The Annual Index of the Massachusetts Innovation Economy **2021 Edition**

THE INNOVATION INSTITUTE
at the MassTech Collaborative

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About the Index

The Index of the Massachusetts Innovation Economy has been published by the Massachusetts Technology Collaborative annually since 1997. *The Index* is the premier fact-based benchmark for measuring the performance of the Massachusetts innovation economy.

Massachusetts Technology Collaborative

The Massachusetts Technology Collaborative, or MassTech, is a unique state agency working to strengthen the Commonwealth's position as the leading hub for innovation and entrepreneurship. MassTech serves as a catalyst, convener, project manager, researcher, and partner within the technology community on behalf of state government, driving job growth and statewide economic impact.

Our focus is on Cluster Development & Ecosystem Support, Talent Support & Workforce Development, and Business Assistance for Technology Firms.

Through our three major divisions - the Innovation Institute, the Massachusetts eHealth Institute (MeHI), and the Massachusetts Broadband Institute (MBI) - MassTech is fostering innovation and helping shape a vibrant economy.

We develop meaningful collaborations across industry, academia and government which serve as powerful catalysts, helping turn good ideas into economic opportunity.

We accomplish this in three key ways, by:

- FOSTERING the growth of dynamic, innovative businesses and industry clusters in the Commonwealth, by accelerating the creation and expansion of firms in technology-growth sectors;
- ACCELERATING the use and adoption of technology, by ensuring connectivity statewide and by promoting competitiveness; and
- HARNESSING the value of effective insight by supporting and funding impactful research initiatives.

Welcome to the 2021 Edition of the "*Index of the Massachusetts Innovation Economy*." For 25 years, the *Index* has provided an important benchmark for the performance and growth of the Commonwealth's Innovation Economy, which accounts for nearly 40% of jobs in our state. Access to these data and insights inform our approach to economic development, as we work to build an inclusive and vibrant economy in all regions of the Commonwealth.

The COVID-19 pandemic resulted in one of the largest economic disruptions in our history. In spring 2020, the Commonwealth saw a decline of 791,000 jobs and the unemployment rate reached 16.4%, higher than what we saw at the peak of the Great Recession in 2009-2010. It cannot be overstated how deeply the virus impacted our state, our country, and the world, not just in economic disruption but in the human impact as well.

Finding the appropriate balance between public health mitigation measures and reopening the economy, paired with the extensive uptake of vaccinations by residents (in many cases using vaccines designed or made in Massachusetts), allowed the Commonwealth to stabilize and grow the economy while combating the spread of the virus. As of December 2021, the unemployment rate had fallen to 3.9%, a feat that took nearly 7 years following the Great Recession.

Many businesses, especially in our Innovation Economy, were able to successfully move to remote work, and, as you will see in this year's *Index*, critical inputs such as research activity and capital investment have continued to grow, which bodes well for the future. While the Commonwealth's economy is poised to return to its pre-pandemic strength, more work remains to address a shortage of skilled talent, a gap in equity and diversity, and a high cost of living, especially housing. The Baker-Polito Administration continues to put resources and thought leadership toward addressing these challenges, and leveraging Massachusetts' core strengths to usher in a more equitable recovery and future.

Thank you for your interest in the *Index* and the performance of the Massachusetts Innovation Economy. We encourage you to explore the data to see why Massachusetts remains the best state for innovation and be an active participant in the conversations on how to make an ever more competitive, innovative and inclusive Commonwealth.

Mike Kennealy
Secretary of Housing and Economic Development

Introduction

Massachusetts is home to one of the strongest innovation economies in the world. Three key resources - talent, research activity, and access to capital - are the main drivers of the Commonwealth's Innovation Economy. These resources enable the transformation of basic research and new ideas into innovative products, services, and business models that serve as catalysts for economic growth and high-paying jobs. The COVID-19 Pandemic has demonstrated that the Innovation Economy provides more than just an economic engine. Countless lives have been saved by vaccines developed in Massachusetts, while institutions such as CIC Health and the Broad Institute created systems for the large scale administration of vaccines and for testing, efforts that have kept society functioning.

The Commonwealth offers one of the most attractive environments for innovation in the world, due to the factors described above, an advantage that is hard to replicate. However, Massachusetts cannot afford to be complacent in its success, as it faces rising competition for newly- mobile talent and business from established innovation clusters in regions like Silicon Valley and New York City, as well as fast growing states, such as North Carolina and Texas. The emergence of remote work presents another challenge as the Commonwealth competes to attract people and companies that in many cases can choose to live and work from any connected location in the world. Internal challenges, such as the rising cost of housing and aging infrastructure, create obstacles to the Commonwealth's continued success as an innovation hub.

On the pages that follow, the *Index of the Massachusetts Innovation Economy* examines the factors that make Massachusetts a global hub of innovation, how the Commonwealth's performance compares to the Leading Technology States (LTS), and the challenges Massachusetts faces to maintain its leading position.

The COVID-19 pandemic has impacted all three pillars of the Massachusetts Innovation Economy and resulted in unprecedented disruption to the Commonwealth's overall economy. However, Massachusetts entered the pandemic in a strong position relative to its competitors among the LTS and early indicators do not signal a permanent impairment of the Commonwealth's Innovation Economy. Below we summarize several key takeaways from the current Index in four key areas: Talent, Research, Capital, and Economic Impact.

TALENT

The Commonwealth's education system was disrupted from top to bottom in 2020, with widespread closures of K-12 schools, colleges, and universities, and an unprecedented shift to virtual learning at scale. Massachusetts is by no means unique in this regard as COVID-19 impacted education systems around the U.S. and the world. For those already in the workforce, the shift to remote work in a number of industries put at risk regional labor pools that enable the growth of innovation clusters in Massachusetts. 82% of companies surveyed by the Massachusetts Competitiveness Partnership plan to allow employees to work remotely at least some of the time and 32% plan to allow employees to work either entirely or primarily remotely[1]. More employees are no longer geographically tied to local innovation clusters and can choose to live anywhere with an internet connection. This means Massachusetts must continue to be a desirable and accessible place for people to live, regardless of where their employer is based.

RESEARCH

The COVID-19 pandemic and the government's response appear to have driven a renewed interest in expanded research funding, and not just for fields related to infectious disease. While it is too soon to say whether this will result in a permanent increase in government investment in research,

[1]https://www.masscompetes.org/covid-survey-june-2021

it represents a welcome shift from the strained research budgets seen post-Great Recession (2009). Patent activity in Massachusetts increased in 2020 (8,790 patents filed) relative to 2019, which was already a record year. Massachusetts also received $271M more in research funding from the National Institutes of Health in 2020 than in 2019. The Commonwealth is not unique in this regard, as all Leading Technology States received more NIH funding in 2020 than 2019, and at a faster growth rate than total NIH research spending.

CAPITAL

Access to capital, at least in aggregate, has not been a problem for the Innovation Economy. The dip in global stock markets and the crunch in access to financing proved limited to the early stages of the pandemic. Venture capital, particularly important to scaling innovation economy companies, set records in Massachusetts and the U.S. in 2020. Venture investment in Massachusetts hit $15.3B in 2020, a 49% increase from 2019. The Commonwealth's 88.2% growth rate in venture investment since 2015 is 4th among the LTS, but significantly faster than any state receiving more than $1B in annual investment in 2015. 2021 is shaping up to be another record breaking year as FinTech firms in Greater Boston alone raised $3.8B[2].

While it is impossible to pin the increase in venture investment on any single factor, the economic response to the pandemic and rapid increase in digital commerce may have played a role in the increased appetite among investors for venture investments in tech firms[3].

ECONOMIC IMPACT

While the pillars of the Commonwealth's Innovation Economy, as of this writing, appear to have come out of the pandemic in relatively good shape, such a large disruption to the global economy inevitably had negative impacts on the Massachusetts economy overall. With the exception of two categories (Biopharmaceuticals & Medical Devices, Scientific, Technical, & Management Services), all Key Sectors in the Massachusetts Innovation Economy experienced job losses in 2020, in some cases quite dramatically such as Post-Secondary Education where employment declined by -7.3% (see page 28). A similar scenario played out among the rest of the LTS as well.

A net 44,000 Massachusetts innovation economy jobs were lost in 2020. While many of these individuals have already been re-employed, a continued focus a swift economic recovery will enable more people to return to the workforce and minimize the long term impacts on employment and career trajectories.

LOOKING FORWARD

The impacts of the pandemic have yet to show up in most of the data collected for the Index. Even in the cases where data is available for 2020, it is too soon to say whether or not trends in employment or venture investment will continue, stabilize, or revert towards the pre-pandemic state of affairs.

However, we do expect the pandemic to have lasting effects on Massachusetts and the Innovation Economy. The degree to which education and employment are accomplished through fully remote environments could have long term effects on the economy in the Commonwealth. A world in which a large fraction of the workforce never uses a physical office, and can access quality higher education without ever setting foot on campus, will look very different from one where in-person education is still highly desirable and most people work from a physical office several days per week. Massachusetts also has strong innovation sectors such as Biotechnology, Healthcare Delivery, and Advanced Manufacturing, where remote work is not possible for many employees.

[2]Greater Boston includes Providence and Portland Metro Areas as well as Southern New Hampshire. $1B of total FinTech capital raised is from IPOs of Flywire and Toast: https://blue-dun.com/boston-fintech-startups-raised-3-8-billion-in-2021/

[3]https://www.reuters.com/business/finance/global-venture-capital-investments-hit-record-high-2021-07-21/

Many jobs in Innovation sectors have been successfully performed remotely for much of the past two years. This opens up new avenues for Massachusetts-based companies to hire the best talent from all over the world, which is particularly beneficial for high growth start-ups that need to scale rapidly. While global access to employees may help accelerate the growth of Massachusetts firms, this also means more jobs that would have been located in Massachusetts pre-pandemic may end up outside the Commonwealth.

Research in emerging technologies such as AI, Robotics, and Quantum Information Sciences is receiving renewed interest at the federal level and these are areas in which the Commonwealth's research institutions and innovative companies have world leading expertise. Commercializing new developments in these and other fields provides an opportunity to power the next decade or more of Innovation Economy growth in Massachusetts.

The rapid rise in venture investment is a welcome development for the Commonwealth, but capital is increasingly available elsewhere, including the rest of the LTS outside the traditional leaders California, New York, and Massachusetts. In the long term, this may lessen the need for high-growth firms to locate in the handful of elite Innovation Ecosystems.

The Massachusetts Innovation Economy has historically proved to be quite resilient to external shocks. Critical inputs for innovation industries such as talent, research, and capital are more abundant in the Commonwealth than in much of the United States and are likely to remain concentrated in certain places post-pandemic. The Commonwealth benefits from a serendipitous combination of anchor institutions and other local assets. This includes state-supported efforts to improve the innovation economy, including the establishment of the Massachusetts Life Sciences Center, a Collaborative R&D Matching Grant Program to increase innovation capacity at research institutions, and support for start-up accelerators and incubators such as MassChallenge. Matched with robust R&D investment from the private sector, Massachusetts has remained a global leader in innovation for many decades and the ongoing pandemic is unlikely to alter that trajectory.

Leading Technology States (LTS)

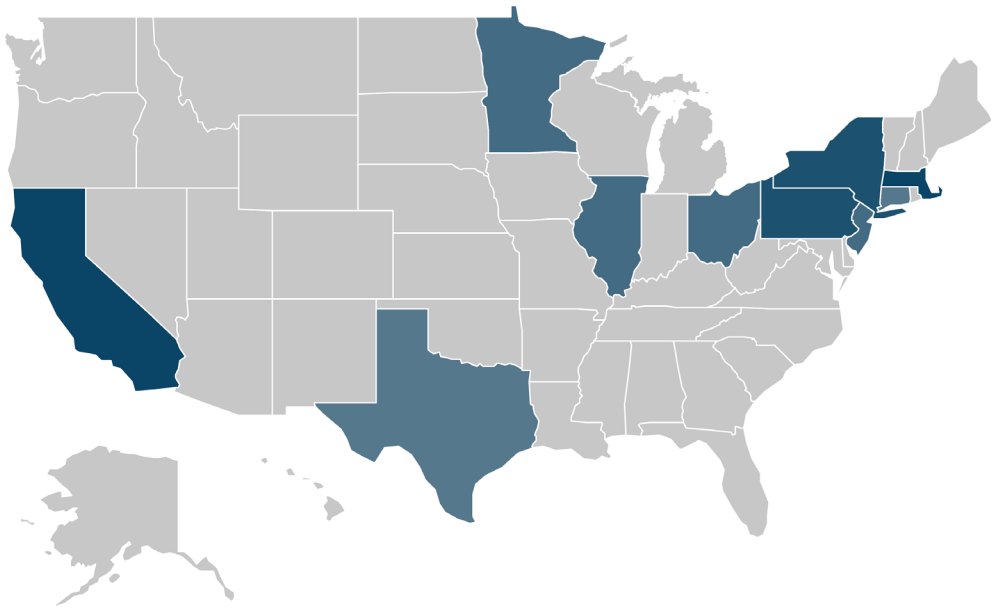
Every year, the *Index* compares Massachusetts' performance on a number of metrics to a group of "Leading Technology States" (LTS). The LTS have economies with a significant level of economic concentration and size in the 11 key sectors that compose the Innovation Economy (IE) in Massachusetts. The *Index* accounts for three metrics deemed representative of not only the intensity of the Innovation Economy, but also the size and breadth of a state's Innovation Economy and evaluates them simultaneously.

