16th, because of major improvements in STTR awards.

FIGURE 3 **Research and Development Inputs Composite Index map:** 2014

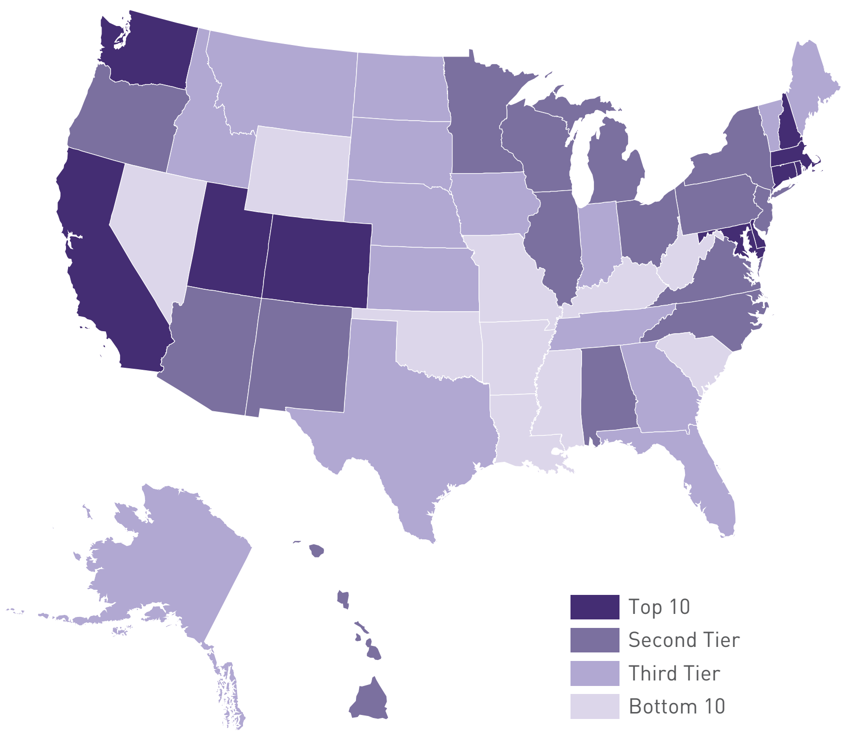
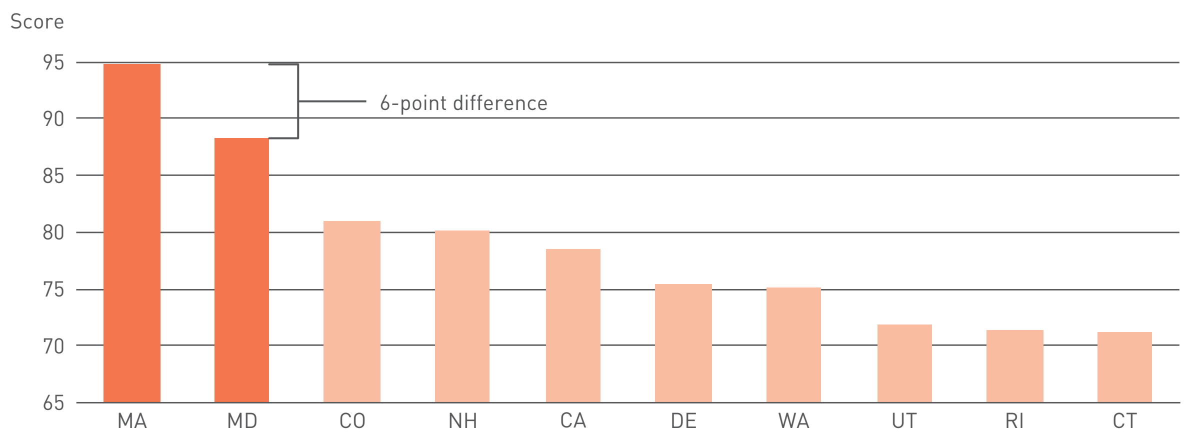


FIGURE 4 **Research and Development Inputs Composite Index:** Top 10 states, 2014



Source: Milken Institute

TABLE 2 Research and Development Inputs Composite Index: State rankings, 2014

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Massachusetts	1	1	0	94.82
Maryland	2	2	0	88.28
Colorado	3	3	0	81.03
New Hampshire	4	11	7	80.20
California	5	4	-1	78.59
Delaware	6	5	-1	75.42
Washington	7	10	3	75.13
Utah	8	16	8	71.88
Rhode Island	9	9	0	71.36
Connecticut	10	7	-3	71.24
Pennsylvania	11	8	-3	69.05
Virginia	12	6	-6	66.56
Oregon	13	15	2	65.72
Michigan	14	13	-1	64.79
New Mexico	15	12	-3	64.04
Illinois	16	23	7	60.84
Arizona	17	14	-3	60.72
New York	18	19	1	59.04
North Carolina	19	25	6	58.08
Wisconsin	20	20	0	57.57
New Jersey	21	21	0	56.86
Alabama	22	26	4	56.83
Hawaii	23	22	-1	55.08
Minnesota	24	18	-6	54.79
Ohio	25	28	3	54.06
Indiana	26	24	-2	53.60
Vermont	27	17	-10	53.21
Iowa	28	27	-1	52.69
Montana	29	29	0	50.91
Idaho	30	34	4	47.56
Georgia	31	33	2	43.64
Texas	32	30	-2	43.32
Alaska	33	36	3	43.15
North Dakota	34	31	-3	42.06
Nebraska	35	32	-3	38.13
Kansas	36	35	-1	37.43
Tennessee	37	39	2	36.71
Maine	38	38	0	32.10
South Dakota	39	42	3	29.47
Florida	40	44	4	28.66
Kentucky	41	46	5	26.62
Wyoming	42	41	-1	26.46
South Carolina	43	40	-3	25.64
Missouri	44	37	-7	25.04
Mississippi	45	43	-2	23.68
West Virginia	46	48	2	21.47
Oklahoma	47	50	3	21.15
Nevada	48	49	1	19.41
Arkansas	49	45	-4	18.93
Louisiana	50	47	-3	16.02

RISK CAPITAL AND ENTREPRENEURIAL INFRASTRUCTURE

Entrepreneurs are prime drivers of growth and job creation. They create new businesses and use technology to increase productivity. They manipulate existing technologies and services, which speeds up the learning curve. And their new products increase competition, persuading established players to innovate as well or risk losing market share. This competition drives down prices and brings about better products. This year's Risk Capital and Entrepreneurial Infrastructure Composite had a change in indicators. The venture capital in clean technology and the venture capital investment in green technology were combined into one indicator and venture capital in biotechnology was added.

Over the past few decades, an explosion of available capital has helped entrepreneurs bring their products to market. Intel, Microsoft, Apple, Cisco, Genentech, and Amazon were all venture-backed firms. Studying venture capital activity is an excellent way to assess the level of confidence in the new ideas and entrepreneurial infrastructure in a region.

Composite Index Components

To measure each state's entrepreneurial culture, the Risk Capital and Entrepreneurial Infrastructure Composite Index looks at 12 indicators in categories involving venture capital investment, initial public offerings, business creation, and patent activity.

Flow and strength of venture capital investment: To assess a region's potential for tech-based enterprises, we look at indicators such as growth in total venture capital funding, the number of companies receiving VC investment per 10,000 firms, and VC investment as a percentage of gross state product.

Small Business Investment Company (SBIC) funds: The SBIC program, administered by the Small Business Administration, is geared toward incubator-type establishments that support small businesses with services ranging from financial capital to management consulting. Like venture capitalists, an SBIC identifies profit potential in unleveraged small businesses and funds it in hopes of high returns on investment.

Business incubators: These aim to provide up-and-coming small businesses with guidance and resources such as physical facilities, office equipment, business assistance services, and management consulting.

Patents: On a state-by-state basis, the greater the number of patents per 100,000 people, the more inventive and scientifically curious the agencies and institutions are. The numbers also indicate the likelihood of commercialization because the cost and time required to register and protect an idea are significant.

Business formation: Business starts and initial public stock offerings are indicators of entrepreneurship and optimism. Companies that go public typically have a proven track record by means of revenues or sales history.

Clean-tech/green-tech, nanotechnology, and biotechnology investments: Nanotechnology, clean-tech, and biotech are regarded as the forefront of technological innovation. Investments in these areas represent a cutting-edge mentality and serve as a measure of each state's willingness to take risks. Biotechnology is a new variable in the 2014 index.

State Rankings

Performance in Risk Capital and Entrepreneurial Infrastructure is dependent on a state's ability to attract investment and create new business through innovation.

AT THE TOP

Massachusetts remains in its designated first-place spot in the Risk Capital and Entrepreneurial Infrastructure composite, which it has held in every index except 2008. However, its overall composite score decreased by almost 6 points to 81.50. While this is a significant decline, Massachusetts managed to maintain its first-place ranking, attesting to its dominance in this indicator in 2012. Massachusetts ranks first in four of the 12 indicators: companies receiving venture capital, venture capital as a percentage of gross state product (GSP), and venture capital in nanotechnology and biotechnology. Massachusetts' leadership in two indicators, companies receiving venture capital and venture capital as a percentage of GDP, reveal the prominence of venture capital throughout the state's economy.

California returns to its second-place position, up from fourth in 2012. The state had been in second place in 2010, 2004, and 2002; in the 2008 index, California finished first. Thanks largely to Silicon Valley, California performed exceptionally well on the venture capital indicators. It was second in both venture capital investment as a percentage of GDP and the number of companies receiving venture capital behind Massachusetts. The state also ranked first in patents issued per 100,000 people, which is an impressive statistic considering California's large population.

New York continues its success story despite falling to third place in 2014. It ranked second in 2012, a huge leap from 16th place in 2010 with a score of 57.34. This year, it scored 73.00. The state has seen a resurgence of venture capital as New York City repositions itself as a technology and science hub. The state ranked second in business starts and in IPO proceeds as a percentage of GSP, coinciding with the state's new growth. New York ranked fifth in venture capital investment as a percentage of GDP.

Texas had the greatest improvement in the Top 10. In fourth place, Texas jumped 11 places from 15th. It significantly improved its performance in SBIC funds (30th to ninth), venture capital in nanotech (16th to second) and clean/green technology (10th from 19th). Texas also has a lot of new growth, ranking third in business startups.

Maryland also made a significant jump to fifth place, jumping eight spots from 13th. This matches the state's best performance, in 2004. The amount of venture capital in Maryland has increased enough that venture capital as percentage of GDP rose 10 spots to sixth overall from 16th.

Pennsylvania, Colorado, New Jersey, New Hampshire, and **Utah** round out the Top 10. Pennsylvania jumped eight spots to finish in sixth place and Utah improved one spot to finish in 10th. Colorado, New Jersey, and New Hampshire all scored lower in 2014 than the previous index, but remained in the Top 10. The scores on average are lower this year, indicating increased competition among the Top 10 states.

AT THE BOTTOM

Wyoming, Alaska, and **Montana** were 48th, 49th, and 50th, respectively. None of these states have ever performed well on this composite and have virtually no venture capital market. One bright spot is a Top 5 ranking in the number of net business starts in both Wyoming and Alaska. Montana's best performance was 17th in IPO proceeds as a share of GDP.

BIGGEST GAINERS

Risk Capital and Entrepreneurial Infrastructure has been the most volatile composite since the beginning of the index due to the nature of venture capital. Large one-year investments in small states have enormous effects. The top gainers were **North Dakota** (with a 22-spot jump to 16th from 38th), **South Carolina** (up 15 spots to 28th from 43rd), **Ohio** (up 14 places to 20th from 34th), and **North Carolina** (up 13 spots to 12th from 25th). North Dakota has recently had huge growth and investment, dramatically improving the state's score in venture capital growth, business incubators, and business starts. North Carolina and South Carolina saw immense growth in venture capital in clean/green technology, with North Carolina also benefitting from the new biotechnology variable.

FIGURE 5 **Risk Capital and Entrepreneurial Infrastructure Composite Index map:** 2014

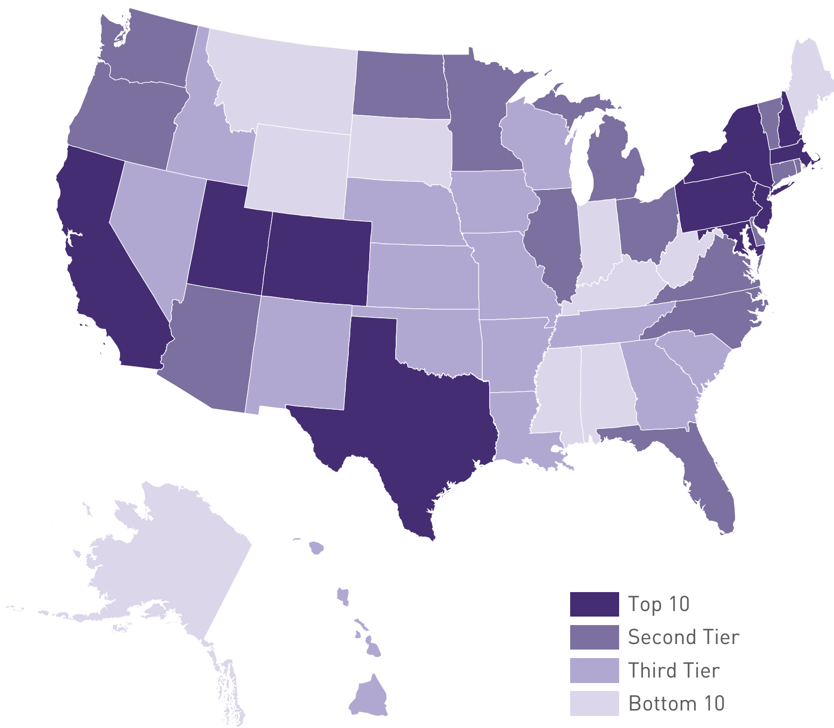
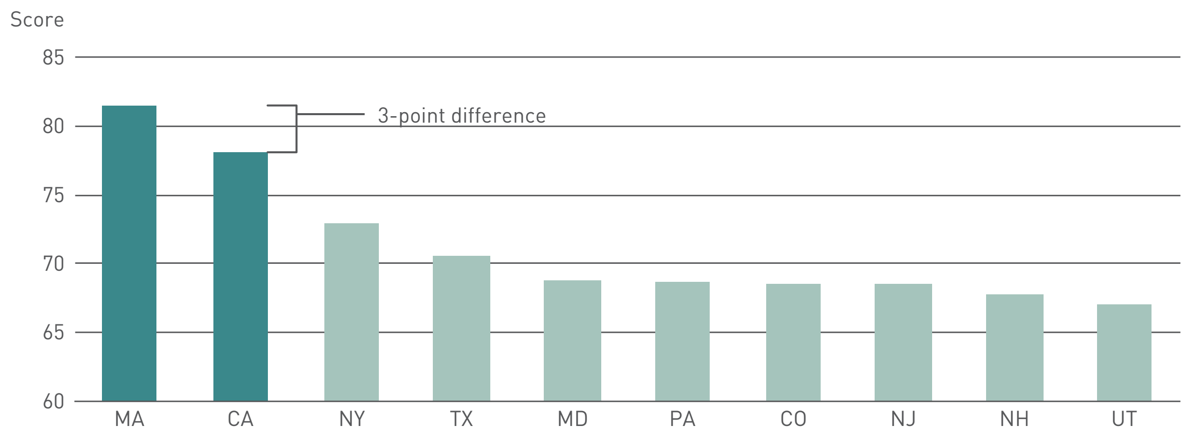


FIGURE 6 **Risk Capital and Entrepreneurial Infrastructure Composite Index:** Top 10 states, 2014



Source: Milken Institute

TABLE 3 Risk Capital and Entrepreneurial Infrastructure Composite Index: State rankings, 2014

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Massachusetts	1	1	0	81.50
California	2	4	2	78.17
New York	3	2	-1	73.00
Texas	4	15	11	70.50
Maryland	5	13	8	68.83
Pennsylvania	6	14	8	68.67
Colorado	7	5	-2	68.55
New Jersey	7	9	2	68.55
New Hampshire	9	3	-6	67.80
Utah	10	11	1	67.09
Minnesota	11	18	7	64.17
North Carolina	12	25	13	63.82
Virginia	13	6	-7	63.60
Connecticut	14	6	-8	62.18
Washington	15	10	-5	61.82
North Dakota	16	38	22	61.40
Arizona	17	12	-5	61.00
Vermont	18	17	-1	60.60
Delaware	19	21	2	59.80
Ohio	20	34	14	59.64
Florida	21	24	3	59.09
Rhode Island	22	31	9	58.20
Illinois	23	8	-15	57.83
Oregon	24	20	-4	57.00
Michigan	25	22	-3	56.18
Georgia	26	28	2	55.27
Tennessee	27	19	-8	54.73
South Carolina	28	43	15	53.80
Nevada	29	41	12	51.40
New Mexico	30	30	0	49.64
Missouri	31	16	-15	49.20
Louisiana	32	29	-3	49.00
Nebraska	33	47	14	48.80
Kansas	34	27	-7	48.40
Oklahoma	35	23	-12	48.36
Wisconsin	36	33	-3	46.00
Iowa	37	36	-1	44.89
Arkansas	38	48	10	44.67
Hawaii	39	42	3	44.20
Idaho	40	46	6	42.60
Maine	41	25	-16	42.18
Indiana	42	32	-10	42.17
Kentucky	43	39	-4	37.80
Mississippi	44	49	5	35.40
Alabama	45	35	-10	34.36
West Virginia	46	40	-6	34.20
South Dakota	47	37	-10	32.25
Wyoming	48	43	-5	29.14
Alaska	49	50	1	23.14
Montana	50	45	-5	17.11

HUMAN CAPITAL INVESTMENT

Capital and land used to be an economy's key productivity forces, but talent is the driving force in today's knowledge-based economy. Regions with the educational institutions to produce highly skilled workers benefit from a virtuous cycle: Their human capital attracts cutting-edge companies and innovative startups, which draws skilled labor from outside the region, which draws more companies, and so on. Because education determines the quality of a region's workforce, this composite index looks at educational attainment and state funding for schools.

Composite Index Components

The Human Capital Investment composite index contains 21 indicators in the following categories that measure educational attainment and state funding for schools as a way of determining a region's commitment to an educated workforce.

The prevalence of various degrees: We look at almost a dozen indicators involving bachelor's, master's, and doctoral degrees and focus particularly on the fields of science and engineering. These indicators suggest the labor pool's interests, its level of sophistication and skill development, and the availability of quality R&D centers and centers of higher education. They also give clues as to the local job base and the area's ability to attract grants and other research funding.

State spending: We look at state spending on student aid and appropriations for higher education and the change in appropriations, which indicate a region's commitment to producing an educated workforce and the future quality of the labor force.

Home computer penetration and Internet access: These illustrate the extent to which the population is technically proficient. Penetration coupled with Internet access allows access to resources, both commercial and educational, for which residents might otherwise have to travel long distances.

Test scores: This includes the Scholastic Aptitude Test (SAT) and American College Testing Assessment (ACT) scores of high school students on a time-series and cross-sectional basis. Average math scores in particular measure the strength and effectiveness of secondary schools' math and critical-thinking curriculum.

State Rankings

Human Capital Investment forecasts a state's ability to perform well in technology and science fields in the future. A highly skilled and technologically advanced workforce is a necessity for all successful economies.

AT THE TOP

Massachusetts ranks first in Human Capital Investment as it did in 2012. The state turned in an incredible performance, not only maintaining but improving on its 10-point score increase from the previous index. From 2010 to 2012, Massachusetts moved from 75.24 to 84.67, then raised its score by almost one point in 2014 to 85.33. Massachusetts' 2012 score was the first time that a state scored over 80 in Human Capital Investment. The fact that Massachusetts has surpassed 85 and is still the only state to exceed the 80 mark shows the state's dominance. Massachusetts leads in almost every educational attainment indicator and made large improvements in percent change in state appropriations for higher education starting in 2012.

Maryland, which has performed strongly in the Human Capital Investment composite since 2008, finished second, scoring more than 6 points behind Massachusetts at 79.14. Maryland has consistently scored in the high 70s but has not sufficiently advanced in any indicator to challenge Massachusetts' top position. Maryland is first only in percentage of population with Ph.D. degrees, even though the state is in the Top 5 in 12 of the 21 indicators. Maryland did make significant improvements in state appropriations for higher education (18th to 11th) and percent change in state appropriations for higher education (29th to 11th).

Connecticut held on to third place by raising its score significantly, from 71.24 in 2012 to 75.90 in 2014. This five-point improvement came amid increased competition among the Top 4 states, which all raised their Human Capital Investment scores without changing rank. Connecticut ranked second in the number of science, engineering, and health post-doctorates awarded, as it did in 2012, and second in ACT scores. Connecticut also placed in the Top 10 on bachelor's, master's, and Ph.D. attainment.

Fourth place again goes to **Minnesota,** with a score jump from 70.76 to 74.86. Minnesota has consistently ranked in the Top 5 in this composite since the first index in 2002. Minnesota performs well in share of graduate students in science, engineering, and health (second place), and the similar indicator of recent master's degrees in science and engineering (fourth). The state also shows strength in the standardized testing indicators SAT verbal (sixth), SAT math (fourth), and ACT (sixth).

Utah finishes fifth, stepping up one spot from 2012. Utah has landed in the Top 10 in Human Capital Investment every year of the index except in 2004, when it finished 11th. The state has raised its score in this composite every year since 2008; this year it improved by almost two points to 69.24 from 67.52 in 2012. The state finished in the Top 10 in science, engineering, and health post-doctorates, recent bachelor degrees in science and engineering, all recent degrees in science and engineering, and households with a computer.

Colorado, New York, Virginia, Vermont, and **Delaware** complete the Top 10. These five states' scores varied by less than four points, in contrast to over 16 points among the Top 5. Delaware was the only state to climb back into the Top 10, leaping six spots from 16th place in 2012, one of the biggest jumps in the composite. Delaware's best finish was seventh in 2002.

AT THE BOTTOM

Arkansas, Mississippi, and **Nevada** were 48th, 49th, and 50th, respectively. Arkansas ranks in the bottom 10 in about half of the composite's 21 indicators but came in eighth in spending on student aid. However, the lack of strong universities is a significant hurdle. Similarly, Mississippi ranks in the bottom 10 on most indicators; however, it did finish eighth in state appropriations in higher education. Nevada, meanwhile, has consistently ranked last in this composite except in 2004. This year, its score fell by more than two points from 23.71 in 2012 to 21.43.

BIGGEST GAINERS

Oregon (22nd from 29th) and **Illinois** (11th from 18th) both jumped seven spots in this composite. Oregon posted huge gains in percentage change in state appropriations for higher education, vaulting to 12th place in 2014 from 50th in 2012. It also improved its ranking in science engineering and health post-doctorates, placing 24th, compared with 28th in 2012. Illinois also made its largest improvements in state appropriations for high education (27th to ninth) and in percentage change in state appropriations for higher education (32nd to fourth). **Delaware** (10th from 16th), **Iowa** (18th from 24th), and **Arizona** (29th from 35th) all gained six spots in the rankings.

