2012

STATE TECHNOLOGY AND SCIENCE INDEX

Enduring Lessons for the Intangible Economy

April 2013

Kevin Klowden and Michael Wolfe

Milken Institute

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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.

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Data for each state can be found at

www.statetechandscience.org

Executive Summary

The 2012 State Technology and Science Index is the Milken Institute's fifth in the decade since the first report was released in 2002. The overwhelming trend this year is that technology and science are leading the economic recovery, and as a result, competition among the states is getting tougher. Here are some of the highlights:

- Massachusetts ranked first—again—with its highest score ever. By widening the gap between it and other states, Massachusetts has further cemented its lead in science and technology. With a critical mass of universities, research institutions, and cutting-edge firms, the indomitable state has placed first in every edition of the index.
- Competition at the very top has increased significantly this year, making it more difficult to break into the top 10. In past indexes, the distribution of scores among the states had evened out slightly, but the field is more cutthroat now because some regions had faster, stronger recoveries after the recession.
- The economic resurgence of the technology and science sector is clear. In the 2010 index, performance was down across the board, even in economically strong regions such as Silicon Valley, as the nation coped with uncertainty brought on by the downturn. But the science and tech sectors are storming back and will likely lead any economic renaissance.
- The threat from global competition cannot be overemphasized. In 2007 the United States ranked first on the INSEAD Global Innovation Index; now it is 10th.[1] The recession made clear the importance of continuing to invest in innovation and education. Regions that did so are emerging from the recession stronger.

The index is composed of five equally weighted composites that establish common ground for comparison and analysis. Seventy-nine indicators (see the appendix) make up these five components. Each one is computed and measured against the relevant indicator: population, gross state product (GSP), number of establishments, number of businesses, etc. Then the 50 states are ranked accordingly. Sources include governmental agencies, foundations, and private sources.

- **Research and development inputs:** We examine a state's R&D capacity to see if it has the facilities that attract funding and create innovations that could be commercialized and contribute to economic growth.
- **Risk capital and entrepreneurial infrastructure:** This determines the success rate of converting research into commercially viable products and services.
- **Human capital investment:** We look at how much is invested in developing the workforce—the most important intangible asset of a regional or state economy.
- **Technology and science workforce:** This composite measures the relative presence of high-end technical talent.
- **Technology concentration and dynamism:** We evaluate technology outcomes to assess how effective policymakers and other stakeholders have been at parlaying regional assets into regional prosperity.

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

Top 10: Overall rankings, 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Massachusetts	1	1	0	86.40	Georgia	26	25	-1	51.47
Maryland	2	2	0	79.41	Indiana	27	28	1	50.63
California	3	4	1	75.70	Ohio	28	29	1	49.06
Colorado	4	3	-1	75.07	Missouri	29	30	1	48.90
Washington	5	6	1	71.88	Alabama	30	31	1	48.59
Virginia	6	8	2	71.23	Iowa	31	32	1	47.30
Utah	7	5	-2	69.83	North Dakota	32	33	1	46.75
Delaware	8	10	2	69.16	Nebraska	33	34	1	45.44
Connecticut	9	9	0	68.49	Idaho	34	27	-7	44.70
New Hampshire	10	7	-3	66.07	Tennessee	35	41	6	44.44
Pennsylvania	11	14	3	64.16	Hawaii	36	36	0	44.19
Minnesota	12	12	0	63.39	Montana	37	35	-2	43.20
New York	13	16	3	62.85	Florida	38	40	2	42.15
Vermont	14	17	3	62.43	Maine	39	42	3	40.74
New Jersey	15	11	-4	62.11	Oklahoma	40	39	-1	39.93
Arizona	16	15	-1	61.56	Alaska	41	37	-4	38.73
Rhode Island	17	22	5	61.22	South Dakota	42	38	-4	37.79
Illinois	18	20	2	60.81	South Carolina	43	43	0	37.12
Texas	19	19	0	59.91	Louisiana	44	45	1	35.64
Oregon	20	21	1	57.84	Kentucky	45	47	2	32.40
North Carolina	21	13	-8	57.80	Wyoming	46	44	-2	32.18
New Mexico	22	18	-4	56.55	Nevada	47	46	-1	30.80
Michigan	23	26	3	55.03	West Virginia	48	49	1	30.61
Kansas	24	23	-1	53.64	Arkansas	49	50	1	28.28
Wisconsin	25	24	-1	53.07	Mississippi	50	48	-2	26.05

Massachusetts claimed the top spot again while it pulled even farther ahead of the pack. To say that Massachusetts, with world-renowned universities and cutting-edge firms, has the right technological and scientific assets is an understatement. Massachusetts scored 86.40 this year, an increase of almost four points since the 2010 index.

Second-ranked **Maryland** did well in all the composite indexes. The Risk Capital and Entrepreneurial Infrastructure composite was the only one in which the state failed to make the top 10. Maryland scored 79.41, up from 77.05 on the 2010 index.

California is back in the top three, riding the recovery of its science and technology sector. Its overall score of 75.70 marked a slight improvement over the 2010 index but was off almost five points from its record 80.37 in the first index in 2002.

Colorado fell to fourth place—another notch in its slow decline from second in 2002. Still, officials have little cause for worry: Colorado's overall score dipped only slightly (from 75.73 to 75.07), and the state's performance in the majority of indicators remained strong.

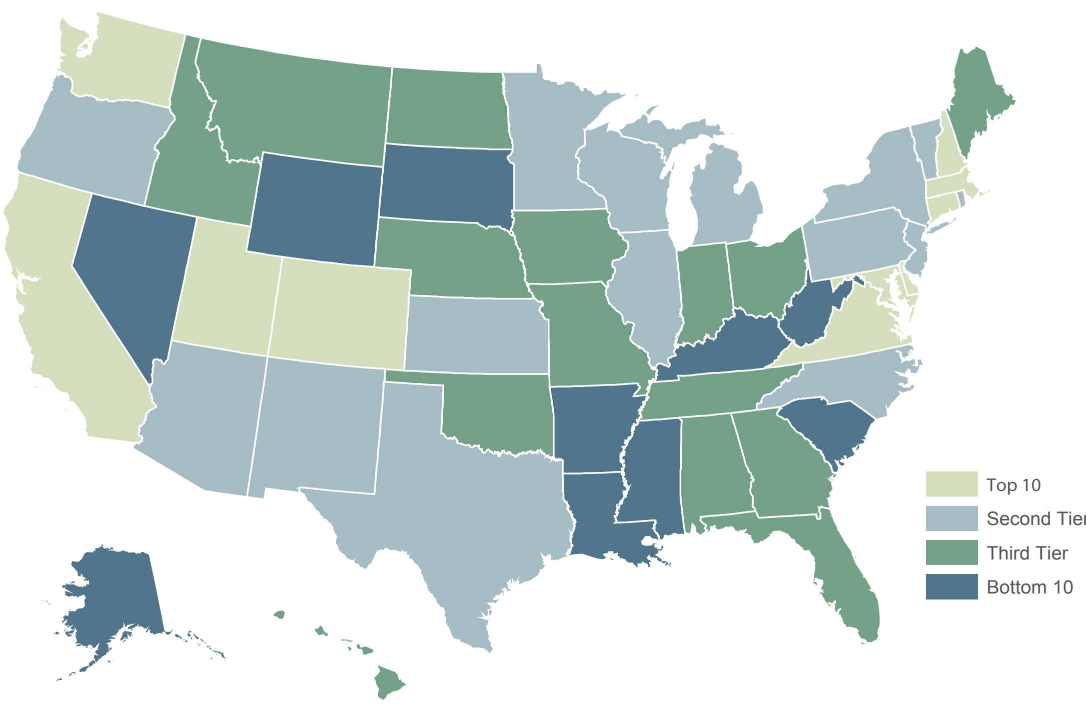
Washington inched up one spot to fifth and boosted its score to 71.88 from 70.23. Its performance was a bit mixed, improving in a couple of the composite indexes while losing four places in the R&D composite index. Although its score improved a number of points in the Risk Capital and Entrepreneurial Infrastructure Composite Index, the state's rank was unchanged, reflecting the increased competition.

Ranking sixth through 10th, respectively, were **Virginia**, **Utah**, **Delaware**, **Connecticut**, and **New Hampshire**. All were in the top 10 in the 2010 index. The 2012 index saw only a minor shuffling at the top, but the scores are a different matter. In 2010, a score of 63 was enough to place in the top 10, but this year New Hampshire dropped to 10th from seventh with a score of just over 66.

Biggest gainers

Huge gains were nowhere to be found this year. The biggest gainers were **Tennessee**, which leaped from 41st to 35th thanks to gains in the Risk Capital and Entrepreneurial Infrastructure Composite Index, and **Rhode Island**, which jumped from 22nd to 17th due to its top 10 performance in the Technology and Science Workforce Composite Index.

How does your state stack up? State Technology and Science Index 2012



ON THE WEB

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Introduction: Innovation and Growth

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. The purpose is not only to provide a method for comparing states' performance but also to help states see the trends that will affect their future economies.

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

- Competition at the very top has increased this year and is almost equal to the level in our first index in 2002. It is becoming more difficult to break into the top 10. The score distribution among the states evened out slightly in past indexes, but as regions emerge from the recession they are becoming more competitive again. The trend seems to be driven by risk capital and entrepreneurial infrastructure.
- The importance of the threat posed by increasing global competition cannot be overemphasized.
- In 2007 the United States ranked first on the INSEAD Global Innovation Index; now it is 10th.[2] The recession made clear the importance of continuing to invest in innovation and education. Regions that did so are emerging from the recession stronger. 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.
- Each year a theme emerges. In 2008 it was the trend toward outsourcing. In 2010 it was the pullback of the science and technology sectors brought on by the recession. Thanks to the recovery, the 2012 index reflects the resurgence of these sectors—and points to the importance of innovation in state economies. States that are traditionally strong in science and technology are emerging from the recession on the backs of these sectors. The incredible performance of Massachusetts on this year's index is one example of this; California is another.