Eleven Key Innovation Economy Sectors

- Advanced Materials
- Biopharmaceuticals & Medical Devices
- Business Services
- Computer and Communications Hardware
- Defense Manufacturing and Instrumentation
- Diversified Industrial Manufacturing
- Financial Services
- Healthcare Delivery
- Postsecondary Education
- Scientific, Technical, and Management Services
- Software and Communications Services

2021 Leading Technology States

State	LTS Score
Massachusetts	2.27
California	2.15
Pennsylvania	1.94
New York	1.83
Minnesota	1.47
Ohio	1.47
New Jersey	1.46
Illinois	1.43
Connecticut	1.38
Texas	1.37



The Metrics Used to Select the 2021 LTS

The number of key sectors with significantly above average employment concentration are defined as the number of innovation economy sectors in each state where employment concentration is more than 10% above the national average and is a measure of the breadth of a state's Innovation Economy.

Overall Innovation Economy employment concentration relative to the nation is defined as the percent of a state's workers who are employed in the Innovation Economy relative to the national percentage and is a measure of the overall intensity of a state's Innovation Economy.

Total Innovation Economy employment measures the number of employees who work within one of the Innovation Economy sectors in each state and is a measure of the absolute size of a state's Innovation Economy. A score is then applied to all of the states in order to determine the top 10.

Talent

Talent is the most basic and essential foundation for the Massachusetts Innovation Economy. The Commonwealth is known world-wide for its high-quality public school systems, excellent system of public and private colleges and universities, and innovative workforce development programs that sustain and improve the state's well-educated workforce. These strengths are frequently cited as main reasons that businesses choose to locate and grow in Massachusetts. Access to top notch intellectual, technical, and managerial talent allows innovative companies of all sizes to develop ground-breaking products and services in Massachusetts.

PUBLIC COMMITMENT TO EDUCATION

Development of talent in Massachusetts begins with a strong commitment to high-quality K-12 education. Investments in elementary, middle, and high schools are critical for preparing an innovation ready workforce. The Commonwealth's strong education systems help to attract and retain workers who want excellent educational opportunities and skills for themselves and their children.

Per Pupil Spending[1]
Public Elementary/Secondary School Systems
Massachusetts, LTS & U.S., 2019

State	2014 Per Pupil	2018 Per Pupil Spending	2019 Per Pupil	2014 - 2019 % Growth	2018 - 2019 % Growth
New York	$25,496	$29,104	$30,198	18.4%	3.8%
Connecticut	$22,490	$23,808	$24,957	11.0%	4.8%
New Jersey	$22,434	$23,121	$23,905	6.6%	3.4%
Pennsylvania	$18,824	$21,067	$21,461	14.0%	1.9%
Massachusetts	$19,560	$21,219	$21,168	8.2%	-0.2%
Illinois	$16,129	$19,235	$19,225	19.2%	0.0%
California	$12,266	$14,912	$17,074	39.2%	14.5%
Minnesota	$14,967	$16,054	$16,522	10.4%	2.9%
U.S.	$13,963	$15,254	$15,844	13.5%	3.9%
Ohio	$15,303	$15,796	$15,726	2.8%	-0.4%
Texas	$11,618	$12,497	$13,036	12.2%	4.3%

KEY TAKEAWAYS

- **Massachusetts invested $21,168 in K-12 education per pupil (#5 in LTS).**
- **Investment in K-12 education per pupil increased by 8.2% from 2014 to 2019.**
- **The Commonwealth's investment in education delivers results. Massachusetts ranks #1 among LTS in 4th and 8th grade science, being tied for 1st in 8th grade scores in 2015, and #2 in 4th Grade Math and #1 in 8th Grade Math in 2019 according to the National Assessment of Educational Progress (NAEP).**

4th Grade Science Performance[3]
MA, U.S., & LTS, 2009 & 2015 (Out of 300)

State	2009	2015
California	136	140
Connecticut	156	154
Illinois	148	151
Massachusetts	160	161
Minnesota	158	157
New Jersey	155	155
New York	148	150
Ohio	157	157
Pennsylvania	154	-
Texas	148	155
United States	149	153

8th Grade Science Performance[3]
MA, U.S., & LTS, 2009 & 2015 (Out of 300)

State	2009	2015
California	137	143
Connecticut	155	155
Illinois	148	150
Massachusetts	160	162
Minnesota	159	162
New Jersey	155	156
New York	149	150
Ohio	158	157
Pennsylvania	154	-
Texas	150	156
United States	149	153

4th Grade Math Performance[3]
MA, U.S., & LTS, 2009, 2015, 2019 (Out of 500)

State	2009	2015	2019
California	232	232	235
Connecticut	245	240	243
Illinois	238	237	237
Massachusetts	252	251	247
Minnesota	249	250	248
New Jersey	247	245	246
New York	241	237	237
Ohio	244	244	241
Pennsylvania	244	243	244
Texas	240	244	244
United States	239	240	240

8th Grade Math Performance[3]
MA, U.S., & LTS, 2009, 2015, 2019 (Out of 500)

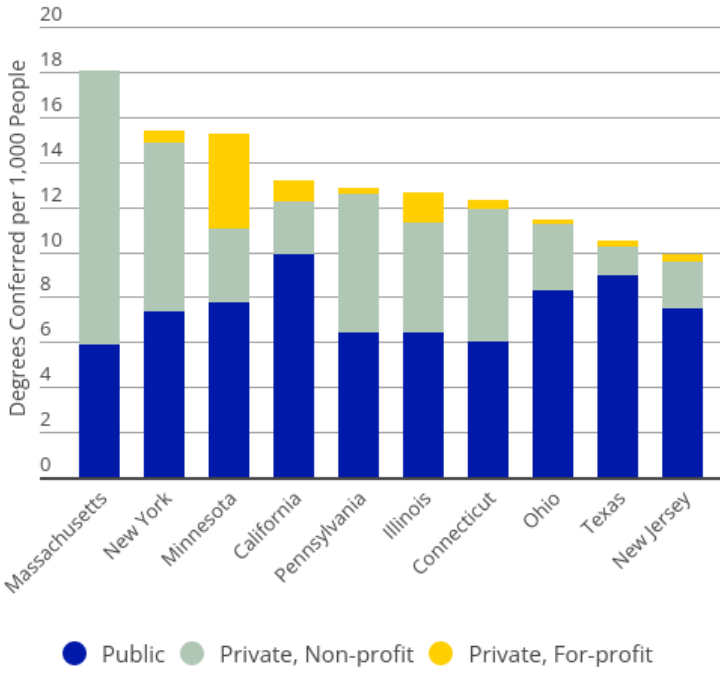
State	2009	2015	2019
California	270	275	276
Connecticut	289	284	286
Illinois	282	282	283
Massachusetts	299	297	294
Minnesota	294	294	291
New Jersey	293	293	292
New York	283	280	280
Ohio	286	285	286
Pennsylvania	288	284	285
Texas	287	284	280
United States	282	281	281

Massachusetts will further strengthen its K-12 education system through the expansion of Innovation Pathways programs that provide industry relevant training to high school students in high demand innovation driven industries such as advanced manufacturing and robotics. These and other programs at the Commonwealth's vocational technical high schools will expand access and opportunity to career pathways in innovation sectors both for those who do or do not wish to pursue post-secondary education.

POST-SECONDARY EDUCATION

As intended, the Commonwealth's performance in education extends into the post-secondary level where colleges and universities train many of the skilled workers fueling the growth of emerging tech sectors in Massachusetts. The Commonwealth continues to stand out as a leader in both the training of college educated workers and the proportion of its workforce with college degrees. While college degrees are not the only signifier of valuable innovation economy skills, they are a reliable historical metric that provides a useful gauge for prevalence of these skills in a state, and colleges and universities remain a core component of the talent pipeline.

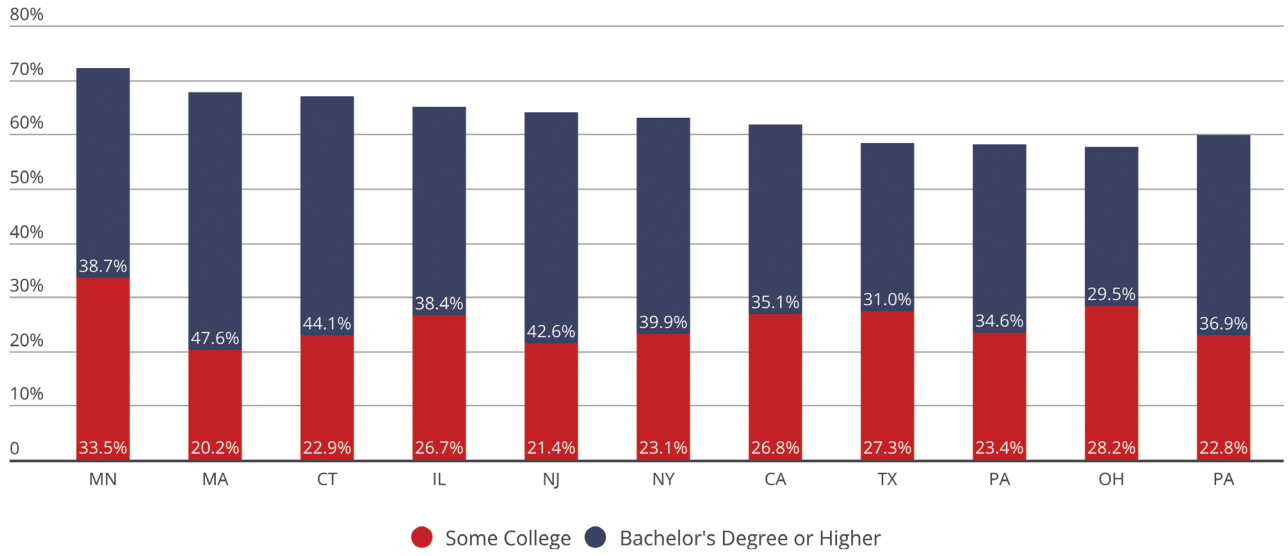
Post-Secondary Degrees Conferred[5]
Per 1,000 people
Massachusetts & LTS, 2018-2019



KEY TAKEAWAYS

- **Massachusetts leads in training knowledge workers. The Commonwealth has the highest number of degrees conferred per capita among the LTS (18.1 per 1,000 Residents).**
- **Massachusetts continues to have a highly educated workforce. 47.6% of the workforce has at least a bachelors degree, higher than any other state and well above the U.S. average of 34.4% and the LTS average of 36.2%.**
- **Massachusetts has increased higher education investment per student at a higher rate than any LTS aside from California, with appropriations per student up 29.4% since 2015.**

Educational Attainment of Working Age Population[5]
Massachusetts, LTS, & U.S.,
Three-Year Rolling Average, 2016-2018

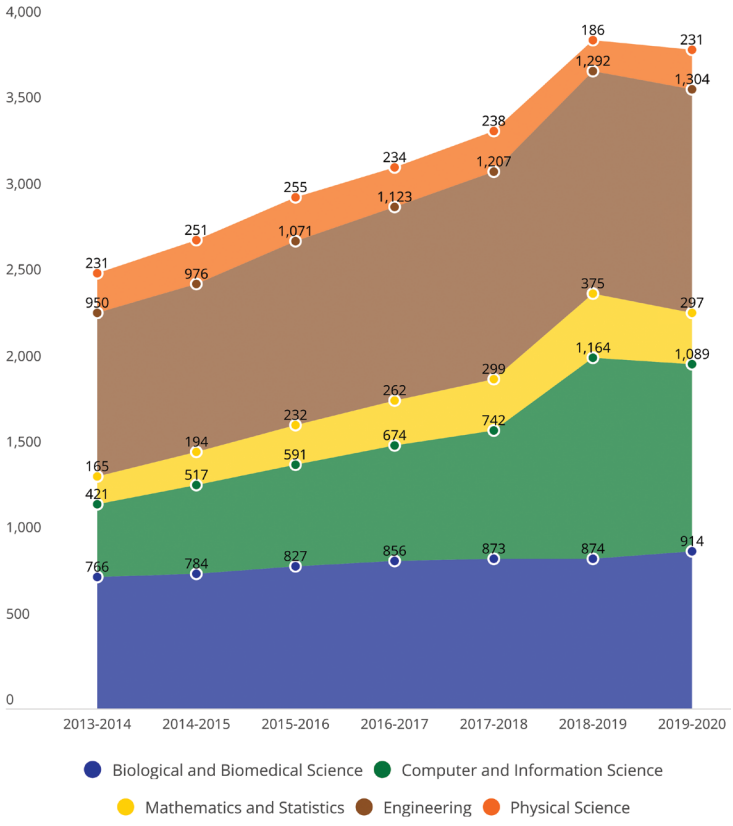


State Higher Education Appropriations[2] Per Full-Time Equivalent Student
Massachusetts, LTS, & U.S., 2015-2020

State	State Educational Appropriations per Students 2020	2015-2020 % Change
California	$ 11,425	29.7%
Connecticut	$ 14,449	9.9%
Illinois	$ 15,930	19.0%
Massachusetts	$ 10,465	29.4%
Minnesota	$ 7,608	27.4%
New Jersey	$ 8,624	10.3%
New York	$ 12,215	26.1%
Ohio	$ 5,686	11.0%
Pennsylvania	$ 5,428	29.1%
Texas	$ 7,425	11.9%
U.S.	$ 8,636	22.2%

STEM education is a critical driver of the Massachusetts innovation economy as it provides skills that increase business productivity, leads to the creation of new technologies and high-growth companies, and establishes the basis for higher-paying jobs. STEM degree holders also provide value beyond the tech sector, as more than 72% of graduates with STEM degrees work in non-STEM occupations[1]. Demand for innovation in industries across the economy will continue to blur the line between STEM and non-STEM skill sets.