FIGURE 7 **Human Capital Investment Composite Index map:** 2014

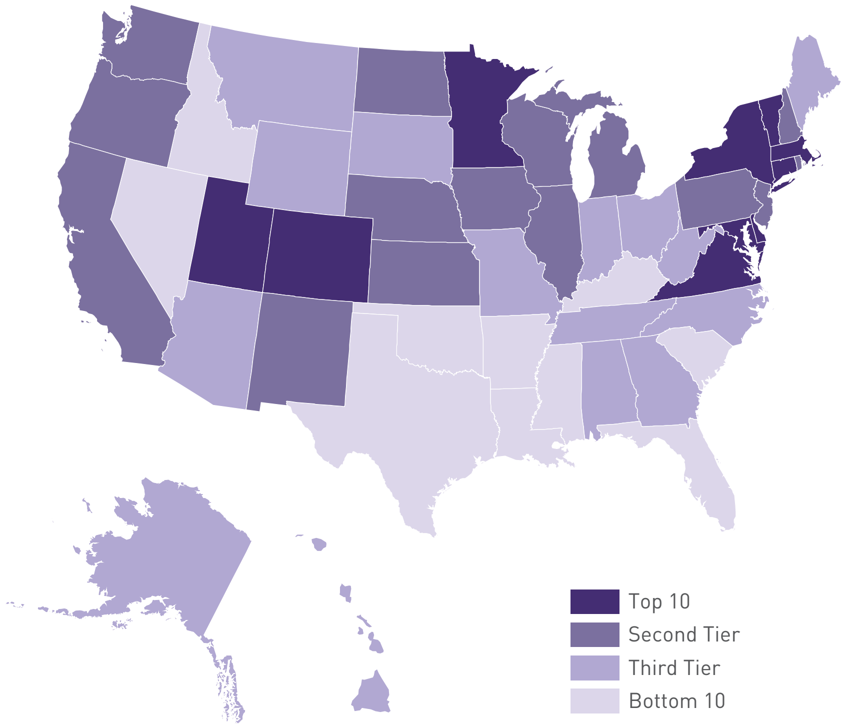
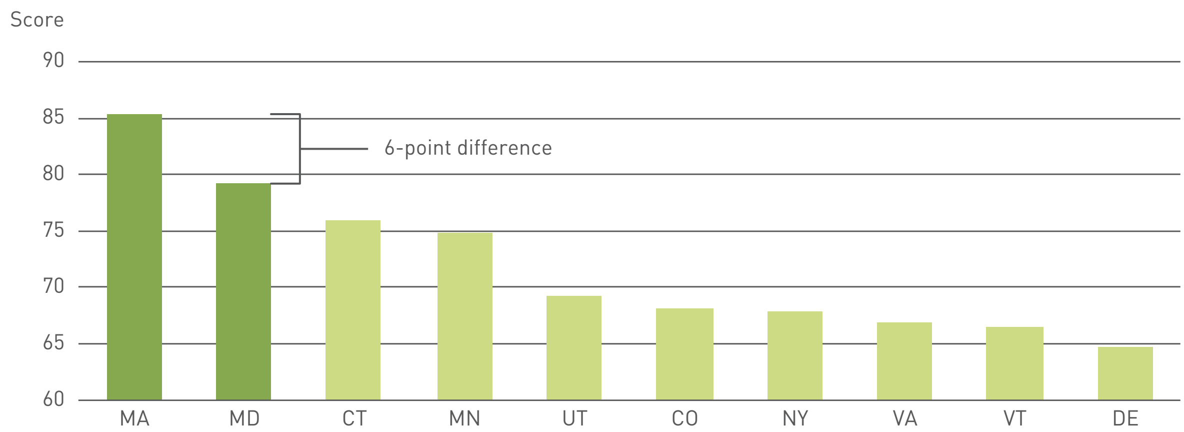


FIGURE 8 **Human Capital Investment Composite Index:** Top 10 states, 2014



Source: Milken Institute

TABLE 4 **Human Capital Investment Composite Index:** State rankings, 2014

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Massachusetts	1	1	0	85.33
Maryland	2	2	0	79.14
Connecticut	3	3	0	75.90
Minnesota	4	4	0	74.86
Utah	5	6	1	69.24
Colorado	6	5	-1	68.10
New York	7	8	1	67.90
Virginia	8	9	1	66.95
Vermont	9	7	-2	66.57
Delaware	10	16	6	64.67
Illinois	11	18	7	63.81
North Dakota	12	15	3	63.62
Rhode Island	13	14	1	63.43
New Hampshire	14	13	-1	63.24
Nebraska	15	11	-4	62.30
Pennsylvania	16	9	-7	62.00
California	17	12	-5	60.76
Iowa	18	24	6	58.95
Washington	19	21	2	58.29
Michigan	20	17	-3	57.90
New Jersey	21	20	-1	57.62
Oregon	22	29	7	54.29
Wisconsin	23	19	-4	51.52
Kansas	24	22	-2	51.24
New Mexico	25	25	0	51.05
Indiana	26	27	1	50.76
Missouri	27	26	-1	50.38
North Carolina	28	23	-5	49.05
Arizona	29	35	6	48.67
South Dakota	30	33	3	47.30
Ohio	31	34	3	44.67
Wyoming	32	32	0	44.30
Georgia	33	30	-3	43.90
Tennessee	34	36	2	43.33
Montana	35	28	-7	43.05
Alabama	36	31	-5	42.29
Alaska	37	41	4	40.40
West Virginia	38	39	1	38.86
Hawaii	39	39	0	38.19
Maine	40	37	-3	37.90
Texas	41	38	-3	36.67
Oklahoma	42	42	0	34.76
Florida	43	45	2	33.24
Idaho	44	43	-1	33.05
Kentucky	45	46	1	31.62
Louisiana	46	44	-2	30.29
South Carolina	47	48	1	28.95
Arkansas	48	47	-1	25.81
Mississippi	48	49	1	25.81
Nevada	50	50	0	21.43

TECHNOLOGY AND SCIENCE WORKFORCE

Transforming innovation into commercial products and services requires a skilled tech and science workforce. Regions with these skilled workers are more competitive and better positioned for economic growth and for sustaining high-tech firms as they mature. Although these workers generally constitute only a small percentage of the workforce on average, their outsized influence on their regional economies belies their small numbers.[32]

Composite Index Components

The Technology and Science Workforce Composite Index reveals the research and innovative capacity in specific fields of high-tech employment. The occupations chosen as indicators—in the broad fields of computer and information science, life and physical science, and engineering—are considered the foundations of a high-tech economy, so the 18 occupations collectively also convey the entrepreneurial activity present in each region. We look at their “intensity,” or prevalence, relative to total state employment.

Intensity of computer and information science experts: This group contains the intensity scores of computer and information scientists, computer programmers, software engineers, computer support specialists, systems analysts, and database and network administrators. These jobs represent high value-added occupations and are a necessity in most technology and science firms.

Intensity of life and physical scientists: This looks at the intensity of agricultural and food scientists, biochemists and biophysicists, microbiologists, medical scientists, physicists, and miscellaneous life and physical sciences. These occupations are important to the scientific community because they support and promote entrepreneurial activities.

Intensity of engineers: This calculates the prevalence of electronics engineers, electrical engineers, computer hardware engineers, biomedical engineers, architectural engineers, and other engineers. These professionals drive vitality because they design and construct everything from the largest of bridges to the tiniest, most intricate medical devices.

State Rankings

There are few surprises this year in the Technology and Science Workforce composite, with only one new state in the Top 10.

AT THE TOP

Once again, **Massachusetts** ranks first in this composite, though its score dropped half a point to 87.06. Massachusetts performed well across the board: It ranks in the Top 5 in 11 of the 18 indicators in this composite and came in first in five (biomedical engineers, medical scientists, microbiologists, biochemists/biophysicists, and software engineers). This is largely due to the number of universities, research facilities, hospitals, and high-tech employment clusters.

32. Jarle Moen, “Is Mobility of Technical Personnel a Source of R&D Spillover?,” NBER Working Paper, No. 7834 (2000).

Although still in second, **Maryland** is gaining on Massachusetts. Its score rose from 84.89 to 86.47, in contrast to Massachusetts' small decline. With Top 5 rankings in 10 indicators, Maryland performs evenly across all three occupational categories, but finishes first in computer information science and computer hardware engineers. Not surprisingly, agricultural scientists and agricultural engineers are the least prevalent.

Washington remains in third, after inching up to this position in the 2012 index with an almost identical score of 83.22. The state is in the Top 5 in four indicators, including first in computer programmers. The state improved slightly in life and physical science occupations, making significant improvements in biochemists and biophysicists after a large decline in 2012.

California rose to fourth from fifth place, posting its best performance in this composite since 2004. But while its score increased by 2 points, California's elevation in rank movement is more due to Delaware's seven-place drop from fourth in 2012 to 11th in 2014. California's own gains largely reflect the recovery of the state's technology sector. The state performed in the Top 5 in eight of the 18 indicators. However, California's rankings vary widely, from the Top 5 to 24th place.

Virginia also benefitted from Delaware's decline, improving one place to fifth with a score increase of only one point to 78.78. Virginia is the top performer in computer science and information science intensity, finishing in the Top 3 on five of the computer specific occupations.

Ranking sixth through 10th, respectively, were **Colorado, Minnesota, Utah, Rhode Island** and **Texas**. Colorado was only half a point below Virginia at 78.22, but it significantly outpaced the next-best state (Minnesota at 71.06). Utah had the biggest gain in this composite, moving up eight spots to land eighth after having finished 16th in 2012. Rhode Island was able to remain in ninth after having steadily gained ground since ranking 32nd on the first index in 2002. Texas fell three spots from seventh in 2012, rounding out the Top 10.

AT THE BOTTOM

West Virginia and **Nevada** ranked 48th and 49th while **Louisiana** remained in last place. The three states have never ranked higher than 40th in this composite.

BIGGEST GAINERS

The biggest gainer this year was **Utah**, gaining eight spots (16th to eighth) due to small improvements in almost every occupation as well as large jumps in electronics engineers (13th to sixth) and electrical engineers (20th to 15th). **North Carolina** improved by seven places (26th to 19th) with a rise in engineering occupations. Both **Montana** (42nd to 36th) and **Michigan** (30th to 24th) rose six spots.

FIGURE 9 **Technology and Science Workforce Composite Index map:** 2014

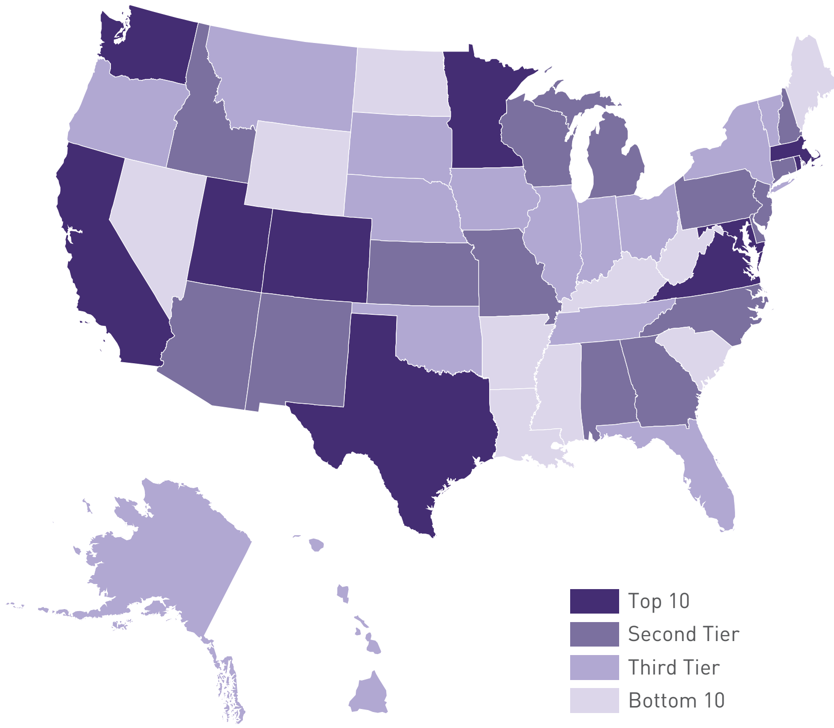
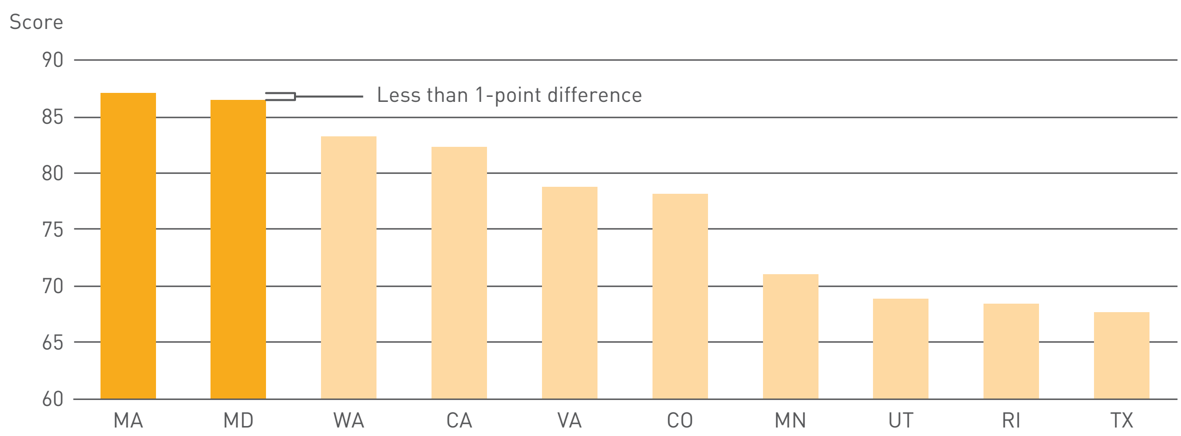


FIGURE 10 **Technology and Science Workforce Composite Index:** Top 10 states, 2014



Source: Milken Institute

TABLE 5 Technology and Science Workforce Composite Index: State rankings, 2014

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Massachusetts	1	1	0	87.06
Maryland	2	2	0	86.47
Washington	3	3	0	83.22
California	4	5	1	82.33
Virginia	5	6	1	78.78
Colorado	6	8	2	78.22
Minnesota	7	10	3	71.06
Utah	8	16	8	68.93
Rhode Island	9	9	0	68.50
Texas	10	7	-3	67.67
Delaware	11	4	-7	63.83
Pennsylvania	12	15	3	63.78
New Hampshire	13	18	5	63.43
Arizona	14	11	-3	63.29
Georgia	15	17	2	63.00
Connecticut	16	13	-3	62.00
Wisconsin	17	23	6	61.41
New Mexico	18	20	2	61.25
North Carolina	19	26	7	61.00
New Jersey	20	12	-8	60.71
Kansas	21	19	-2	60.53
Alabama	22	22	0	59.75
Idaho	23	14	-9	59.00
Michigan	24	30	6	57.53
Missouri	25	24	-1	56.47

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
New York	26	28	2	56.35
Illinois	27	21	-6	55.11
Alaska	28	31	3	53.64
Nebraska	29	29	0	53.50
Ohio	30	27	-3	53.11
Vermont	31	24	-7	52.80
Indiana	32	34	2	52.13
Oregon	33	32	-1	51.20
Tennessee	34	33	-1	49.06
Iowa	35	35	0	47.25
Montana	36	42	6	46.33
South Dakota	37	41	4	45.14
Florida	38	36	-2	44.56
Oklahoma	39	37	-2	44.00
Hawaii	40	39	-1	43.14
South Carolina	41	38	-3	42.00
Maine	42	45	3	39.73
Arkansas	43	43	0	35.69
Mississippi	44	47	3	34.29
Kentucky	45	44	-1	33.88
Wyoming	46	48	2	31.75
North Dakota	47	40	-7	30.50
West Virginia	48	49	1	27.71
Nevada	49	46	-3	25.38
Louisiana	50	50	0	24.27

TECHNOLOGY CONCENTRATION AND DYNAMISM

High-tech industries are critical to a region's economic development; it is where new companies are formed and innovations emerge. States with strong high-tech clusters simply grow faster than those without them. The component on technology concentration and dynamism applies several metrics to ascertain the intensity and prevalence of high-tech businesses by state and whether the sector is expanding.

Composite Index Components

After states pull in financing from public and private sources, invest in human capital, and amass a skilled workforce, what results do they produce? In essence, this composite reveals each state's entrepreneurial, governmental, and policymaking success (or failure) based on high-tech employment, payroll activity, net business formations, and growth.

High-tech employment: High-tech businesses are vital to a region's economic growth, especially given that jobs in this sector typically command above-average salaries. Drawing comparisons between employment and establishments in the high-tech sector to salaries being paid to high-tech workers allows analysts to determine the quality of jobs being created in the sector and in the economy as a whole. We look at the percentage of high-tech businesses, employment and payroll in each state.

High-tech business births: New companies are a sign of economic stability and optimism—and business births in the technology sector are particularly important because regional prosperity during the past three decades has been linked to high-tech expansion. This indicator looks at net formation of high-tech business establishments and percentage of business births in the tech sector.

High-performing tech companies: The number of companies named in the Technology Fast 500—an index that identifies the fastest-growing private tech companies—reflects the growth and expansion of the high-tech sector. We also look at the Inc. 500 rankings for a general snapshot of all companies. Taken together, they measure how well tech firms are performing against a wider field.

Growth in tech-sector industries: To see which industries in the high-tech sector are more successful in different parts of the country, we look at the average yearly growth in high-tech industries to capture where technology has grown fastest in the past five years, the number of industries that are growing faster than the U.S. average, and high-tech industries with a location quotient higher than 1.0—a way to capture how prevalent those industries are in a region.

State Rankings

There was little change at the top of this year's Technology Concentration and Dynamism Composite Index. Nine of the Top 10 were also best performers in 2012; the only new entrant was Oregon, replacing Delaware. The Top 10 collectively scored higher than in the 2012 index, an impressive outcome on the heels of a similar increase from 2010 to 2012.

AT THE TOP

Utah once again ranked first, this time scoring 92.89 (compared with 86.00 in 2012). The state's phenomenal performance puts it in the Top 10 of all of nine indicators in the composite index. Utah also rebounded remarkably, to fifth place from 25th, from its only weak area in 2012: net formation of high-tech establishments. The data for this 2012 downfall could have reflected a recessionary pullback that reversed as the economy improved. While it's possible that Utah's growth is unsustainable, the state has not yet slowed down, having secured first-place finishes in this composite since 2008 and finishing with a six-point score increase in 2014.

Washington remained in second place, posting a one-point score increase to 85.11, still far below Utah. Washington was able to maintain most of its gains from 2012, when it strengthened in eight of the 10 indicators. It continues to rank first in the percentage of employment and percentage of payroll in high-tech industries. Washington will need to continue to make improvements in its weak indicators such as the number of Inc. 500 companies, where it finished 24th, if it is going to stay in second, since Maryland and Massachusetts are both less than one point behind Washington.

Maryland finished third, its best ranking since 2008 (when it finished second) and its highest score ever of 84.67. In three of the nine indicators, Maryland placed in the Top 5, with its best performance being second place in percentage of establishments in high-tech North American Industry Classification System (NAICS) code. Maryland performed poorly in only one indicator: It ranked 33rd in the number of high-tech industries growing at a faster rate than the U.S. average.

Massachusetts' fourth-place rank marks this as the only composite in which the state does not rank first. However, Massachusetts is improving in this index, moving up two spots from its No. 6 ranking in 2012 and being less than a half a point behind third-place Maryland.

California this year lost its race with Maryland. The two states had been tied in fifth place in 2010 and fourth in 2012. This year, Maryland moved up to third while California fell to fifth. In five of the nine indicators, California ranked in the Top 5. The state struggled in the growth indicators due to its already large technology industry, with a 19th-place finish in high-tech industry growth and 37th in net formation of high-tech establishments. The state absolutely dominated in the number of high-tech industries with a location quotient above 1.0 (17 industries vs. 14 for next-ranked Massachusetts). It also performs well in all high-tech density indicators, percentage of high-tech establishments (fourth), percent of high-tech employment (third), and percent of high-tech payroll (second).

Virginia, North Carolina, Colorado, Texas, and **Oregon** ranked sixth through 10th, respectively. Both Virginia and North Carolina had three position improvements. Colorado experienced the largest drop in the Top 10, from third to eighth, and Texas fell two places to ninth. In 10th place, Oregon was the only new state to enter the Top 10, jumping three spots from 13th in 2012, with a score improvement of over five points.

AT THE BOTTOM

Wyoming, Oklahoma, and **South Dakota** brought up the rear. Wyoming improved one spot to 48th, Oklahoma had a major 14-place fall from 35th to 49th, and South Dakota for the first time finished 50th, falling from 42nd.

Wyoming's overall poor performance had one bright spot: It placed sixth in net formation of high-tech establishments. Oklahoma (27th) and South Dakota (34th) also ranked third tier instead of bottom 10 in the net formation of high-tech establishments because the indicator favors states with a poor high-tech base.

BIGGEST GAINERS

Wisconsin was the biggest gainer with a 13-position leap (25th from 38th). Next was **Montana's** 11-position jump (19th from 30th), followed by three states that moved up 10 places: **Georgia** (11th from 21st), **Michigan** (30th from 40th), and **Arkansas** (40th from 50th).

