The Research and Development Ecosystem: Engine of the Massachusetts Economy

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UMassAmherst
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The Research and Development Ecosystem: Engine of the Massachusetts Economy

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Executive Summary

Massachusetts is a leader in high-tech innovation and research, driven by its strong universities and academic medical centers. Robust research directly translates into the development of globally competitive industries, including life sciences, clean energy, medical equipment, electronics, an array of defense technologies, among many others, which form the foundation of the state economy. Federal research and development funding is the critical engine that drives the state's research dynamic as private funders, seeing early-stage research as risky, frequently do not take active roles until they see the promise of commercial viability and the potential for profitable returns. In response to federal policy changes (notably affecting agencies like the National Institutes of Health and National Science Foundation, among others) and accompanying uncertainties, this study by the UMass Donahue Institute traces the importance of federal funding to the state's broader research and development ecosystem.

Ultimately, the report demonstrates that federal research funding is a catalyst for a much, much greater range of economic activity (downstream effects going significantly beyond the actual federally funded research) that forms the bulwark of much of the Massachusetts economy.

The Importance of Federal Funding to Set the Research Process in Motion

- Federal research funding is concentrated at the earliest stages of the research and development innovation continuum. Usually in the form of grants, federal funding provides the catalyst to set the innovation process, which can take years to decades, in motion, and keep the process growing continuously. This very early-stage research and prototyping taking place at Massachusetts universities and medical institutions is often seen as too risky and loss-leading by private industry.
- Research funding begins to shift to private business sectors as innovations become more promising for commercialization. During the latter stages of development and with an innovation appearing increasingly viable in the marketplace, researchers can successfully apply for loans and attract private investment, including venture capital.
- At its culmination, a new company may start-up to build and market a new product or an existing business may license or pay royalties for use of the invention. The scaling of these types of enterprises in Massachusetts, requiring a combination of funding and talent, brings jobs and stimulates economic growth in the state.

The Size and Extent of Massachusetts Research and Development Industry and Its Ecosystem

This report demonstrates that research and development activities form a cornerstone of the Massachusetts economy. In terms of direct measurement, research and development industries are described in three ways: (1) the scientific research and development activities industry; (2) value-added (gross domestic product) from research and development; and (3) the research and development ecosystem.

- **Scientific research and development activities**. This industry represents firms conducting original investigations to gain knowledge and/or apply research findings for the creation of new or significantly improved products or processes.
    - The concentration and strength of this industry in Massachusetts is an essential starting point for understanding the state's preeminence and R&D when compared around the nation.
    - The industry more than doubled in size in Massachusetts between 2014 and 2024, more than twice the rate of national growth. Its 105,000 jobs represent one-in-nine U.S. jobs in the industry compared to the state's one-in-forty share of U.S. employment.
- **Value-added (gross domestic product) from research and development**. From the U.S. Bureau of Economic Analysis (BEA), an estimate of research and development's direct contribution to GDP is available across industries.
    - In 2023, research and development activities accounted for $45 billion of Massachusetts GDP. Six percent of all U.S. GDP from R&D takes place in the state according to this measure.
    - On a per capita basis, R&D's contribution to GDP is three times more concentrated in Massachusetts than the national average.
- **Research and development ecosystem**. This is a hybrid, more encompassing group of industries that benefit from federal research investment in basic research, including "Eds and Meds" as well as other elements of the private sector that leverage discovery into breakthroughs benefiting manufacturing, medicine, technology, and other key areas. This group of industries includes dozens of sub-industries including scientific research and development activities, as well as software development, computer hardware manufacturing, computer systems design, high-tech equipment sales, aerospace, life sciences, and others.
    - In total, the research and development ecosystem directly employs over 376,000 people in Massachusetts with scientific R&D services and computer systems design being the leading industries.