Massachusetts STEM Completions[4] Per 1 Million Residents 2013-2014 to 2019-2020

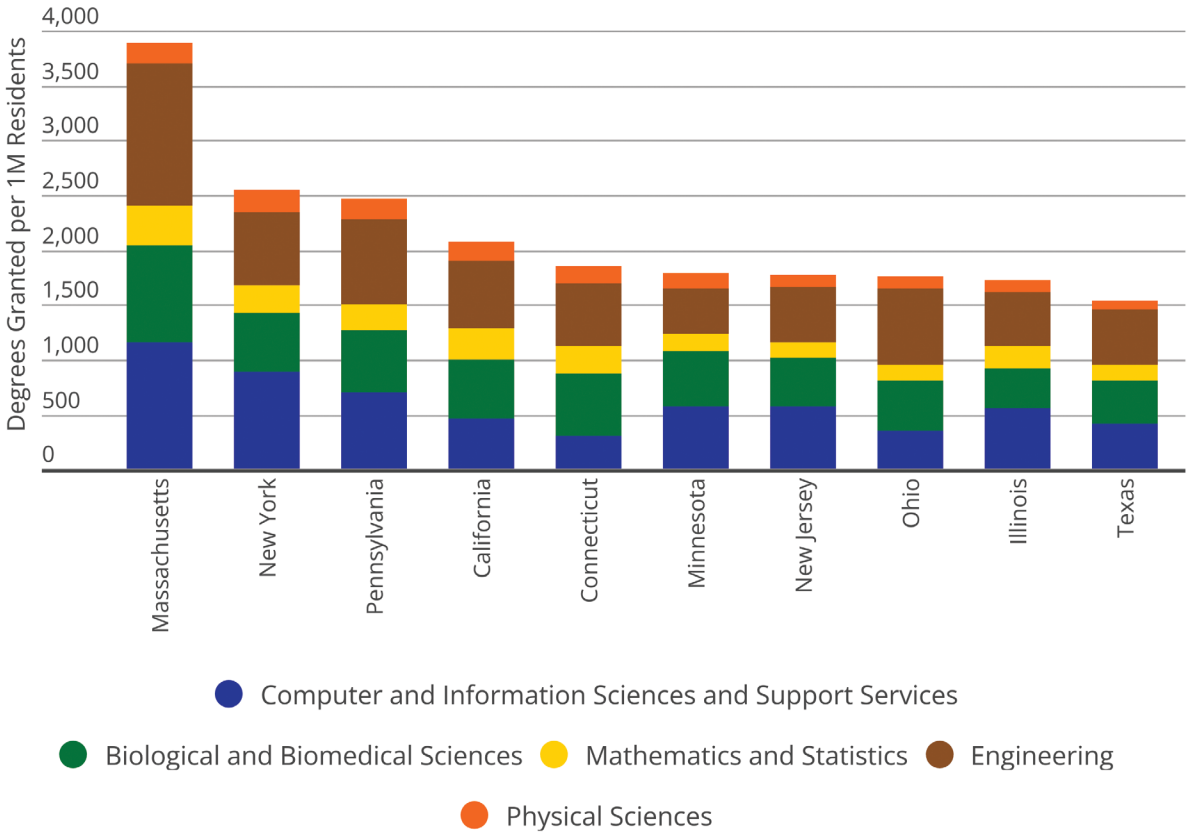


KEY TAKEAWAYS

- **The Commonwealth continues to lead in training new STEM talent and has expanded the STEM talent pipeline.**
  - **Massachusetts had the highest rate of STEM degree completions per capita among the LTS (3,835/ per M residents) in the 2019-2020 school year.**
  - **STEM Degree completions per million residents have grown in Massachusetts by 39.6% since the 2014-2015 school year, #2 in the LTS. However, STEM completions declined slightly during 2020, possibly due to the pandemic. California is #1 with a 42.5% increase.**

[1]https://www.census.gov/library/stories/2021/06/does-majoring-in-stem-lead-to-stem-job-after-graduation.html

Degrees Granted in STEM Fields[4]
All Degree Levels
Per 1 Million Residents, Massachusetts & LTS, 2019-2020



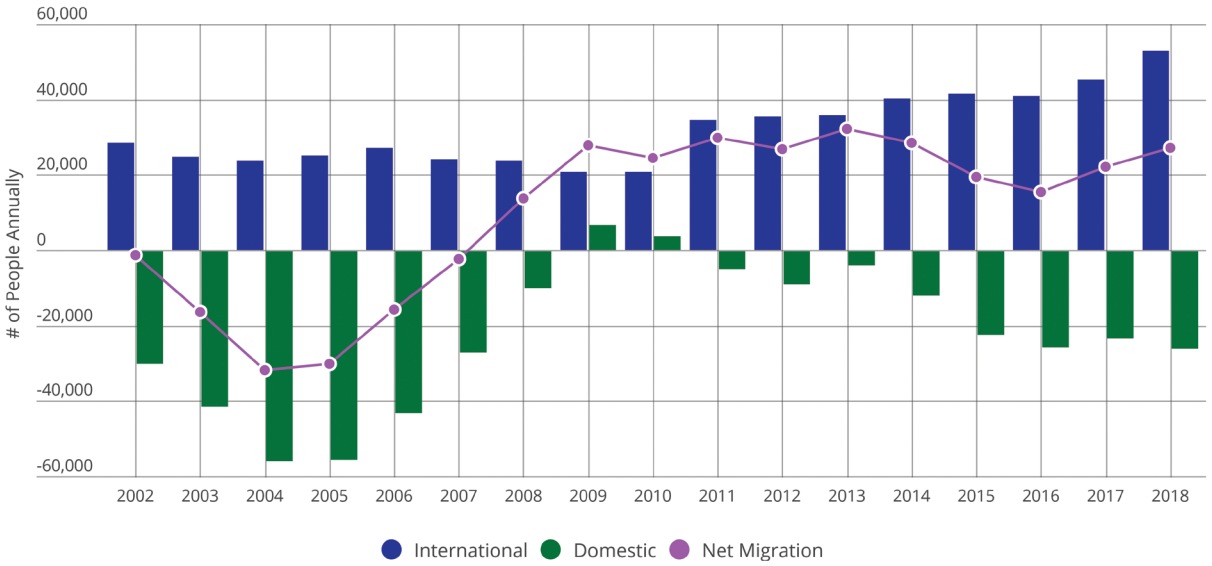
REFRESHING THE TALENT PIPELINE

Talent has been a primary factor in the attractiveness of Massachusetts for new business development and a driver of the state's strong innovation economy. Investments in post-secondary education are critical to increase the ability of public academic institutions and non-degree training programs to prepare students for skilled and well-paying employment. In addition, well-regarded public higher education programs enhance Massachusetts' distinctive ability to attract students from around the globe, many of whom choose to work in the Commonwealth after graduation. Migration patterns are a key indicator of a region's attractiveness. Regions that are hubs of innovation have high concentrations of educated, highly-skilled workers and dynamic labor markets that are refreshed by inflows of talent. In-migration of well-educated individuals fuels innovative industries with an infusion of diverse and high-demand skill sets. Since 2010, international migration, people moving here from out of the country, has more than offset domestic out-migration, people moving within the country. Prior to the pandemic, Massachusetts had seen much less domestic out-migration since 2010 than it did in the years preceding the Great Recession, while international migration had increased as well. This indicates that Massachusetts was becoming a more attractive place to live and to work over the last decade, despite challenges with housing costs and transportation infrastructure.

The population of Massachusetts also grew faster during the 2010s than any other New England state and achieved the 2nd highest growth rate of any northeastern state, trailing only Delaware.

The pandemic was a major disruption to migration patterns seen during the past decade, with the international border all but closed to the new arrivals who account for so much of the Commonwealth's growth. While we do not yet have updated data, we do expect that there will be a marked change from what is shown in the chart below. It is still too early to know how long this new pattern will last or whether it will revert to historical trends, but will be among the most important data to monitor going forward.

Domestic & International Migration[6]
Massachusetts, 2002-2018



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
International	28,517	24,961	23,944	25,220	27,123	24,226	23,643	20,866	20,659	34,572	35,460	35,960	40,091	41,526	40,898	45,298	53,013
Domestic	-29,936	-41,300	-55,788	-55,426	-42,821	-26,666	-9,799	6,843	3,720	-4,679	-8,675	-3,709	-11,569	-22,087	-25,606	-23,089	-25,755
Net Migration	-1,419	-16,339	-31,844	-30,206	-15,698	-2,440	13,844	27,709	24,379	29,893	26,785	32,251	28,522	19,439	15,292	22,209	27,258

MAXIMIZING THE ECONOMIC POTENTIAL OF THE WORKFORCE THROUGH EQUAL OPPORTUNITY

Diversity is another important metric for talent in an innovation ecosystem as unequal representation in innovation-oriented occupations (represented by "Computer, Engineering, and Science Occupations") may indicate that not all people have the same opportunity to participate in the innovation economy.

Tech industry leadership has repeatedly stated the goal of increasing the diversity of their workforce on the grounds of fairness, but also the strong business case that a more diverse workforce leads to increased creativity, more innovation, enhanced consumer understanding, richer brainstorming, and better decision making.

Demographics of Individuals in the Workforce, All Occupations[7]
Massachusetts, 2015-2019

Demographic	2015	2016	2017	2018	2019
Male	50.8%	50.7%	51.0%	50.7%	50.9%
Female	49.2%	49.3%	49.0%	49.3%	49.1%
White; Not Hispanic or Latino	75.6%	75.3%	74.1%	73.2%	72.5%
Hispanic or Latino	9.6%	9.6%	10.3%	10.7%	11.0%
Asian	6.3%	6.4%	6.6%	6.9%	7.1%
Black or African American	6.9%	6.9%	7.4%	7.5%	7.6%
Some Other Race Alone	3.7%	3.9%	3.6%	4.3%	4.2%
Two or More Races	2.1%	2.4%	2.2%	2.7%	2.8%

Demographics of Individuals Holding Computer, Engineering,and Science Occupations[7]
Massachusetts, 2015-2019

Demographic	2015	2016	2017	2018	2019
Male	71.6%	72.3%	71.9%	70.3%	70.6%
Female	28.4%	27.7%	28.1%	29.7%	29.4%
White; Not Hispanic or Latino	73.4%	71.5%	71.7%	69.1%	67.9%
Hispanic or Latino	3.9%	5.0%	5.5%	6.2%	6.1%
Asian	18.6%	18.7%	17.7%	18.6%	20.2%
Black or African American	2.3%	2.8%	3.2%	4.0%	3.7%
Some Other Race Alone	1.0%	1.8%	1.5%	1.6%	1.7%
Two or More Races	2.1%	2.0%	1.8%	2.7%	2.5%

KEY TAKEAWAYS

- **The Commonwealth's tech workforce is not representative of the demographics of the workforce in general. However, it has become somewhat more diverse over the last five years. As of 2019:**
  - **29% of the tech workforce is female, vs. 49.1% of all occupations.**
  - **6.1% of the tech workforce identifies as Hispanic or Latino, vs 11% of all occupations.**
  - **3.7% of the tech workforce identifies as Black or African American, vs 7.6% of all occupations.**
  - **The share of the tech workforce for the above groups grew faster than their share of all occupations from 2015-2019.**

Research

The second key pillar of the Massachusetts Innovation Economy is research activity. The Commonwealth benefits from a dense network of research universities and institutes performing cutting-edge science and blazing new trails in transformative fields such as artificial intelligence, biotechnology, quantum computing, and robotics. Research & Development (R&D) performance is an indicator of the size and health of the science and technology enterprise. Although not all new ideas or products emerge from defined R&D efforts, R&D performance provides a basis for estimating a region's general capacity for innovation & knowledge creation.

RESEARCH & DEVELOPMENT FUNDING ENABLES NEW DISCOVERIES

R&D occurs across the economy in a mix of entities that contribute to an innovative and diverse ecosystem. R&D entities are referred to as "performers" and fall into five categories: federal R&D, federally funded R&D centers, business R&D, university R&D, other non-profits R&D, and state internal.