FIGURE 11 **Technology Concentration and Dynamism Composite Index map:** 2014

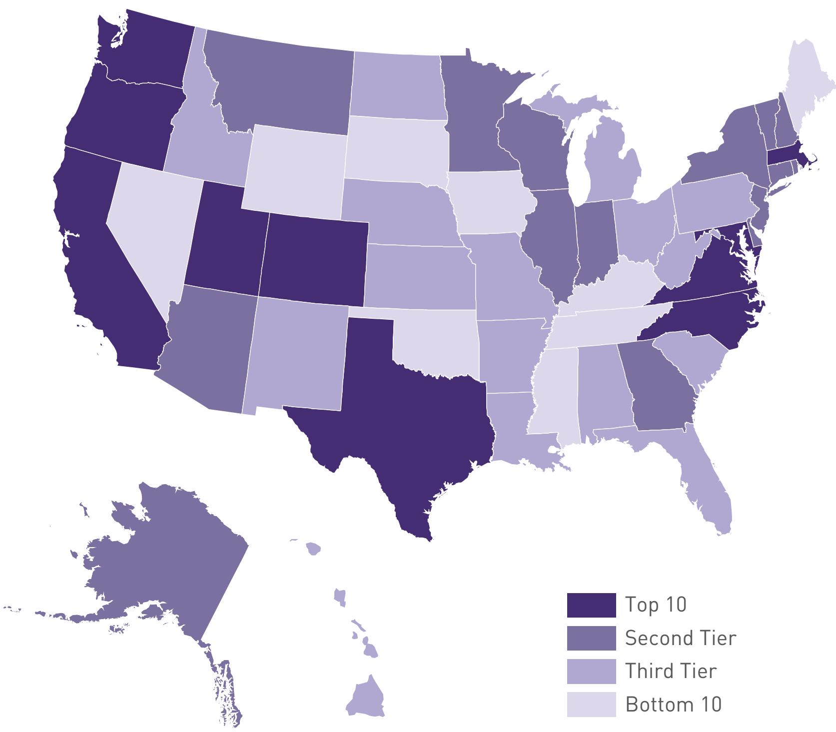
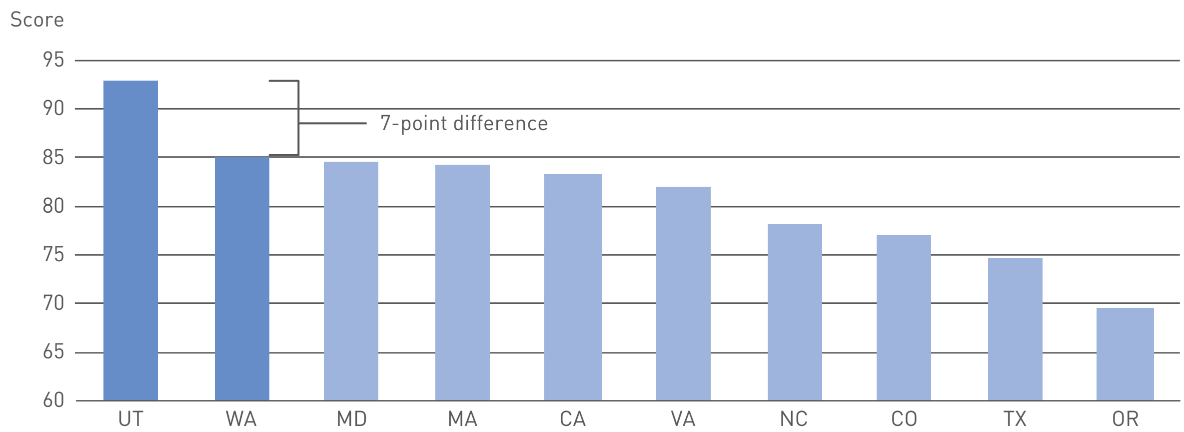


FIGURE 12

Technology Concentration and Dynamism Composite Index:
Top 10 states, 2014

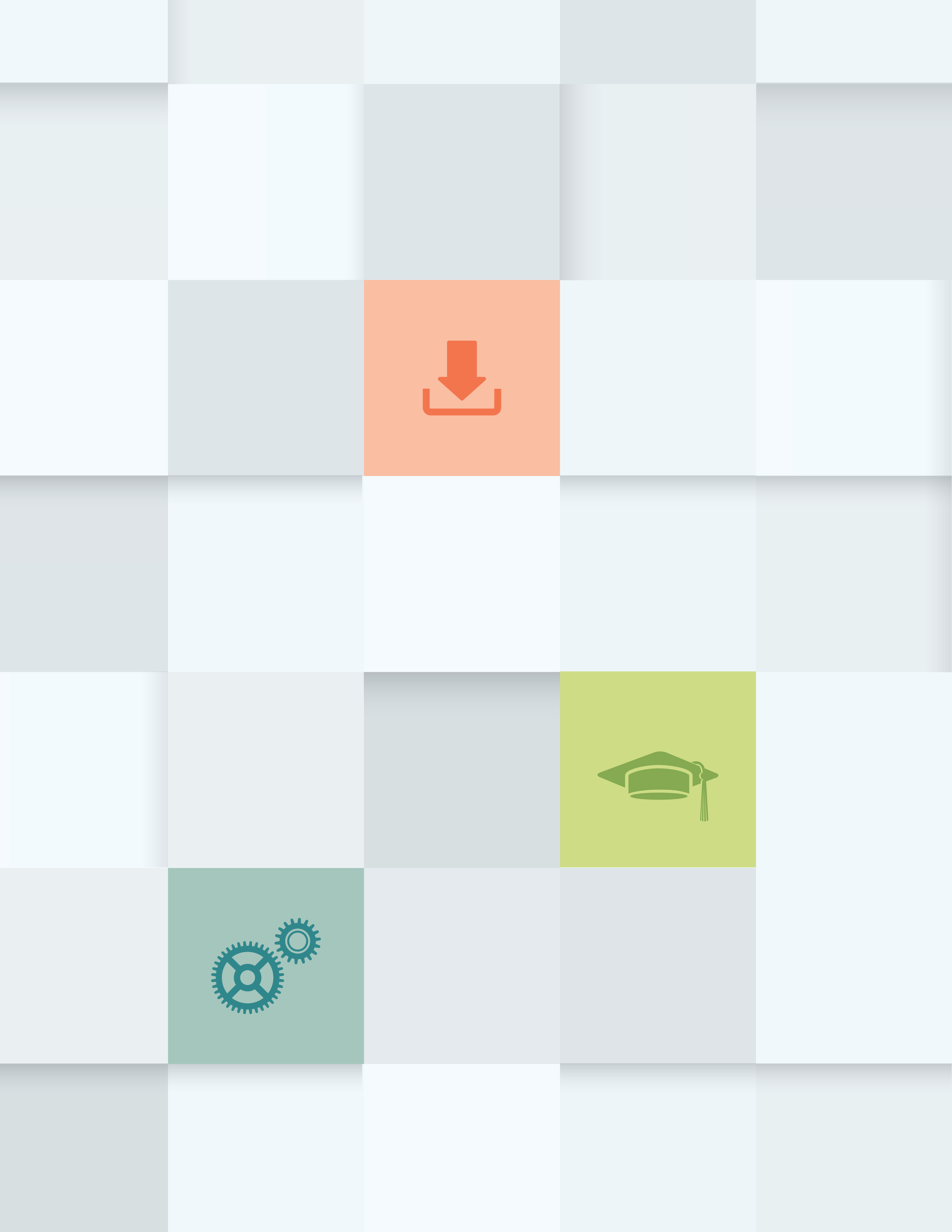


Source: Milken Institute

TABLE 6

Technology Concentration and Dynamism Composite Index:
State rankings, 2014

STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE	STATE	2014	2012	RANK CHANGE 2012 TO 2014	AVERAGE SCORE
Utah	1	1	0	92.89	Florida	26	26	0	51.78
Washington	2	2	0	85.11	Pennsylvania	26	21	-5	51.78
Maryland	3	4	1	84.67	Kansas	28	18	-10	49.75
Massachusetts	4	6	2	84.22	South Carolina	29	25	-4	49.56
California	5	4	-1	83.33	Michigan	30	40	10	49.11
Virginia	6	9	3	82.00	New Mexico	31	27	-4	48.57
North Carolina	7	10	3	78.25	Ohio	32	34	2	47.11
Colorado	8	3	-5	77.11	North Dakota	33	33	0	46.00
Texas	9	7	-2	74.67	Idaho	34	23	-11	45.00
Oregon	10	13	3	69.56	Missouri	35	44	9	42.00
Georgia	11	21	10	69.33	Hawaii	36	28	-8	41.25
New York	12	19	7	68.67	West Virginia	37	45	8	38.29
Delaware	13	8	-5	63.00	Nebraska	38	37	-1	38.00
New Jersey	14	15	1	62.89	Alabama	39	39	0	37.33
Vermont	15	14	-1	61.75	Arkansas	40	50	10	37.14
Arizona	16	11	-5	61.11	Louisiana	40	36	-4	37.14
New Hampshire	17	16	-1	59.75	Iowa	42	40	-2	36.25
Rhode Island	18	24	6	59.50	Nevada	43	32	-11	36.22
Montana	19	30	11	57.33	Mississippi	44	48	4	35.11
Minnesota	20	20	0	56.89	Tennessee	45	47	2	34.89
Connecticut	21	12	-9	56.22	Kentucky	46	46	0	33.33
Alaska	22	29	7	55.75	Maine	47	43	-4	31.33
Illinois	23	17	-6	53.78	Wyoming	48	49	1	29.00
Indiana	24	30	6	53.33	Oklahoma	49	35	-14	26.00
Wisconsin	25	38	13	53.00	South Dakota	50	42	-8	21.14



California's Position in Technology and Science:

A Comparative Benchmarking Assessment

INTRODUCTION

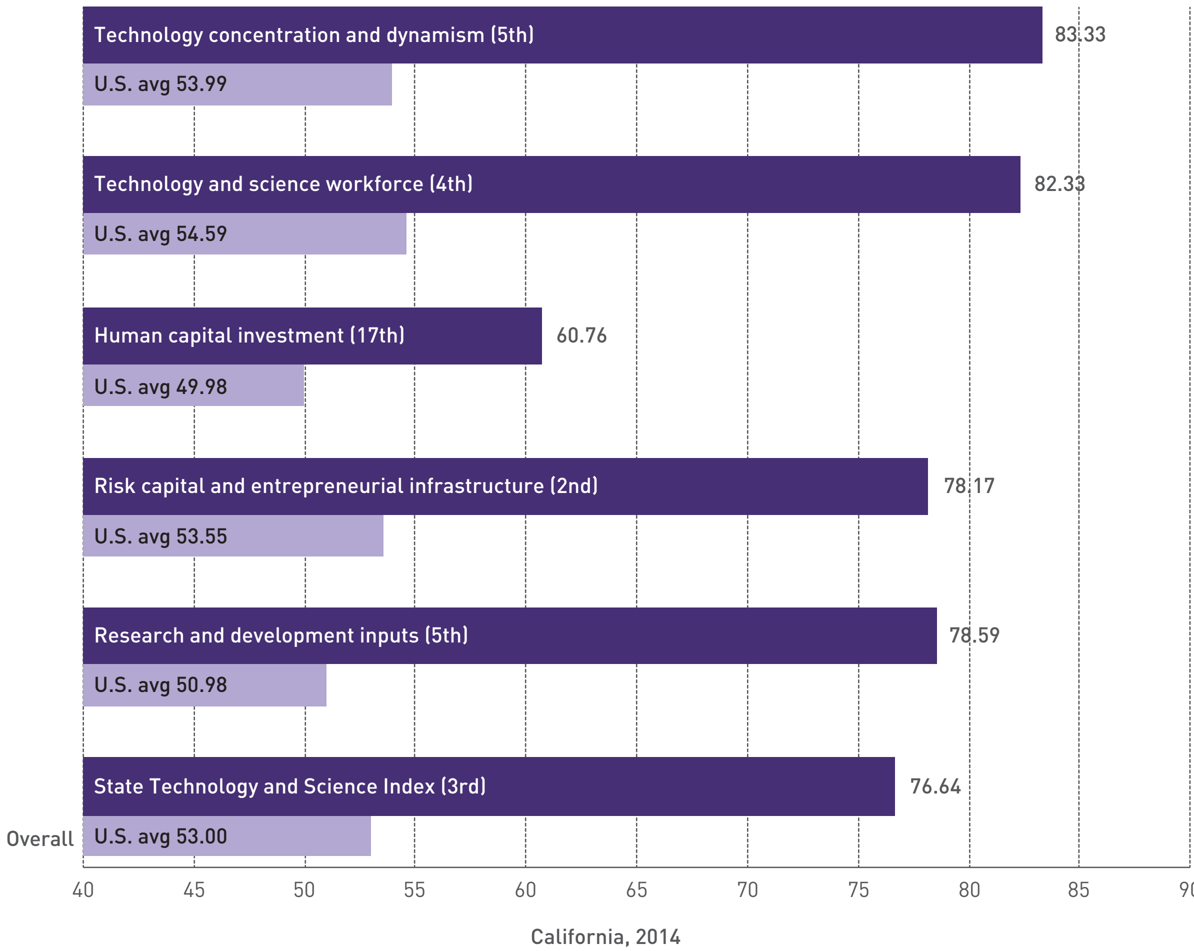
Since 2002, the Milken Institute's State Technology and Science Index has examined each state's technology and science capabilities and their impact on regional economic growth. The index is a method for comparing states' performance, but it also helps states see trends that will affect their economies. In the initial index, we included a section profiling California's comparative position in the index. Since 2004, we have provided a companion piece focusing on California and the issues affecting the state. The 2012 companion piece was published in late 2013 with updated data. This means that in the current index, California is being assessed in comparison to its performance in both 2013 and 2012, whereas the State Technology and Science Index has only 2012 for comparison. In the 2014 index, we include California in order to provide a more in-depth examination of the indicators as well as to profile key trends in the nation's largest center of science and technology. We examine, discuss, and compare 24 of 78 indicators as they pertain to California. These chosen indicators either posted the largest changes since the last index or have a large effect on the overall California economy.

This year, California performed best in the Risk Capital and Entrepreneurial Infrastructure Composite Index, ranking second nationally. It's the state's latest climb in this category, up a spot from last year and two spots from 2012. The leverage of high-tech industries in Silicon Valley, as well as strong showings in venture capitalist investment, contributed to California's high ranking.

While California continues to reap the benefits of today's high-tech companies, it must do more to ensure that the next generation of scientists and engineers are adequately educated. Although the state did improve in Human Capital Investment, rising three spots from last year, it continues to be an area of relative mediocrity. California ranked 17th in the nation in this category, its worst performance among all the composites. It continues to struggle in areas pertaining to science and engineering education, which serve as a key indicator of a state's ability to compete consistently in high-tech sectors. Just as states such as Massachusetts continue to emphasize science and engineering education, California must do more to maintain its role as the national leader in technological innovation.

Through referendums and rising tuition costs, California's overall higher-education spending rose dramatically from last year. The increase in these appropriations was the eighth-highest nationally, a considerable change from last year, when the state saw the third-lowest increase in that category. This steep rise of 40 spots represents the largest change in rankings for California this year.

FIGURE 13 California's Performance in the State Technology and Science Index, 2014



The performance of California in the overall index and the five composites are as follows:

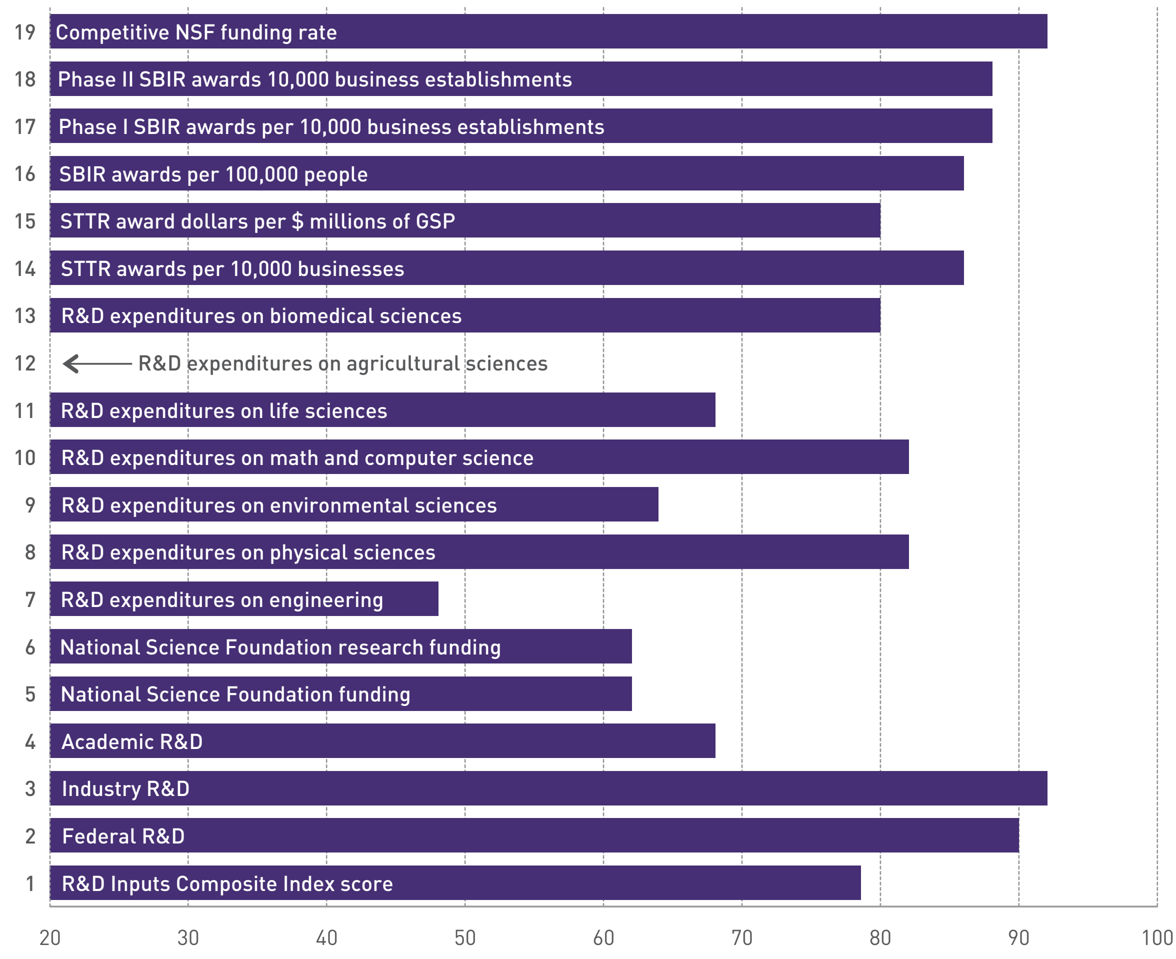
- » California's position in the overall **State Technology and Science Index** remains unchanged from the 2012 index, improving slightly from a score of 75.70 to 76.64. However, this is an improvement from the 2013 index, when California fell to fourth with a score of 74.98.
- » California fell to fifth place in the **Research and Developments Inputs Composite Index** despite an improved score of 78.59. This marks the first year of improvement since 2008, when it scored 80.12, then fell to 79.06 in 2010, to 77.84 in 2012, and further down to 77.01 in 2013. Competition among the Top 4 is more intense this year with every state scoring at least 80. California will need to show continued improvement to reclaim the fourth spot.
- » The state reclaimed its second-place ranking in the **Risk Capital and Entrepreneurial Infrastructure** index for the first time since 2010. It is California's best ranking in a composite. The state's 78.59 score is almost a three-point increase over 2013's score of 75.33 or the 76.00 in the national index in 2012.
- » The most significant story comes from the **Human Capital Investments Composite Index**. Here, California's score of 60.76 is an improvement on 56.29 in 2013, when it plummeted nearly 10 points from its 2012 national index score of 65.05. This year, California finished 17th, five places below its 2012 ranking, but at least it was an improvement over 2013, when it finished in 20th place. This index is still being affected by recessionary budget cuts in higher education.
- » California remained in fourth place in the **Technology and Science Workforce Composite Index**. This ranking is the same as in 2013, but with a slight drop in score, from 82.56 to 82.33. California has shown major improvement since finishing seventh in 2010 (scoring 74.67) and fifth in 2012 (scoring 79.89).
- » In the **Technology Concentration and Dynamism Composite Index**, competition has pushed California down two spots to fifth from third in 2013. The state actually improved its score (from 82.20 to 83.33), but not by enough to keep Maryland and Massachusetts from leapfrogging California. The tech industry is becoming more and more competitive, and growth in the sector propelled San Francisco and San Jose to the Top 5 of the Milken Institute Best Performing Cities Index in 2013. However, the growth in California's tech sector is primarily occurring in the Bay Area, and the rest of the state has not seen the same levels of growth in job creation and economic activity. Technology in California needs to continue to expand throughout the state.

CALIFORNIA: RESEARCH AND DEVELOPMENT INPUTS

This composite index measures a state's ability to attract funding and create innovations that can be commercialized. The category includes measures such as industrial, academic, and federal R&D; Small Business Innovation Research awards; and the Small Business Technology Transfer program, among others.

Since the 2010 index, California has ranked fourth in Research and Development Inputs, but this year has fallen to fifth with a score of 78.59. New Hampshire (80.20) took fourth place instead, edging out California; in 2013, New Hampshire had scored only half a point less than California. Colorado (81.03) remains in third place, having unseated California from that position in 2012. This year's best scorers, Massachusetts (94.82) and Maryland (88.28), improved their numbers over the 2013 index and now hold the top two spots for the fifth consecutive index. The other Top 10 states are Delaware (75.42), Washington (75.13), Utah (71.88), Rhode Island (71.36), and Connecticut (71.24).

FIGURE 14 California's scores in research and development inputs indicators



California maintains its strong No. 3 spot in the State Technology and Science Index because its leaders in both business and government recognize the importance of research and development. California remained in the Top 10 in federal and industry R&D per capita, despite its large population. However, in academic R&D, California's ranking fell two positions from the 2012 index to 17th due to increased competition even as spending increased from $200.37 per capita in 2013 to $218.87 this year.

California performed well in almost all of the Research and Development Inputs indicators, but fell below the national average in R&D expenditures on engineering, on environmental science, and on agricultural sciences—the same categories in which it scored below the national averages in the 2010, 2012, and 2013 indexes. California improved in National Science Foundation research funding: The state moved up three places from 2013 and scored above the national average, receiving $39.48 per $100,000 of GSP and ranking 20th. Meanwhile, California fell to 20th (from 18th in 2013) in overall National Science Foundation funding, even with the NSF research improvement.

California's Competitive NSF Proposal Funding Rate score fell from 2013 to 26.3%, but competition in this measure has decreased, and California improved three places to finish fifth.

The SBIR-related measures made minor changes in ranking from 2013 to 2014. California fell one spot to finish eighth in the number of SBIR awards per 100,000 residents, remained seventh in Phase I, and improved one spot to also finish seventh in Phase II SBIR Awards per 100,000 people.

INDUSTRY R&D DOLLARS PER CAPITA

Why Is It Important?

This indicator illustrates the role of industry R&D in a state's economy. It is a strong indicator of how companies are investing in their future. Firms spend their R&D dollars primarily in states with talented and educated workforces. The fruits of R&D often take years to materialize, but without this investment, companies eventually lose their competitive edge.

Industry R&D and California

California received $1,952 per capita in industry R&D funding, up over $200 from the last year's index. The increase, based on the most recent data (2011), moved California up to fifth place in the nation, up one spot from last year's index. California far outpaces the national average of $712, but still trails national leader Massachusetts by about $400. Thanks to Silicon Valley, it is no surprise that California continues to perform well in this measure even with the state's large population.