Economic Impacts of the Massachusetts Research and Development Ecosystem

The 376,000 direct jobs in the research and development ecosystem (as defined in this report) comprise about 10 percent of Massachusetts employment. There is a much larger impact, however, when the spinoff effects (also known as "multiplier effects") associated with business-to-business ("indirect effects") and consumer spending ("induced effects") across the entire Massachusetts economy are considered. To calculate the overall economic impacts of the R&D ecosystem, UMDI applied the IMPLAN input-output model, a highly regarded econometric model. With this, the total economic impact of the research and development ecosystem in Massachusetts, including multiplier effects, was found to support:

- Just over one million jobs (28 percent of 2024 employment);
- $142 billion in labor income (40 percent of all wages in the state);
- $218 billion to gross state product (28 percent of the state economy);
- $347 billion in total economic activity;
- $8.7 billion in state taxes (equivalent to 15 percent of the FY2024 state budget); and
- $4.6 billion in local taxes.

Massachusetts Compared to Other Leading Research and Development States in R&D Ecosystem Jobs

Massachusetts has an outsize impact on the research and development economy, nationwide, but has numerous competitive rivals. To better understand Massachusetts' competitive position and relative strengths, the state is compared to a list of nine competitor states which also rank highly on research and development related metrics. These states are California, Florida, Illinois, Maryland, New York, North Carolina, Pennsylvania, Texas, and Washington.

- Massachusetts' research and development ecosystem is a quarter of the size of California's and just over half the size of Texas' despite having a fraction of the population of either state.
- When looking at per capita employment, for every 1,000 residents in Massachusetts, 52 people are employed in the research and development ecosystem, the highest of any state.
- While Massachusetts is far ahead on many metrics of research and development ecosystem performance, other states are gaining ground. The R&D ecosystem grew by 29 percent between 2014 and 2024, below the national rate, and ranking Massachusetts only 7th among the competitor states for growth (10 total states including Mass.).

Federal Funding Shifts

There is considerable uncertainty in federal funding for research even as this study reaches the publication point (March 2026). Funding cuts announced in early 2025 may or may not come to fruition and there are early signs of funding returning to a semblance of normalcy. Even if this occurs, however, it is still far from certain that funds will be distributed as appropriated by congress, or according to established processes. The innovation process can take years to decades and the combination of uncertainty and a lack of confidence for consistent future funding is disruptive to ongoing efforts in the research pipeline.

- Proposed cuts in the current administration for the FY2026 budget included a nearly 40 percent reduction at the NIH ($18 billion), and a 56 percent reduction ($3.9 billion) at the National Science Foundation (NSF), along with cuts to the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and the Department of Education, among others.
- Research funding from the NIH, NSF, and DOE are particularly critical for supporting the innovation pipeline in Massachusetts.
- Changes to grant distribution have had a negative impact on research with funding being distributed to a smaller number of grants.
- NIH grants traditionally are awarded for five-year periods with up to a two-year no cost extensions. The administration in 2025 constrained these to four years with only a single year of extension. In practice, researchers have less time to do their work and less funding annually, on average, with this system.
- Fewer and shorter grants means that researchers have fewer opportunities to participate in research. New researchers must compete against more seasoned researchers for a smaller pool of projects. Without funding, today's young researchers may not have the opportunity to

become the next generation of innovators in future decades. This is a long-term loss for both Massachusetts and the United States.

- Proposed capping of indirect reimbursement rates on grants to 15 percent (approximately 30 percent is more typical) poses a significant institutional burden as support to fund infrastructure, facilities, and activities that support research (e.g., building and equipment maintenance, administrative staff, etc.) are reduced, stymying research efforts and longer-term investments.
- The current presidential budget proposal would cut funding for scholarships and fellowships by 65 percent compared to FY2024, sharply reducing financial support that enables graduate students and early researchers to pursue STEM (science, technology, education, and math) careers. Postdoctoral fellowships would face an even steeper 91 percent cut with potential severe career ramifications.
- Delays in the awarding of grants and uncertainties about the future of grant funding have caused hesitation among researchers to apply for grants, further delaying innovation efforts.

Research Funding in Massachusetts

Massachusetts ranks among the leading states in most measures of research support, whether federally funded, venture capital, or private business spending on research. The combination of funding sources, each playing a key role, provides the framework for Massachusetts to push innovation forward, from idea to commercialization, marketability, and scaling.