Total R&D Expenditures[8]
MA, LTS, & U.S., 2013 & 2018

State	2013 Total R&D Expenditure	2018 R&D Expenditure	% Change 2013-2018	2018 R&D as a % of GDP
Massachusetts	$26,806	$36,430	35.9%	6.19
California	$116,295	$169,494	45.7%	5.53
New Jersey	$17,639	$23,582	33.7%	3.73
Connecticut	$10,137	$9,125	-10.0%	3.16
U.S. total	$506,722	$624,874	23.3%	2.91
Minnesota	$8,716	$9,015	3.4%	2.35
Pennsylvania	$16,379	$18,023	10.0%	2.25
Ohio	$12,403	$14,715	18.6%	2.11
Illinois	$18,811	$17,650	-6.2%	1.98
Texas	$24,098	$28,058	16.4%	1.52
New York	$20,686	$26,622	28.7%	1.51

Distribution of R&D by Performer[8]
MA & LTS, 2018

State	Federal R&D	Federally Funded R&D Centers	Business R&D	Universities and Colleges R&D	Other Nonprofits R&D	State, Internal
U.S.	6.07%	3.56%	73.53%	12.36%	1.39%	0.11%
California	1.30%	3.93%	87.91%	6.19%	0.62%	0.05%
Connecticut	0.23%	0.00%	84.60%	14.54%	0.38%	0.26%
Illinois	1.09%	6.46%	77.00%	15.01%	0.43%	0.01%
Massachusetts	1.13%	5.00%	77.21%	11.49%	5.15%	0.02%
Minnesota	0.48%	0.00%	84.69%	11.44%	3.40%	0.01%
New Jersey	5.04%	0.36%	88.54%	5.94%	0.12%	0.01%
New York	1.16%	2.14%	67.83%	25.69%	2.25%	0.93%
Ohio	13.94%	0.00%	67.58%	16.60%	1.81%	0.06%
Pennsylvania	2.54%	0.82%	69.24%	25.20%	2.16%	0.04%
Texas	1.71%	0.02%	76.91%	20.74%	0.62%	0.01%

KEY TAKEAWAYS

- **The Commonwealth continues to be a national leader in R&D performance, landing among the top states in terms of total R&D investment, intensity of R&D investment, and growth of R&D investment.**
- **Massachusetts attracts more R&D investment ($36B in 2018) than any state aside from California.**
- **R&D investment is equivalent to 6.19% of the Commonwealth's GDP (2nd Nationally).**
- **35.9% growth in R&D investment in Massachusetts since 2013 (2nd amongst LTS).**
- **Most R&D in all LTS is performed by industry (77.21% in Massachusetts, slightly lower than the LTS Average of 81.94%).**

KEY TAKEAWAYS

- **Massachusetts is a leading hub for healthcare related research.**
  - **$3.3B in 2020 National Institutes of Health (NIH) funding in Massachusetts (second among LTS).**
  - **$5,659 of NIH funding per $1 million GDP, (1st in LTS).**
  - **11 research institutions in Massachusetts received more than $100M in NIH funding in 2020.**

Massachusetts Research Organizations Receiving $100M+ in NIH Funding[15]
2020

Organizations Receiving $100M+ in NIH Funding	Awards	Funding
Massachusetts General Hospital	999	$551,214,295
Brigham and Women's Hospital	613	$327,644,200
University of Massachusetts Medical School Worcester	349	$294,146,927
Boston Children's Hospital	381	$209,484,975
Broad Institute, Inc.	103	$191,864,802
Harvard Medical School	350	$178,569,161
Dana-Farber Cancer Institute	272	$174,094,914
Boston University Medical Campus	308	$164,685,352
Harvard School of Public Health	179	$146,629,556
Beth Israel Deaconess Medical Center	245	$135,941,803
Massachusetts Institute of Technology	247	$113,554,200

National Institutes of Health (NIH) R&D Funding per $1 million GDP[15]

Massachusetts & LTS, 2019-2020

State	$ Value 2019	2019 Awards	2019 Award $ per GDP	$ Value 2020	2020 Awards	2020 Award $ Per GDP	% Change in $	% Change in Awards
CA	$4,591,581,664	8,558	$1,504	$4,996,305,832	8,900	$1,661	8.8%	4.0%
CT	$603,000,869	1,292	$2,093	$683,555,538	1,385	$2,473	13.4%	7.2%
IL	$1,012,456,813	2,200	$1,137	$1,130,299,723	2,285	$1,317	11.6%	3.9%
MA	$3,024,098,902	5,548	$5,097	$3,295,948,531	5,654	$5,659	9.0%	1.9%
MN	$619,407,697	1,224	$1,617	$682,750,216	1,252	$1,827	10.2%	2.3%
NJ	326,693,586	666	$511	$352,260,571	680	$569	7.8%	2.1%
NY	$2,891,776,354	5,681	$1,627	$3,187,154,703	6,081	$1,848	10.2%	7.0%
OH	$883,089,814	1,899	$1,274	$982,992,962	1,921	$1,451	11.3%	1.2%
PA	$1,944,017,304	3,848	$2,431	$2,040,306,377	4,080	$2,643	5.0%	6.0%
TX	$1,370,180,699	3,056	$735	$1,509,154,057	3,201	$850	10.1%	4.7%
US	$34,647,343,566	61,933	$1,621	$34,963,147,380	62,581	$1,673	0.9%	1.0%

Industry funding of academic research is one measure of the ability to transfer academic research into the commercial market. Industry-university research partnerships may result in advances in technology and industries by promoting research with potential commercial applications. Moreover, university research occurring in projects funded by industry helps educate individuals in areas directly relevant to industry needs.

KEY TAKEAWAYS

- **Massachusetts has increased its share of total U.S. industry funding for academic science and engineering (S&E) research by 37.2% from 2014-2019.**
- **The Commonwealth receives the 2nd highest share of academic S&E research funding from Industry among the LTS.**

Industry Share of States' Total Academic R&D Funding in Science & Engineering[9]
Massachusetts & LTS, 2019

State	Industry Share of States' Total Academic R&D Funding in S&E
Ohio	9.18%
Massachusetts	7.56%
Texas	7.31%
New York	6.89%
California	6.71%
Illinois	6.62%
Pennsylvania	6.40%
Connecticut	6.27%
New Jersey	5.01%
Minnesota	4.95%

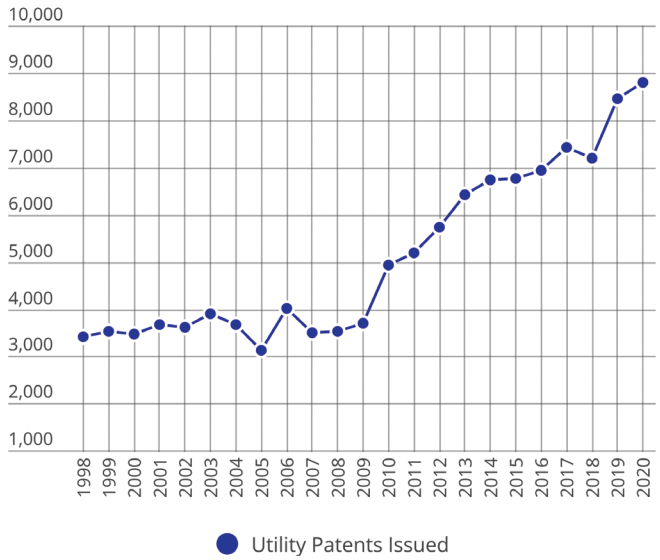
INTELLECTUAL CAPITAL FUELS COMMERCIALIZATION AND COMPANY GROWTH

Utility patents provide a gauge of the innovation and idea generation quality present in an economy. High levels of patenting activity indicate an active R&D enterprise combined with the capacity to codify and translate research into ideas with commercial potential. While not all utility patents turn into new products, these are where many new products or new versions of existing products or services come from. In many cases patented technology forms the basis for the creation of new businesses.

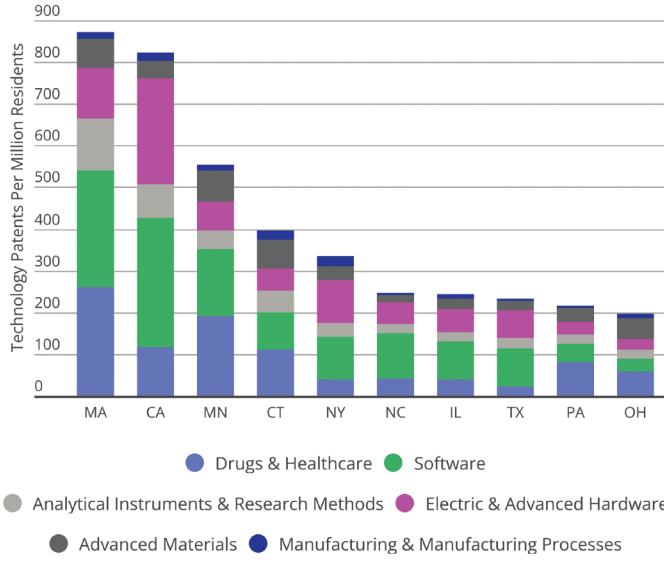
Technology Patents are a subset of utility patents in fields that align with the innovation sectors tracked by the Index. These patents are thought to be of particularly high value for business growth.

Academic articles are an indicator of research activity at very early stages and sometimes are the basis for a patented technology that is eventually commercialized.

Utilities Patents Issued[11]
Massachusetts, 1997-2020



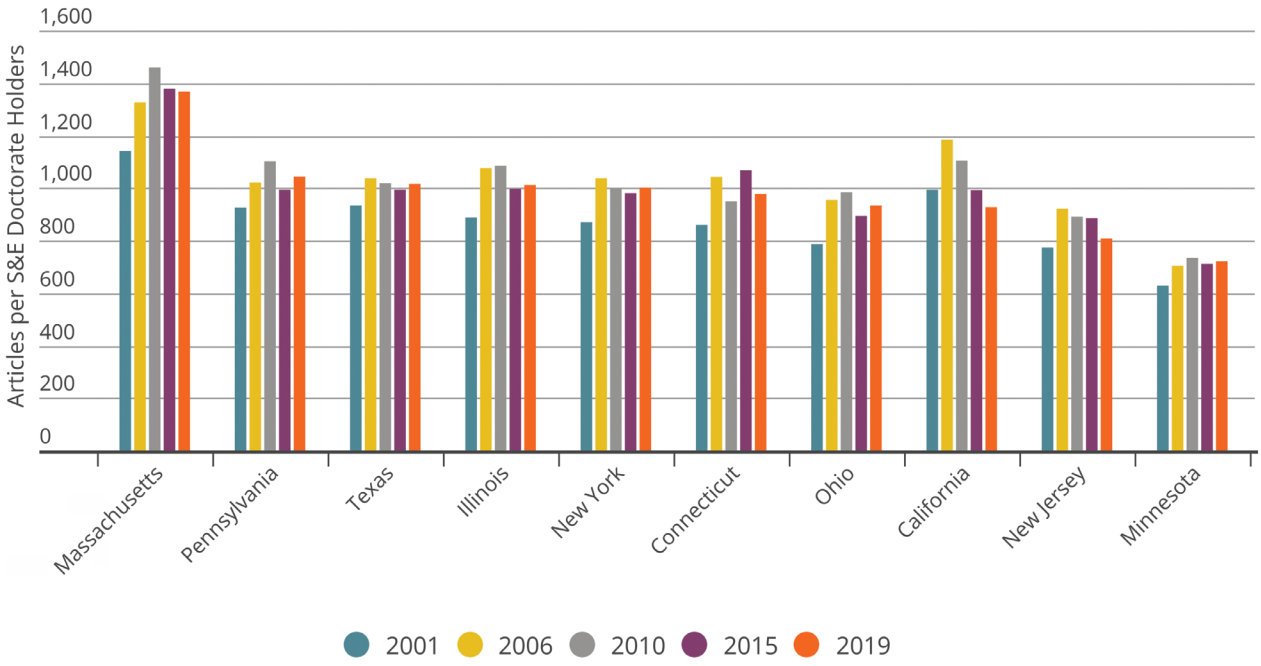
Technology Patents Per Million Residents by Field[12]
Massachusetts & LTS, 2018



KEY TAKEAWAYS

- **8,790 utility patents were issued in Massachusetts in 2020 (4th in the LTS).**
- **Massachusetts is one of the leading producers of patents per capita, with 1,275 utility patents per million residents in 2020 (2nd in the LTS).**
- **The Commonwealth is also the top producer of technology patents among the LTS, with 871 per million residents.**
- **Massachusetts lead the LTS in all categories of technology patents per million residents aside from manufacturing & manufacturing processes.**
- **Massachusetts has led the LTS in Science & Engineering articles produced per 1,000 S&E doctorate holders since 1997, producing 1,367 articles per 1,000 S&E Doctorate holders in academia in 2019, 31.1% more than the 2nd place Pennsylvania.**

Science and Engineering (S&E) Academic Article Output per 1,000 S&E Doctorate Holders[13]
Massachusetts & LTS, 2001, 2006, 2010, 2015, 2019



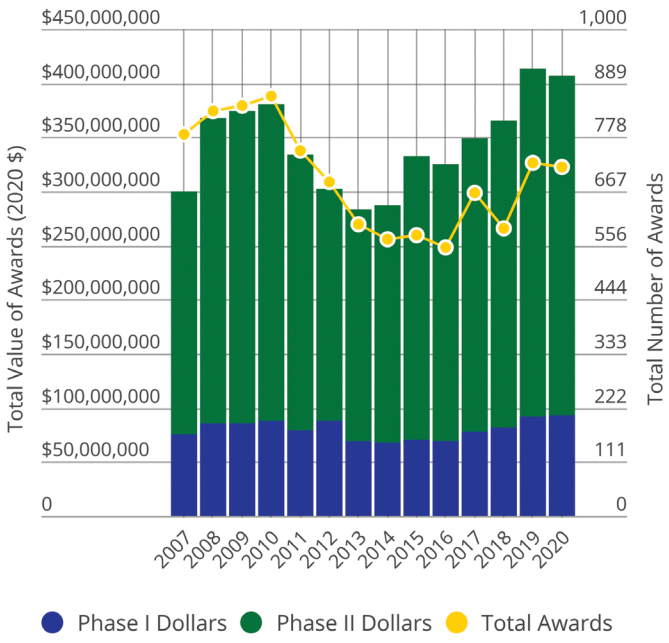
Capital

Capital is the third pillar of the Massachusetts Innovation Economy. While the Commonwealth is a national leader in the quality of its workforce and R&D, it faces fierce competition for these resources. Other states have skilled workforces and/or cutting-edge research institutions, but very few states can combine these assets with access to capital. Capital is the critical factor that allows a skilled workforce to turn cutting-edge research into new or expanded businesses, thereby creating jobs and providing innovative products and services. Access to various sources of capital is important for the growth of innovative businesses whose needs vary at each stage of the growth cycle. Massachusetts performs well across the capital spectrum, from grant funding to seed and early stage investments to growth capital and initial public offerings (IPOs).