FIGURE 15

Industry R&D dollars per capita: 2011

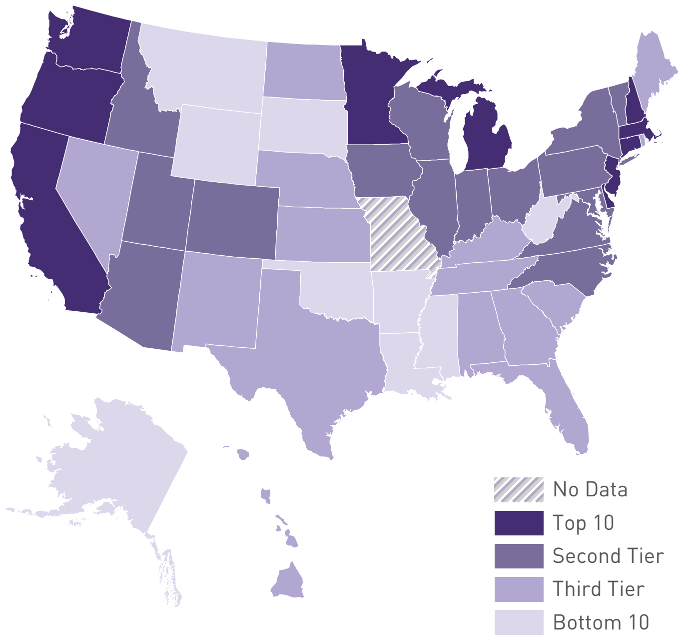
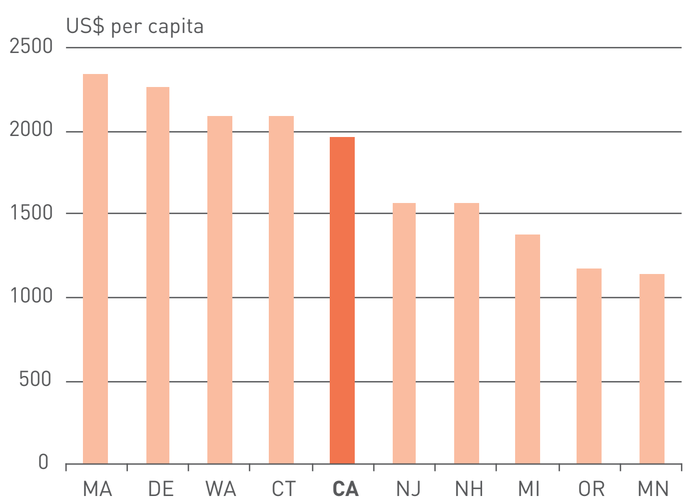


FIGURE 16

Industry R&D dollars per capita: Top 10 states, 2011



Source: Milken Institute, National Science Foundation, U.S. Census Bureau

ACADEMIC R&D DOLLARS PER CAPITA

Why Is It Important?

R&D performed by colleges and universities differs from government and industry R&D because it typically focuses on fundamental scientific discoveries rather than product or technology development. Although academic research has traditionally been somewhat divorced from the marketplace, academic R&D can serve as a magnet for fostering and attracting knowledge-intensive businesses that seek to hire academic researchers and benefit from their discoveries.

Academic R&D and California

California continues to spend considerably less on academic R&D compared with federal and industry R&D funding. The state spends $218 per capita, up from $200 last year and only slightly ahead of the national average. Despite the small increase in spending, California dropped two spots to 17th in the nation in this category. Maryland and Massachusetts, which have consistently led the nation in academic R&D spending per capita, spent $568 and $470 per capita, respectively.

FIGURE 17

Academic R&D dollars per capita: 2012

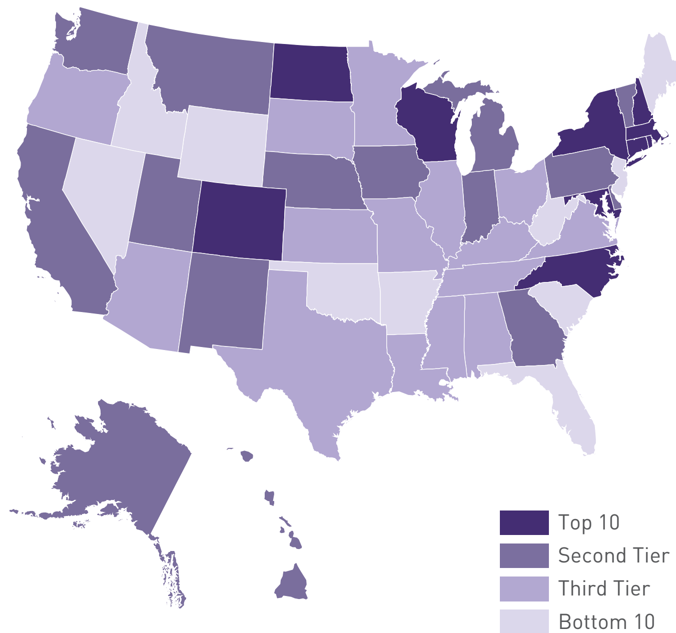
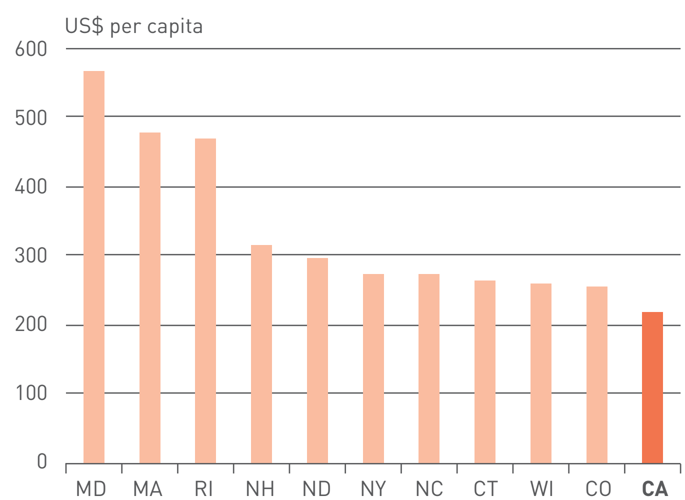


FIGURE 18

Academic R&D dollars per capita: Top 10 states and California, 2012; California ranked 17th



Source: Milken Institute, National Science Foundation, U.S. Census Bureau

R&D EXPENDITURES ON AGRICULTURAL SCIENCES

Why Is It Important?

Agriculture-related studies have long been an important component of scientific advancement. Today, it is imperative to find innovative solutions to such problems as world hunger and forest degradation, and agricultural R&D is at the forefront of efforts to address these challenges. Agricultural science R&D blends old and new technologies, radically modernizing the field.

Agricultural Sciences R&D and California

Despite leading the nation in food production, California continues to rank in the bottom 10 in agricultural R&D. It remained at 46th nationally, and its per-capita expenditures were $2.04, less than half the U.S. average and far short of spending levels in the Top 5 states (led by Montana at $25.27). While these top states are heavily dependent on farming, the lack of major agricultural R&D projects limits the options of California's agricultural workforce.

FIGURE 19

R&D expenditures on agricultural sciences: 2012

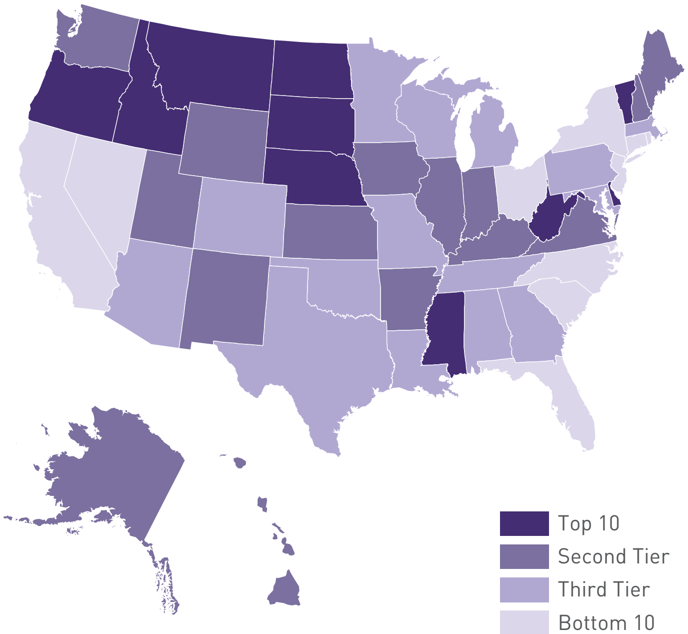
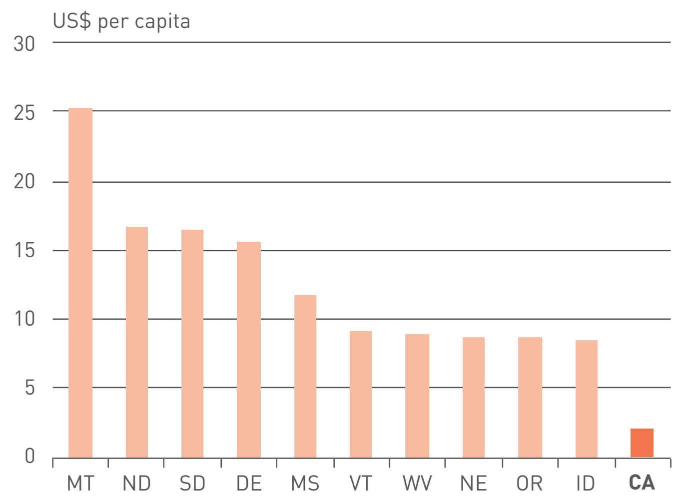


FIGURE 20

R&D expenditures on agricultural sciences: Top 10 states and California, 2012; California ranked 46th



Source: National Science Foundation, U.S. Census Bureau

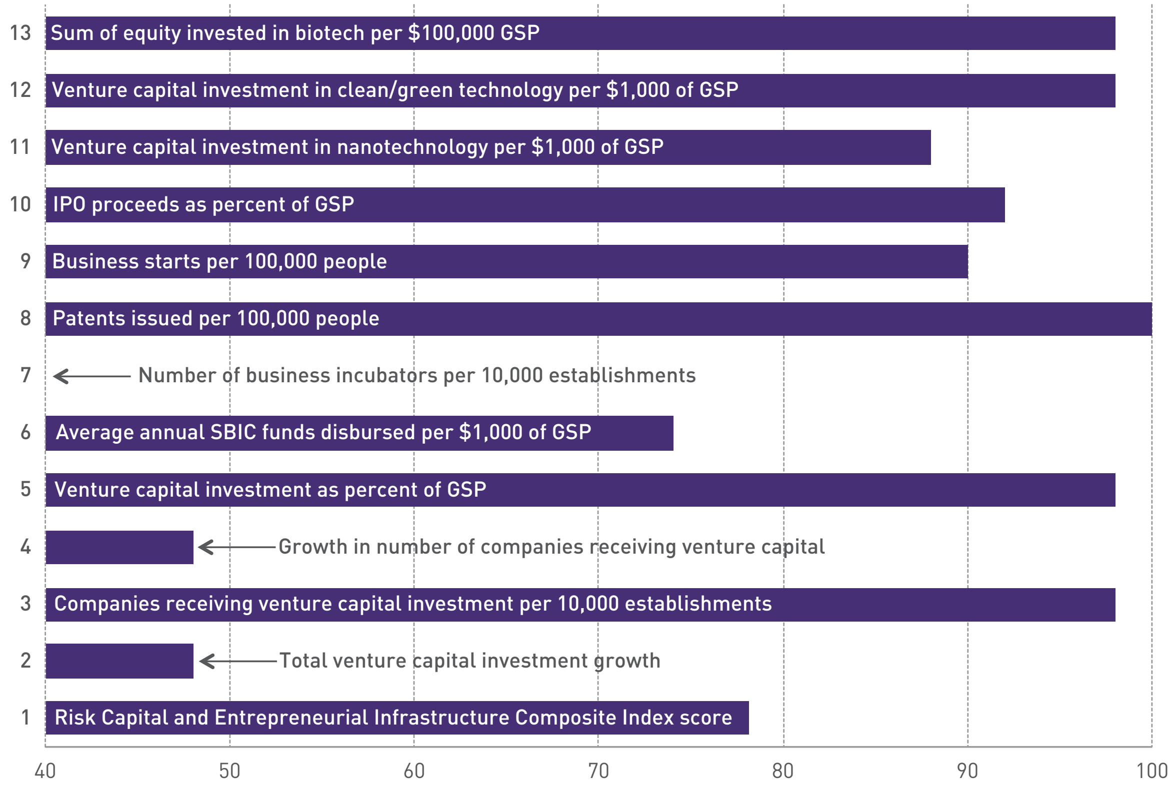
CALIFORNIA: RISK CAPITAL AND ENTREPRENEURIAL INFRASTRUCTURE

Entrepreneurial capacity and risk capital infrastructure are factors that determine how successful a state will be in converting research into commercially viable technology services and products. In this composite index, we include several measures of venture capital activity as well as entrepreneurial pursuits, including patenting activity, business formations, and initial public offerings. This year, the Risk Capital and Entrepreneurial Infrastructure Composite Index combines two indicators—venture capital in clean technology and venture capital investment in green technology—into one, and adds an indicator for venture capital in biotechnology.

Over the last few years, California's ranking has jumped around in the Risk Capital and Entrepreneurial Infrastructure Composite Index. This year, it ranked second. It ranked third in 2013, fourth in 2012, and second in 2010. With a score of 78.17, California reclaimed the No. 2 spot this year from New York, which finished more than five points behind at 73.00 (in 2013, New York outscored California by almost 10 points). Meanwhile, first-place Massachusetts scored 81.50.

In specific indicators, the Golden State placed second in venture capital investment as a percentage of GSP, second in the number of companies receiving venture capital, second in clean/green technology investment, second in biotechnology investment, and first in patents issued. This is a strong performance, but California still lags far behind Massachusetts, which placed first in four indicators.

FIGURE 21 California's scores in risk capital and entrepreneurial infrastructure indicators



In six of the indicators, California ranked in the Top 5. Massachusetts and California were dominant in venture capital investment as a percentage of GSP, ranking first and second, respectively: Massachusetts had 0.70 percent, and California had 0.67 percent. The national average is drastically less at, 0.09 percent, and third-ranking Washington scored 0.23 percent. These rankings are similar to those in 2013, but the spread between Massachusetts, California, and the remaining states declined slightly.

Although California performed well in the overall Risk Capital and Entrepreneurial Infrastructure composite, weakness in two components could indicate future problems. First, its ranking continues to fall in the indicator for business incubators per 10,000 business establishments: California ranked 48th with 0.22 incubator, compared with the national average of 0.70. In fact, California has declined in this indicator every year since the index began in 2002. (It ranked fourth in 2002, with 2.56 incubators per 10,000 business establishments; 13th in 2004, with 1.68; 33rd in 2008, with 1.29; 44th in 2010, with 0.66; and 48th in 2012 with 0.26.) The continuing slide suggests entrepreneurship in California may be oriented toward startups managed by experienced officers. Second, in the indicator for total venture capital investment growth, California has also steadily declined. Even with a 3 percent increase in 2014, the state fell to 27th place (it ranked 21st in 2013, 20th in 2012, and 18th in 2010).

California topped the rankings in patents issued, with 96.44 patents per 100,000 people and outperforming the U.S. average of 36.29. California bested second-place Massachusetts (94.94) by almost two patents per 100,000 people, and third-place Washington (89.16) by almost five per 100,000 people. California also placed in the Top 10 in nanotechnology (seventh place), clean/green tech (second), and biotech investment (second). In number of business starts per 100,000 people, the state again declined. However, this decline was smaller than in most other states and California finished sixth, indicating a lack of new-business starts throughout the nation.

TOTAL VENTURE CAPITAL INVESTMENT GROWTH

Why Is It Important?

Venture capital financing remains highly important to a new firm's formation and growth. Facebook, Google, Apple, Microsoft, Intel, Compaq, Federal Express, and Genentech are examples of companies that have benefited from early-stage venture capital investment.

Venture capital investment and California

California continues to show significantly diminished growth in venture capital investment. Down from 24 percent growth in 2012, the state saw that figure drop to just 1 percent in 2013, with only a minor improvement to 3 percent in 2014, good for 27th in the nation. This places California a staggering 1,607 percent behind Arkansas, the nation's leader in this area. Venture capital investment is a volatile category, with seven of the leading eight states rising from double-digit rankings last year. Conversely, last year's leader, New York, dropped to 23rd. This illustrates how difficult is to sustain consecutive years of large growth in this category. California's size works against it in this indicator, as well.

FIGURE 22

Total venture capital investment growth: 2012-2013

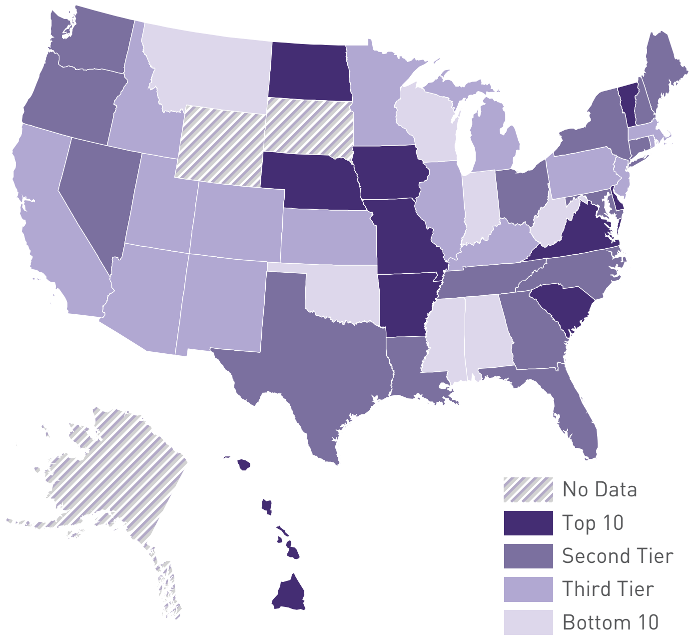
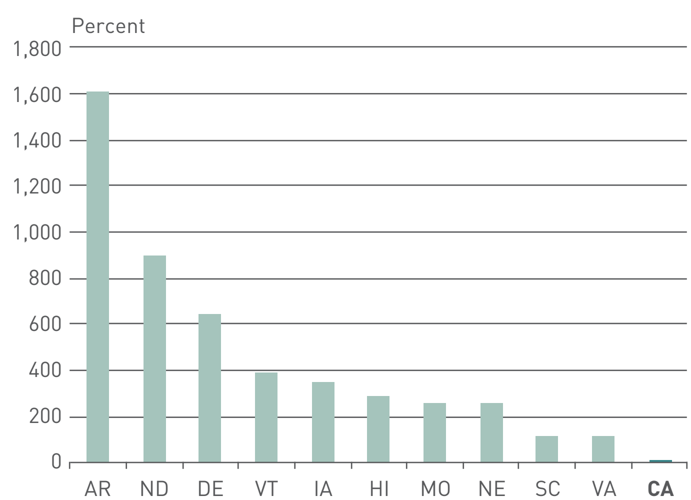


FIGURE 23

Total venture capital investment growth: Top 10 states and California, 2012-2013; California ranked 27th



Sources: PricewaterhouseCoopers/National Venture Capital Association MoneyTree. Report on data from SDC Platinum.

VENTURE CAPITAL INVESTMENT AS PERCENT OF GSP

Why Is It Important?

The proportion of a state's gross state product (GSP) that comes from venture capital investment reflects the degree to which risk capital figures into the value of a state's overall economic output. The indicator is a proxy of how adventuresome a state's economy is.

Venture Capital Investment as Percentage of GSP and California

California performed well in this measure, with venture capital investment making up 0.672 percent of GSP. For the second straight year, California ranked second after Massachusetts, where venture capital made up 0.695 percent of GSP. Although ranked highly nationally, California saw a dip from last year's figure of 0.82 percent. The remaining three states in the Top 5 lag far behind the leaders. Given the size of California's economy, the proportion of venture capital investment remains impressive.

FIGURE 24

Venture capital investment as percent of GSP: 2013

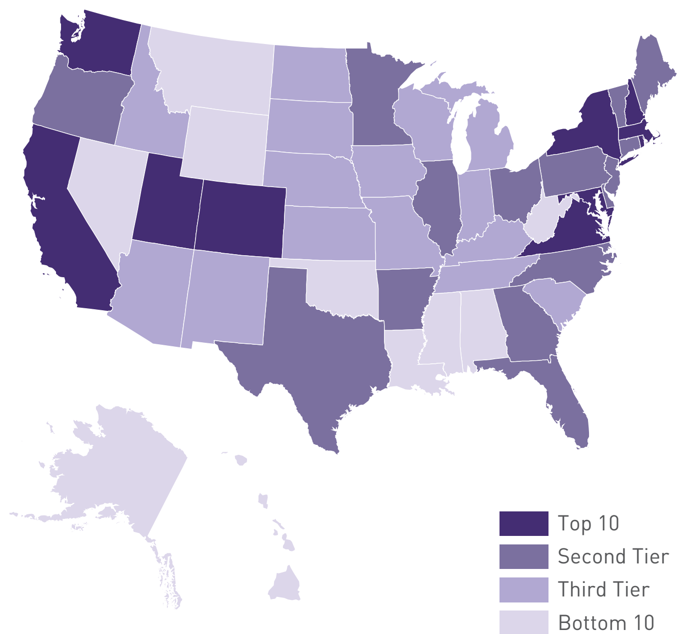
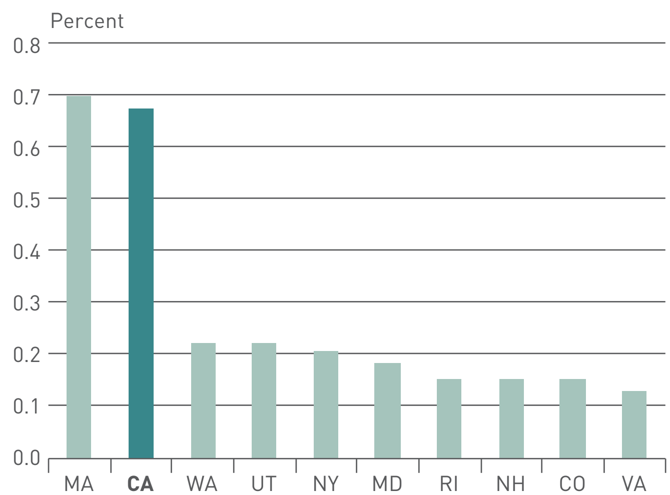


FIGURE 25

Venture capital investment as percent of GSP: Top 10 states, 2013



Sources: PricewaterhouseCoopers/National Venture Capital Association MoneyTreeTM Report on data from Thomson Reuters.

BUSINESS INCUBATORS PER 10,000 ESTABLISHMENTS

Why Is It Important?

Business incubators provide embryonic businesses with guidance and resources that assist company formation and growth. They provide "hard" assets, such as office facilities and equipment, as well as "soft" assets, such as assistance services and financial and management consulting. The right incubator aid can make a critical difference to companies that otherwise would not survive on their own.

Business Incubators and California

California remains in the bottom five states, ranking 48th with 0.22 incubator per 10,000 business establishments, less than one-third of the national average of 0.7. California has fallen drastically since the 2002 index, when the state ranked fourth with 2.56 incubators per 10,000 establishments. A possible explanation is that leading states are increasingly showing support for innovative businesses, while states with more mature tech sectors such as California and Washington use incubators less.