- Federal research funding obligations in Massachusetts were valued at $10 billion in 2023. The state is fourth nationwide for total federal R&D funding as well as for per capita federal funding obligations. The high per capita value reflects a notable concentration of intensive research activities taking place in the state.
- The National Institutes of Health (NIH) is the largest single agency source of funding for the state, providing $3.5 billion in funding in 2024, behind only California and New York. Massachusetts, with smaller population size than either state, continues to receive the highest NIH funding per capita of any state by a significant margin.
- On a per capita basis, Massachusetts was also the number one recipient of funding through the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards in 2024. Massachusetts was well ahead of any competitor states on a per capita basis, attracting just over twice as much funding per capita compared to second place California.
- Venture capital (VC) is especially important to support the latter stages of technology development and Massachusetts has a well-developed VC network. With nearly $16 billion in VC in 2024, Massachusetts ranked third, behind California and New York. Although the dollar values are high, there is concern that both California and New York, driven by investments in artificial intelligence (AI), have been pulling away from Massachusetts in the last couple of years.
- The scale of business spending on R&D in Massachusetts is substantial ($49 billion in 2023) and reflects industry recognizing the state as an effective location for transforming ideas into marketable products and services. Massachusetts ranks third in the country in business spending on research, only behind California and the state of Washington.

Mobility of International and Domestic Researchers

Massachusetts' ability to attract funding to support research is reflective of the state's talent, including being the most educated state in the country. Federal policies, however, are jeopardizing the state's stature as a magnet for leading researchers especially on the international side but affecting the domestic side, as well.

- With federal funding cuts, both real and threatened, and canceled grants, scientists and researchers around the country saw the summer of 2025 as "the summer of despair".
- Federal visa programs are a primary means of bringing international talent to Massachusetts. In 2024, Massachusetts was the second ranking (despite being only the 16th most populous state) destination state for J-1 visas for research scholars, short-term scholars, and college professors.
- J-1 visas, like all other visas, are vulnerable to increasing restrictions by the federal government. In early 2026, visa issuances to residents of 75 different countries were paused, including for Brazil which is the fourth largest origin for research and short-term scholars in the nation.
- H1-B visas which allow employers to hire skilled foreign workers in specialty occupations. In FY2025, H1-B visas in Massachusetts declined by 18 percent compared to the previous year. With nearly half of H1-B holders working in professional, scientific, and technical services, the decline may hit the research and development ecosystem particularly hard. Massachusetts ranked 7th amongst the states in H1B approvals for new employees in FY2025.
- If saddled with further restrictions, the international talent pipeline that benefits Massachusetts will divert their talents to competing nations. Already, China, Germany, the United Kingdom, and Japan are all offering visa programs, among other incentives, which are not contingent on a specific job offer.
- For researchers already conducting their investigations in the United States as well as for PhD candidates confronting funding cuts, potential moves abroad are gaining traction as they no longer see a clear path forward to proceed with their work.
- Other states, too, see an opportunity to recruit Massachusetts university researchers who have become unmoored from their work due to federal funding cuts by providing incentives (e.g., lab space and funding) to continue pursuing their work in other locations.

Importance of Federal R&D Funding – Interview Findings

The UMass Donahue Institute interviewed 15 professionals representing a range of roles, including startup founders, academics, research funding professionals, public policy makers, and representatives from industry groups. Key themes that emerged include:

- Interviews confirmed that federal funding supports early-stage research that private industry would otherwise not pursue due to high levels of risk. The proposed federal research funding cuts may not have an immediate impact on active research today but will become more visible in the future. In a five-to-ten-year time horizon, there will be a shortage of new startups and new innovations because of the current disruption in federal R&D funding. At that point, we will not even know about society- and industry-benefiting innovations that could have been put into practice.