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. Some estimates credit technological innovation for over 50 percent of economic growth in OECD countries.[3] State governments must recognize this and adopt policies that maximize their ability to innovate.

How a state fares in the index does not directly correlate to current economic performance and overall job creation, but it does clearly show which states are more likely to create high-paying and future-proofed positions for its residents.

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

3 Jorge Niosi, "Connecting the Dots between University Research and Industrial Innovation," *IRPP Choices* 14, no. 14 (2008).

Overall Findings

This year's index clearly demonstrates the resurgence of the technology and science fields in the U.S. economy. In the 2010 index, performance was down across the board, even in economically strong regions such as Silicon Valley, as the nation coped with economic uncertainty brought on by the downturn. Although the economy is still fragile, the science and tech sectors are storming back and will likely lead any economic renaissance. This is most noticeable in the Risk Capital and Entrepreneurial Infrastructure Composite Index. The total score for all states is much higher than in 2010 as competition for venture capital is heating up.

States that are traditionally strong in technology are again dominant with only minor shakeups in this year's index. Massachusetts has cemented its position at the top, and states such as New York and Pennsylvania are gradually improving their science and tech assets. A few states improved their scores but either fell or stagnated in ranking. This reflects the increasing competition states are facing in science and technology industries.

At the Top

Massachusetts not only claimed the top spot but also pulled even farther ahead of the pack. The state scored 86.40 in the overall index—the best it's ever done—and widened the gap between it and second-place Maryland. Massachusetts is by far the most dominant state, placing first in all but one of the five composite indexes that make up the overall rankings. Even in its weakest area—technology concentration and dynamism— Massachusetts still ranked sixth, which was a small improvement over seventh in 2010.

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. The state increased its scores by more than seven points in risk capital and entrepreneurial infrastructure and almost 10 points in human capital investment. In technology and science, Massachusetts has weathered the recession better than most of its peers.

Massachusetts continues to fund and create programs that address technology and science outcomes. A $1 billion Life Science Initiative is underway although its success has been tempered somewhat by the recession.[4] An advisory council created in 2009[5] has helped develop a plan for excellence in science, technology, engineering and math

[4] Weisman, Robert. "Massachusetts life sciences initiative brings fewer jobs than expected - Business." The Boston Globe. http://www.bostonglobe.com/metro/2012/06/13/massachusetts-life-sciences-initiative-brings-fewer-jobs-than-expected/GLERSTY8ZpoKStz1aivLDJ/story.html (accessed September 13, 2012).

[5] "Governor's Science, Technology, Engineering & Math Advisory Council." Mass.Gov. http://www.mass.gov/governor/administration/ltgov/lgcommittee/stem/ (accessed September 13, 2012).

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 ecosystem that contributes to job and wealth creation. The index computes and measures 79 individual indicators relative to population, gross state product (GSP), number of establishments, number of businesses, 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.

(STEM) education.[6] The state's economic development efforts include improving its already excellent innovation capabilities.[7] Finally, the Massachusetts Technology Collaborative, a unique public economic development agency, is another sign that key actors in Massachusetts understand the importance of technology and science.[8]

Maryland once again comes in second in the index. It scored 79.41, an improvement from 77.05 in 2010 but still slightly less than its score in 2008. The state slid to second in human capital investment, but its score improved in all five composite indexes. The state's weakest area is 13th in risk capital and entrepreneurial infrastructure, up from 14th in 2010.

Maryland's strongest performance is in the R&D inputs and human capital composite indexes. 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 such leading research universities as Johns Hopkins.[9] This also helps explain Maryland's performance in human capital: It has the most Ph.D. holders per capita.

As mentioned, Maryland's weakness is in the risk capital and entreprenurial infrastructure category, an area in which it has consistently underperformed. However, the state's leadership is working on programs to attract funding and streamline the commercialization of university research. 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 venture capital gap.[10] Similarly, Innovate Maryland seeks to move discoveries from academia into the marketplace more quickly. Support is provided through TEDCO, Maryland's state-run technology transfer organization, and the goal is to commercialize 40 inventions a year.[11] These programs are new and their effectiveness as yet unclear, but they do improve the state's science and tech ecosystem.

California moved back into the top three after idling at fourth since the 2008 index. The state scored 75.70, an improvement from 2010 but far from its pinnacle of 80.37 in 2002. California advanced in every category except the R&D inputs composite index (held steady at fourth) and risk capital and infrastructure (slid two spots to fourth). It is worth noting that the slip in risk capital is due to increased competition instead of a decline in performance.

A comeback in the tech sector played a big role in California's improved status. Patents jumped 30 percent from 2009 to 2010, and venture capital was up 17 percent over the same period.[12] (Again, the state's slip in the risk capital composite index is due to other states' stellar performances.)

Since the 2010 index, Jerry Brown has replaced Arnold Schwarzenegger as governor, taking office amid significant economic turmoil and budgetary uncertainty. Although Brown has taken steps to address the state's fiscal woes, it is too soon to tell how they will impact California's science and tech performance. But the good news includes no tuition increases this year at the University of California and California State University systems, which have seen student fees triple since 2000;[13] support for innovations such as high-speed rail and renewable energies;[14] and the governor's intention to create a foreign trade office in China[15] (after our last

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6 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).

7 Governor Patrick Signs Economic Development Bill." Mass.Gov. http://www.mass.gov/governor/pressoffice/pressreleases/2012/2012807-governor-patrick-signs-economic-development-bill.html (accessed September 10, 2012).

8 "Meet Mass Tech." Massachusetts Technology Collaborative. http://www.masstech.org/meet-masstech (accessed September 20, 2012).

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 "State's Economic Development Agency Releases FY 2012 Annual Report." Maryland Economic Development Association. http://www.medamd.com/content/state-s-economic-development-agency-releases-fy-2012-annual-report (accessed September 24, 2012).

11 "Annual Report 2012." Maryland Department of Business and Economic Development. www.emarketingmd.org/pubs/documents/dbedAr2012.pdf (accessed September 27, 2012).

12 "2012 Silicon Valley Index." Joint Venture. www.jointventure.org/images/stories/pdf/2012index-r2.pdf (accessed January 12, 2013).

13 http://www.cpec.ca.gov/FiscalData/FeesGraph.ASP

14 "Brown Lauds Job Creation at World's Largest Solar Energy Project." Office of Governor Edmund G. Brown Jr.. http://gov.ca.gov/news.php?id=17090 (accessed September 12, 2012).

15 "Governor Brown to Open New Trade and Investment Office in China." Office of Governor Edmund G. Brown Jr. http://gov.ca.gov/news.php?id=17423 (accessed September 10, 2012).

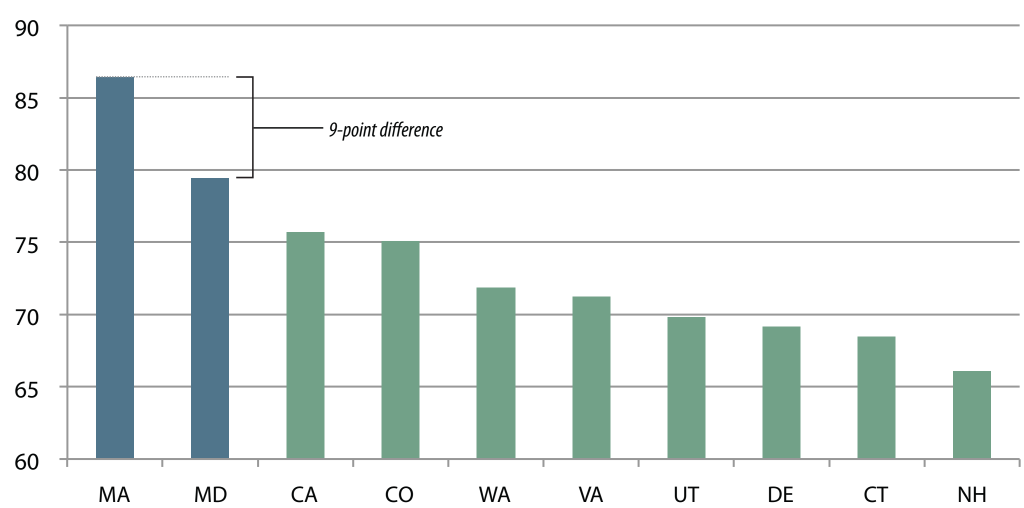
index lamented California's complete lack of foreign trade offices). These are positive developments and could be a sign that California is returning to an even more dominant position in science and technology.

Fourth-ranked **Colorado** marks its second consecutive drop in score—albeit by less than a point this year. The state's performance in the indicators was mixed. It improved in the R&D composite index and gained 8 points in its risk capital score, but lost a little ground in the three other indexes. The state's biggest drop was from fifth to eighth in technology and science workforce. It should be noted that Colorado actually improved its score in tech concentration and dynamism, but Washington's strong performance pushed Colorado from second to third place in that category.

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

Colorado has also experienced a change in governor since the last index (although not a change in political party). Governor John Hickenlooper, sworn into office in 2011, has introduced programs supporting science and technology, including the Colorado Innovation Network. This new initiative is designed to bring together leaders in the innovation ecosystem and set an agenda for economic growth. Announced in late 2011, the network so far has committed to creating a yearly innovation index and hosting an annual innovation summit.[16] In addition, the state's annual report has set forward an agenda that will continue to strengthen science and technology industries, emphasizing greater capital access and formalizing strategies by sector. The report also highlights the state's recent success at attracting a number of technology-related businesses.[17]

Figure 1. State Technology and Science Index: Top 10 States 2012



16 "About | Colorado Innovation Network." Colorado Innovation Network | Collaboration for Innovation. http://coloradoinnovationnetwork.com/about/ (accessed October 22, 2012).