FIGURE 26

Business incubators per 10,000 establishments: 2014

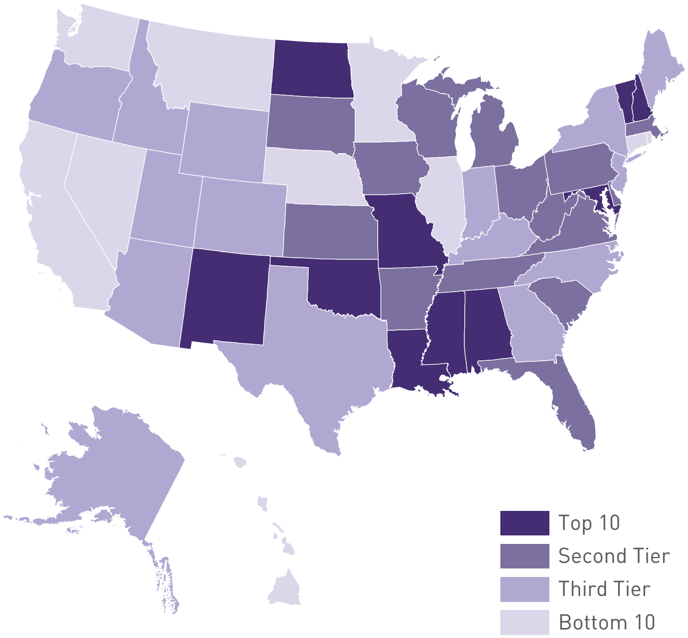
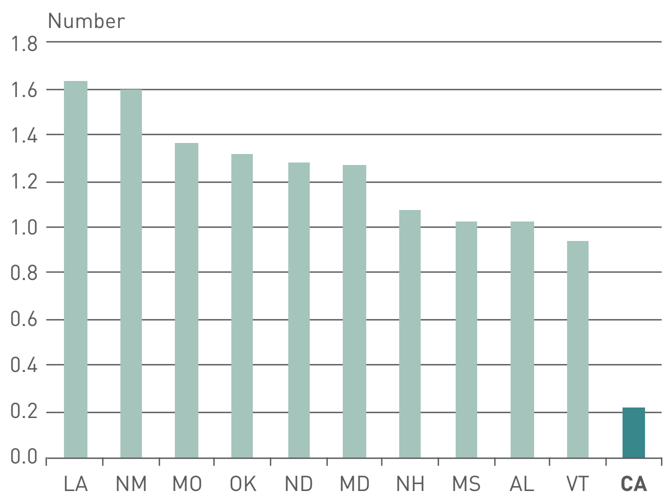


FIGURE 27

Business incubators per 10,000 establishments:
Top 10 states and California, 2014; California ranked 48th



Sources: National Business Incubation Association, U.S. Census Bureau

PATENTS ISSUED PER 100,000 PEOPLE

Why Is It Important?

Patents are granted by the Patent and Trademark Office, a division of the U.S. Department of Commerce. Innovation and scientific advancement are protected through patents by prohibiting others to make, use, or sell the invention. The term of a new patent is 20 years from the time the application was filed. The patent rate is a good indicator of the vibrancy of a state's high-tech industry. Innovative designs and new technologies have a positive impact on state economies.

Patents Issued and California

California leads the nation in this category, continuing an upward trend since 2010 when the state finished fifth. With 96.44 patents issued per 100,000 people, California has more than double the national average. As the epicenter of U.S. technological innovation, California remains the top state for number of tech company headquarters, commercialization, and research and development.

FIGURE 28

Patents issued per 100,000 people: 2013

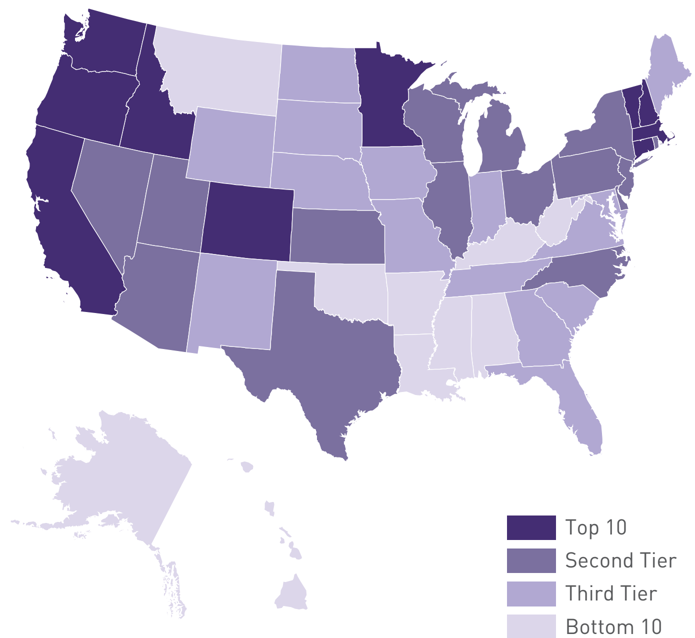
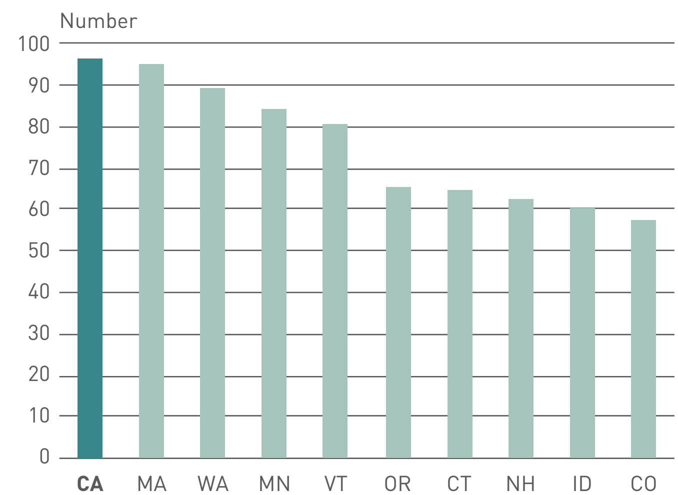


FIGURE 29

Patents issued per 100,000 people: Top 10 states, 2013



Sources: USPTO, Milken Institute, U.S. Census Bureau

NET BUSINESS STARTS PER 100,000 PEOPLE

Why Is It Important?

Net business starts represent one of the clearest measures of a state's entrepreneurial dynamism. When considered in relation to a state's population, additional layers of meaning concerning a state's overall economic creativity emerge, including factors such as a population's commercially adventuresome spirit and optimistic expectations. A state's performance in new firm formation also reflects on its ability to attract financial resources, tolerate risk, and create new jobs. In addition, IPOs can be a major factor in a state's economic performance.

Net Business Starts and California

California's ranking in this indicator has been fairly volatile, diving from second place in 2010 to 23rd in 2012, then to 29th in 2013. In 2014, however, a major recovery elevates California to No. 6 nationally. The state's statistic of -2.35 business starts per 100,000 people suggest an economy that is still slowly recovering from the Great Recession. Due to the amount of time it takes to compile information for this category, the data for each ranking is two years older than the ranking date. Therefore, the data for this year's rankings do not reflect recent economic developments or statistics.

FIGURE 30

Net business starts per 100,000 people: 2012

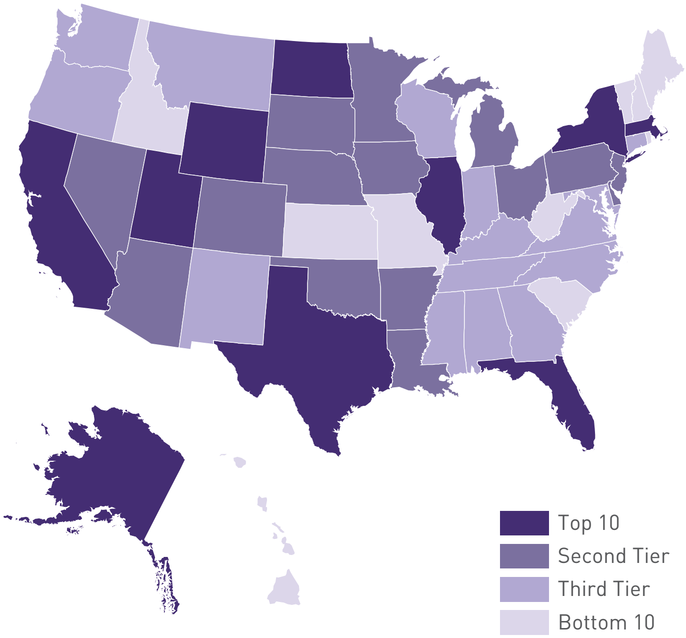
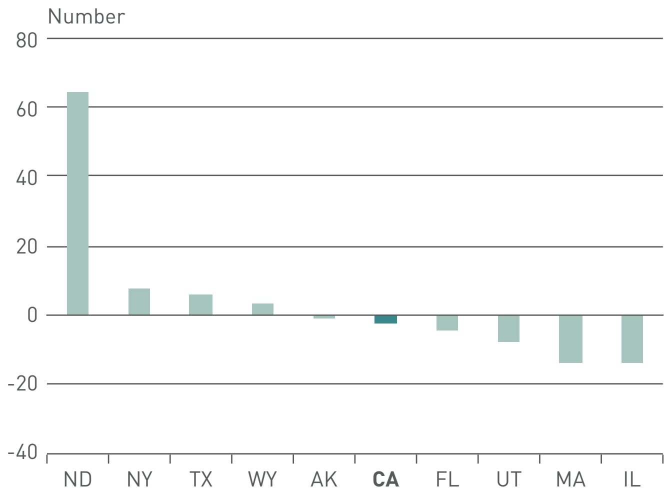


FIGURE 31

Net business starts per 100,000 people: Top 10 states, 2012



Sources: Small Business Administration, U.S. Census Bureau

IPO PROCEEDS AS A PERCENTAGE OF GSP

Why Is It Important?

An IPO occurs when a company decides to sell shares of its common stock to the general public. Companies that go public typically demonstrate a proven record of revenues or sales and, as is increasingly the case, exciting new technologies. An IPO is a company's first sale of stock to the public, and it represents another method available to companies for raising capital to meet corporate goals and for risk capitalists to cash in on their investment.

IPO Proceeds and California

With IPO proceeds representing 1.96 percent of its GSP, California ranks fifth in this indicator, a significant improvement over its 15th -place finish in 2013. The state's IPO proceeds percentage is nearly 1.5 percent higher than the national average, an indication of more effective leveraging of the state's tech companies. Since California taxes them at a relatively high rate, IPOs can play a large role in the state's budget. Facebook's 2012 IPO, for example, initially valued in the billions of dollars, saw its stock prices drop, which created a hole in the state's projected revenue the following year.

FIGURE 32

IPO proceeds as percent of GSP: 2013

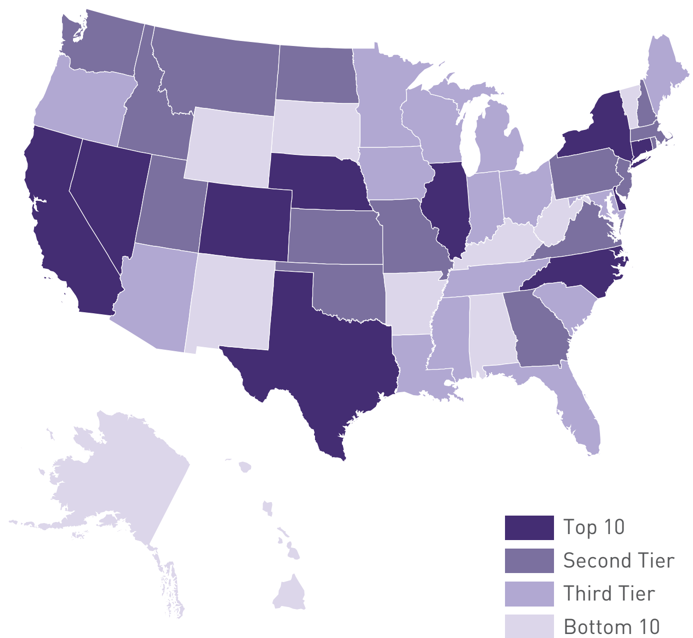
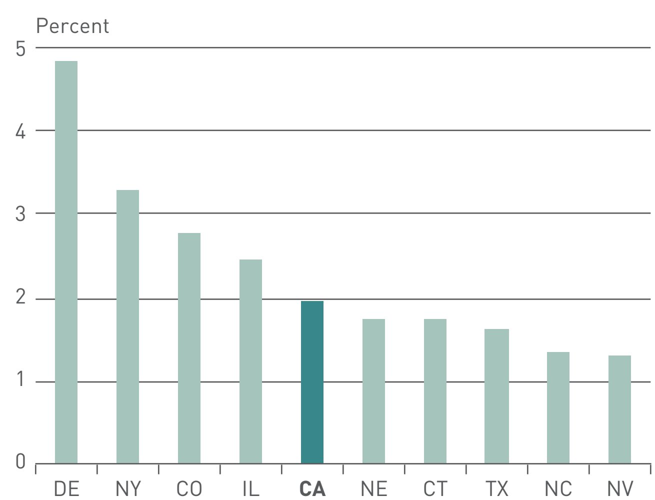


FIGURE 33

IPO proceeds as percent of GSP: Top 10 states, 2013



Sources: Security Data Corporation, Thomson Finacial, Milken Institute, U.S. Bureau of Economic Analysis

VC INVESTMENT IN CLEAN TECHNOLOGY/GREEN TECHNOLOGY PER $1,000 OF GSP

Why Is It Important?

Venture capital investments in clean and/or green technology and nanotechnology are indications of a state's openness to new ideas. They represent a cutting-edge mentality and serve as a measure of each state's willingness to accept risks and take new ideas to commercialization. The strength of a state's clean-technology policy is also indicative of a progressive mind-set.

VC in Clean Technology/Green Technology and California

With $0.62 per $1,000 of GSP, California ranked second in this category, ceding to Colorado the top spot it held last year. In our earlier reports, several states ranked highly due to their abundant wide-open spaces for wind turbines and solar paneling. More recently, however, our reports indicate a trend toward more densely populated states ranking highly. This may be due, in part, to a larger focus on hybrid and electric automobiles, which see greater use in urban areas.

FIGURE 34

VC Investment in clean technology/green technology per $1,000 of GSP: 2013

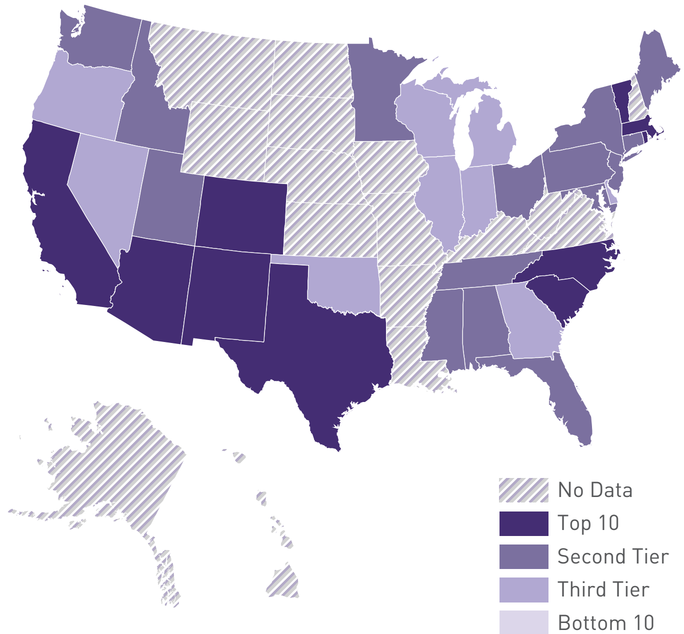
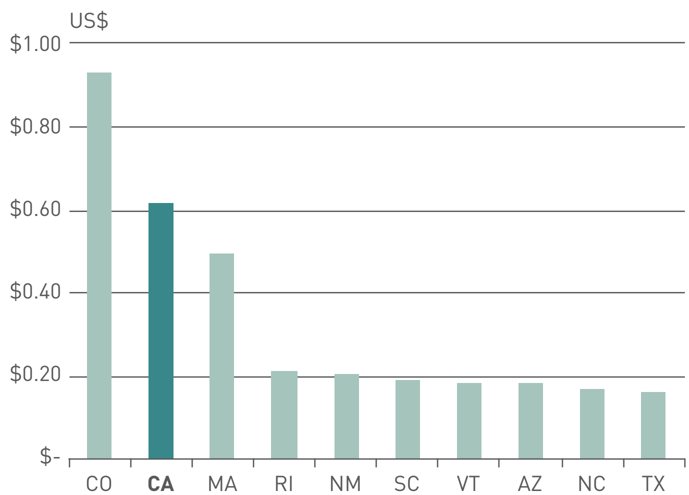


FIGURE 35

VC investment in clean technology/green technology per $1,000 of GSP: Top 10 states, 2013



Sources: SDC Platinum, U.S. Bureau of Economic Analysis

VC INVESTMENT IN BIOTECHNOLOGY PER $1,000 OF GSP

Why Is It Important?

As noted in the previous indicator, states' allocation of funds to modern technological advances is usually an indicator of their willingness to engage in innovative economic development strategies.

VC in Clean Biotechnology and California

This year's index marks the debut of this indicator measuring venture capital in biotechnology. Biotech is exploding: In just over 40 years, worldwide sales of biotech products (biologics and bioengineered vaccines) have grown to more than $153 billion.[33] California finished second in this indicator, spending $7.64 per $1,000 of GSP. While this is much higher than third-place Washington's spending ($3.63), it is also lower than first-place Massachusetts' ($22.15).

33. http://www.gene.com/stories/bullish-on-the-future-of-biotech

FIGURE 36

VC investment in biotechnology per $1,000 of GSP:
2012-2013

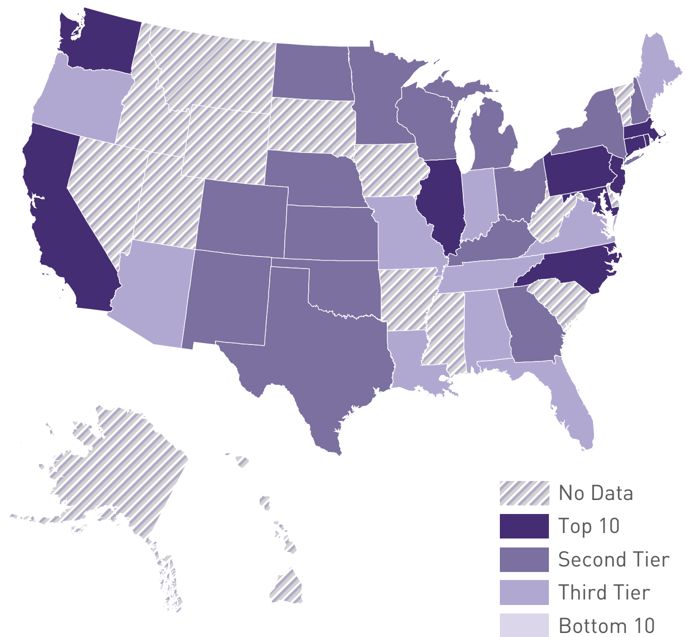
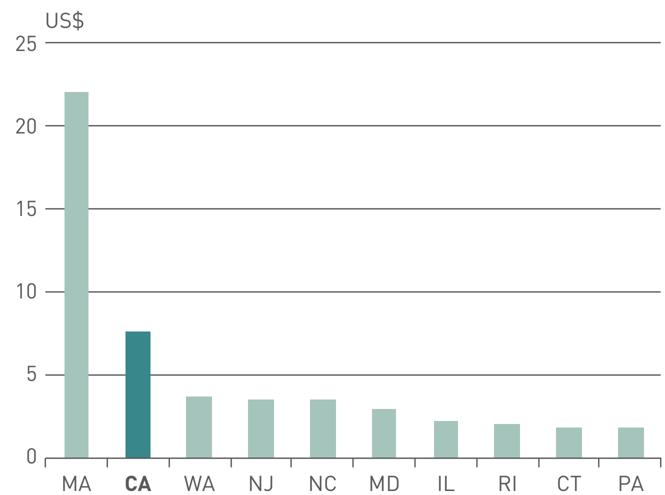


FIGURE 37

VC investment in biotechnology per $1,000 of GSP:
Top 10 states, 2012-2013



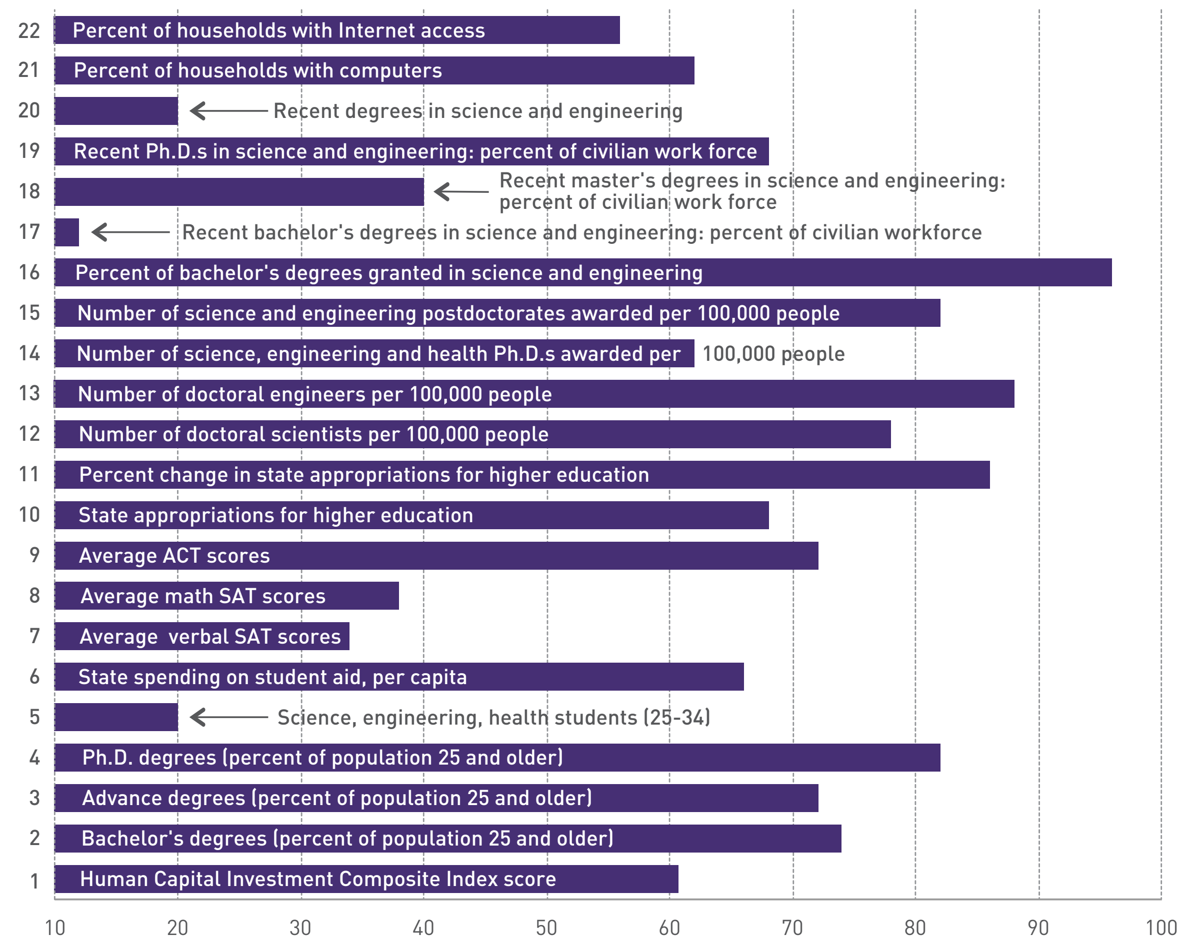
Sources: SDC Platinum, U.S. Bureau of Economic Analysis

CALIFORNIA: HUMAN CAPITAL INVESTMENT

Human capital is the most important intangible asset of a regional or state economy. We look at indicators that suggest the skill levels of the current and future workforce. Examples include the number of bachelor's, master's and doctorate degrees relative to a state's population, and measures specific to science, engineering and technology degrees.