- Massachusetts has been a leader in life sciences research but also excels in material sciences, defense technology, clean energy, and AI-driven innovation.
- Massachusetts has an edge on providing its own capital for research, beginning in 1946 with the American Research and Development Corporation and continuing through today with such initiatives as the Mass Life Sciences Center, the Mass Clean Energy Center, and Mass Ventures. Out-of-state firms are attracted to Massachusetts due to the abundance of services available to startups.
- The threat of losing talent due to federal funding cuts cannot be understated as Massachusetts has an incredible competitive advantage in talent. Attracting and retaining these populations is paramount.
- Massachusetts' high costs for real estate and utilities mean that firms may start up in-state, then scale up elsewhere (e.g., North Carolina attracted nearly $11 billion in life sciences industry investments in 2024, alone). Cuts in federal funding may push these types of cost considerations higher.
- Decades ago, Massachusetts had a clear leadership position in high technology areas including computers and software. With the demise of mini-computers formerly led by companies like Digital Equipment, Prime Computer, WANG, and Data General, Massachusetts stature as the top-ranking tech leader was usurped by Silicon Valley in the late 1980s and early 1990s. Nearly forty years later, the state now has a diverse technology portfolio, including a globally recognized strength in life sciences. The competition for technology leadership between states and countries, however, is fierce and the federal research funding uncertainty represents a grave concern for Massachusetts. Strategically, efforts to support innovation and business scaling, and addressing business climate concerns (e.g., housing, energy, transportation, etc.) can benefit the state longer-term.
- Climate technology (climatetech) continues to be seen as an area full of potential for growth in Massachusetts despite opposition from the current federal administration. Innovations continue in areas like lightweight materials, energy storage, building decarbonization, fusion power generation, rare earth minerals technologies, quantum computing, and artificial intelligence (although California and New York are receiving much of the AI venture capital, the Massachusetts life sciences industry applies AI for discovery, diagnostics, process optimization, etc.). Massachusetts may also benefit from a federal funding priority on defense technology development.
- While Massachusetts tends to be high cost particularly in the eastern part of the state, quality of life is cited as extremely high. Multiple interviews highlighted that research and development firms can attract people because of the high quality of life in the state, including excellent public schools.

In short, Massachusetts stands as a cornerstone of the U.S. economy, driven by a uniquely integrated innovation ecosystem that unites world-class universities, research hospitals, businesses, and nonprofits to generate breakthroughs in life sciences, clean energy, advanced manufacturing, computing, and defense. Federal research funding—particularly from agencies such as the National Institutes of Health, the National Science Foundation, and the U.S. Department of Energy—has long served as the critical catalyst that transforms early-stage research into commercialization, investment, and job creation across both technology and supporting industries. That said, recent federal funding cuts, policy uncertainties, cost concerns, as well as rising competition from other states and countries threaten this virtuous cycle by undermining talent retention, weakening global competitiveness, and disrupting the state's ability to attract and sustain top researchers. While early signs of restored research support in 2026 are encouraging, continued federal stability alongside sustained state-level investments will be essential to preserving Massachusetts' leadership in innovation and ensuring long-term economic growth.

Introduction

Massachusetts is a leader in high-tech innovation and research, driven by its strong universities and medical teaching hospitals. Historically, Massachusetts has been at the leading edge of many technological innovations including computing, the birth of the internet, and life sciences. Much of this was initiated and backed by federal research funding, which is critical to early-stage discovery and acts as a catalyst for the innovation process. Any disruption, reduction, or elimination of that funding will undoubtedly have a negative impact on the Commonwealth and the broader economy, both statewide and nationally. The Information Technology and Innovation Foundation, a non-partisan technology and education think tank, recently estimated that cuts to research and development will shrink the U.S. economy by over $1 trillion in the next 10 years. These cuts will also hurt U.S. competitiveness, particularly with China which continues to push its research and development pipeline forward as it seeks global preeminence in several targeted key technologies.[1] As vital federal funding source languishes, the U.S. is also becoming less competitive for international research talent. Other nations such as Germany, England, Japan, France, Israel, and China have made it easier for scientists and experts confronting cuts to their work to immigrate while the U.S. visa process becomes increasingly difficult to navigate.[2]