SBIR & STTR PROGRAMS ATTRACT PROOF OF CONCEPT CAPITAL

The number and value of Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards that go to the Commonwealth's businesses are excellent indicators of the ability of the R&D in Massachusetts to attract proof of concept (PoC) capital.

SBIR & STTR Awards
Total Number of Awards and Value (by Phase) of Awards Granted[17]
Massachusetts, 2007-2020



Year	Phase I Dollars	Phase II Dollars	Total Awards
2007	$76,013,944	$223,915,437	784
2008	$85,709,130	$282,576,896	833
2009	$86,205,510	$288,707,616	843
2010	$87,960,753	$292,749,291	863
2011	$79,706,880	$254,123,051	752
2012	$88,380,612	$214,184,126	685
2013	$69,538,049	$214,621,340	600
2014	$68,421,310	$218,568,429	569
2015	$69,988,296	$263,038,427	578
2016	$69,002,116	$256,757,524	551
2017	$78,080,365	$271,464,425	665
2018	$82,037,493	$283,249,470	592
2019	$91,827,600	$321,600,917	726
2020	$93,577,862	$313,192,421	717

KEY TAKEAWAYS

- **Massachusetts received the 2nd most SBIR/STTR awards in the nation in 2020 with 717 awards totaling $306.2 million. 1st is California with 1459 grant awards.**
- **Massachusetts received the highest SBIR/STTR award funding relative to GDP, with $525.61 worth of funding per $1 million in GDP. California is #2 with $223.17.**

WHAT IS SBIR/STTR?

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs are highly competitive federal grant programs that enable small companies to conduct proof-of-concept (Phase I) research on technical merit and idea feasibility and prototype development (Phase II) that builds on Phase I findings. Unlike many other federal research grants and contracts, SBIR and STTR grants are reserved for applicant teams led by for-profit companies with fewer than 500 employees. Participants in the SBIR and STTR programs are often able to use the credibility and experimental data developed through their research to design commercial products and to attract strategic partners and investment capital.

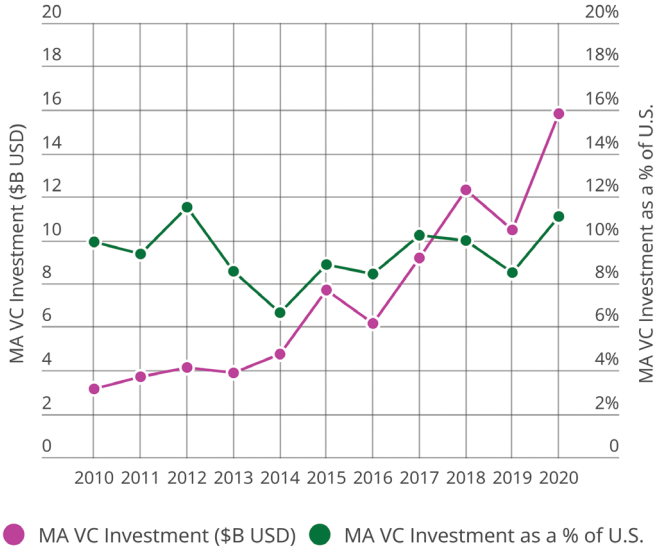
SBIR/STTR Obligation Funding[17]
Massachusetts & LTS, 2020

State	SBIR/STTR Total Obligation Amount	Obligation Amount per $1 Million GDP
MA	$406,770,284	$698
CA	$836,352,299	$278
PA	$162,542,843	$211
OH	$138,680,251	$205
CT	$46,331,964	$168
MN	$54,142,416	$145
NY	$187,825,824	$109
NJ	$63,332,290	$102
TX	$161,498,721	$91
IL	$77,194,993	$90

VENTURE CAPITAL (VC) ACCELERATES THE INNOVATION ECONOMY

The wealth of talent and R&D activity in the state makes Massachusetts an attractive destination for investors. VC firms provide an important source of funds for the creation and development of high-growth companies that accelerate the Massachusetts Innovation Economy.

Venture Capital Investment
Total ($ Billions) & as % of U.S.[18]
Massachusetts, 2010-2020



KEY TAKEAWAYS

- **The Commonwealth's share of US VC investment grew dramatically in 2020, increasing from 8% in 2019 to over 11%. However, this is within the within historical range seen over the last decade.**
- **VC investment in Massachusetts reached a record high in 2020 ($15.8B, a 49.3% increase from 2019 and representing an average annual growth of 32.8% from 2010).**

KEY TAKEAWAYS

- **Massachusetts VC investment grew 88.3% from 2015-2020. This represents the 4th fastest level of VC investment in LTS, behind Minnesota, Ohio, and Pennsylvania, respectively. The Commonwealth was the fastest growing state with more than $1B in 2015 venture capital investment.**
- **In relative terms, Massachusetts ranks 1st in the LTS in attracting VC in terms of the size of the state economy. Massachusetts received $27.12 in VC investments per $1,000 of its GDP, while California came in 2nd and New York had 3rd.**

Venture Capital Investment[18]
Massachusetts & LTS, 2015-2020
Millions of 2020 $

State	VC Investment 2020 (Mill $)	2015-2020 % Change	2019-2020 % Change	2020 VC Investment per $1000 GDP
CA	$71,298	42.8%	14.7%	$23.71
CT	$722	0.7%	8.6%	$2.61
IL	$2,476	50.1%	17.7%	$2.88
MA	$15,796	88.3%	49.3%	$27.12
MN	$1,619	175.8%	0.2%	$4.33
NJ	$1,362	2.7%	132.4%	$2.20
NY	$16,059	51.3%	-1.1%	$9.31
OH	$1,007	106.1%	15.3%	$1.49
PA	$1,769	100.6%	-33.2%	$2.29
TX	$4,285	20.2%	7.1%	$2.41

IPOs AND MERGERS & ACQUISITIONS INDICATE MATURATION OF INNOVATIVE COMPANIES

The exit of startups from their initial phases is also important information for venture capitalists. The prevalence of businesses that exit the startup lifecycle through IPOs or M&As can be an attractive metric as investors consider their return prospects. IPOs and M&As represent important business outcomes through which emerging companies can access capital, expand operations, and support business growth beyond their private funding rounds. IPOs and M&As are opportunities for early-stage investors to liquidate their investments and free up capital for future investment. IPOs of venture-backed companies can reflect investor confidence in the market.

Number of Initial Public Offerings (IPOs)[19]
Massachusetts & LTS, 2014-2020

No. of IPOs by State	2014	2015	2016	2017	2018	2019	2020	2020 IPO Total $
California	47	35	14	27	48	53	70	$23,592,770,000
New York	0	0	0	0	3	13	17	$11,778,665,000
Massachusetts	21	10	13	17	20	15	32	$6,435,670,000
Ohio	0	0	0	0	4	2	2	$1,956,980,000
North Carolina	3	3	2	3	9	1	3	$1,870,000,000
Pennsylvania	5	4	0	4	3	5	10	$1,722,750,000
Texas	7	4	4	12	4	7	13	$1,718,425,000
Illinois	4	2	0	2	2	3	2	$1,241,625,000
Minnesota	1	0	1	2	4	2	2	$628,710,000
Connecticut	5	0	0	1	2	2	2	$594,000,000

KEY TAKEAWAYS

- **Massachusetts has placed 2nd among the LTS in numbers of IPOs held every year since 2013.**
- **In 2020, Massachusetts companies raised $6.4B through IPOs, placing 3rd among the LTS, behind California ($23.6B) and New York ($11.8B).**
- **The largest 2020 IPO in Massachusetts was for Digital Health company Amwell which raised $742,000,000.**
- **237 Massachusetts companies acquired another firm in 2020. Since 2017, more Massachusetts companies have acquired another firm than been acquired themselves.**

Number of Companies Acquiring Others[19]
Massachusetts & LTS, 2014-2020

No. of Companies Acquiring Others, by State	2014	2015	2016	2017	2018	2019	2020
California	542	503	698	648	748	721	800
New York	181	189	310	301	338	331	339
Texas	118	109	182	204	261	211	218
Massachusetts	127	120	170	171	223	207	237
Illinois	117	129	183	157	190	203	192
Pennsylvania	63	43	115	105	120	128	108
Ohio	33	32	70	88	93	88	79
New Jersey	80	73	117	130	114	141	128
Minnesota	37	40	62	67	76	66	59
Connecticut	35	52	69	49	64	37	63

Number of Companies Being Acquired[19]
Massachusetts & LTS, 2014-2020

No. of Companies Acquired, by State	2014	2015	2016	2017	2018	2019	2020
California	536	534	721	651	730	642	689
Texas	93	109	169	190	216	204	205
New York	106	112	179	143	186	191	187
Massachusetts	132	101	176	168	168	166	185
Illinois	65	73	101	96	141	113	143
Pennsylvania	43	67	99	94	91	110	104
Ohio	32	35	67	67	81	69	77
Minnesota	26	24	61	63	59	68	59
New Jersey	57	85	96	98	106	102	93
Connecticut	25	21	34	37	47	53	47

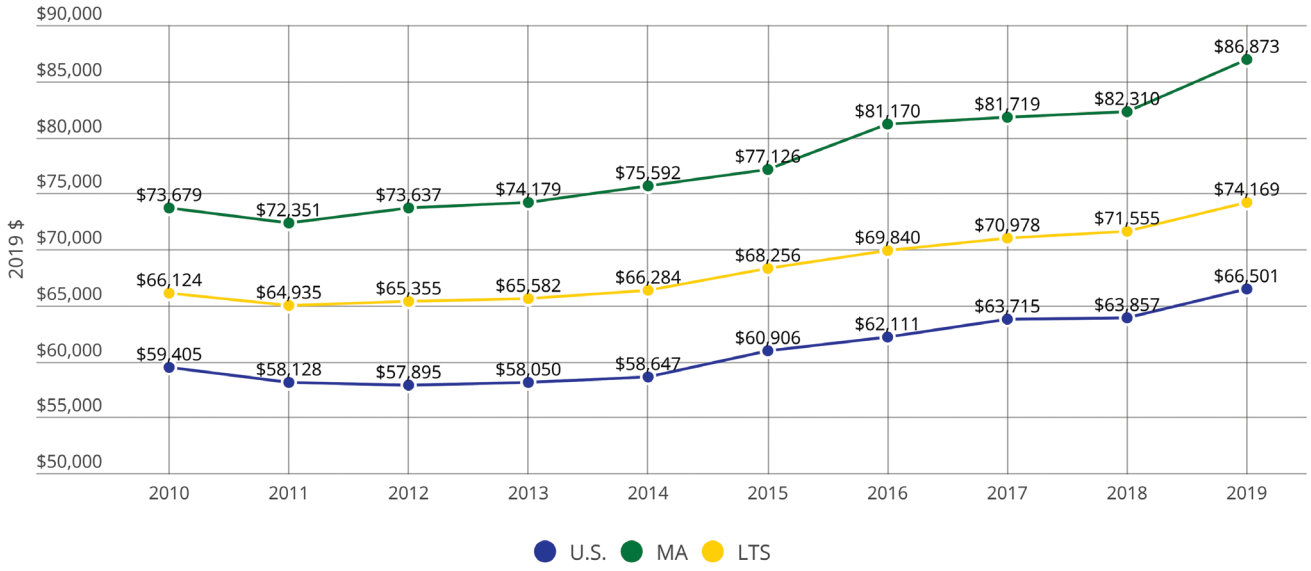
Economic Impact

The combination of world-class talent, R&D capabilities, and access to capital gives Massachusetts a competitive advantage among global innovative ecosystems. This trifecta attracts business formation and expansion in the state and has considerable benefits for the economy and people of Massachusetts.