17 "2012 Colorado Blueprint Annual Report." OEDIT | Office of Economic Development and International Trade. http://www.advancecolorado.com/news/gov-hickenlooper-oedit-release-2012-colorado-blueprint-annual-report (accessed November 2, 2012).

Washington inched up one spot to fifth. It saw improvements in the Technology Concentration and Dynamism category (from third to second) and Technology and Science Workforce Composite (from fourth to third). In the individual indicators, the state improved significantly in high-technology industries growing faster than the U.S. average (from seventh to third). Home to Microsoft and its related suppliers, the state ranked first in high-tech payroll and employment. Not surprisingly, Washington has a high concentration of computer scientists, but it also ranks third in the concentration of physicists and medical scientists.

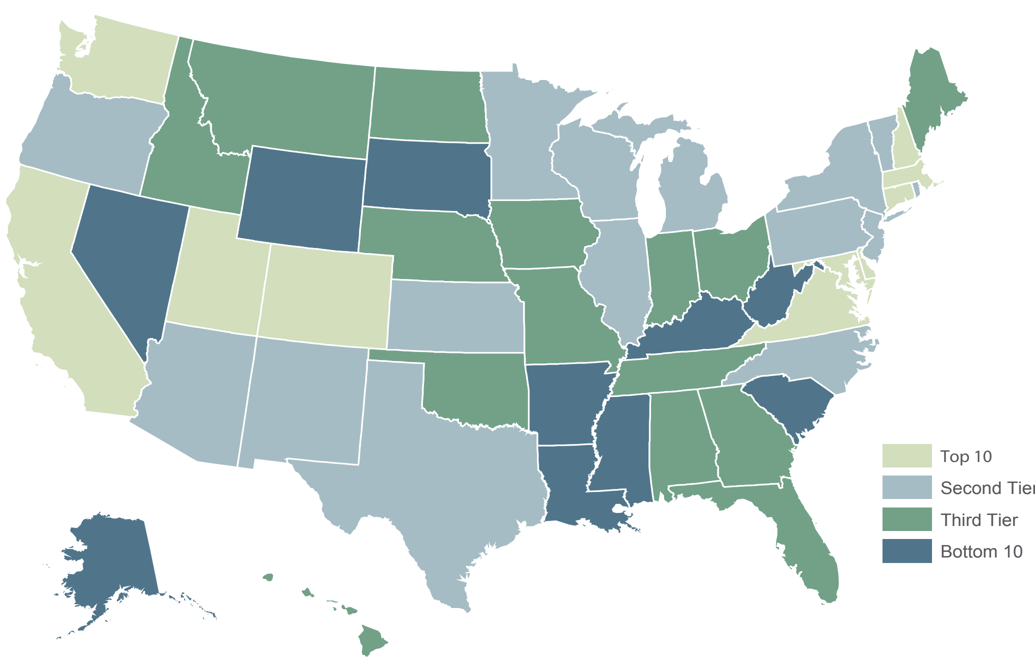
However, state officials should be wary of certain negative trends. The state dropped four spots to 10th in the R&D inputs composite index and, since 2008, has declined six spots to 10th in risk capital infrastructure. The state's human capital ranking has remained steady in recent years but at 21st is not only its weakest area but also a huge decline from eighth in 2002.

Washington performs poorly on indicators measuring science and engineering graduate degrees and state appropriations for higher education. It is likely that the state's high technology companies hire a significant portion of their workers from out of state to help bridge this gap. This presents an area of opportunity for Washington.

Virginia leapfrogged two spots to sixth largely on the strength of its performance in the risk capital composite index. The state's vault from 26th to sixth in risk capital was prompted by a very strong recovery in venture capital. Virginia also received considerable SBIC funding and saw a steady increase in business starts. The state jumped from 15th to ninth in the human capital composite index, but this was largely due to the weak performances of other states.

Virginia continues to fall in tech concentration and dynamism. It ranks ninth—a significant drop from first in 2004. Although the state is still strong in its overall number of high-tech companies and industries, the story is different for emerging and growing tech businesses. Virginia's inability to grow these sectors could harm its well-being in the years to come. Governor Bob McDonnell's recent legislative agenda, which passed with strong support, provides a number of measures designed to boost the state's science and tech ecosystem. For instance, his Opportunity at

Figure 2. State Technology and Science Index Map: 2012



Work initiative is designed to help new and existing businesses grow as well as recruit new employees.[18]

Utah dropped two spots to seventh with a score of 69.83 vs. 71.26 in 2010. The decrease is due to stronger competition from other states and Utah's slide in several composite indexes. In 2010 Utah ranked in the top 10 in four of five composites but now places at the top in just two—human capital investment and technology concentration and dynamism. The state still ranks first in technology concentration and dynamism thanks to the impressive number of high-tech companies in the sparsely populated state. Utah 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 star scientists to Utah's research universities and has a number of initiatives that support research commercialization under way.[19] In addition, the governor's office made supporting the renewable energy sector a priority.[20]

Delaware jumped two spots to eighth amid tough competition from other states. A consistently good performer, Delaware leaped from 29th to 21st in risk capital infrastructure and, most significantly, from 24th to eighth in technology concentration and dynamism—a record high for the state. The 2010 index mentioned Delaware's plan to convert an old Chrysler factory to a high-technology laboratory, and a facility to produce energy fuel cells recently broke ground at the site.[21] Delaware's biggest strengths are top five rankings in R&D inputs and technology and science workforce.

Stiff competition kept **Connecticut** at ninth this year despite a slightly improved score of 68.49. The state dipped from third to sixth in the risk capital composite index, which was offset by a shift from fifth to third in human capital. The most impressive gain was a leap from 18th to 12th in technology concentration and dynamism. Governor Dan Malloy has a fair understanding of policies that will help the science and technology sector grow, calling small businesses "synonymous with innovation" and acknowledging that these companies "must constantly create new methods and products to be successful."[22] It is no surprise that Connecticut performs well in small-business grants and loans.

New Hampshire dropped three spots to 10th with a score of 66.07. It shed 10 points and eight positions (from third to 11th) in research and development inputs. New Hampshire's performance in tech concentration and dynamism was even worse: a 15-point drop in score and a drop in ranking from eighth to 16th—its worst rank since 2002. It did however move from seventh to third in risk capital and infrastructure. New Hampshire's performance in high-tech industry growth has declined significantly in recent years. However, since 2007 New Hampshire has had an R&D tax credit.[23] A more recent effort is the Green Launching Pad, a partnership between the state and the University of New Hampshire that encourages companies to bring clean-tech products to market. In addition, it seems that attractive real estate prices and a low tax burden have helped to draw a number of tech firms from Massachusetts to New Hampshire.[24] New Hampshire's proximity to Boston is an asset the state can use to its advantage.

Biggest Gainers

Big leaps in ranking were hard to come by this year. **Tennessee** was the biggest gainer; it jumped from 41st to 35th, due largely to an impressive 26-spot jump to 19th in risk capital infrastructure. Tennessee made major inroads in a number of indicators, most notably, growth in the number of companies receiving venture capital and a huge increase in IPO proceeds. Gov. Bill Haslam created a $50 million initiative aimed at supporting innovation called INCITE (innovation, commercialization, investment, technology and entrepreneurship).[25]

18 "Governor McDonnell's 2011 Agenda Receives Broad Support." Governor Robert F. McDonnell. http://www.governor.virginia.gov/News/viewRelease.cfm?id=623 (accessed September 24, 2012).

19 "Annual Report highlights USTAR's progress |Innovation Utah." USTAR | The Utah Science Technology and Research initiative | HomeInnovation Utah. http://www.innovationutah.com/blog/annual-report-highlights-ustars-progress/ (accessed September 26, 2012).

20 "Priorities: Energy." Utah.gov - The Official Website of the State of Utah. http://www.utah.gov/governor/priorities/energy.html (accessed November 9, 2012).

21 Eisenbrey, Jessica. "Fuel cell plant begins to Bloom at old Chrysler building in Newark." Delaware - State News Updates, Obituaries, Classifieds, Real Estate. http://delaware.newszap.com/home/113450-84/fuel-cell-plant-begins (accessed September 8, 2012).

22 State of the State Address, Office of Governor Sean Parnell, January 20, 2010. http://gov.alaska.gov/parnell/press-room/full-press-release.html?pr=5246 (accessed October 5, 2010).

23 "Research & Development Credit | Frequently Asked Questions | NH Department of Revenue Administration." Welcome | NH Department of Revenue Administration. http://www.revenue.nh.gov/faq/dra_165.htm (accessed October 5, 2012).

24 Farrell, Michael. "New Hampshire tries to build tech start-up cluster - Business - The Boston Globe." The Boston Globe. http://www.bostonglobe.com/business/2012/08/11/new-hampshire-tries-build-tech-start-cluster/wL8FsNkeSCLgoDXvbsc2eO/story.html (accessed October 11, 2012).

25 "Innovation in Tennessee ." Department of Community and Economic Development. www.tn.gov/ecd/Innovation.shtml (accessed October 3, 2012).

Rhode Island vaulted from 22nd to 17th; it performed extremely well in the Technology and Science Workforce Composite Index and increased its score by 10 points. Improvements in the computer and information science occupations contributed to this gain. Among the top 15, **New York** and **Pennsylvania** made the biggest gains, jumping three spots each. New York scored 62.85, which isn't far off from its 2002 record of 64.54. New York's improvement is largely due to a second-place ranking in risk capital and entrepreneurial infrastructure, which benefited from a leap from 46th to 11th in net business starts per 100,000 people. This is Pennsylvania's best year yet; it ranked in the top 10 on two of our five composites and improved significantly in risk capital infrastructure.