Cuts to federal funding and reductions in indirect cost support harm educational and medical institutions. Early research takes place at colleges, universities, and research hospitals across the Commonwealth. These institutions provide support to transition new research ideas into basic knowledge that can evolve into a workable, consumer-facing product. The private sector is not eager to invest in high-risk, early-stage research and accordingly waits on the sidelines to become involved until a new technology or product has proven viability with a higher chance of commercialization success and profit.[3] Without the risk-taking of early-stage research, innovation will be inhibited, and the pipeline for future breakthroughs will be stymied or altogether cutoff. The U.S. government's willingness to invest in early-stage research over the post-World War II period was essential to placing the U.S. at the top of the research and development ecosystem worldwide. Defunding the early-stage research supported historically by agencies like the National Institutes of Health and National Science Foundation is an existential risk for U.S. technological and scientific development and industry leadership. Cuts to research at educational and medical institutions will lead to fewer discoveries and prevent potentially beneficial products from being introduced. These institutions are foundational to the success of Massachusetts' research and development ecosystem which will be examined in this report.

Funding Opportunities by Development Stage

Federal research funding is concentrated at the earliest stages of research and development innovation continuum (see the first column in **Figure 1**). This funding, usually in the form of grants, is intended for the early, fundamental research phase and the later prototyping phase. Fundamental research provides the catalyst to set the innovation process, which can take years to decades, in motion. This fundamental

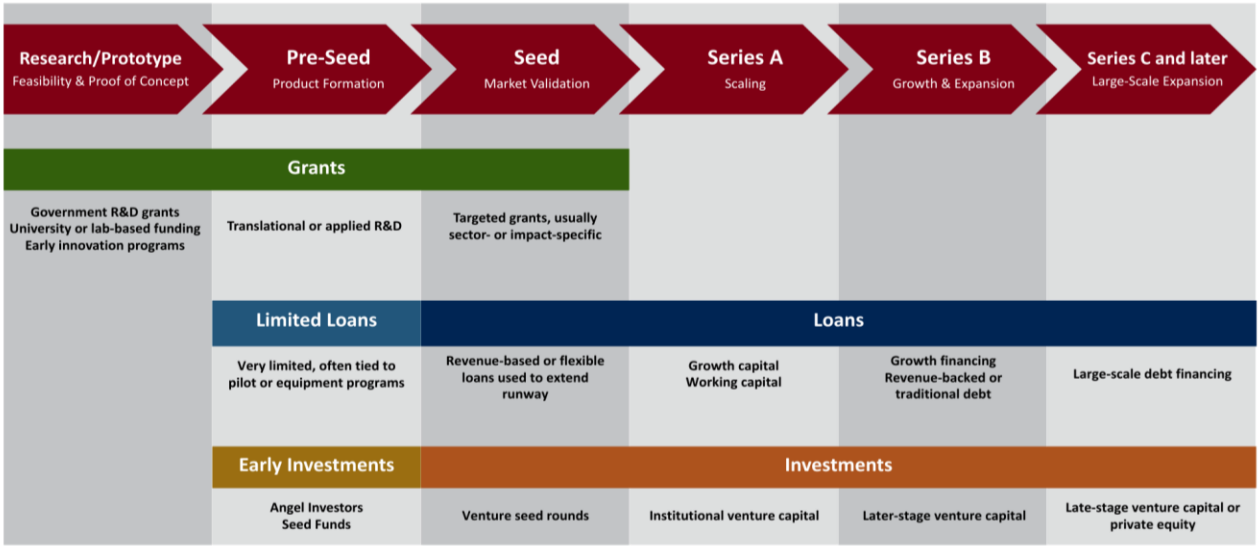
[1] Meghan Ostertag, *How Reducing Federal R&D Reduces GDP Growth* (Information Technology and Innovation Foundation, 2026), https://itif.org/publications/2025/09/15/how-reducing-federal-rd-reduces-gdp-growth/.

[2] Chris R. Glass, "The Best and Brightest Scientists Won't Put up with This," *Washington Post* (Opinion), Spring 2025.