HIGH WAGES FOR MASSACHUSETTS RESIDENTS AND FAMILIES

The Innovation Economy tends to create jobs that pay more than positions in other sectors of the economy. Household income and wages in most occupations demonstrate this and are significantly higher than in the average LTS or the U.S. as a whole.

Median Household Income[20]
MA, LTS & U.S., 2010-2019



KEY TAKEAWAYS

- **The Commonwealth's median household income increased in 2019 to a new high of $86,873 (in 2020 dollars), significantly higher than both the U.S. median of $66,500 and the LTS average of $74,168. This is offset partially by the Commonwealth's above average cost of housing.**
- **The gap between Massachusetts and both the LTS and U.S. median household income has increased since 2010. The Commonwealth's median household income was 11% higher than the average LTS and 24% higher than the U.S. median in 2010. As of 2019, the median household income in Massachusetts was 17% and 30% higher respectively.**
- **The percentage of households earning more than $100,000 is much higher in Massachusetts than in the LTS on average and the U.S. as a whole. New Jersey is the only LTS to have a higher percentage than Massachusetts, with New Jersey having 43.59% compared to Massachusetts' 43.55%.**

Percentages of Households by Income Level[21]
MA, LTS & U.S., 2019

Household Income	MA	LTS Average	US
Under $35,000	21.62%	24.71%	26.49%
$35,000-$99,999	34.83%	39.96%	42.14%
Above $100,000	43.55%	35.33%	31.37%

KEY TAKEAWAY

- **Comparatively, wages in Massachusetts are generally higher than those of the US and the LTS in 9 of the 11 occupational categories tracked by the Index. The only exceptions are Community & Social Services and Arts & Media, where wages fall below the LTS average, but are above the national average.**

Average Wages by Occupation[23]
MA, LTS & U.S., 2020

Occupation	Massachusetts	U.S.	LTS
Arts and Media	$69,780	$64,400	$71,513
Construction and Maintenance	$64,310	$53,181	$57,169
Education	$75,040	$59,810	$65,166
Healthcare	$70,913	$62,894	$63,936
Computer and Mathematical	$105,400	$96,770	$102,026
Science, Architecture, and Engineering	$96,279	$86,580	$90,825
Other Services	$41,036	$35,453	$37,610
Community and Social Services	$53,400	$52,180	$55,360
Production	$46,130	$41,760	$42,781
Business, Financial, and Legal	$120,812	$103,581	$112,267
Sales and Office	$51,405	$43,782	$46,617
All Occupations	$70,010	$56,310	$60,542

INNOVATION ECONOMY EMPLOYMENT, WAGES, AND OUTPUT - SEEING THE IMPACT OF THE PANDEMIC

Technology and knowledge-intensive industry sectors critical to the Innovation Economy lead the way in increasing prosperity through high-paying jobs across the state. Increased employment concentration in these sectors indicates a competitive advantage for Massachusetts and the potential for future economic growth.

KEY TAKEAWAYS

- **Innovation Economy job growth in Massachusetts since 2015 has been driven by Biopharmaceuticals and Medical Devices (+37.8%), Scientific, Technical, & Management Services (+25.4%), and Software & Communications Services (+16.8%). Despite 2020 data capturing the worst of the recession caused by the COVID-19 Pandemic, these three sectors are all well above their 2015 employment levels. The first two sectors actually added jobs in Massachusetts in 2020.**
- **In 7 of 11 Key Sectors, all 10 LTS saw net job losses during 2020.**
- **Innovation Economy job losses since 2015 have been concentrated in manufacturing sectors such as Diversified Industrial Manufacturing (-6.9%), Advanced Materials (-7.4%), and Computer & Communications Hardware (-16.9%).**

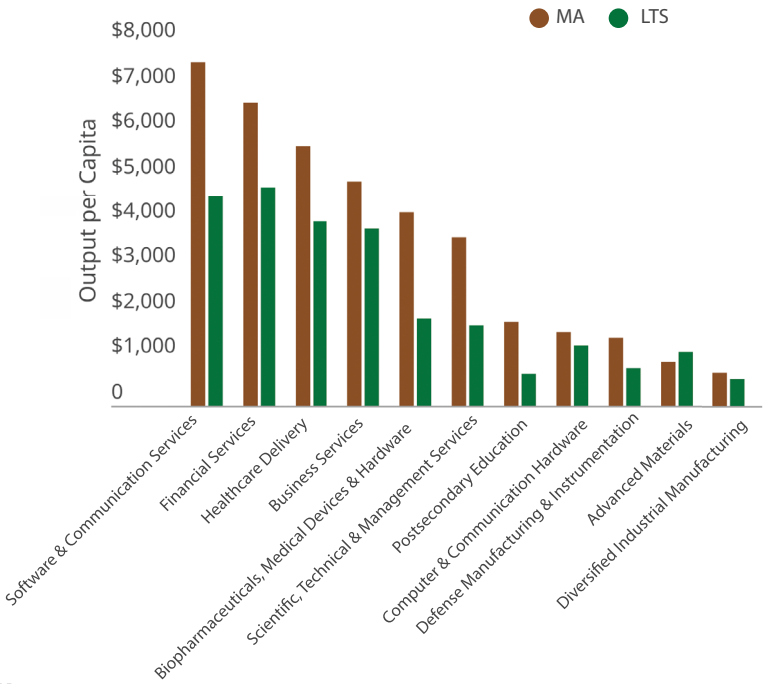
Employment and Annual Average Wage in Key Sectors[22]
Massachusetts, 2015-2020 & 2019-2020

Sectors	2015 Employment	2019 Employment	2020 Employment	2015-2020 % Employment Change	2019-2020 % Employment Change	2015 Average Wage	2019 Average Wage	2020 Average Wage	2015-2020 % Wage Change	2019-2020 % Wage Change
Advanced Materials	28,905	28,390	26,762	-7.4%	-5.7%	$74,699	$74,147	$76,007	1.8%	2.5%
Biopharma & Medical Devices	59,239	78,639	81,655	37.8%	3.8%	$184,895	$186,542	$206,869	11.9%	10.9%
Business Services	150,269	165,042	157,104	4.5%	-4.8%	$125,055	$123,491	$131,381	5.1%	6.4%
Computer & Communications Hardware	35,164	31,813	30,255	-14.0%	-4.9%	$131,688	$124,684	$129,308	-1.8%	3.7%
Defense Manufacturing & Instrumentation	36,923	36,847	36,420	-1.4%	-1.2%	$119,795	$120,748	$129,740	8.3%	7.4%
Diversified Industrial Manufacturing	38,271	38,115	35,629	-6.9%	-6.5%	$82,835	$85,683	$85,952	3.8%	0.3%
Financial Services	157,925	160,287	157,326	-0.4%	-1.8%	$160,648	$169,112	$177,081	10.2%	4.7%
Healthcare Delivery	375,314	393,072	375,201	0.0%	-4.5%	$74,395	$74,289	$77,454	4.1%	4.3%
Postsecondary Education	155,906	166,864	154,609	-0.8%	-7.3%	$70,355	$71,061	$75,808	7.7%	6.7%
Scientific, Technical & Management Services	83,511	104,330	104,724	25.4%	0.4%	$121,309	$131,041	$135,796	11.9%	3.6%
Software & Communications Services	155,148	181,381	181,246	16.8%	-0.1%	$136,392	$145,818	$155,497	14.0%	6.6%

Employment Growth in Key Sectors[22]
Massachusetts & LTS, 2019-2020

State	Advanced Materials	Biopharma & Medical Devices	Business Services	Computer & Communications Hardware	Defense Manufacturing & Instrumentation	Diversified Industrial Manufacturing	Financial Services	Healthcare Delivery	Postsecondary Education	Scientific, Technical & Management Services	Software & Communications Services	Total Innovation Economy
California	-3.5%	2.5%	-4.4%	-1.1%	-1.7%	-7.2%	-1.3%	-1.7%	-7.0%	-2.1%	0.9%	-2.3%
Connecticut	-4.5%	-1.9%	-5.0%	-7.5%	-3.0%	-5.9%	-2.3%	-3.8%	-4.6%	-2.4%	-2.1%	-3.6%
Illinois	-5.0%	3.8%	-5.4%	-6.2%	-6.2%	-7.8%	-0.7%	-3.6%	-6.2%	-1.7%	-1.7%	-3.6%
Massachusetts	-5.7%	3.8%	-4.8%	-4.9%	-1.2%	-6.5%	-1.8%	-4.5%	-7.3%	0.4%	-0.1%	-3.2%
Minnesota	-3.7%	3.5%	-3.8%	-3.0%	-3.4%	-4.9%	-1.2%	-3.6%	-6.6%	-2.4%	-3.9%	-3.2%
New York	-5.9%	-1.9%	-4.4%	-5.9%	-0.9%	-7.8%	-2.0%	-4.8%	-6.7%	1.4%	0.9%	-3.4%
New Jersey	-4.7%	-3.1%	-6.7%	-3.0%	-7.9%	-10.8%	-1.8%	-2.8%	-7.9%	-1.3%	2.6%	-3.5%
Ohio	-4.6%	5.6%	-3.2%	-4.4%	-12.7%	-7.5%	0.8%	-2.5%	-6.6%	-1.4%	-1.5%	-3.1%
Pennsylvania	-4.5%	-0.2%	-5.4%	-6.4%	-2.3%	-8.1%	-0.4%	-2.7%	-5.8%	-0.1%	0.3%	-3.0%
Texas	-2.5%	6.5%	-1.8%	-0.6%	-2.8%	-6.5%	1.7%	-0.8%	-3.4%	1.5%	2.2%	-0.5%

Output per Capita in Key Industry Sectors[24]
Massachusetts & LTS, 2020



KEY TAKEAWAYS

- **The Commonwealth continues to outperform the LTS in generating Innovation Economy output. Every key sector, with the exception of Advanced Materials, outperformed the LTS average in per capita output in 2020 (by at least 20% in all cases).**
- **Software & Communications Services ($7,601), Financial Services ($6,710), and Healthcare Delivery ($5,753) are the top three sectors in output per capita in Massachusetts, each outperforming the LTS average by more than $1,500 per capita in 2020.**
- **The Commonwealth's Biopharma & Medical Devices sector is particularly strong relative to the LTS with the Commonwealth producing $2,337 (+122%) more output per capita than the average LTS.**
- **Since 2015 output has grown more than 10% in 6 of the 11 key sectors, and more than 20% in 3 of those six.**

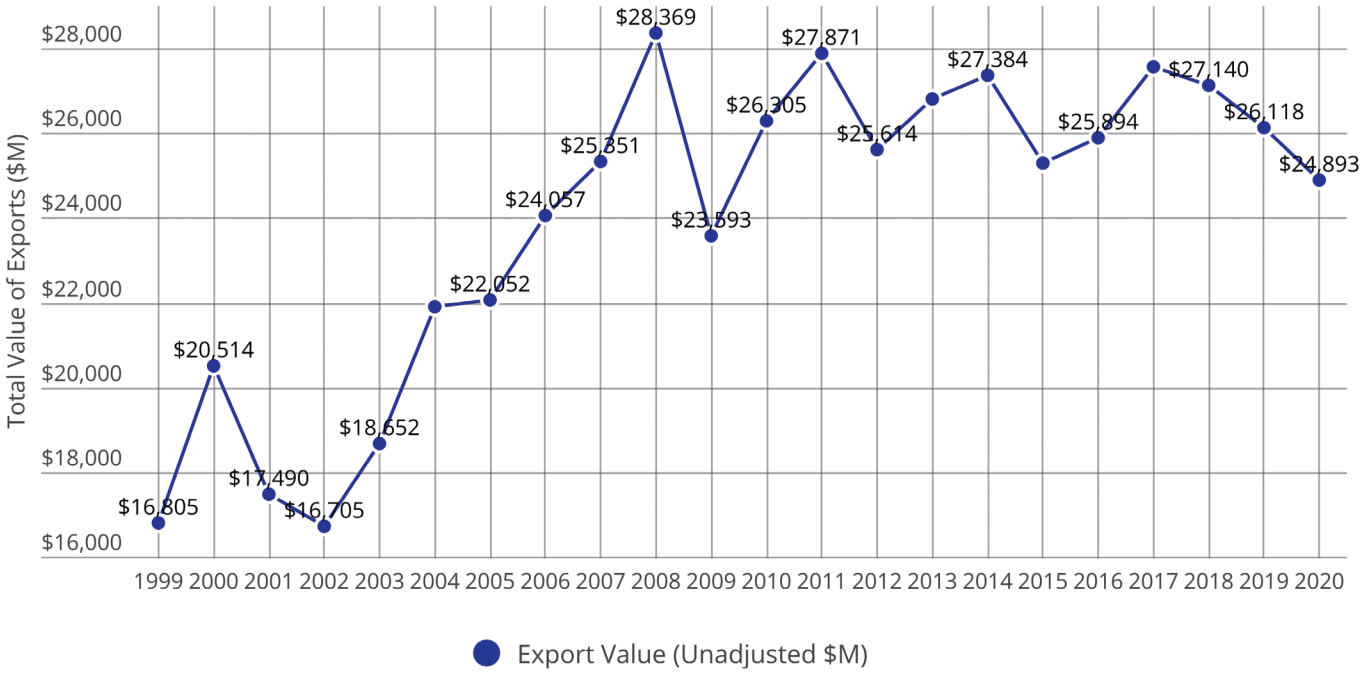
Output in Key Sectors[24]
Massachusetts, 2015, 2019 & 2020
$M