It is interesting to note that of the three biggest gainers in the 2010 report, **Indiana** is the only state that has not regressed. Indiana showed progress again in this year's index, but **Alaska** and **North Carolina** experienced large declines. Alaska's prior success was due less to a strong performance and more to other states' weaknesses and a government grant that has since ended. (During the 2010 study Alaska received a one-time research grant of $170 million for the Alaska Region Research Vessel, skewing its overall performance.) North Carolina's eight-spot decline reverses an upward trend since 2004 in both score and rankings. The state's dramatic drop of 17 places in the risk capital and entrepreneurial infrastructure composite reflects North Carolina's balky economy. It fell from ninth to 34th in venture capital growth and from third to 28th in number of net business starts.

Table 1. State Technology and Science Index: State Rankings 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Massachusetts	1	1	0	86.40	Georgia	26	25	-1	51.47
Maryland	2	2	0	79.41	Indiana	27	28	1	50.63
California	3	4	1	75.70	Ohio	28	29	1	49.06
Colorado	4	3	-1	75.07	Missouri	29	30	1	48.90
Washington	5	6	1	71.88	Alabama	30	31	1	48.59
Virginia	6	8	2	71.23	Iowa	31	32	1	47.30
Utah	7	5	-2	69.83	North Dakota	32	33	1	46.75
Delaware	8	10	2	69.16	Nebraska	33	34	1	45.44
Connecticut	9	9	0	68.49	Idaho	34	27	-7	44.70
New Hampshire	10	7	-3	66.07	Tennessee	35	41	6	44.44
Pennsylvania	11	14	3	64.16	Hawaii	36	36	0	44.19
Minnesota	12	12	0	63.39	Montana	37	35	-2	43.20
New York	13	16	3	62.85	Florida	38	40	2	42.15
Vermont	14	17	3	62.43	Maine	39	42	3	40.74
New Jersey	15	11	-4	62.11	Oklahoma	40	39	-1	39.93
Arizona	16	15	-1	61.56	Alaska	41	37	-4	38.73
Rhode Island	17	22	5	61.22	South Dakota	42	38	-4	37.79
Illinois	18	20	2	60.81	South Carolina	43	43	0	37.12
Texas	19	19	0	59.91	Louisiana	44	45	1	35.64
Oregon	20	21	1	57.84	Kentucky	45	47	2	32.40
North Carolina	21	13	-8	57.80	Wyoming	46	44	-2	32.18
New Mexico	22	18	-4	56.55	Nevada	47	46	-1	30.80
Michigan	23	26	3	55.03	West Virginia	48	49	1	30.61
Kansas	24	23	-1	53.64	Arkansas	49	50	1	28.28
Wisconsin	25	24	-1	53.07	Mississippi	50	48	-2	26.05

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.[26] 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.[27]

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.

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 originates from the federal government.[28]

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.

State Rankings

At the Top

Massachusetts has dominated this category since the inception of the State Technology and Science Index, and this year is no exception. While its score is slightly lower than in 2010, it far outpaces that of second-place Maryland. 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 two of the 18 indicators.

Maryland holds steady in second with an improved score of 86.52 from 84.91. The state ranks first in federal and academic R&D funding and a

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

[27] 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.

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

number of R&D expenditure categories. It also receives an impressive number of SBIR grants.

Third place goes to **Colorado**, which gained two spots and about one point in the scoring. Fourth place again belongs to **California** although its score dropped by almost two points. **Delaware** leaped six spots to fifth—its highest ranking ever in this category.

Rounding out the top 10 are **Virginia**, **Connecticut**, **Pennsylvania**, **Rhode Island**, and **Washington**. Washington, which ranked sixth in 2010, was the only top 10 state to lose ground this year. The scores suggest competition for R&D funding was tougher at the bottom of the top 10 than at the top, where fifth-place Delaware came in almost six points lower than the fifth-place state (Colorado) in 2010.

At the Bottom

West Virginia, **Nevada**, and **Oklahoma** rank 48th, 49th, and 50th, respectively, in the R&D inputs composite index. West Virginia—also in the bottom three last year— and Oklahoma performed poorly across almost all R&D indicators. Nevada plunged six spots to 49th as federal, private, and academic R&D funding has suffered the past few years.

Biggest gainers

No state made huge leaps in this composite. Delaware gained the most ground at six spots, followed by **Michigan**, **Vermont**, **Indiana**, and **Kansas** at five positions each. All these states except Kansas improved their score by around six points; Kansas' score rose by almost three.

Table 2. Research and Development Inputs Composite Index: State Rankings 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Massachusetts	1	1	0	92.26	Alabama	26	25	-1	54.45
Maryland	2	2	0	86.52	Iowa	27	30	3	53.91
Colorado	3	5	2	79.96	Ohio	28	20	-8	53.79
California	4	4	0	77.84	Montana	29	27	-2	49.52
Delaware	5	11	6	72.80	Texas	30	28	-2	48.76
Virginia	6	8	2	72.18	North Dakota	31	31	0	45.42
Connecticut	7	7	0	71.26	Nebraska	32	35	3	40.73
Pennsylvania	8	9	1	71.03	Georgia	33	34	1	39.32
Rhode Island	9	12	3	69.47	Idaho	34	38	4	39.10
Washington	10	6	-4	68.71	Kansas	35	40	5	38.92
New Hampshire	11	3	-8	68.19	Alaska	36	32	-4	38.47
New Mexico	12	10	-2	66.27	Missouri	37	36	-1	37.75
Michigan	13	18	5	65.72	Maine	38	37	-1	36.56
Arizona	14	15	1	65.27	Tennessee	39	41	2	35.52
Oregon	15	14	-1	64.98	South Carolina	40	39	-1	30.97
Utah	16	13	-3	64.05	Wyoming	41	33	-8	29.80
Vermont	17	22	5	60.69	South Dakota	42	44	2	26.05
Minnesota	18	21	3	59.46	Mississippi	43	42	-1	25.20
New York	19	17	-2	57.87	Florida	44	45	1	24.51
Wisconsin	20	19	-1	57.81	Arkansas	45	49	4	24.07
New Jersey	21	24	3	57.42	Kentucky	46	48	2	23.79
Hawaii	22	26	4	57.38	Louisiana	47	47	0	20.79
Illinois	23	23	0	56.98	West Virginia	48	46	-2	20.06
Indiana	24	29	5	56.41	Nevada	49	43	-6	18.60
North Carolina	25	16	-9	55.87	Oklahoma	50	50	0	17.47

Figure 3. Research and Development Inputs Composite Index: Top 10 States 2012

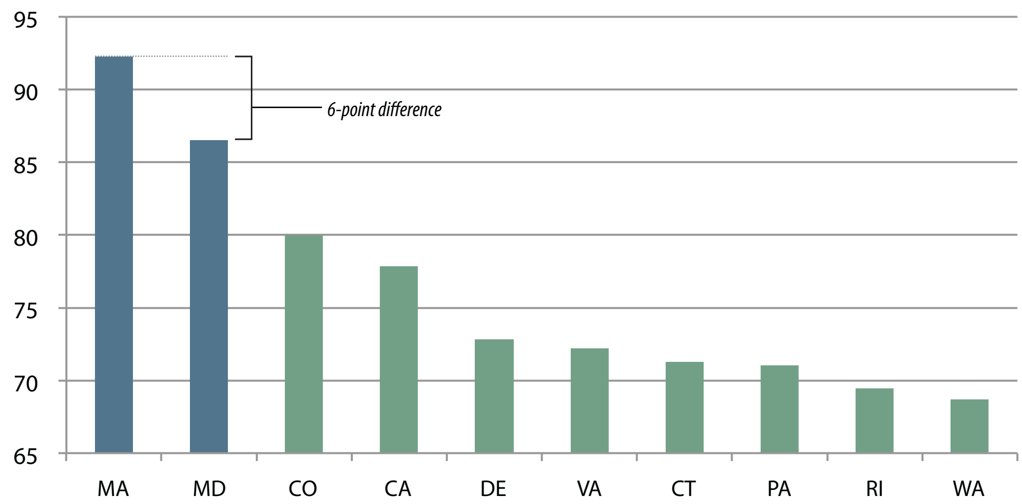
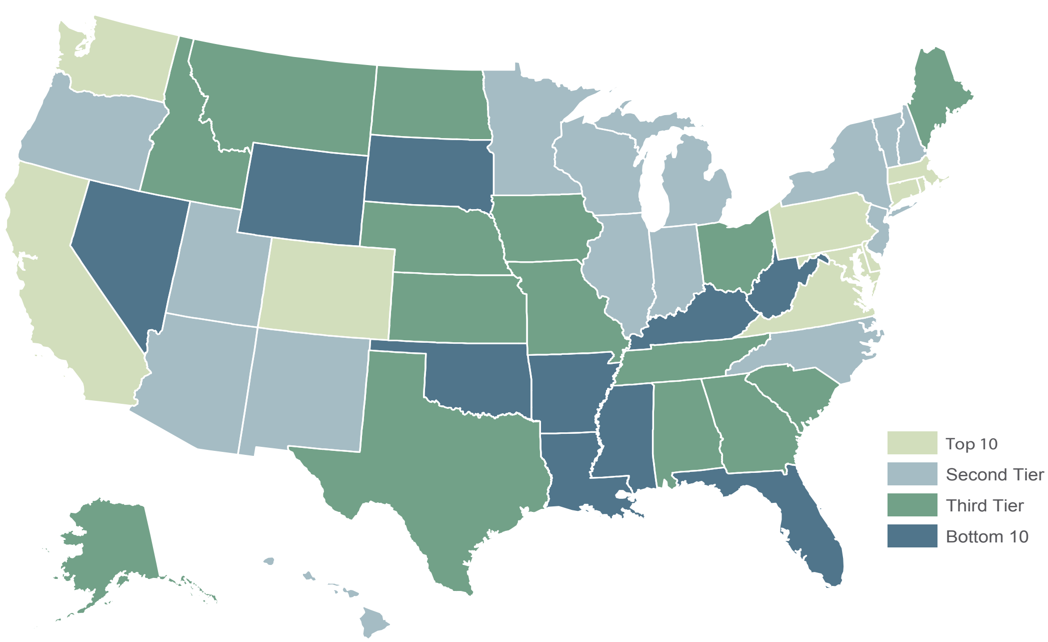


Figure 4. Research and Development Inputs Composite: Index Map 2012



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 inno-vate as well or risk losing market share. This competition drives down prices and brings about better products.