California again fails to make the Top 10 in the Human Capital Investment Composite Index. It had climbed one spot to 12th in 2012 from 13th in 2010, then fell to 20th in the 2013 rankings. California improved three spots in 2014 to finish 17th, still a poor performance but one showing slight improvements. Twenty indicators make up the Human Capital Investment Composite Index. California ranked in the Top 10 in five, and scored below the national average in seven indicators. The Top 5 spots in the composite belong to Massachusetts (85.33), Maryland (79.14), Connecticut (75.90), Minnesota (74.86), and Utah (69.24). These same states were also in the 2013 Top 5, with this rearrangement in 2014: Connecticut moved up from fifth to third, pushing both Minnesota and Utah down one spot each.

FIGURE 38 California's scores in human capital investment indicators



In indicators measuring rates of academic degrees, California finished 10th for the percentage of population over 25 with a Ph.D. (1.47 percent), third for all bachelor's degrees granted in science and engineering (40.22 percent), seventh for doctoral engineers (43.39 per 100,000 people), and 10th for science, engineering, and health post-doctorates among residents ages 25-34 (171.80 per 100,000).

California continues to underperform in verbal and math SAT testing, ranking 34th and 32nd respectively, scoring about 20 points lower than the national average.

In state appropriations for higher education per capita, California finished 17th. The five-rank jump from 22nd place in 2013 is a reaction to increased government spending in education following the recession. Earlier, California had fared better in this indicator: 11th place in 2012 and 15th in 2010. In terms of percent change in state appropriations for higher education, California came in at 10 percent, while the overall national average rose only 4.9 percent. This strong growth propelled California from 48th in 2013 to eighth place in 2014. Funding for higher education in California is dependent on the state's budget, which can fluctuate year to year. The increased spending is one of the main reasons behind California's slightly improved performance in the Human Capital Composite Index.

California remained at the bottom in the indicator for recent degrees in science and engineering, ranking 41st with 3.62 recent degrees in science and engineering per 1,000 civilian workers, about one less than the national average of 4.76. This, too, could be related to cutbacks in education funding, as well as California's large population with varying levels of education. The thin supply of science and engineering graduates could lead to lower scores in future state indexes.

GRADUATE STUDENTS IN SCIENCE, ENGINEERING, AND HEALTH

Why Is It Important?

Counting graduate students in science, engineering, and health provides one of the more direct indicators of how well a state is preparing its population to work in a high-tech economy. Strong graduate programs are one of the most effective means of attracting high-tech companies to a state.

Science, Engineering, and Health and California

California came in below the national average, with 1.01 percent of 25- to 34-year-olds enrolled in science, engineering, and health programs. The state slid two spots to 41st in the latest calculation, continuing its downward trend in this category. Science, engineering, and health programs form the foundation for high-tech development, so stable growth in workers educated in these areas is necessary for a state to be competitive. California lags far behind Massachusetts, which leads the nation with 3.18 percent of qualifying students enrolled in these programs. The lack of sufficient state graduate programs in these fields, combined with the fact that most students enter Ph.D. programs directly after receiving their bachelor's degree, contributes significantly to California's poor showing in this indicator.

FIGURE 39

Graduate students in science, engineering, and health: 2011

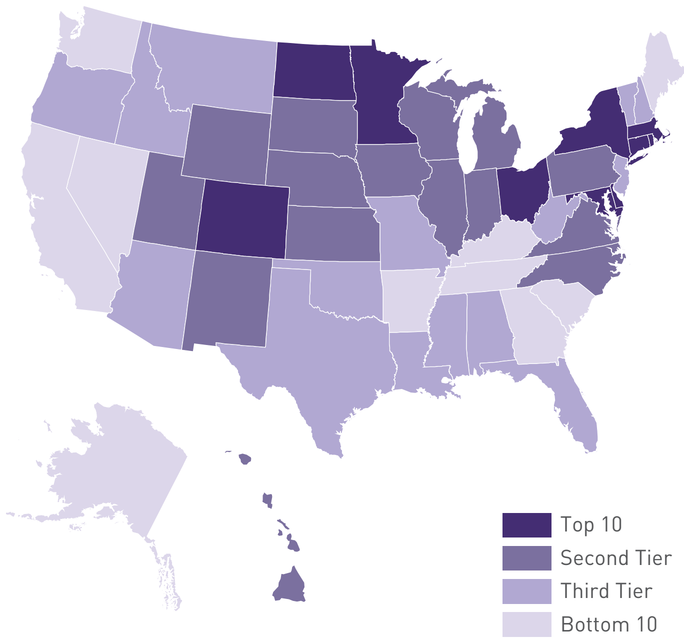
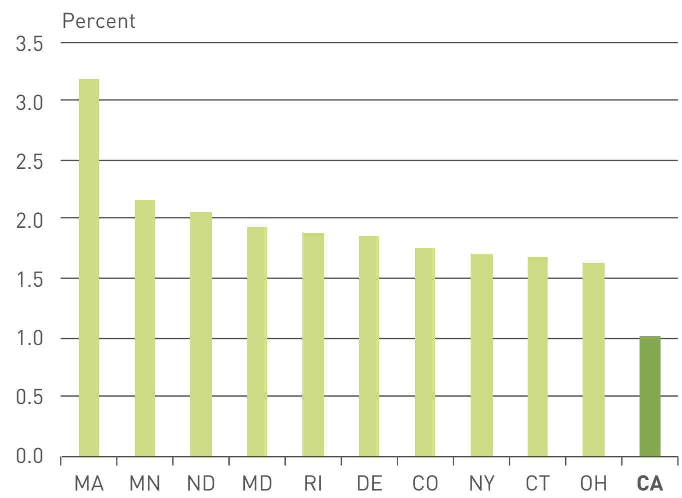


FIGURE 40

Graduate students in science, engineering, and health: Top states and California, 2011; California ranked 41st



Sources: EPSCoR, U.S. Census Bureau

PER-CAPITA STATE SPENDING ON STUDENT AID

Why Is It Important?

State-sponsored financial aid can open the door to higher education. State student aid typically complements federal forms of financial assistance. As with any human capital resource, states must compete for talent. State-sponsored student aid is one of many factors that can encourage advanced learning and attract out-of-state talent to contribute to a knowledge economy.

Per-capita state spending on student aid can provide a useful gauge of commitment to facilitating access to higher education.

Student Aid Spending and California

The 2013 index data remains the most current for this indicator. California spends $39.31 per capita on state-sponsored student aid, an increase of nearly 60 percent since the 2010 index. This increase helped California jump seven places to rank 18th, up from 25th in the 2010 index. If funding levels for student aid do not increase to match tuition increases, the state could suffer major declines in human capital components like standardized test scores and recent university graduates per capita. The top five states in this measure were Nebraska ($70.93), West Virginia ($70.91), South Carolina ($70.29), New Jersey ($68.91), and Oklahoma ($65.41).

FIGURE 41

Per-capita state spending on student aid: 2011-2012

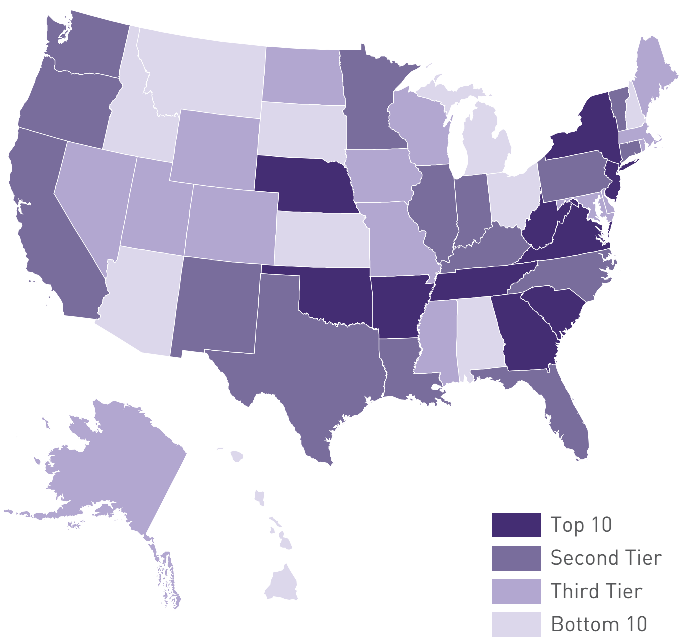
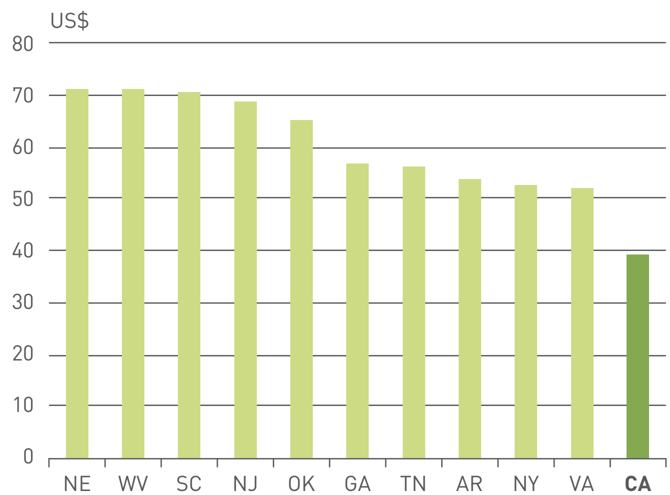


FIGURE 42

Per-capita state spending on student aid: Top 10 states and California, 2012; California ranked 18th



Sources: EPSCoR, U.S. Census Bureau

STATE APPROPRIATIONS FOR HIGHER EDUCATION

Why Is It Important?

When averaged out on a per-capita basis, spending on higher education reveals the extent of each state government's commitment to providing the infrastructure for higher learning. Somewhat similar to an earlier indicator showing state spending on student financial aid per capita, this component focuses on money provided directly to institutions of higher learning. These two measures, taken together, plus an additional indicator for percent change in appropriations for higher education (see next page), offer a composite picture of how well a state's government supports higher education.

State Appropriations and California

California is showing improvement in this indicator, finishing 17th and spending $274.86 per capita on higher education. In 2013, California finished 22nd, a drop of 11 places from the 2012 index, and spending only $246.55 per capita on higher education. California is still far below the 2012 index when the state finished 11th and devoted $320.71 per capita. The state falls behind others in this measure, in part because of its large population, but also due to state fiscal constraints that have affected available funding. The Top 5 states in this measure were Wyoming ($604.85 per capita), North Dakota ($566.35), Alaska ($521.17), New Mexico ($417.74), and Hawaii ($368.80).

FIGURE 43

State appropriations for higher education per capita: 2012

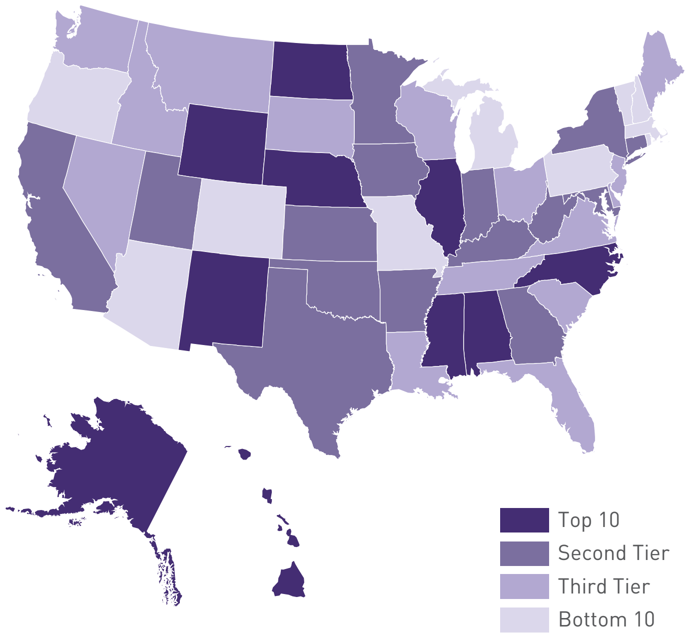
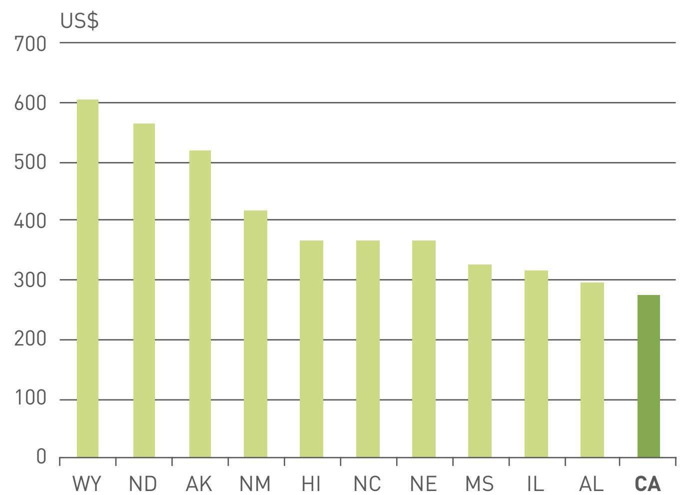


FIGURE 44

Per-capita state appropriations for higher education: Top 10 states and California, 2012; California ranked 17th



Sources: EPSCoR, U.S. Census Bureau

PERCENT CHANGE IN APPROPRIATIONS FOR HIGHER EDUCATION

Why Is It Important?

As noted in the previous indicator, appropriations for higher education reveal how much a state's government is committing to provide the infrastructure for higher learning. While the previous indicator gives a static picture of appropriations for a given year, this indicator compares appropriations over the most recent two-year period. Taken in conjunction with the two related indicators (state spending on student aid per capita and state appropriations for higher education per capita), this indicator provides a composite picture of a state's financial commitment to providing advanced education.

Growth in State Appropriations and California

California saw a 10 percent increase in state appropriations for higher education, well above the national average of 4.9 percent. The state ranked eighth in this category, a significant turnaround from last year, when it ranked 48th. Recent budget surpluses brought about by temporary tax increases in ballot measure Proposition 30 have greatly contributed to the state's recovery in education spending. However, concerns remain about spending after Proposition 30 expires and the impact of significantly increased state tuition levels.

FIGURE 45

Percent change in appropriations for higher Education: 2013-2014

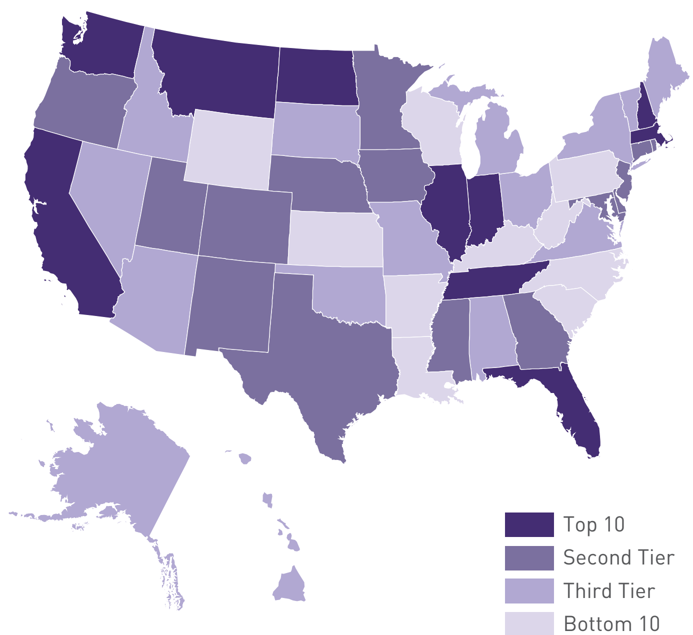
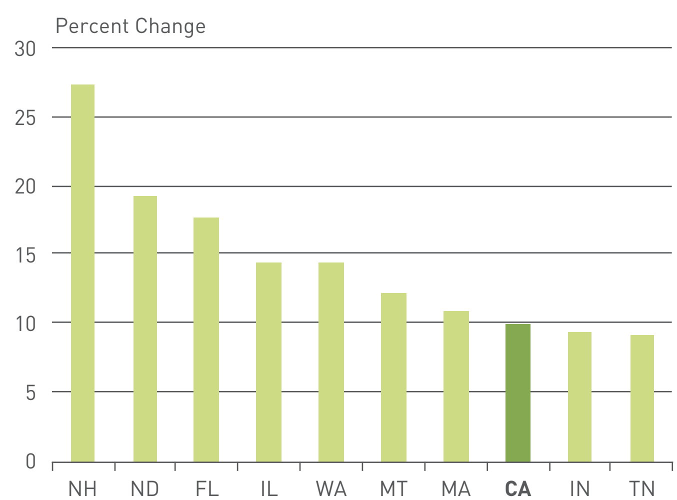


FIGURE 46

Percent change in appropriations for higher education: Top 10 states, 2013-2014



Sources: EPSCoR, U.S. Census Bureau

SCIENCE, ENGINEERING, AND HEALTH PH.D.S AWARDED

Why Is It Important?

This indicator assesses how many doctoral scientists and engineers a state's higher education system produces. In this sense, the indicator measures a state's capacity to generate and train highly skilled knowledge workers. Producing such specialized individuals can be conducive to high-tech industry innovation, new business formation, and growth. Producing a critical mass of science and engineering doctorate degree-holders also attracts technology firms to a state.

Science, Engineering, and Health Ph.D.s and California

California ranked 20th this year, rising three spots from 2013. The state produces 65.17 Ph.D. holders in science, engineering, and health for every 100,000 residents age 24 to 34, which nearly mirrors the national average of 65.33. As in previous years, Massachusetts leads the pack with 176.3, reflecting the significant gap between California and leaders in the northeastern United States.

FIGURE 47

Science, engineering, and health Ph.D.s awarded: 2012

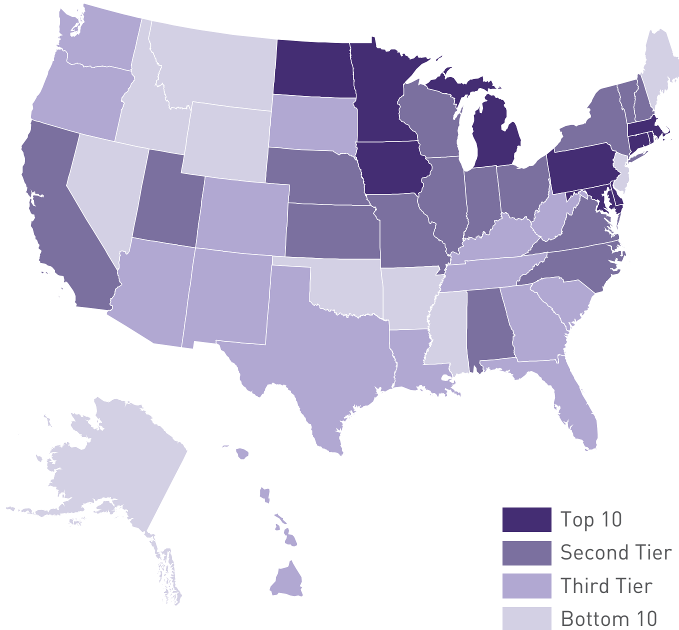
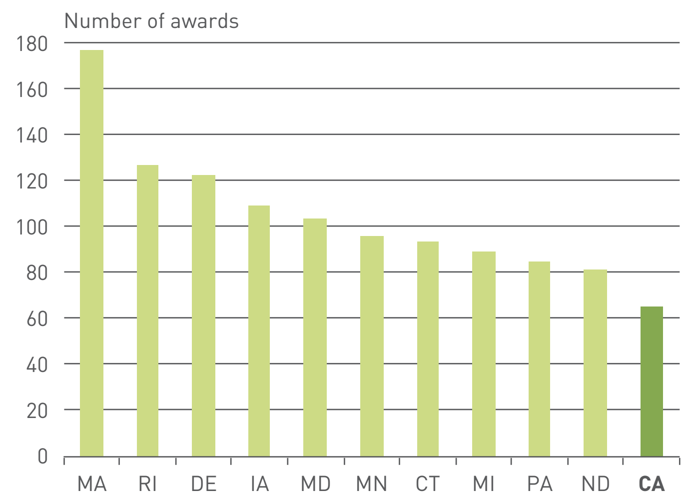


FIGURE 48

Science, engineering, and health Ph.D.s awarded:
Top 10 states and California, 2012; California ranked 20th



Sources: National Science Foundation, U.S. Census Bureau

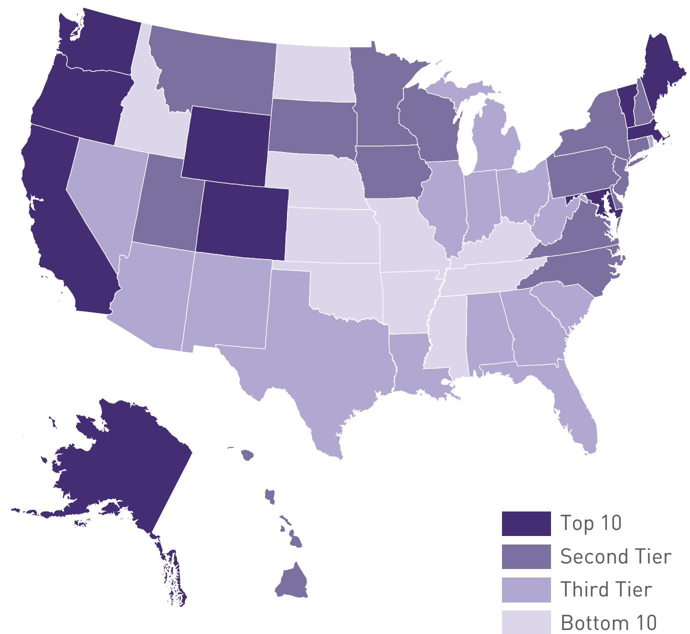
PERCENTAGE OF BACHELOR'S DEGREES IN SCIENCE AND ENGINEERING

Why Is It Important?

A large share of degrees granted in science or engineering suggests correspondingly high interest in science- and engineering-related professions, but it does not automatically correlate with a flourishing high-tech economy. Many high-scoring states such as Vermont and Maryland likely attract a much higher percentage of science and engineering majors than recognizably high-tech states like California and Massachusetts because the university curricula of the former are comparatively more limited. Nevertheless, a large percentage of science and engineering graduates can undeniably help feed a high-tech labor pool.