[3] Ostertag, *How Reducing Federal R&D Reduces GDP Growth*, 4.

research is often seen as too risky and loss-leading by private industry and is therefore mostly dependent on public funding.

Figure 1: Funding Timeline



Source: Mass Ventures and UMDI Analysis

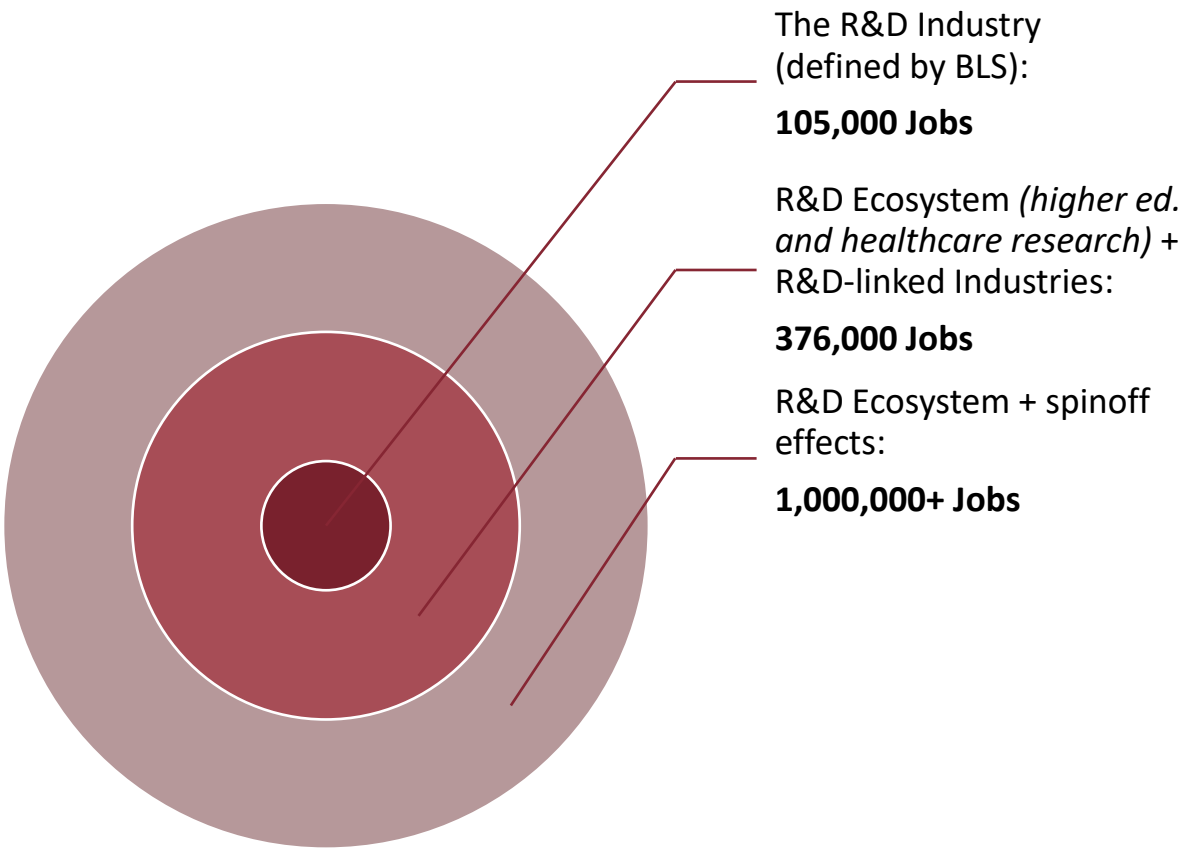
A research team at a university, medical center, or a non-profit organization developing a concept can use federal funding to test ideas and create early versions of what will eventually become their final product. For follow-up work and development, funding begins to shift to the private sector as the innovation becomes more promising for commercialization. For example, a company interviewed for this report, Electro Magnetic Applications (EMA) in Pittsfield, received an NSF SBIR (Small Business Innovation Research) grant to prototype a one-of-a-kind testing chamber which simulates the vacuum of space. This technology allows companies to test hardware in the extreme conditions of space, without having to launch a rocket. The initial NSF grant was $225,000. To develop their business further, EMA sought additional support from the City of Pittsfield. Having that initial NSF funding and development motivated local government to support EMA's efforts to open offices in the city. While federal funding was not the only source of resources, it was essential in the earliest stages and provided proof to other funders that the idea had merit.