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 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 Association, 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 and nanotechnology investments: Nanotechnology and clean-tech 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.

State Rankings

A huge shakeup took place in the Risk Capital and Entrepreneurial Infrastructure Composite Index. First, three states that weren't among 2010's best performers (New York, Virginia, and Illinois) joined the top 10 this year. Second, the top 10 collectively scored much higher than the best performers in the previous index. And third, venture capitalists post-recession are far more willing to invest in the most competitive regions than they were in 2010, and nowhere is this shift more dramatic than among the top 10.

At the top

Massachusetts once again ranks first on the risk capital composite index. Its overall score increased a dramatic seven points, which padded its lead over second place. Massachusetts ranks in the top five on nine of the 12 indicators in the risk capital category and ranks first on four of them. The state does particularly well on indicators involving venture capital investment, patents and business starts.

New York represents a major success story. It ranked 16th in 2010 with a score of 57.34. It now ranks second and scored 79.83—one of the largest increases in any of the composite indexes. 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 green technology equity and fifth in VC investment in both nano and clean technology. And it ranked fourth in VC investment as a percent of GDP vs. 13th two years ago.

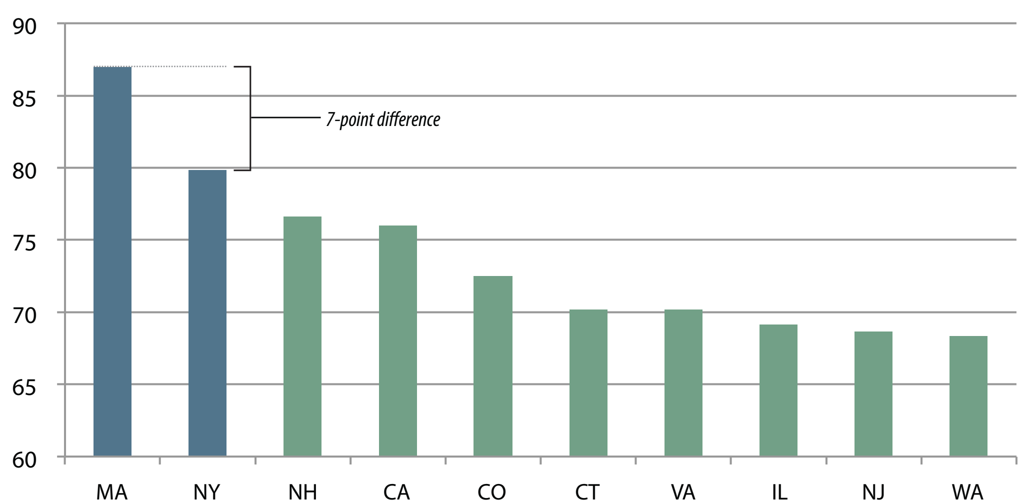
With a score of 76.60, **New Hampshire** ranked third in this composite index compared to seventh in 2010 and 18th in 2008. The state ranks in the top 10 on all our measures of venture capital investment, patents and SBIC money. Indicative of New Hampshire's newfound success is a second-place ranking in the growth in the number of companies receiving venture capital.

Fourth-place **California** scores right behind New Hampshire with 76.00, a slight improvement from 2010. Thanks largely to Silicon Valley, California performed exceptionally well on the venture capital indicators. It was second in both VC investment as a percent of GDP and the number of companies receiving venture capital, first in clean-tech investment and third in nanotechnology investment.

Colorado rounds out the top five with a score of 72.50. The state scored eight points higher than in 2010 but gained just one position—a sign of how competitive its rivals are in the area of venture capital. Colorado did well in venture capital per capita and the number of companies receiving venture capital. However, it ranks in the teens in recent growth in VC investment. Although this underperformance could be worrisome in the long term, Colorado has improved significantly in these indicators since 2010.

Connecticut and **Virginia** tied for sixth place, and **Illinois**, **New Jersey**, and **Washington** brought up the rear. Virginia leaped 20 spots and Illinois nine to crack the top 10. The other three states improved their scores, but the competition was much tougher this year.

Figure 5. Risk Capital and Entrepreneurial Infrastructure Composite Index: Top 10 States 2012



At the bottom

Arkansas, **Mississippi**, and **Alaska** were 48th, 49th, and 50th, respectively. Alaska has never performed well on this composite and has virtually no venture capital market. Its one bright spot is a top 10 ranking in the number of net business starts. Mississippi made the top 10 in business incubators, but this was the only area in which it performed well. Arkansas failed to crack the top 10 on any indicator in the composite though its performance improved slightly from previous years.

Biggest gainers

Tennessee gained 26 spots to rank 19th with significant growth in venture capital and in the number of companies receiving it. In addition, it leaped from 20th to third in initial public offering proceeds. As mentioned, **Virginia** moved up 20 positions. Meanwhile, **Missouri** rode improvements in business starts and growth in the number of companies receiving venture capital to reach 16th from 31st in the composite index rankings.

Figure 6. Risk Capital and Entrepreneurial Infrastructure Composite Index Map: 2012

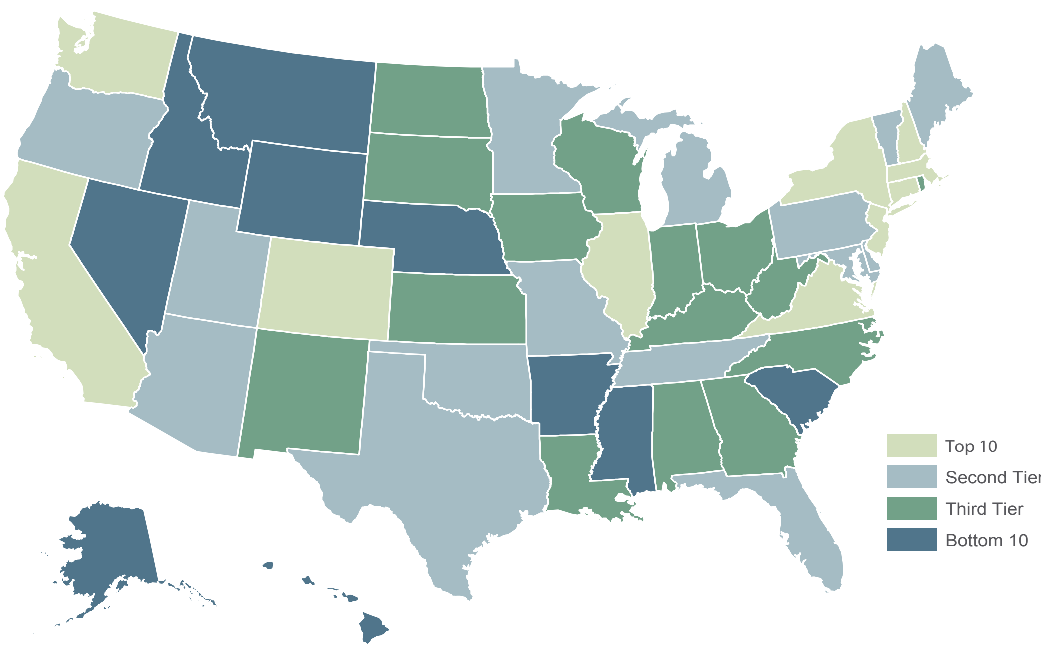


Table 3. Risk Capital and Entrepreneurial Infrastructure Composite Index: State Rankings 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Massachusetts	1	1	0	87.00	North Carolina	25	8	-17	56.67
New York	2	16	14	79.83	Kansas	27	22	-5	55.20
New Hampshire	3	7	4	76.60	Georgia	28	15	-13	53.83
California	4	2	-2	76.00	Louisiana	29	33	4	53.00
Colorado	5	6	1	72.50	New Mexico	30	23	-7	52.60
Connecticut	6	3	-3	70.17	Rhode Island	31	28	-3	51.83
Virginia	6	26	20	70.17	Indiana	32	19	-13	50.55
Illinois	8	17	9	69.17	Wisconsin	33	11	-22	50.20
New Jersey	9	4	-5	68.67	Ohio	34	20	-14	48.36
Washington	10	10	0	68.33	Alabama	35	38	3	43.56
Utah	11	5	-6	67.82	Iowa	36	34	-2	41.80
Arizona	12	9	-3	67.78	South Dakota	37	24	-13	41.00
Maryland	13	14	1	66.50	North Dakota	38	41	3	40.00
Pennsylvania	14	21	7	66.00	Kentucky	39	39	0	38.73
Texas	15	12	-3	65.67	West Virginia	40	40	0	36.00
Missouri	16	31	15	64.36	Nevada	41	36	-5	35.11
Vermont	17	18	1	64.00	Hawaii	42	42	0	33.78
Minnesota	18	13	-5	62.83	South Carolina	43	48	5	33.11
Tennessee	19	45	26	62.60	Wyoming	43	42	-1	33.11
Oregon	20	25	5	62.22	Montana	45	47	2	30.44
Delaware	21	29	8	59.09	Idaho	46	32	-14	29.50
Michigan	22	30	8	57.83	Nebraska	47	44	-3	27.25
Oklahoma	23	27	4	57.82	Arkansas	48	50	2	27.00
Florida	24	35	11	57.09	Mississippi	49	46	-3	22.00
Maine	25	37	12	56.67	Alaska	50	49	-1	18.75

Human Capital Investment

Capital and land used to be an economy's key productive 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 draw 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 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

At the Top

Massachusetts ranks first on the Human Capital Investment composite for the first time since 2002. The state turned in an incredible performance with a score more than 10 points higher than in 2010 (84.67 vs. 75.24) and a seven-point lead on second-ranked Maryland. In contrast, most states' scores were roughly the same as in 2010, and the overall point distribution changed only slightly. Massachusetts' most notable area of improvement was a jump from 47th to fourth in the percent change in appropriations for higher education per capita.