FIGURE 49

Percentage of bachelor's degrees in science and engineering: 2012

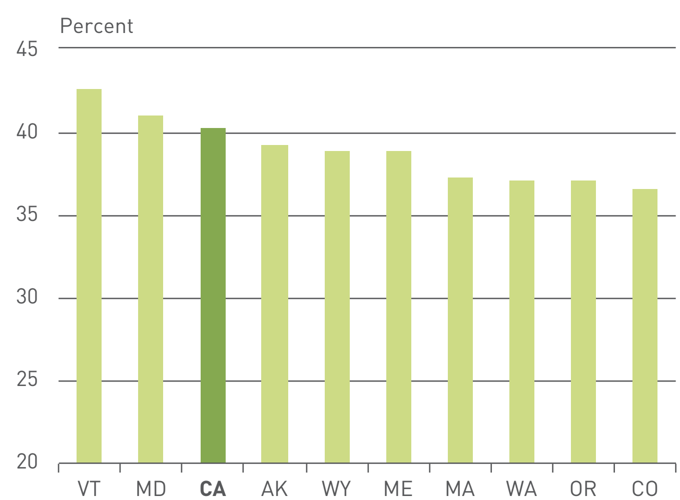


Science and Engineering Bachelor's Degrees and California

California ranked third, up six spots from last year. About 40.22 percent of university graduates in California received bachelor degrees in science or engineering. California has been in the Top 10 since the 2008 index. The continued pursuit of science and engineering degrees indicates a strong focus on high-tech jobs. The key concern for California is matching these degree holders to jobs in-state and retaining them in the workforce.

FIGURE 50

Percentage of bachelor's degrees in science and engineering: Top 10 states, 2012



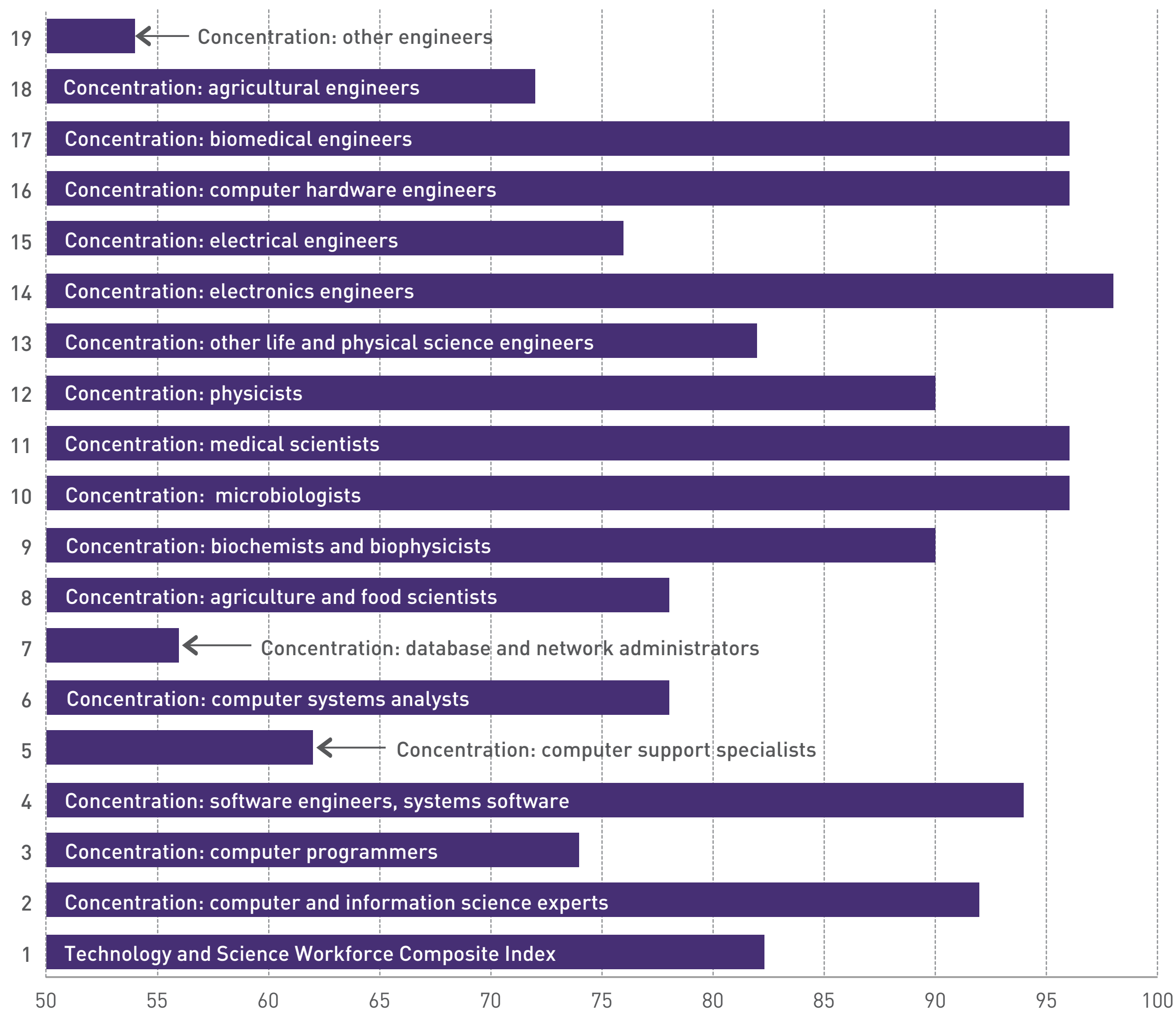
Sources: National Center of Education Statistics

CALIFORNIA: TECHNOLOGY AND SCIENCE WORKFORCE

The intensity of the technology and science workforce indicates whether states have sufficient depth of high-end technical talent. Intensity is derived from the share of employment in a particular field relative to total state employment. We look at 18 occupation categories in three main areas of employment: computer and information sciences, life and physical sciences, and engineering.

California was able to maintain its fourth-place finish from the 2013 index in the Technology and Science Workforce Composite. This once again ties the state's highest finish since 2004. Few indicators saw a major change but California was able to make improvement in four indicators, remain the same in six, and record only small decreases in eight of the 18 indicators. California's biggest improvement occurred in intensity of other engineers, moving up six places in the rankings.

FIGURE 51 California's scores in technology and science workforce indicators



In 2010, California ranked seventh in this composite index, but it fell below the national average in only two indicators: agricultural engineers and other engineers. In the 2014 index, California ranked fourth with still only two indicators below the national average: intensity of agricultural engineers (14th) and intensity of other engineers (24th). In both indicators, California made improvements for 2014.

While California scored below the national average in two indicators, it finished in the Top 10 in 10 of the 18 indicators. These were intensity of computer and information scientists, fifth; intensity of software engineers, systems software, fourth; intensity of biochemists and biophysicists, sixth; intensity of microbiologists, third; intensity of medical scientists, third; intensity of physicists, sixth; intensity of other life and physical science, 10th; intensity of electronics engineers, second; intensity of computer hardware engineers, third; and intensity of biomedical engineers, third.

From 2010 to 2012, California improved in 16 of the 18 indicators in the Technology and Science Workforce Composite, and from 2012 to 2013, it is remarkable that California continued its improvement in 11 of the 18 indicators. So, California's small decline in seven indicators exhibits a stabilization after the large growth and improvement. Those seven indicators are intensity of computer programmers, intensity of software system engineers, intensity of system analysts, intensity of biochemist/biophysicists, intensity of physicists, intensity of electrical engineers, and intensity of computer hardware engineers.

INTENSITY OF COMPUTER AND INFORMATION SCIENCE EXPERTS

Why Is It Important?

Computer and information science (IS) professions are important to a state's economic vitality for several reasons. They represent high value-added occupations, and there is a further strategic value in having skilled knowledge workers in these fields because so much in high-technology and other advanced sectors of a modern economy functions on an information-technology platform.

Computer and Information Science Experts and California

This year, California finished seventh, breaking into the composite's Top 10 with 76 computer and IS experts per 100,000 workers. The last time the state finished in the Top 10 was 2004, when state data still reflected the benefits of the tech bubble. The improvement does show hope that computer and IS experts continue to be important and employable in California despite outsourcing to cheaper states and countries. The Top 5 states are Virginia (92.67), Maryland (90.33), Massachusetts (86.67), Washington (83.33), and Georgia (80.67). Colorado ranked sixth, just ahead of California.

FIGURE 52

Intensity of computer and information science experts: 2013

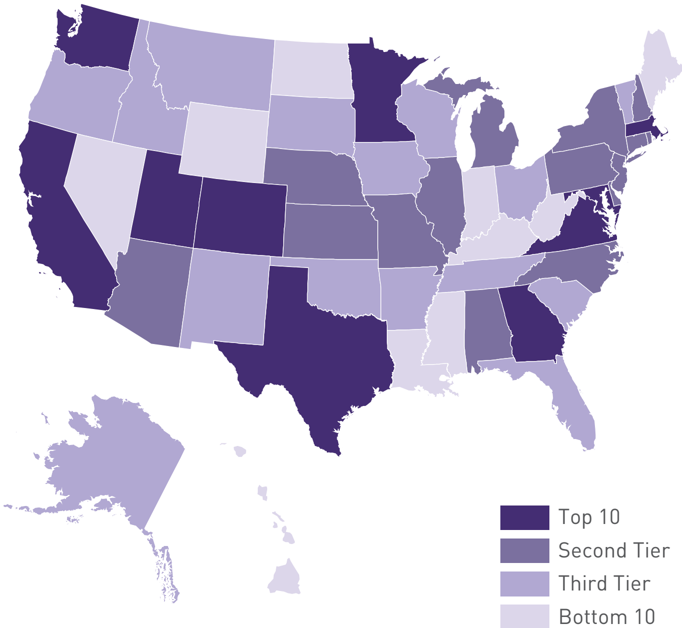
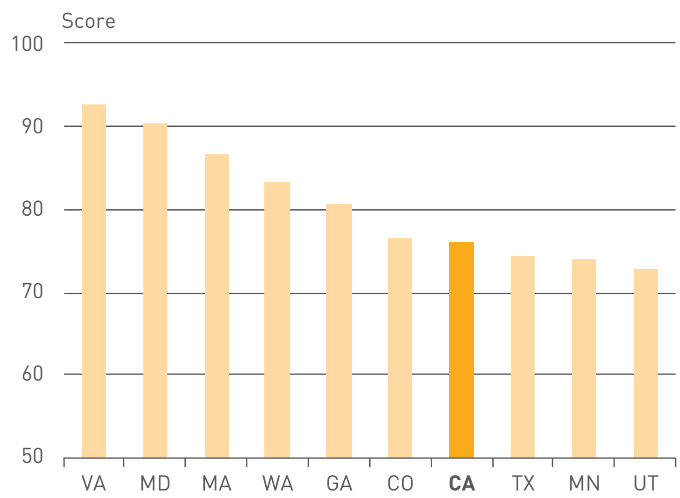


FIGURE 53

Intensity of computer and information science experts: Top 10 states, 2013



Sources: Milken Institute, Bureau of Labor Statistics

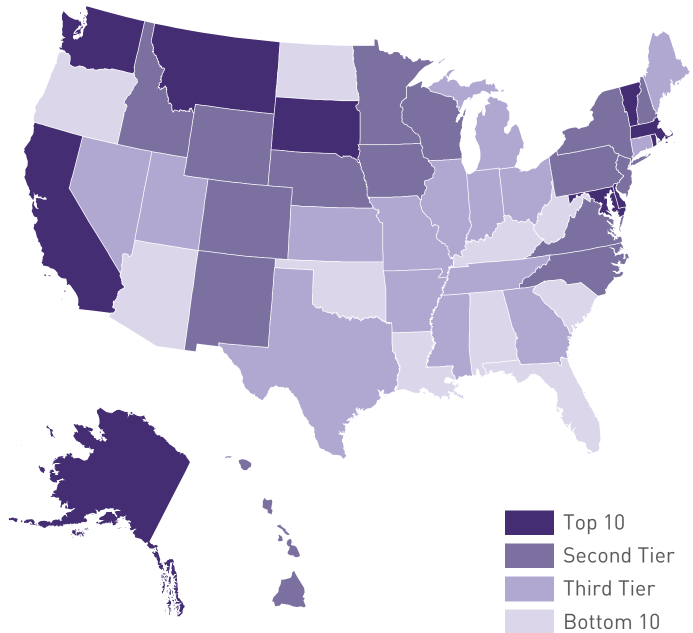
INTENSITY OF LIFE AND PHYSICAL SCIENTISTS

Why Is It Important?

Life and physical scientists are leading developments in some of the most promising and fastest-growing high-tech sectors. These sectors include biotech and medical devices and related fields that require in-depth knowledge of biochemistry, biophysics, microbiology, and medical science. Because these industries are growing and have a propensity toward innovation, these knowledge workers can disproportionately contribute to a region's techno-entrepreneurial dynamism. A strong concentration of life and physical scientists also helps promote a region to potential investors and corporations, and in turn stimulates an additional inflow of such scientists.

FIGURE 54

Intensity of life and physical scientists: 2013

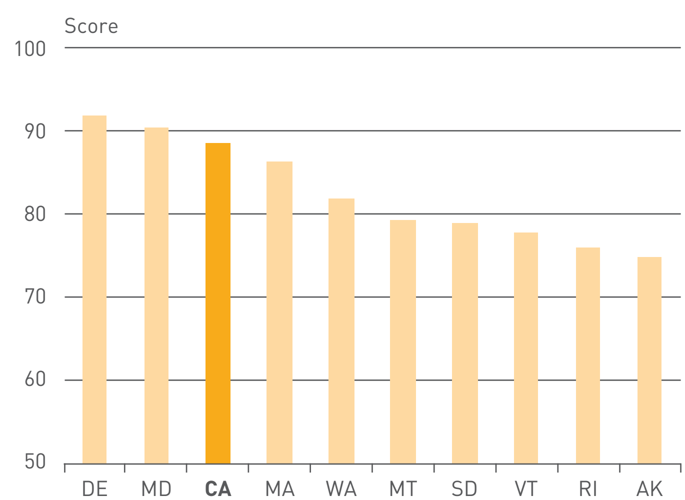


Life and Physical Scientists and California

California finished third with a score of 88.67, earning its third consecutive Top 5 showing. Its score was up a point from the 2013 index and well above the national average of 59.82. Only Delaware (92.00) and Maryland (90.67) fared better. The improvements mirror the overall rankings in the tech and science workforce composite. The sector remains a key source of comparative strength for the state, with only the strong concentrations of the chemical industry in Delaware and medical research in Maryland placing ahead.

FIGURE 55

Intensity of life and physical scientists: Top 10 states, 2013



Sources: U.S. Bureau of Labor Statistics

INTENSITY OF ENGINEERS

Why Is It Important?

Engineering is the mainstay of a technology-based economy. This applied discipline draws on a range of scientific knowledge to turn theories and concepts into reality. Engineering is especially important in such high-tech sectors as electronics, computers, and medical devices. Apart from their contributions to technology sectors, engineers also serve as all-around innovators and problem-solvers in areas such as workplace productivity and building construction.

Engineers and California

California placed fourth, down two spots from the last index, with an average score of 82.33 in this category. While California is performing relatively well, more must be done to prevent engineering students from leaving the state after they graduate. The state must also encourage engineering students to continue their education by obtaining post-graduate degrees in the field, as California ranks 41st in the nation in that category.

FIGURE 56

Intensity of engineers: 2013

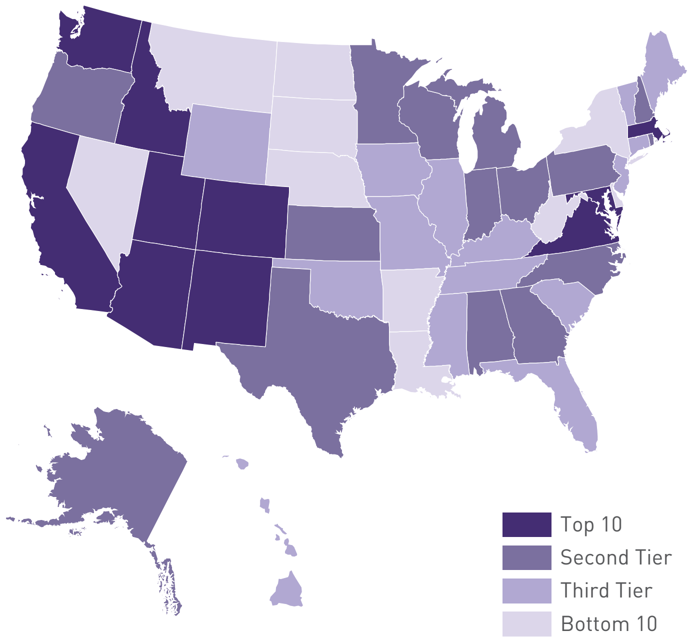
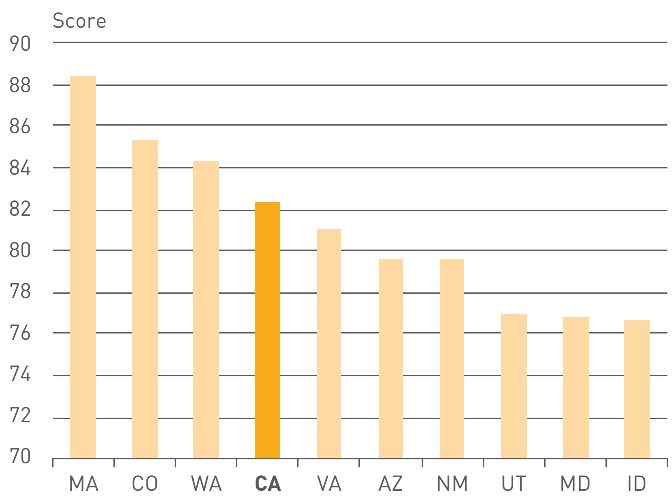


FIGURE 57

Intensity of engineers: Top 10 states, 2013



Sources: Milken Institute, U.S. Bureau of Labor Statistics

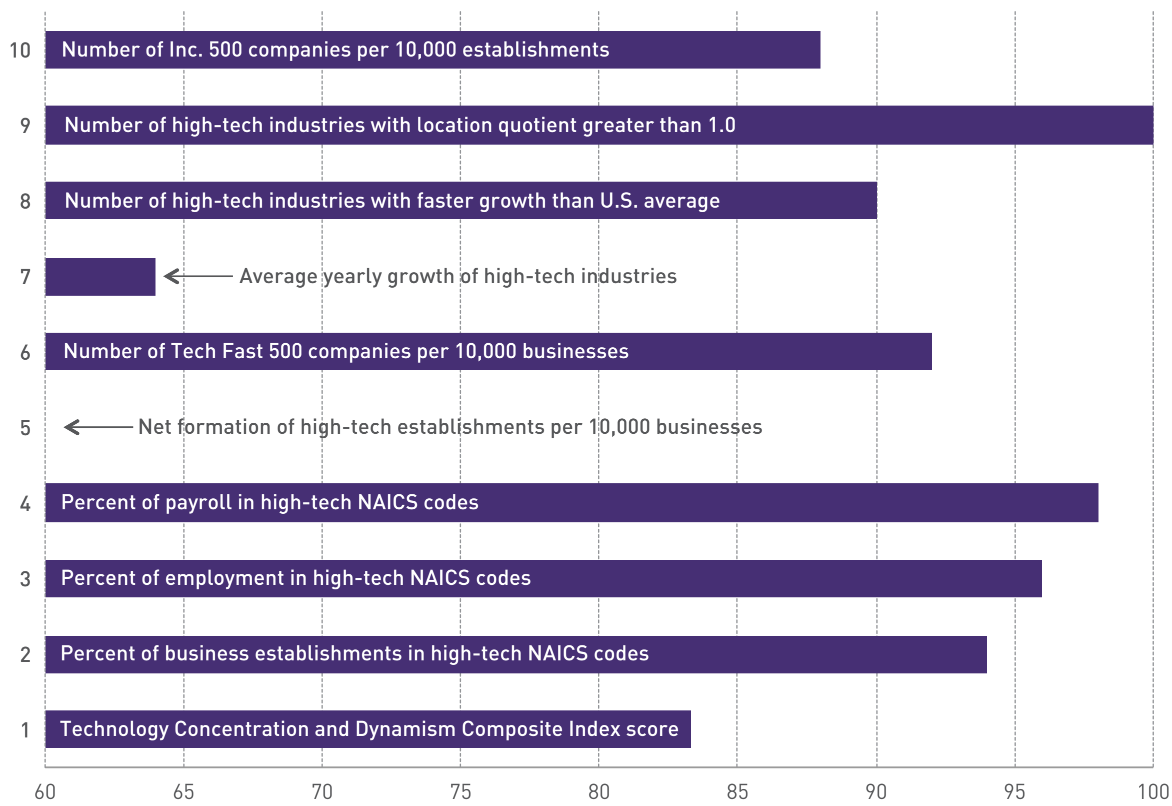
CALIFORNIA: TECHNOLOGY CONCENTRATION AND DYNAMISM

By measuring technology growth, we are able to assess how effective policymakers and other stakeholders have been at transforming regional assets into regional prosperity. This includes measures such as the percentage of establishments, employment, and payrolls that are in high-tech categories. It also measures growth in a number of technology categories.

In the 2014 index, the Technology Concentration and Dynamism Composite Index drops the indicator for percent of establishment births in high-tech NAICS codes due to a lack of data updates. Instead, the composite relies solely on the indicator for net formations of high-tech establishments, which is updated more consistently and gives a more accurate view of the high-tech startup ecosystem.

This year, despite improved performance, California fell to fifth place in the composite, slipping back to its 2010 ranking. It had finished third in 2013 (in a tie with Colorado) and fourth in 2012. The 2014 index shows that competition in this composite has intensified. Despite scoring more than a point higher in 2013 (83.33 vs. 82.20), California dropped two places from last year amid stronger scores all around. Every other Top 5 state raised its numbers from 2013: Utah (92.89, from 86.00); Washington (85.11, from 82.40), Maryland (84.67, from 80.40), and Massachusetts (84.22, from 80.40).

FIGURE 58 California's scores in technology and concentration dynamism indicators



In seven of the composite's nine indicators, California placed in the Top 10. Some highlights:

- » The state absolutely dominated in the component for number of high-tech industries, with a location quotient (LQ) above 1.0 (17 industries vs. 14 each for next-ranked Massachusetts and Utah). The only indicator in which California scored below the national average was in net formation of high-tech establishments per 100,000 business establishments, ranking 37th.
- » California ranked second in percent of payroll in high-tech NAICS codes, third in percent of employment in high-tech NAICS codes, and fourth in percent of establishments in high-tech NAICS codes.
- » California finished first for the fourth time since 2008 in the indicator for 17 high-tech industries with LQs higher than 1.0. This is consistent with previous findings, given the Golden State's dominant high-tech clusters, particularly in San Jose. Massachusetts tied with Utah, trailing California with 14 industries each, followed by Colorado (10th) and a three-way tie among Maryland, New Hampshire, and Washington (ninth).

California has struggled in the indicator for net formation of high-tech establishments since its 11th place finish in 2010. In 2012 and 2013 (based on the same data due to a lack of updates), California plummeted to negative territory (-11) in net formation of high-tech business establishments, pulling the state down to a ranking of 42nd. Net formations of high-tech businesses in California is still in the negative, but barely at -.10. However, this is in contrast to the national average of 5.5 new high-tech establishments. California isn't seeing the establishment growth that other states are, which is why California ranked 37th, a slight improvement over 2012 and 2013. It will be important for California to post a positive result in this indicator in the next index to ensure growth in high-tech establishments. This indicator has historically favored smaller states without high-tech clusters. This year's Top 5 includes Virginia (29.41), West Virginia (25.64), Maryland (25.44), Alaska (24.60), and Utah (22.70).