As grant funding gradually runs out in early phases, researchers can seek out loans, though these are challenging to acquire in the earliest stages of product development. Researchers can also seek out and attract private investment from angel investors or seed funds, but that is only possible if the innovation is beginning to show viability and the chance for future success in the marketplace. As a project progresses to later stages and can begin scaling, more private investment opportunities open-up, including venture capital. At this point a new company may start-up to build and market the new product or an existing business may license or pay royalties for use of the invention. It is during these latter stages of innovation that the private sector, seeing less risk and sensing future opportunity, increases its involvement and develops a willingness to manage the final stages of research needed to introduce new technology and products to market.

The Size and Extent of the Massachusetts Research and Development Ecosystem

Research and development can be thought of as its own sector of the economy, as activity or investment occurring within many industries, as the commercialization of R&D activity across industries or as a combination of all three of these forms. In this report we will look at the extent of research and development industries in two different ways. The most concentrated and concise definition of the research and development industry is using the North American Industry Classification System (NAICS) Code 5417, "scientific research and development activities".

Figure 2: Hierarchy of the Research and Development Ecosystem



This industry classification is a subsector of the larger professional, scientific, and technical services sector of the economy, which includes a wide array of highly specialized fields requiring advancing training and skill, including various elements of biotech and high tech. However, the official industry code for scientific research and development captures only a slice of firms that are on the forefront of innovation in the state and that are developing and/or applying advanced practices in their production. For this study, we define this latter hybrid and more encompassing group of industries as the "Research and Development Ecosystem."

This ecosystem includes those parts of the economy that benefit from federal research investment in basic research, most specifically portions of the Eds and Meds sector, as well as the elements of the private sector that leverages basic scientific discovery into commercialized, cutting-edge breakthrough in manufacturing, technology, medicine, and other key areas. These definitions of research and development fit into a hierarchy shown in **Figure 2.** Scientific research and development activities form the core of the ecosystem and then added onto it are other industries that engage heavily in R&D, including parts of universities and the healthcare system. The overall impact of this ecosystem includes the activity not only of those industries, but also the ripple effects of their activity across the Massachusetts economy.

Scientific Research and Development Activities

As discussed previously, the core of the research and development ecosystem is the industry "scientific research and development". This industry is defined as firms "conducting original investigation undertaken on a systematic basis to gain new knowledge (research) and/or the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes (experimental development)."[4] While this subsector is too narrow for describing the entire nexus of research and development related activities across the academic, medical, and private sector, its concentration and strength in the Massachusetts economy is in instructive starting point for understanding the preeminence of the sector when compared to rest of the nation.