Now second, **Maryland** couldn't hang on to its first-place ranking due to Massachusetts' stellar performance and Maryland's static score. Maryland placed in the top five on 12 of the 21 indicators in this composite and, compared to 2010, ranked either the same as or better on 15. The only significant decline was a drop from 13th to 29th in percent change in state appropriations for higher education.

Connecticut gained two spots to take third and managed a modest increase in score (71.24 vs. 70.29 in 2010). The state ranked second in the number of science, engineering and health post-doctorates awarded, as it did in 2010, and second in ACT scores. Connecticut also placed in the top 10 on bachelor's, master's, and doctorate attainment.

Fourth place again goes to **Minnesota** although its score dropped from just under 73 to 70.76. Minnesota has consistently ranked among the top five in this composite since the first State Technology and Science Index in 2002. While its ranking declined from sixth to 14th in state spending for student aid this year, it performed well in number of master's degrees in science and engineering (fifth vs. 16th in 2010) and percentage of people with bachelor's degrees in science and engineering (13th from 21st in 2010).

Colorado fell two spots to fifth in the rankings, and its score dropped about four points from the 2010 index, primarily due to a lack of recent graduates in science and engineering. However, Colorado still had a strong showing on many other educational attainment indicators. The biggest improvement was a stunning leap to first from 17th in the percent change in state appropriations.

Utah, **Vermont**, **New York**, **Pennsylvania**, and **Virginia** filled out the top 10 with Pennsylvania and Virginia tying for ninth. The five states' scores varied by just three points in contrast to almost 15 points among the top five. Neither Virginia nor Pennsylvania ranked in the top 10 in the 2010 index. Pennsylvania was 11th in the previous index, and Virginia jumped from 16th to ninth. Virginia's biggest improvements were in student aid spending and recent science and engineering Ph.D.s.

At the Bottom

South Carolina, **Mississippi**, and **Nevada** were 48th, 49th, and 50th, respectively. South Carolina ranks in the bottom 10 on about half of the 21 indicators but came in fourth 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 but finished in the top 10 in state appropriations. Finally, except for 2004, Nevada has consistently ranked last in this composite index. It did improve its score by about four points and is closing in on its best score of 27 points in 2004.

Biggest Gainers

Alabama jumped nine spots to 31st, and **Georgia** gained seven to come in 30th. Georgia made significant gains in investment, ranking third in percent change in appropriations for higher education and second in spending on student aid. Alabama jumped from 40th to 13th in the percent change of state appropriations.

Figure 7. Human Capital Investment Composite Index: Top 10 States 2012

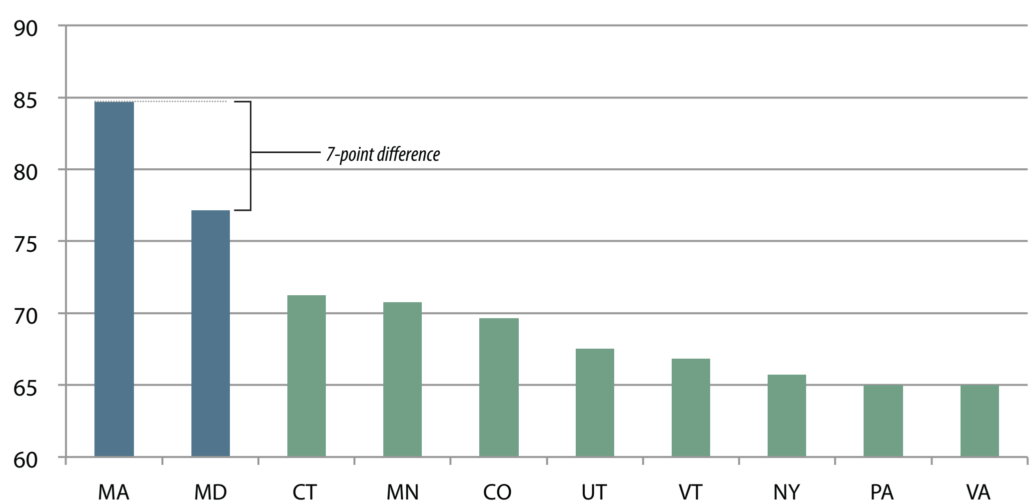


Figure 8. Human Capital Investment Composite Index Map: 2012

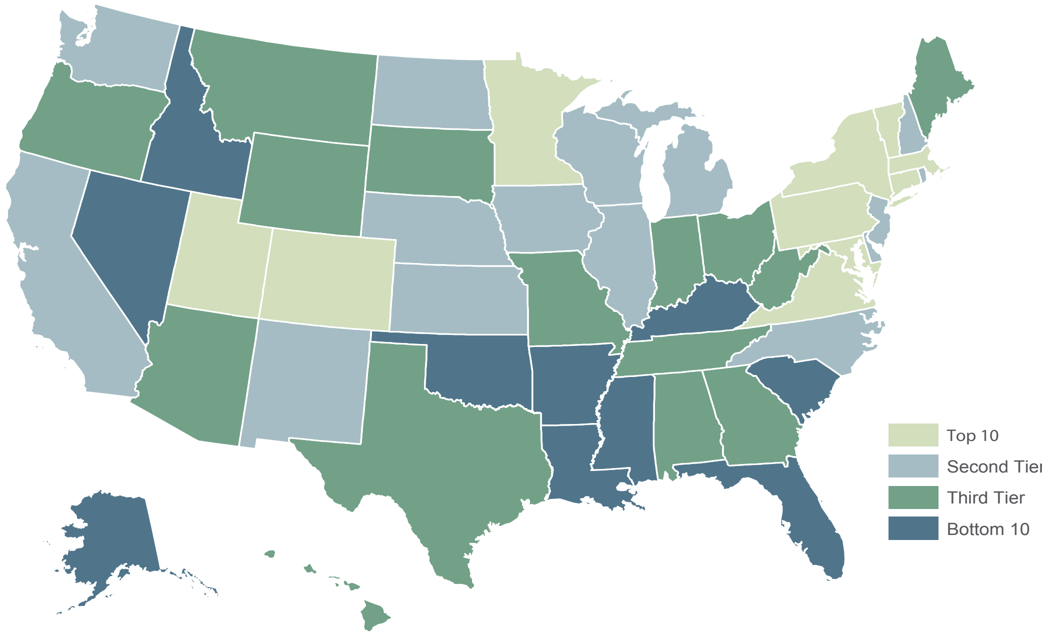


Table 4. Human Capital Investment Composite Index: State Rankings 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Massachusetts	1	2	1	84.67	Missouri	26	29	3	50.76
Maryland	2	1	-1	77.14	Indiana	27	30	3	50.38
Connecticut	3	5	2	71.24	Montana	28	24	-4	48.76
Minnesota	4	4	0	70.76	Oregon	29	27	-2	46.86
Colorado	5	3	-2	69.62	Georgia	30	37	7	45.71
Utah	6	8	2	67.52	Alabama	31	40	9	44.86
Vermont	7	6	-1	66.86	Wyoming	32	33	1	44.57
New York	8	9	1	65.71	South Dakota	33	28	-5	44.19
Pennsylvania	9	11	2	64.95	Ohio	34	35	1	43.71
Virginia	9	16	7	64.95	Arizona	35	32	-3	43.33
Nebraska	11	13	2	64.38	Tennessee	36	42	6	42.19
California	12	14	2	62.76	Maine	37	34	-3	40.57
New Hampshire	13	17	4	61.90	Texas	38	38	0	38.57
Rhode Island	14	10	-4	61.62	Hawaii	39	43	4	37.33
North Dakota	15	7	-8	61.52	West Virginia	39	39	0	37.33
Delaware	16	12	-4	61.14	Alaska	41	31	-10	37.05
Michigan	17	20	3	60.19	Oklahoma	42	44	2	36.95
Illinois	18	14	-4	58.76	Idaho	43	36	-7	36.76
Wisconsin	19	18	-1	58.48	Louisiana	44	41	-3	36.19
New Jersey	20	23	3	56.00	Florida	45	47	2	31.81
Washington	21	21	0	54.86	Kentucky	46	45	-1	31.71
Kansas	22	18	-4	54.19	Arkansas	47	49	2	30.57
North Carolina	23	26	3	53.71	South Carolina	48	48	0	24.86
Iowa	24	22	-2	53.14	Mississippi	49	46	-3	24.57
New Mexico	25	25	0	52.10	Nevada	50	50	0	23.71

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.[29]

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 or 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

At the Top

There are few surprises in the Technology and Science Workforce composite. The top eight states were also the best performers in the 2010 index. Once again, **Massachusetts** ranks first in this composite though its score dropped almost two points to 87.65. Massachusetts performed well across the board: It ranks in the top five in 11 of the 18 indicators in this composite and came in first in four (biomedical engineers, medical scientists, microbiologists, and software engineers). This is largely due to the number of universities, research facilities, hospitals, and high-tech employment clusters.

Maryland remains ensconced in second place, and its score is almost unchanged from the previous index. With top 5 rankings in 11 indicators, Maryland performs evenly across all three occupational categories. Not surprisingly, agricultural scientists and agricultural engineers are the least prevalent.

Washington inches up one position to third with a slightly better score than in 2010. It performed well in engineering and computer and information sciences occupations. The state improved slightly in life and physical science occupations despite a significant decline in the prevalence of biochemists and biophysicists.

At fourth, **Delaware** dropped one place in rank and nearly four points in score. It still has one of the highest concentrations of life and physical scientists in the nation, but its engineering indicators suffered. Delaware has a relatively small engineering sector, and because of this, data were withheld for some

29 Jarle Moen, "Is Mobility of Technical Personnel a Source of R&D Spillover?," *NBER Working Paper*, no. 7834 (2000).

occupations. This made it difficult to determine the exact areas of weakness. Delaware lost ground in the majority of indicators and plunged from 22nd to 41st in "other engineering" occupations.