Key Sectors	2015 Output ($ M)	2019 Output ($ M)	2020 Output ($ M)	2015-2020 Output Growth ($ M)	2019-2020 Output Growth ($ M)	2015-2020 % Change	2019-2020 % Change
Software & Communication Services	$38,271	$48,093	$53,433	$15,162	$5,340	39.6%	11.1%
Financial Services	$44,232	$46,117	$47,174	$2,942	$1,057	6.7%	2.3%
Healthcare Delivery	$40,834	$43,231	$40,445	-$390	-$2,786	-1.0%	-6.4%
Business Services	$31,149	$35,971	$34,965	$3,816	-$1,006	12.3%	-2.8%
Biopharmaceuticals, Medical Devices & Hardware	$24,325	$30,474	$29,918	$5,593	-$556	23.0%	-1.8%
Scientific, Technical & Management Services	$17,819	$26,460	$26,042	$8,222	-$419	46.1%	-1.6%
Postsecondary Education	$13,240	$14,292	$12,968	-$272	-$1,324	-2.1%	-9.3%
Computer & Communication Hardware	$10,098	$10,202	$11,383	$1,285	$1,181	12.7%	11.6%
Defense Manufacturing & Instrumentation	$9,999	$12,611	$10,487	$488	-$2,124	4.9%	-16.8%
Advanced Materials	$6,117	$6,924	$6,802	$685	-$123	11.2%	-1.8%
Diversified Industrial Manufacturing	$5,764	$5,703	$5,140	-$624	-$563	-10.8%	-9.9%

EXPORTS BRING MASSACHUSETTS' INNOVATIONS TO THE WORLD

Exports are an indicator of global competitiveness and selling into global markets can bolster growth in sales and employment. In addition, diversity in export markets and products can offset domestic economic downturns. Nearly all of Massachusetts' top 25 exports are produced within the Innovation Economy. Export data do not capture the full extent of the Commonwealth's global reach. They have historically struggled to capture service exports, such as software design and technical consulting. People from around the world travel to Massachusetts for education and healthcare, activities that functionally are similar to exports but are not captured in the data.

Total Value of Exports[25]
Massachusetts, 1999-2020
Unajusted ($ Millions)



KEY TAKEAWAYS

- **The total value of Massachusetts' exports decreased in both total value and as a percentage of U.S. exports from 2019-2020. Since 2008, exports have fluctuated year-to-year between periods of growth and decline.**
- **While not as steep as the declines following 2000 and 2008 recessions, the Commonwealth's exports have declined in value for 3 years in a row, the longest period of decline this century.**

Appendix

The 2021 Edition of the Index (data gathered 2021 and earlier) tracks a selection of categories that MassTech and its Index Advisory Committee (page 40) view as being the most comprehensive set of data for benchmarking the Innovation Economy. Category choices can change from year-to-year as new data sources become available and best-practices in tracking economic data are updated. MassTech and the Index Advisory Committee review the selection of categories each year to determine whether to add or remove any sections and whether or not better sources of data are available.

Data Sources for Categories and Selection of Leading Technology States (LTS)

I. **Note on Data Availability:** Categories are calculated with data from proprietary and other existing secondary sources. In most cases, data from these sources were organized and processed for use in the *Index*. Since these data are derived from a wide range of sources, content of the data sources and timeframes are not identical and cannot be compared without adjustments. This appendix provides information on the data sources for each category. *The Index* always displays the most recent year of data available for data at the time of writing.

II. **Note on Price Adjustment:** *The Index* uses inflation-adjusted figures for most data. Dollar figures represented in this report, where indicated, are 'chained' (adjusted for inflation) to the latest year of data unless otherwise indicated. Price adjustments are according to the Consumer Price Index for all Urban Consumers, U.S. City Average, All Items, Not Seasonally Adjusted. Bureau of Labor Statistics, U.S. Department of Labor (www.bls.gov/data).

III. **Note on Per-Capita Comparisons:** *The Index* makes frequent use of per-capita metrics in order to make meaningful comparisons between states of vastly different sizes since the Leading Technology States (LTS) range from roughly 1 million people to nearly 40 million. Per-capita or "as a % of" metrics allow the *Index* to make comparisons on density in certain measures, which MassTech views as crucial to cluster formation and growth. Where performance is less tied to a state's population, the *Index* includes absolute figures as well.

IV. **Note on Selection of LTS for Benchmarking Massachusetts' Performance:** *The Index* benchmarks Massachusetts' performance against other leading states and nations to provide the basis for comparison. In 2021, the LTS were chosen using three criteria: (i) by the number of select key industry sectors with a high concentration (10% above average) of employment, (ii) the percent of employment in these sectors, and (iii) the size of each states' Innovation Economy (measured by number of employees). The sectors used to represent the Innovation Economy include: Advanced Materials, Biopharma & Medical Devices, Business Services, Computer & Communication Hardware, Defense Manufacturing & Instrumentation, Diversified Industrial Manufacturing, Financial Services, Healthcare Delivery, Postsecondary Education, Scientific, Technical, & Management Services, and Software & Communications Services. The sector employment concentration for each state measures sector employment as a percent of total employment to the same measure for the U.S. as a whole. This ratio, called the 'location quotient' (LQ), is above average if greater than one. The three criteria are assessed simultaneously and with equal weighting. The score assigned to each state for each criterion is between 0 and 1, with 1 going to the leading state and 0 going to the bottom state. The scores for the rest of the states are determined by their relative position within the spread of data. The criteria scores are added together to get an overall score. The states with the 10 highest overall scores are then chosen for the LTS. The Innovation Economy Score is used only to select the LTS as described above, it does not reflect performance on all data used in the *Index*.

V. **Note on Selection of Comparison Nations:** For all the data that include international comparisons, countries displayed on the table are the top performers for that measure. Some countries were excluded from comparison due to a lack of data reported for required years.

VI. **Note on Data Timeframes:** *The Index* uses multiple time intervals when looking at data within the categories, but generally shows five years or ten years of change from a base year (i.e. 2010-2015 or 2005-2015). Depending upon space and data availability, sometimes all data collected by MassTech from a series are displayed.

2021 LEADING TECHNOLOGY STATES (LTS)

State	LTS Score	# of IE Jobs	% of Jobs in IE	# of Key Sectors with LQ Above 1.1
Massachusetts	2.27	1,375,839	41.4%	8
California	2.15	5,039,775	30.8%	5
Pennsylvania	1.94	1,895,623	34.5%	7
New York	1.83	3,034,837	35.3%	4
Minnesota	1.47	923,689	34.1%	5
Ohio	1.47	1,708,083	33.3%	4
New Jersey	1.46	1,222,845	32.6%	5
Illinois	1.43	1,784,444	32.0%	4
Connecticut	1.38	562,200	36.4%	4
Texas	1.37	3,700,010	30.7%	1

CATEGORY: TALENT

PUBLIC INVESTMENT IN EDUCATION

[1]Per Pupil Spending in K-12
Public elementary & secondary school finance data is from the U.S. Census Bureau,"Per Pupil (PPCS) Amounts and One-Year Percentage Changes for Current Spending of Public Elementary-Secondary School Systems by State"(page 10). Figures are presented in current dollars. Data excludes payments to other school systems and non K-12 programs. (https://ncsesdata.nsf.gov/webcaspar/) and new ones will be at (https://ncsesdata.nsf.gov/ids/)

[2]State Higher Education Appropriations per Full-Time Equivalent (FTE)
Data on public higher education appropriations per full-time equivalent (FTE) student is provided by the State Higher Education Executive Office (http://www.sheeo.org/finance/shef-home.htm). The data consider only educational appropriations–state and local funds available for public higher education operating expenses, excluding spending for research, agriculture, and medical education and support to independent institutions and students. The State Higher Education Finance Report employs three adjustments for purposes of analysis: Cost of Living Adjustment (COLA) to account for differences among the states', Enrollment Mix Index (EMI) to adjust for the different mix of enrollments and cost among types of institutions across the states' and the Higher Education Cost Adjustment (HECA) to adjust for inflation over time. More detailed information about each of these adjustments can be found on the State Higher Education Executive Officers (SHEEO) website.

[3]4th and 8th Grade Science and Mathematics Performance
National Science Foundation's State Indicators for Science & Engineering;(2015,2017).

[4]SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH (STEM) CAREER CHOICES AND DEGREES

STEM Degrees Data about degrees conferred by field of study are from National Center for Education Statistics (NCES), Integrated Postsecondary Education Data System (IPEDS) Completions Survey using the NSF population of institutions (https://nces.ed.gov/ipeds/use-the-data). Fields are

defined by 2-digit Classification of Instructional Program (CIP), listed below.

- Biological & Biomedical Sciences
- Physical Sciences
- Computer & Information Science & Support Services
- Engineering
- Mathematics & Statistics

STEM Degrees and International Science & Engineering Data for STEM Degrees and Science and Engineering (S&E) Talent are provided by the Institute of Education Sciences (IES) through the Integrated Postsecondary Education Data System (IPEDS), using the National Science Foundation's (NSF) population of institutions by searching completions by non-residents and filtering for STEM classification codes.

[5]EDUCATIONAL ATTAINMENT

For this indicator, the workforce is defined as the population ages 25-65. Data on educational attainment of this population is from the U.S. Census Bureau (https://data.census.gov/mdat/#/), Current Population Survey, Annual Social and Economic Supplement. Figures are three-year rolling averages. Data on employment rate by educational attainment are based on the full-time employment rate of the workforce. High School Attainment by the Population Ages 19-24 Data on high school attainment are from the US Census Bureau, Current Population Survey (https://data.census.gov/mdat/#/), Annual Social and Economic Supplement. Figures are three year rolling averages. College Degrees Conferred Data for the U.S. states comes from the National Center for Education Statistics using the sum of all degrees conferred at the bachelor's level or higher.

[6]TALENT FLOW AND ATTRACTION

Relocations to LTS by College Educated Adults Data on population mobility come from the U.S. Census Bureau, American Community Survey; Geographic Mobility in the Past Year by Educational Attainment, 1-year estimate. This is the number of people moving in and includes no information about the number moving out. It can be used as a measure of the ability to attract talent. Net Migration Net Migration figures are derived from the U.S. Census Bureau's population estimates program using annual data.

[7]DIVERSITY

Demographics of Individuals in the Workforce, All Occupations comes from the U.S. Census Bureau, American Community Survey; Occupation by Sex for the Civilian Employed Population 16 Years and Over. This is the percentage of individuals 16 years and older in the workforce that hold computer, engineering, and science occupations by sex.

CATEGORY: RESEARCH

RESEARCH AND DEVELOPMENT

[8]Research and Development (R&D) Performed
Data is from the National Science Foundation (NSF), "Table: U.S. Research and Development Expenditures, by State, Performing Sector and Source of Funding". Data used are the totals for all R&D, Federal, Federally Funded R&D Centers & Universities, Business, Universities and Colleges, and Other Nonprofit. (https://ncsesdata.nsf.gov/webcaspar/ and new ones will be at https://ncsesdata.nsf.gov/ids/)

[9]Industry Performed Research and Development (R&D) As a Percent of Industry Output
Data on Industry Performed R&D are from the NSF Science & Engineering Indicators, "Table 8-45: Business-Performed R&D as a Percentage of Private-Industry Output, by State."

[10]Research and Development (R&D) as a Percent of Gross Domestic Product (GDP)
Data for Massachusetts' R&D as a percent of GDP is from the NSF, "Table: U.S. Research and

Development Expenditures, by State, Performing Sector, and Source of Funding" and the Bureau of Economic Analysis (bea.gov). Data for the LTS are from the NSF National Patterns of R&D Resources, "Table - Research and Development Expenditures, by State, Performing Sector, and Source of Funds". Data used are the totals for all R&D, Federal, FFRDCs, Business, U&C and Other Nonprofit. (https://ncsesdata.nsf.gov/explorer).

[11]UTILITY PATENTS

United States Patent and Trademark Office (USPTO) Patents Granted
The count of patents granted by state are from the U.S. Patent and Trademark Office (USPTO). Patents granted are a count of Utility Patents only. The number of patents per year are based on the date patents were granted (www.uspto.gov). Population estimates are from the U.S. Census Bureau, Population Estimates Branch (https://data.census.gov/cedsci/).

[12]TECHNOLOGY PATENTS

The count of patents granted by state and patent class is from the U.S. Patent and Trademark Office (www.uspto.gov), Patenting By Geographic Region, Breakout by Technology Class. State population data come from the U.S. Census Bureau, Population Estimates Branch. (https://data.census.gov/cedsci/). The number of patents per year is based on the date the patents were granted. Patent categories were developed by the Innovation Institution at MassTech where they were not already defined by the USPTO.

[13]ACADEMIC ARTICLE OUTPUT

LTS data is from the NSF "Table 8-49 - Academic Science and Engineering Article Output per $1 million of Academic S&E R&D, by State and Table 8-48- Academic S&E Articles per 1,000 S&E Doctorate Holders in Academia by state". International data is from the NSF. "Table 5-27 - S&E Articles in All Fields, by Region/Country/Economy". The NSF obtained its information on science and engineering articles from the Thomson Scientific ISI database. LTS population data are from the U.S. Census Bureau (www.census.gov/popest/data/index.html).