California's average yearly growth in high-tech industries is a little better than the national average, which fell 0.78 percent. The state posted growth of 0.36 percent, ranking 14th. California ranked sixth in the number of high-tech industries growing faster than the U.S. average, with 13.

NET FORMATION OF HIGH-TECH ESTABLISHMENTS PER 10,000 BUSINESS ESTABLISHMENTS

Why Is It Important?

This indicator for net formation of high-tech establishments is a specific means of ascertaining the "balance sheet" of high-tech firm births versus deaths. By basing the indicator statistic on the population of all businesses (in units of 10,000 establishments), we get a clearer picture of how this high-tech industrial life cycle plays out. Net high-tech firm formation reveals high-tech entrepreneurial dynamism.

Net High-Tech Formation and California

The most recent data for this indicator is from 2010, reflecting the nation's early emergence from the Great Recession. As a result, California actually posted a net loss in this category, losing these valuable high-tech firms at a rate of 0.09431 businesses per 10,000 establishments, putting it 37th in the nation. Since the state's presence in this sector has always been higher than the rest of the nation, it is not surprising that it was one of the heaviest hit by the recession, a fact reflected by the state's drop from 11th to 42nd when looking at data from 2006 and 2008, that period of struggling economies. In this year's index, Virginia led the nation with 29.41176 new high-tech firms per 10,000 business establishments.

FIGURE 59

Net formation of high-tech establishments per 10,000 establishments: 2010

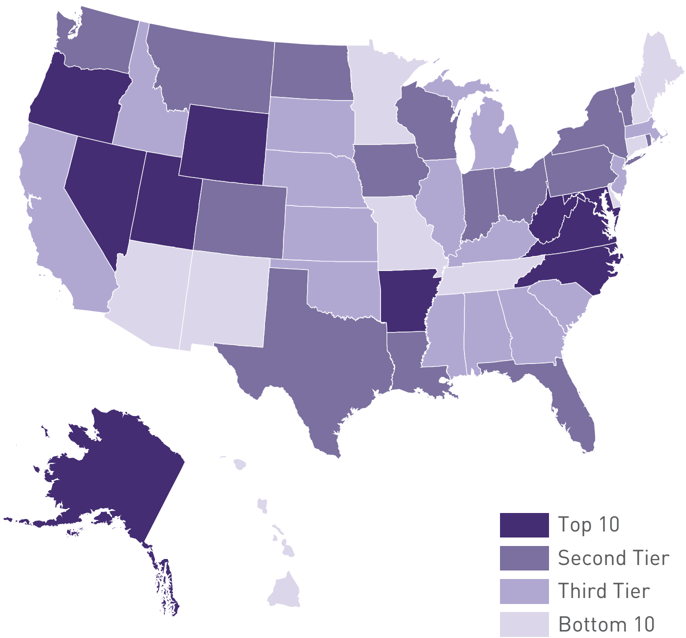
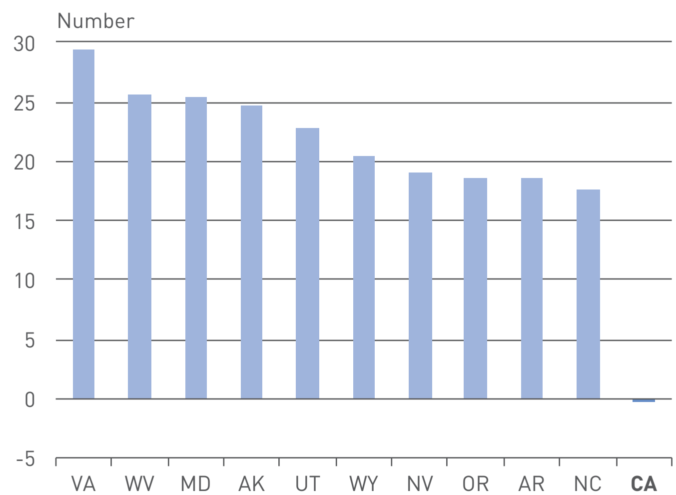


FIGURE 60

Net formation of high-tech establishments: Top 10 states and California, 2010; California ranked 37th



Sources: U.S. Census Bureau

PERCENT OF PAYROLL IN HIGH-TECH NAICS CODES

Why Is It Important?

States benefit from having a significant percentage of employment in technology-related fields for several reasons: The industries have long-term growth potential and tend to contribute disproportionately to an economy, and high-technology employees tend to have above-average salaries and pay packages. This indicator augments and expands on the previous indicator—percentage share of high-tech employment—by showing how much of total payroll income is generated by high-tech employment.

High-tech payroll and California

California finds itself in a second-place tie with Massachusetts in this category with 18 percent of its payroll in high-tech NAICS codes. This suggests that California has a relatively high percentage of high-tech companies among its industries. As it did in the 2013 index, California once again trails Washington, which posted 21 percent.

FIGURE 61

Percent of payroll in high-tech NAICS codes: 2013

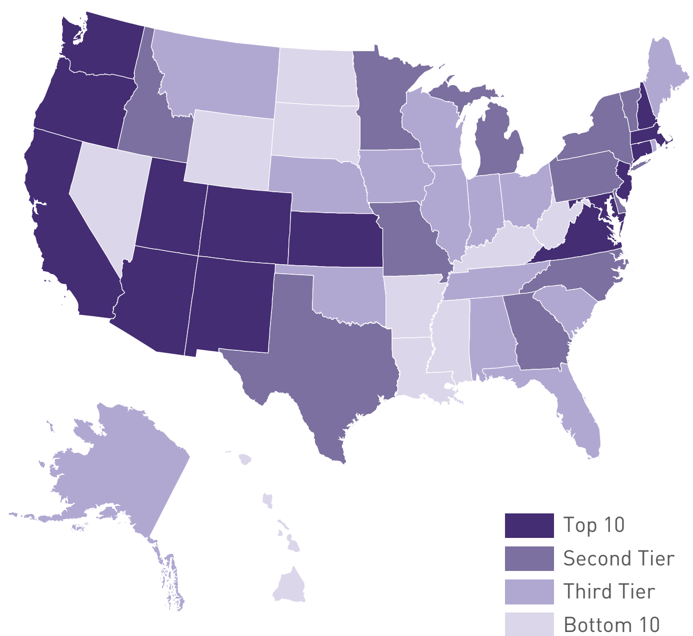
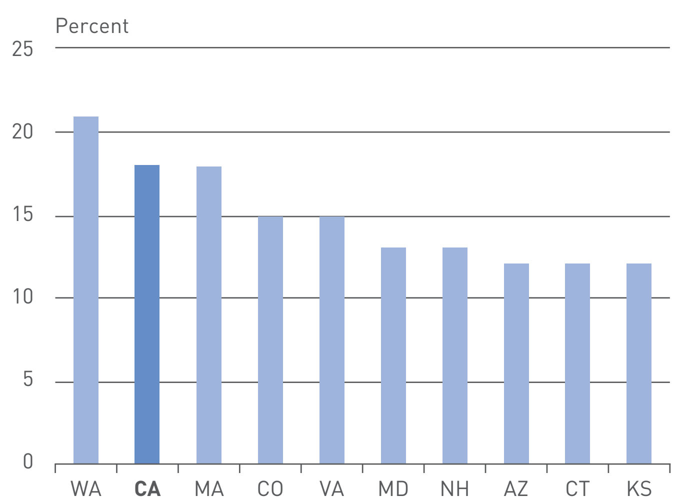


FIGURE 62

Percent of payroll in high-tech NAICS codes: Top 10 states, 2013



Sources: U.S. Census Bureau, Bureau of Labor Statistics, Milken Institute

AVERAGE YEARLY GROWTH OF HIGH-TECH INDUSTRIES

Why Is It Important?

This indicator aims to determine where technology has grown at the fastest rate during the past five years regardless of industry base. This enables stakeholders to identify areas of new technology opportunities throughout the United States and to assess the health of their current investments. Further, the indicator allows states to estimate the ramifications of their policies. Stringent laws governing taxes and businesses practices, coupled with skyrocketing electricity rates from deregulation, for example, could force firms to relocate to other states, or worse, to other countries.

High-Tech Growth and California

California saw a 0.36 percent increase in high-tech employment, a positive turnaround considering the 0.38 percent decrease the state registered the previous year. Despite this improvement, the state moved up just one spot in the rankings to 14th. Besting the national average by a full percentage point, California continues its upward climb in this category, rising a total of 22 spots since 2010. As the state's all-important tech sector continues to recover from losses during the Great Recession, this indicator gives stakeholders a reason to be optimistic about California.

FIGURE 63

Average yearly growth of high-tech industries: 2009-2013

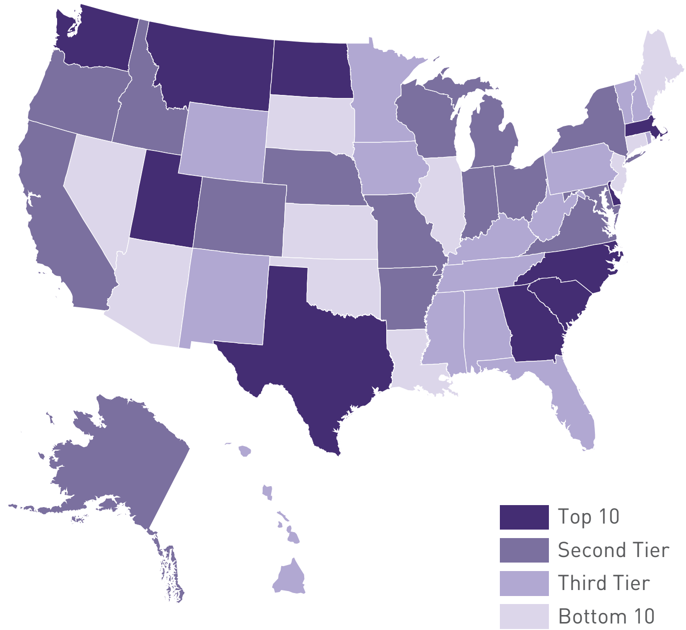
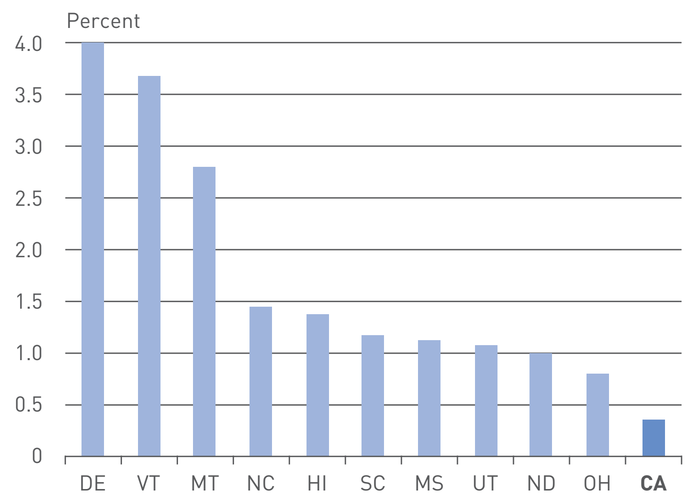


FIGURE 64

Average yearly growth of high-tech industries: Top 10 states and California, 2009-2013; California ranked 14th



Sources: Moody's Analytics, Milken Institute

HIGH-TECH INDUSTRIES WITH LQ HIGHER THAN 1.0

Why Is It Important?

This indicator reveals whether a state has attracted an above-average mass of high-tech industries. States that exceed the national average in high-tech industry location quotients (LQs) have an edge in attracting and retaining high-tech firms due to their dense employment bases and other positive agglomeration factors.

High-Tech Concentration and California

For the seventh straight index, California finds itself on top of the rankings for high-tech industries with LQ higher than 1.0. California holds onto the first spot with 17 industries whose employment concentrations are higher than the U.S. average. The remaining Top 5 states were Massachusetts (14 industries), Utah (14), Colorado (10), and Maryland (9).

FIGURE 65

High-tech industries with LQ higher than 1.0: 2012

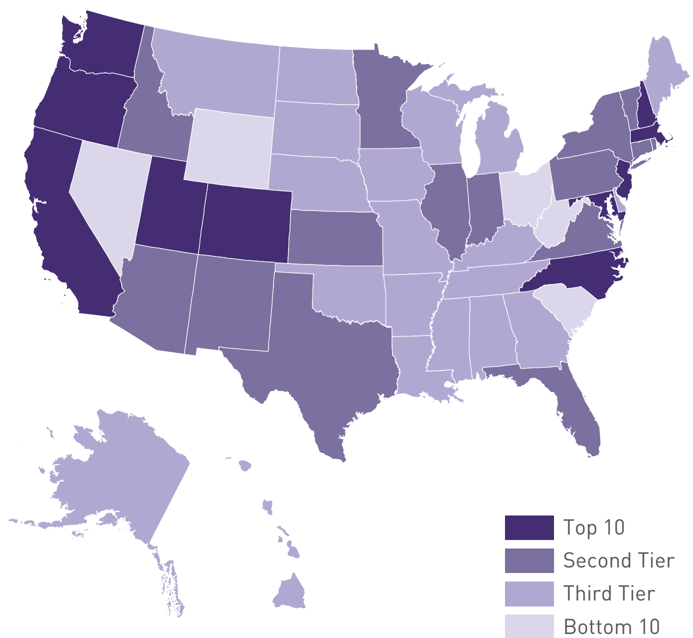
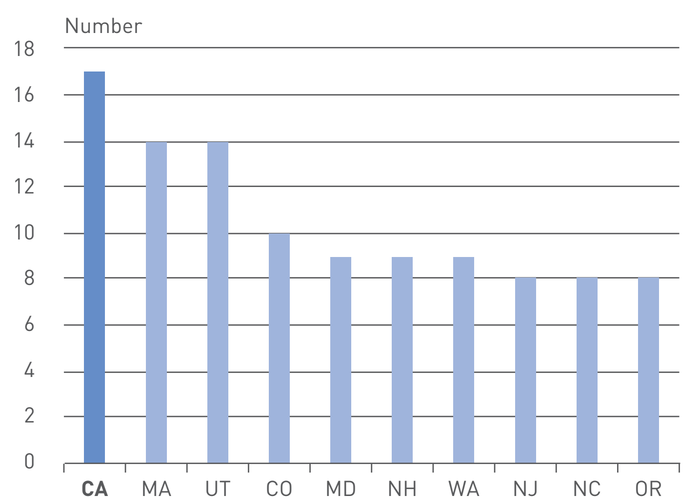


FIGURE 66

High-tech industries with LQ higher than 1.0:
Top 10 states, 2012



Sources: Moody's Analytics, Milken Institute

CONCLUSIONS

California has managed to maintain its No. 3 position in the overall national rankings from the 2012 index, despite slipping in the interim to No. 4 in the 2013 California's Position in Technology and Science assessment. When rankings are not adjusted based on population or the size of the state economy, California remains the clearly dominant force in technology-based economic development. However, continued weakness in the state's investment in human capital suggests again that, in the long term, California will have difficulty maintaining its leadership without a large-enough skilled workforce to retain and grow tech-based companies.

The continued combination of higher tuition costs, higher cost of living, and difficulty in retaining foreign students puts pressure on the state's tech leadership. California's current workforce remains strong in most fields, and the tech sector contributes significantly to overall income in the state—trailing only Washington in the percent of payroll in high-tech NAICS codes. On the other hand, net formation of high-tech establishments per 10,000 businesses has slipped to 37th, reflecting the difficulty in the state's current business environment. In order to maintain and secure California's position, we recommend the following actions:

» Establish long-term fiscal stability for the state of California, and in particular higher education. The 2014 passage of Proposition 2, which created a rainy-day fund, was a good start. Before the advent of 2012's Proposition 30, which provided a temporary boost to state coffers, California saw its percent change in appropriations to higher education drop to 48th place for the 2013 California index. Proposition 30 expires in 2018, and more long-term stabilization measures will be needed.

» Expand programs that provide technical and applied degrees for students in the tech and science industries. Recent moves to offer four-year degrees at community colleges could help cover this gap if the programs are targeted toward immediate employment.

» Identify key cost and regulatory drivers that inhibit the growth of smaller high-tech firms. California has some of the best tech-transfer programs in the world, but a stifling regulatory and local cost structure can inhibit most firms from reaching their potential. Improving how the state is viewed by businesses can have a significant impact.

California remains the primary choice for entrepreneurs the world over to locate in and start a business. The state's system of public and private universities continues to be a tremendous draw for students, professors, investors, and entrepreneurs. However, global and national competition is rising and California cannot afford to let its system of higher education slip. Further, unless California can retain these entrepreneurs either through immigration reform or improved attraction of foreign investment, it will see its position slip both nationally and internationally. California's tech sector has been the driving factor in leading the state out of the recession. But the entire state must be engaged in this recovery, and not just a select few sectors.

APPENDIX: LIST OF COMPONENTS IN EACH COMPOSITE INDEX

RESEARCH AND DEVELOPMENT INPUTS	
Federal R&D Dollars per Capita	National Science Foundation (NSF)
Industry R&D Dollars per Capita	NSF
Academic R&D Dollars per Capita	NSF, Academic R&D Expenditure
National Science Foundation Funding	NSF, Experimental Program to Stimulate Competitive Research
National Science Foundation Research Funding	NSF, Experimental Program to Stimulate Competitive Research
R&D Expenditures on Engineering	NSF, Academic R&D Expenditure
R&D Expenditures on Physical Sciences	NSF, Academic R&D Expenditure
R&D Expenditures on Environmental Sciences	NSF, Academic R&D Expenditure
R&D Expenditures on Math and Computer Science	NSF, Academic R&D Expenditure
R&D Expenditures on Life Sciences	NSF, Academic R&D Expenditure
R&D Expenditures on Agricultural Sciences	NSF, WebCASPAR
R&D Expenditures on Biomedical Sciences	NSF, WebCASPAR
STTR Awards per 10,000 Businesses	Small Business Administration, U.S. Census Bureau
STTR Award Dollars	Small Business Administration
SBIR Awards per 100,000 People	Small Business Administration
SBIR Awards per 10,000 Businesses (Phase I)	NSF, Experimental Program to Stimulate Competitive Research (EPSCoR)
State Establishment Counts	County Business Patterns (data release in June for 2 years prior – i.e. 2010 data released June 2012)
SBIR Awards per 10,000 Businesses (Phase II)	NSF, EPSCoR
State Establishment Counts	County Business Patterns (data release in June for 2 years prior – i.e. 2010 data released June 2012)
Competitive NSF Proposal Funding Rate	NSF, EPSCoR
RISK CAPITAL AND ENTREPRENEURIAL INFRASTRUCTURE	
Total Venture Capital Investment Growth	PricewaterhouseCoopers/National Venture Capital Association MoneyTree Report, Thomson Financial
Number of Companies Receiving VC per 10,000 Firms	PricewaterhouseCoopers/National Venture Capital Association MoneyTree Report, Thomson Financial
Growth in Number of Companies Receiving VC	PricewaterhouseCoopers/National Venture Capital Association MoneyTree Report, Thomson Financial
Venture Capital Investment as Percent of GSP	PricewaterhouseCoopers/National Venture Capital Association MoneyTree Report, Thomson Financial
SBIC Funds Disbursed per $1,000 of GSP	Small Business Administration
Business Incubators per 10,000 Establishments	National Business Incubation Association, U.S. Census Bureau
Patents Issued per 100,000 People	U.S. Patent and Trademark Office
Business Starts per 100,000 People	U.S. Census Bureau
IPO Proceeds as Percent of GSP	Securities Data Corporation, Thomson Financial
VC Investment in Nanotechnology as Percent of GSP	SDC Platinum
VC Investment in Clean/Green Technology as Percent of GSP	SDC Platinum
VC Investment in Biotechnology as Percent of GSP	SDC Platinum
HUMAN CAPITAL INVESTMENT	
Percentage of Population with Bachelor's Degrees or Higher	U.S. Department of Education
Percentage of Population with Advanced Degrees	U.S. Department of Education
Percentage of Population with Ph.D.s	U.S. Department of Education
Graduate Students in Science and Engineering	NSF, EPSCoR
Per Capita State Spending on Student Aid	NSF, EPSCoR
Average Verbal SAT Scores	NSF, EPSCoR

Average Math SAT Scores	NSF, EPSCoR
Average ACT Scores	NSF, EPSCoR
State Appropriations for Higher Education (per capita)	NSF, EPSCoR
Percent Change in State Appropriations for Higher Education	NSF, EPSCoR
Doctoral Scientists per 100,000 People	NSF, Division of Science Resources Studies
Doctoral Engineers per 100,000 People	NSF, Division of Science Resources Studies
Science, Engineering, and Health Ph.D.s Awarded	NSF, Division of Science Resources Studies
Science, Engineering, and Health Post-doctorates Awarded	NSF, Division of Science Resources Studies
Percentage of Bachelor's Degrees in Science and Engineering	National Center for Education Statistics, U.S. Department of Education
Recent Bachelor's Degree in Science and Engineering	NSF, Division of Science Resources Studies
Recent Master's Degree in Science and Engineering	NSF, Division of Science Resources Studies
Recent Ph.D. Degree in Science and Engineering	NSF, Division of Science Resources Studies
Recent Degrees in Science and Engineering	NSF, Division of Science Resources Studies
Percentage of Households With Computers	U.S. Department of Commerce
Percentage of Households With Internet Access	U.S. Department of Commerce
TECHNOLOGY AND SCIENCE WORKFORCE	
Intensity of Computer and Information Scientists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Computer Programmers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Software Engineers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Computer Support Specialists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Computer Systems Analysts	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Database and Network Administrators	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Agricultural and Food Scientists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Biochemists and Biophysicists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Microbiologists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Medical Scientists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Physicists	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Other Life and Physical Science Occupations	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Electronics Engineers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Electrical Engineers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Computer Hardware Engineers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Biomedical Engineers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Agricultural Engineers	U.S. Bureau of Labor Statistics, Milken Institute
Intensity of Other Engineers	U.S. Bureau of Labor Statistics, Milken Institute
TECHNOLOGY CONCENTRATION AND DYNAMISM	
Percent of Businesses in High-Tech NAICS Codes	U.S. Bureau of Labor Statistics, Milken Institute, U.S. Census Bureau
Percent of Employment in High-Tech NAICS Codes	U.S. Bureau of Labor Statistics, Milken Institute, U.S. Census Bureau
Percent of Payroll in High-Tech NAICS Codes	Milken Institute, U.S. Census Bureau
Net Formation of High-Tech Establishments	U.S. Census Bureau, NSF Science and Engineering Indicators
Number of Technology Fast 500 Companies	Deloitte & Touche; U.S. Census Bureau
Average Yearly Growth of High-Tech Industries	Moody's Economy.com; Milken Institute
High-Tech Industries Growing Faster Than U.S. Average	Moody's Economy.com; Milken Institute
High-Tech Industries With LQs Higher Than 1.0	Moody's Economy.com; Milken Institute
Number of Inc. 500 Companies	Inc. Magazine, U.S. Census Bureau

* All population statistics are from the U.S. Census Bureau. All Gross State Product figures are from the U.S. Department of Commerce.

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