California jumped two spots to fifth and gained five points in score—the state's biggest point increase in the five composite indexes. This largely reflects the recovery of California's technology sector. The state lost ground on only four of the 18 indicators. Most impressive was the leap from 35th to 13th in computer programmers. California's engineering indicators were mixed, ranking in the top five in three occupations and then 12th, 18th, and 30th in the others.

Ranking sixth through 10th, respectively, were **Virginia**, **Texas**, **Colorado**, **Rhode Island** and **Minnesota**. Minnesota gained one position to crack the top 10, while Rhode Island shot up 12 spots to ninth—its biggest gain ever in this composite. Rhode Island has steadily gained ground since ranking 32nd on the first index in 2002. Although Virginia turned in its lowest score in the index's history at 77.22, it significantly outpaced the next-best state (Texas at 70.33).

At the Bottom

Wyoming and **West Virginia** again ranked 48th and 49th while **Louisiana** dropped three spots to come in last. The three states have never ranked higher than 40th in this composite index.

Biggest Gainers

Tied for biggest gainer were Rhode Island (up 12 spots to ninth) and **Georgia** (up 12 spots to 17th). Georgia has improved steadily in all three categories as it has made a conscious effort to attract and retain these types of occupations. Arizona gained nine spots to come in 11th thanks to significant improvements in computer and information science occupations as well as engineering.

Figure 9. Technology and Science Workforce Composite Index: Top 10 States 2012

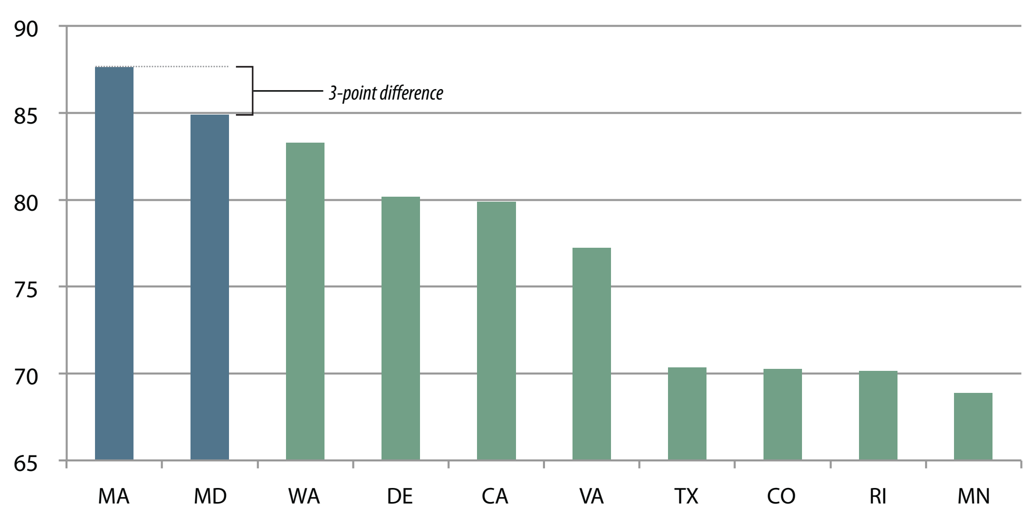


Figure 10. Technology and Science Workforce Composite Index Map: 2012

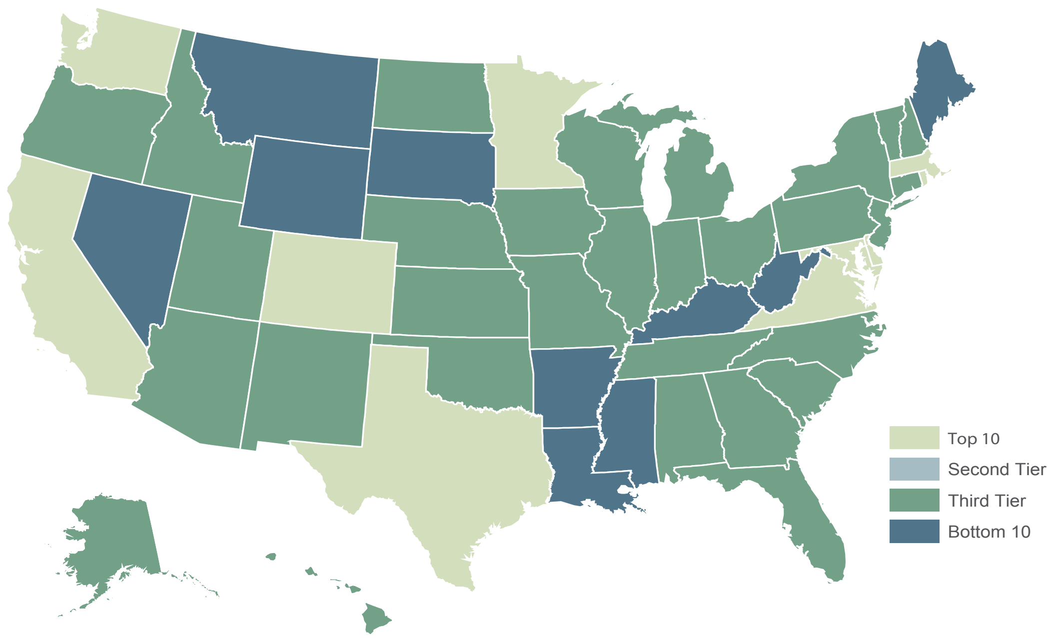


Table 5. Technology and Science Workforce Composite Index: State Rankings 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Massachusetts	1	1	0	87.65	North Carolina	26	15	-11	57.56
Maryland	2	2	0	84.89	Ohio	27	23	-4	56.22
Washington	3	4	1	83.29	New York	28	18	-10	53.41
Delaware	4	3	-1	80.18	Nebraska	29	34	5	53.06
California	5	7	2	79.89	Michigan	30	27	-3	52.82
Virginia	6	6	0	77.22	Alaska	31	33	2	52.40
Texas	7	10	3	70.33	Oregon	32	32	0	51.13
Colorado	8	5	-3	70.27	Tennessee	33	37	4	50.11
Rhode Island	9	21	12	70.15	Indiana	34	39	5	50.00
Minnesota	10	11	1	68.89	Iowa	35	31	-4	49.07
Arizona	11	20	9	66.63	Florida	36	38	2	46.12
New Jersey	12	9	-3	66.47	Oklahoma	37	30	-7	45.00
Connecticut	13	14	1	65.20	South Carolina	38	35	-3	44.89
Idaho	14	18	4	64.15	Hawaii	39	40	1	44.67
Pennsylvania	15	12	-3	64.00	North Dakota	40	36	-4	43.23
Utah	16	8	-8	63.73	South Dakota	41	41	0	42.71
Georgia	17	29	12	63.67	Montana	42	42	0	41.45
New Hampshire	18	13	-5	63.07	Arkansas	43	44	1	35.54
Kansas	19	16	-3	61.88	Kentucky	44	43	-1	35.38
New Mexico	20	25	5	61.00	Maine	45	45	0	35.08
Illinois	21	17	-4	60.35	Nevada	46	50	4	31.57
Alabama	22	28	6	60.27	Mississippi	47	46	-1	28.46
Wisconsin	23	22	-1	58.67	Wyoming	48	48	0	28.22
Missouri	24	24	0	58.00	West Virginia	49	49	0	26.67
Vermont	24	26	2	58.00	Louisiana	50	47	-3	26.24

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 enables analysts to determine the quality of jobs being created in the sector and in the economy as a whole. We look at the percent 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 percent 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

At the Top

There was little change at the top of this year's Technology Concentration and Dynamism Composite Index. Eight of the top 10 were also best performers in 2010, with new entrants **Delaware** and **North Carolina** replacing Arizona and New Hampshire. The top 10 collectively scored higher than in the 2010 index—impressive given that the average score for the 50 states overall declined.

Utah once again ranked first with a score of 86.00 (vs. 86.80 in 2010). The state's phenomenal performance puts it in the top 10 in nine of the 10 indicators in the composite index. Utah's only real weakness was 25th in net formation of high-tech establishments—after ranking first in this indicator since 2004. The data for this indicator are from 2008 and could reflect a recessionary pullback; it's also possible that Utah's growth was unsustainable. Regardless, Utah outperformed most other states in the growth and number of high-tech industries.

Washington moved up one spot to second and improved its score by about 3.5 points. The state gained ground in eight of the 10 indicators, including a huge improvement in the percentage of establishments in high-tech industries (from 25th to 10th). It ranked first in the percentage of employment and percentage of payroll in high-tech industries. Washington declined in just two areas: net formation of high-tech establishments and number of Inc. 500 companies.

Colorado dropped one spot to third despite improving its score by about one point in this year's competitive field. The state ranked in the top 10 in seven of the 10 indicators. Its two weakest areas were the number of high-tech industries growing faster than the U.S. average and the yearly growth of its high-tech industries, although both improved since the 2010 index. The state has almost returned to 2004 levels, when it scored 86 points and ranked second.

California tied with **Maryland** for fourth; scores for both rose about three points. California ranked in the top 10 in seven indicators and absolutely dominated in the number of high-tech industries with a location quotient above 1.0 (18 industries vs. 14 for next-ranked Massachusetts). Maryland's performance is similar to California's. Of note is an increase in the percentage of people employed in high-tech industries (the average for all states in this indicator declined). Maryland is well-positioned for the future with a first-place ranking in the percent of high-tech establishment births (14.5 percent of all new establishments).

Massachusetts, **Texas**, **Delaware**, **Virginia**, and **North Carolina** ranked sixth through 10th, respectively. Massachusetts' sixth-place rank is notable as this is the only composite where the state does not rank first. Virginia experienced the largest drop in the top 10, from fourth to ninth. Delaware vaulted 16 places to eighth due to great improvement in several indicators. Most impressive was the jump from 42nd to fifth in the number of high-tech industries growing faster than the U.S. average.