FEDERAL FUNDING FOR ACADEMIC AND HEALTH R&D

[14]Federal Expenditures For Academic And Nonprofit Research And Development (R&D)
Data is from the NSF, "Federal obligations for research and development for selected agencies, by state and other locations and performer" (https://ncsesdata.nsf.gov/explorer). Data used are the entries for federal funding for universities and nonprofits, excluding university and nonprofit federally funded research and development centers (FFRDCs).

[15]National Institutes of Health (NIH) Funding per Capita, per GDP and Average Annual Growth Rate
Data on federal health R&D is from the NIH (https://report.nih.gov/award/index.cfm). The NIH annually computes data on funding provided by NIH grants, cooperative agreements and contracts to universities, hospitals and other institutions. The figures do not reflect institutional reorganizations, changes of institutions, or changes to award levels made after the data are compiled. Population data are from U.S. Census Bureau (https://data.census.gov/cedsci/l). GDP data are from Bureau of Economic Analysis (bea.gov), U.S. Department of Commerce.

[16]INDUSTRY FUNDING OF ACADEMIC RESEARCH

Data is from the NSF Survey of Research and Development Expenditures at Universities and Colleges and Survey of Research and Development Expenditures at Universities and Colleges, Business Financed Higher Education R&D Expenditures for S&E (https://ncsesdata.nsf.gov/explorer). Since FY1998, respondents have included all eligible institutions. Population data are from U.S. Census Bureau (https://data.census.gov/cedsci/).

CATEGORY: CAPITAL

SMALL BUSINESS INNOVATION RESEARCH (SBIR) AND TECHNOLOGY TRANSFER (STTR) AWARDS[17]

This includes SBIR award and STTR award data. SBIR/STTR award data are from U.S. Small Business Administration (https://www.sbir.gov/sbirsearch/award/all), state population data come from the U.S. Census Bureau, Population Estimates Branch (https://data.census.gov/cedsci/) and GDP Data is from U.S. Bureau of Economic Analysis (www.bea.gov).

[18]VENTURE CAPITAL (VC)

Data for total VC investments, VC investments by industry activity, and distribution by stage of financing is provided by PricewaterhouseCoopers (PwC) in the MoneyTree Report (https://www.pwc.com). Industry category designations are determined by PwC. Definitions for the industry classifications and stages of development used in the MoneyTree Survey can be found at the PwC website (https://www.pwc.com). GDP data is from Bureau of Economic Analysis (bea.gov), U.S. Department of Commerce. This report has been discontinued as of 2022 and a new source will be used in subsequent years.

[19]INITIAL PUBLIC OFFERINGS AND MERGERS AND ACQUISITIONS

Initial Public Offerings (IPOs) IPO data is pulled from crunchbase.com, includes all listed as of January 1, 2021. Mergers & Acquisitions (M&As) Data on M&As are from Crunchbase.com. Crunchbase.com data tends to focus more on innovation economy companies and is less likely to capture mergers of financial holding companies.

HOUSEHOLD INCOME

[20]Median Household Income

Median household income data is from the U.S. Census Bureau, American Community Survey. (https://data.census.gov/cedsci/)

[21]Income Distribution

Data for Distribution of Income is from the American Community Survey from the U.S. Census Bureau.(https://data.census.gov/cedsci/) Income is the sum of the amounts reported separately for the following eight types of income: wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income from estates and trusts; Social Security or railroad retirement income; Supplemental Security Income; public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income.

[22]INDUSTRY SECTOR EMPLOYMENT AND WAGES

Data on sector wages is from the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (www.bls.gov/cew). This survey derives employment and wage data from workers covered by state unemployment insurance laws and federal workers covered by the Unemployment Compensation for Federal Employees program. Wage data denote total compensation paid during the four calendar quarters regardless of when the services were performed. Wage data include pay for vacation and other paid leave, bonuses, stock options, tips, the cash value of meals and lodging, and contributions to deferred compensation plans.

[23]OCCUPATIONS AND WAGES

The U.S. Bureau of Labor Statistics, Occupational Employment Estimates (OES) (www.bls.gov/oes/) program estimates the number of people employed in certain occupations and wages paid to them. The OES data include all full-time and part-time wage and salary workers in non-farm industries. Self-employed persons are not included in the estimates. The OES uses the Standard Occupational Classification (SOC) system to classify workers. MassTech aggregated the 22 major occupational categories of the OES into 11 occupational categories for analysis. The occupational categories in

the *Index* are:

- Arts & Media: Arts, design, entertainment, sports and media occupations.
- Construction & Maintenance: Construction and extraction occupations; Installation, maintenance and repair occupations.
- Education: Education, training and library occupations.
- Healthcare: Healthcare practitioner and technical occupations; Healthcare support occupations.
- Computer and Mathematical: Computer and mathematical occupations.
- Science, Architecture and Engineering Occupations: Architectural and engineering occupations; life, physical and social science occupations.
- Business, Financial and Legal Occupations: Management occupations; Business and financial operations occupations; and Legal occupations.
- Production: Production occupations.
- Sales & Office: Sales and related occupations; Office and administrative support occupations.
- Community and Social Service: Community and social service occupations.
- Other Services: Protective service occupations; Food preparation and serving related occupations; Building and grounds cleaning and maintenance occupations; Personal care and service occupations; Transportation and material moving occupations; Farming, fishing and forestry occupations.

[24]OUTPUT

Output Industry output data is obtained from the Moody's economy.com Data Buffet. Moody's estimates are based on industry output data for 2 and 3 digit NAICS produced by the Bureau of Economic Analysis. (https://www.economy.com/products/tools/data-buffet)

[25]EXPORTS

Exports data is from the U.S. Census Bureau, Foreign Trade Division. Currency data from xe.com. (https://www.census.gov/foreign-trade/statistics/state/data/ma.html)

CATEGORY: CHALLENGES
HOUSING AFFORDABILITY

[26]Housing Price Index
Housing price data is from the Federal Housing Finance Agency's Housing Price Index (HPI) (http://www.fhfa.gov/). Figures are fourquarter percent changes in the seasonally adjusted index. The HPI is a broad measure of the movement of single-family house prices. The HPI is a weighted, repeat-sales index that is based on repeat mortgage transactions on single-family properties whose mortgages have been purchased or securitized by Fannie Mae or Freddie Mac since January 1975.

[27]Housing Affordability
Housing affordability figures are from the U.S. Census Bureau, American Community Survey, "Percent of Mortgaged Owners Spending 30 Percent or More of Household Income on Selected Monthly Owner Costs" and "Percent of Renter-Occupied Units Spending 30 Percent or More of Household Income on Rent and Utilities". Median Household Income Median household income data are from U.S. Census Bureau, American Community Survey, "Median Household Income in the Past 12 Months", 3-year estimate. (https://data.census.gov/cedsci/)

DEFINITIONS

The *Index* makes use of 4, 5 and 6 digit North American Industry Classification System (NAICS) codes to define key industry sectors of the Massachusetts Innovation Economy. The *Index's* key industry sector definitions capture traded-sectors that are known to be individually significant in the Massachusetts economy. Consistent with the innovation ecosystem framework, these sector definitions are broader than 'high-tech'. Strictly speaking, clusters are overlapping networks of firms and institutions which would include portions of many sectors, such as Postsecondary Education and Business Services. For data analysis purposes the *Index* has developed NAICS-based sector definitions that are mutually exclusive.

Modification to Sector Definitions

The 11 key industry sectors as defined by the *Index* reflect the changes in employment concentration in the Massachusetts Innovation Economy over time. For the purposes of accuracy, several sector definitions were modified for the 2007 edition. The former "Healthcare Technology" sector was reorganized into two new sectors: "Biopharmaceuticals, Medical Devices and Hardware" and "Healthcare Delivery." The former "Textiles & Apparel" sector was removed and replaced with the "Advanced Materials" sector. While "Advanced Materials" does not conform to established criteria, it is included in an attempt to quantify and assess innovative and high-growing business activities from the former "Textiles & Apparel" sector.

With the exception of Advanced Materials, sectors are assembled from those interrelated NAICS code industries that have shown to be individually significant according to the above measures. In the instance of the Business Services sector, it is included because it represents activity that supplies critical support to other key sectors. In the 2009 *Index*, the definition of Business Services was expanded to include 5511-Management of Companies and Enterprises. According to analysis by the Bureau of Labor Statistics, this category has at least twice the all-industry average intensity of technology-oriented workers. All time-series comparisons use the current sector definition for all years, and, as such, may differ from figures printed in prior editions of the *Index.* The slight name change in 2009 of the Biopharma and Medical Devices sector does not reflect any changes in the components that define the sector.

Advanced Materials

3133 Textile and Fabric Finishing and Fabric Coating Mills
3222 Converted Paper Product Manufacturing
3251 Basic Chemical Manufacturing
3252 Resin, Synthetic Rubber and Artificial & Synthetic Fibers and Filaments Manufacturing
3255 Paint, Coating and Adhesive Manufacturing
3259 Other Chemical Product and Preparation Manufacturing
3261 Plastics Product Manufacturing
3262 Rubber Product Manufacturing
3312 Steel Product Manufacturing from Purchased steel
3313 Alumina and Aluminum Production and Processing
3314 Nonferrous Metal (except Aluminum) Production and Processing

Biopharmaceuticals, Medical Devices & Hardware

3254 Pharmaceutical and Medicine Manufacturing
3391 Medical Equipment and Supplies Manufacturing
6215 Medical and Diagnostic Laboratories
42345 Medical Equipment and Merchant Wholesalers
42346 Ophthalmic Goods Merchant Wholesale
541711 R&D in Biotechnology
334510 Electro Medical Apparatus Manufacturing
334517 Irradiation Apparatus Manufacturing

Business Services

5411 Legal Services
5413 Architectural, Engineering and Related Services
5418 Advertising and Related Services
5511 Management of Companies
5614 Business Support Services

Computer & Communications Hardware

3341 Computer and Peripheral Equipment Manufacturing
3342 Communications Equipment Manufacturing
3343 Audio and Video Equipment Manufacturing
3344 Semiconductor and Other Electronic Component Manufacturing
3346 Manufacturing and Reproducing Magnetic and Optical Media
3359 Other Electrical Equipment and Component Manufacturing

Defense Manufacturing & Instrumentation

3329 Other Fabricated Metal Product Manufacturing
3336 Engine, Turbine and Power Transmission Equipment Manufacturing
334511 Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing
334512 Automatic Environmental Control Manufacturing for Residential, Commercial and Appliance Use
334513 Instruments and Related Products Manufacturing for Measuring, Displaying and Controlling Industrial Process Variables
334514 Totalizing Fluid Meter and Counting Device Manufacturing
334515 Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
334516 Analytical Laboratory Instrument Manufacturing
334518 Watch, Clock and Part Manufacturing
334519 Other Measuring and Controlling Device Manufacturing
3364 Aerospace Product and Parts Manufacturing

Diversified Industrial Manufacturing

3279 Other Nonmetallic Mineral Product Manufacturing
3321 Forging and Stamping
3322 Cutlery and Handtool Manufacturing
3326 Spring and Wire Product Manufacturing
3328 Coating, Engraving, Heat Treating and Allied Activities
3332 Industrial Machinery Manufacturing
3333 Commercial & Service Industry Machinery Manufacturing
3335 Metalworking Machinery Manufacturing
3339 Other General Purpose Machinery Manufacturing
3351 Electric Lighting Equipment Manufacturing
3353 Electrical Equipment Manufacturing
3399 Other Miscellaneous Manufacturing

Financial Services

5211 Monetary Authorities - Central Bank
5221 Depository Credit Intermediation
5231 Securities and Commodity Contracts Intermediation and Brokerage
5239 Other Financial Investment Activities
5241 Insurance Carriers
5242 Agencies, Brokerages and Other Insurance Related Activities
5251 Insurance and Employee Benefit Funds
5259 Other Investment Pools and Funds

Healthcare Delivery

6211 Offices of Physicians
6212 Offices of Dentists
6213 Offices of Other Health Practitioners
6214 Outpatient Care Centers
6216 Home Health Care Services
6219 Other Ambulatory Health Care Services
622 Hospitals

Postsecondary Education

6112 Junior Colleges
6113 Colleges, Universities and Professional Schools
6114 Business Schools and Computer and Management Training
6115 Technical and Trade Schools
6116 Other Schools and Instruction
6117 Educational Support Services

Scientific, Technical & Management Services

5416 Management, Scientific and Technical Consulting Services
5417 Scientific Research and Development Services*
*Minus the portion apportioned to the Bio sector
5419 Other Professional, Scientific and Technical Services

Software & Communications Services

5111 Newspaper, Periodical, Book and Directory Publishers
5112 Software Publishers
5171 Wired Telecommunications Carriers
5172 Wireless Telecommunications Carriers (except Satellite)
5174 Satellite Telecommunications
5179 Other Telecommunications
5182 Data Processing, Hosting and Related Services
5415 Computer Systems Design and Related Services
8112 Electronic and Precision Equipment Repair and Maintenance
51913 Internet Publishing and Broadcasting and Web Search Portal

Acknowledgements

INDEX ADVISORY COMMITTEE

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