At the Bottom

Mississippi, **Wyoming**, and **Arkansas** brought up the rear. Mississippi dropped eight spots to 48th, Wyoming fell one to 49th, and Arkansas again claimed 50th. Arkansas' generally poor performance had one bright spot: a tie for third in net formation of high-tech establishments. Mississippi (eighth) and Wyoming (first) also did well on this indicator, but this is not necessarily a positive sign as this indicator favors states with a poor high-tech base.

Biggest Gainers

Delaware was the biggest gainer with a 16-position leap. Next was **South Carolina** (38th to 25th), **Rhode Island** (34th to 24th), and **Illinois** (26th to 17th).

Figure 11. Technology Concentration and Dynamism Composite Index: Top 10 States 2012

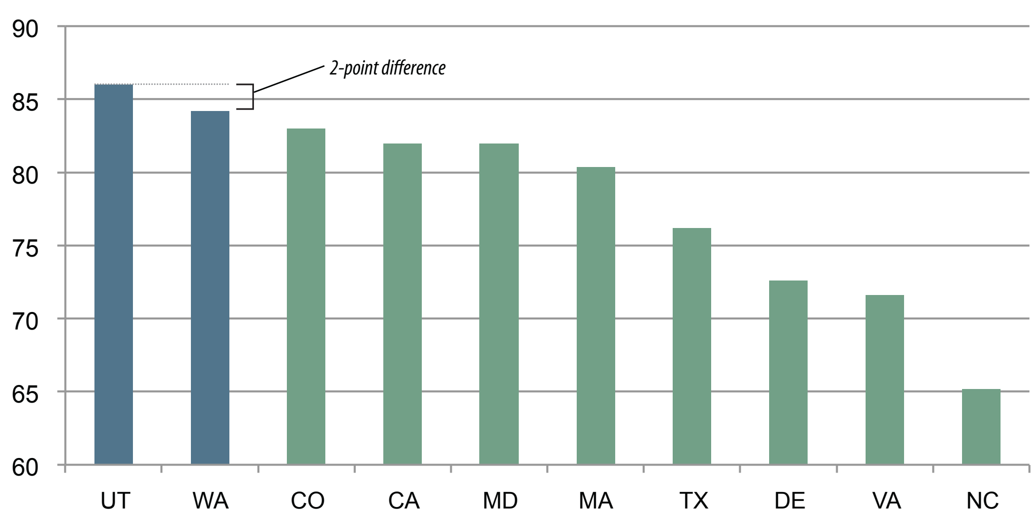


Figure 12. Technology Concentration and Dynamism Composite Index Map: 2012

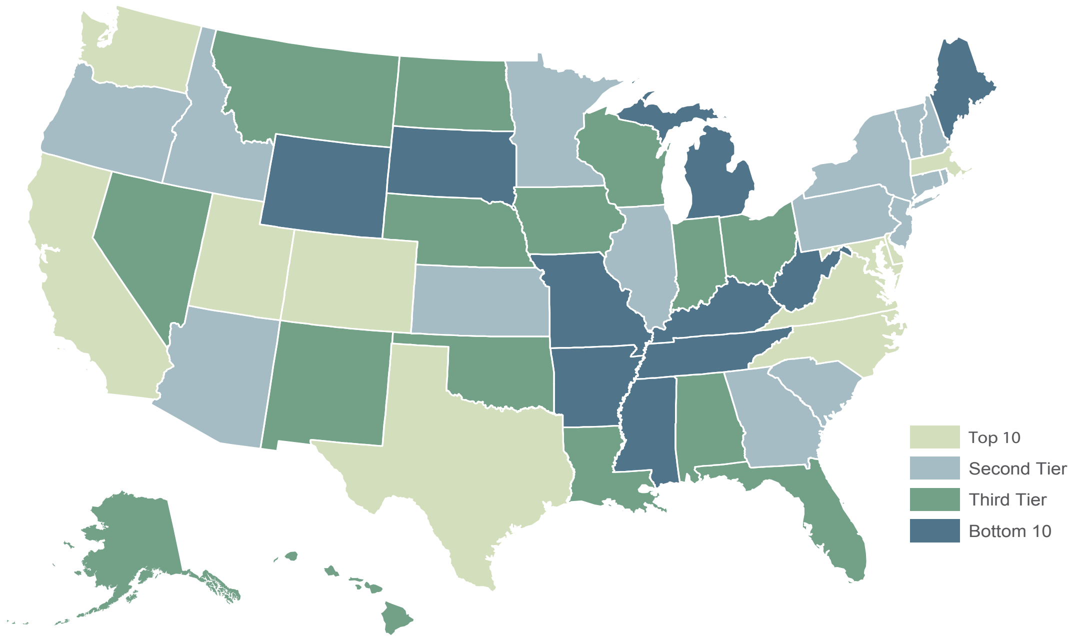


Table 6. Technology Concentration and Dynamism Composite Index: State Rankings 2012

State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score	State	Rank 2012	Rank 2010	Rank change 2010 to 2012	Average Score
Utah	1	1	0	86.00	Florida	26	22	-4	51.20
Washington	2	3	1	84.20	New Mexico	27	17	-10	50.80
Colorado	3	2	-1	83.00	Hawaii	28	28	0	47.80
California	4	5	1	82.00	Alaska	29	29	0	47.00
Maryland	4	5	1	82.00	Indiana	30	29	-1	45.80
Massachusetts	6	7	1	80.40	Montana	30	36	6	45.80
Texas	7	9	2	76.20	Nevada	32	19	-13	45.00
Delaware	8	24	16	72.60	North Dakota	33	41	8	43.60
Virginia	9	4	-5	71.60	Ohio	34	44	10	43.20
North Carolina	10	11	1	65.20	Oklahoma	35	31	-4	42.40
Arizona	11	10	-1	64.80	Louisiana	36	37	1	42.00
Connecticut	12	18	6	64.60	Nebraska	37	33	-4	41.80
Oregon	13	12	-1	64.00	Wisconsin	38	39	1	40.20
Vermont	14	21	7	62.60	Alabama	39	27	-12	39.80
New Jersey	15	15	0	62.00	Iowa	40	43	3	38.60
New Hampshire	16	8	-8	60.60	Michigan	40	46	6	38.60
Illinois	17	26	9	58.80	South Dakota	42	45	3	35.00
Kansas	18	13	-5	58.00	Maine	43	42	-1	34.80
New York	19	23	4	57.40	Missouri	44	32	-12	33.60
Minnesota	20	20	0	55.00	West Virginia	45	49	4	33.00
Georgia	21	14	-7	54.80	Kentucky	46	47	1	32.40
Pennsylvania	21	25	4	54.80	Tennessee	47	34	-13	31.80
Idaho	23	16	-7	54.00	Mississippi	48	40	-8	30.00
Rhode Island	24	34	10	53.00	Wyoming	49	48	-1	25.20
South Carolina	25	38	13	51.80	Arkansas	50	50	0	24.20

Appendix

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)
SBIR Awards per 10,000 Businesses (Phase II)	NSF, EPSCoR
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	Thomson Financial
VC Investment in Clean Technology as Percent of GSP	Thomson Financial
Sum of Equity Invested in Green Tech per $100,000 GSP	Thomson Financial
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 PhDs	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 PhDs Awarded	NSF, Division of Science Resources Studies
Science, Engineering, and Health Postdoctorates 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 Degrees in Science and Engineering	NSF, Division of Science Resources Studies
Recent Master's Degrees in Science and Engineering	NSF, Division of Science Resources Studies
Recent PhD Degrees 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	Current Population Survey, U.S. Census Bureau
Percentage of Households With Internet Access	Federal Communications Commission
Technology and Science Workforce	
Intensity of Computer and Information Scientists	Bureau of Labor Statistics, Milken Institute
Intensity of Computer Programmers	Bureau of Labor Statistics, Milken Institute
Intensity of Software Engineers	Bureau of Labor Statistics, Milken Institute
Intensity of Computer Support Specialists	Bureau of Labor Statistics, Milken Institute
Intensity of Computer Systems Analysts	Bureau of Labor Statistics, Milken Institute
Intensity of Database and Network Administrators	Bureau of Labor Statistics, Milken Institute
Intensity of Agricultural and Food Scientists	Bureau of Labor Statistics, Milken Institute
Intensity of Biochemists and Biophysicists	Bureau of Labor Statistics, Milken Institute
Intensity of Microbiologists	Bureau of Labor Statistics, Milken Institute
Intensity of Medical Scientists	Bureau of Labor Statistics, Milken Institute
Intensity of Physicists	Bureau of Labor Statistics, Milken Institute
Intensity of Other Life and Physical Science Occupations	Bureau of Labor Statistics, Milken Institute
Intensity of Electronics Engineers	Bureau of Labor Statistics, Milken Institute
Intensity of Electrical Engineers	Bureau of Labor Statistics, Milken Institute
Intensity of Computer Hardware Engineers	Bureau of Labor Statistics, Milken Institute
Intensity of Biomedical Engineers	Bureau of Labor Statistics, Milken Institute
Intensity of Agricultural Engineers	Bureau of Labor Statistics, Milken Institute
Intensity of Other Engineers	Bureau of Labor Statistics, Milken Institute
Technology Concentration and Dynamism	
Percent of Businesses in High-Tech NAICS Codes	Bureau of Labor Statistics, Milken Institute, U.S. Census Bureau
Percent of Employment in High-Tech NAICS Codes	Bureau of Labor Statistics, Milken Institute, U.S. Census Bureau
Percent of Payroll in High-Tech NAICS Codes	Milken Institute, U.S. Census Bureau
Percent of Business Births in the High-Tech Sector	U.S. Census Bureau
Net Formation of High-Tech Establishments	U.S. Census Bureau
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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ON THE WEB

Data for each state can be found at **www.statetechandscience.org**

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