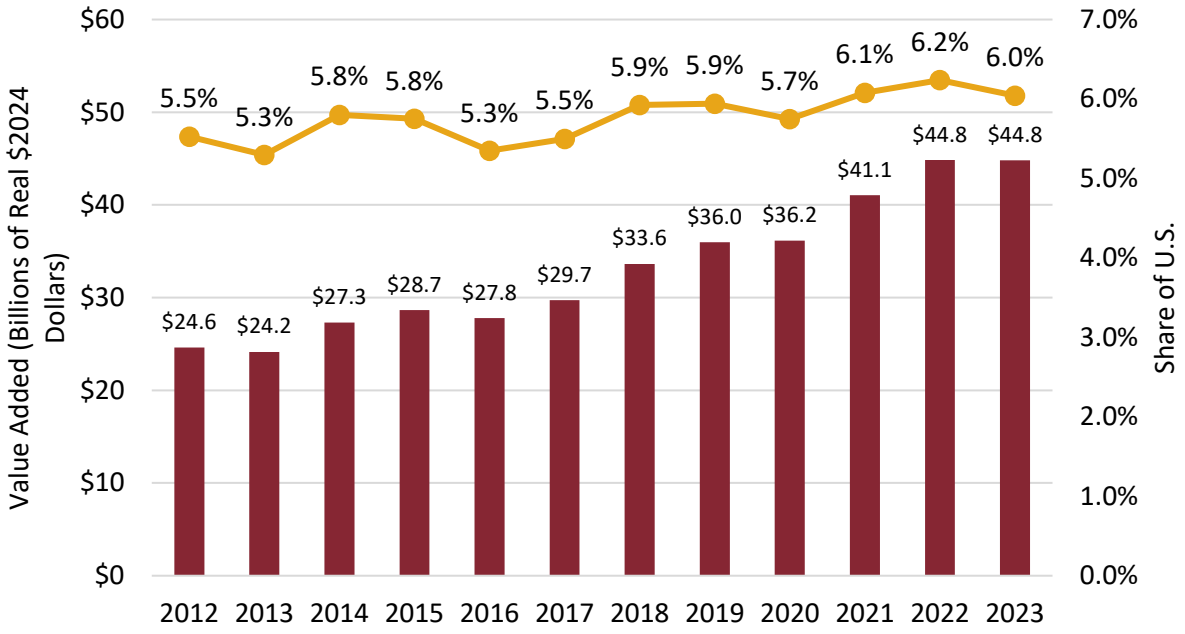
Massachusetts currently has 105,307 jobs in the scientific research and development industry and since 2014 the industry has more than doubled in size, growing at more than twice the rate of the industry nationwide (see **Figure 3**). In 2024, Massachusetts accounted for one-in-nine U.S. jobs in the scientific research industry, far exceeding its one-in-forty share of the U.S. total non-farm employment.

Beyond this core, Bureau of Labor Statistics (BLS) defined, scientific research and development industry, Massachusetts' high-tech innovation and research industries employ thousands more, though the exact count depends on how the industry group is defined. Another useful metric created by the Bureau of Economic Analysis (BEA) is a measure of the industry called the Research and Development Satellite Account. This dataset measures domestic R&D production related to research and development across all industries. The BEA has found that while research and development is just over two percent of total U.S. wage and salary employment it is nearly four percent of total U.S. compensation, reflective of the high salaries and wages paid by the field as well as benefits such as employer contributions towards healthcare and retirement.[5]

[4] U.S. Census Bureau, "North American Industry Classification System (NAICS)- 5417 Scientific Research and Development Services," 2022, https://www.census.gov/naics/?input=5417&year=2022&details=5417.

[5] BEA defines compensation as "the pay to employees (including wages and salaries as well as supplements to wages and salaries, such as employer contributions to pension funds and health insurance) for their R&D work during a given year. Earnings of self-employed individuals and temporary workers are not included."

Figure 3: Massachusetts' Value Added from Research and Development Activity and Its Share of U.S. Total, 2012-2023



Source: BEA Satellite Accounts; Consumer Price Index, adjusted to 2025 dollars.

In 2023, research and development in Massachusetts accounted for $45 Billion Dollars of GDP as shown in **Figure 3** or six percent of the value added (note that GDP and "value added" are the same concept) from this sector nationally. This impact was spread across 173,000 employees statewide for a per employee impact of $253,000, over 13 percent above the U.S. rate of $223,000.

These employees work across the public and private sectors, in non-profit and for-profit roles. The BEA definition captures people working both actively in research and development as well as in funding roles. Most R&D employees work in the private sector, where 164,000 people are employed in research and development activities. Of those, nearly 47,000 people (28%) are employed at non-profit institutions, including private colleges and universities, with a research and development focus. Nearly 9,000 people work in R&D focused roles in government, and this includes employees of public universities whose jobs are focused on research and development. Per capita, R&D in Massachusetts adds to GDP at nearly three times the national rate.

Between 2012 and 2023, research and development's contribution to Massachusetts GDP nearly doubled from $24 billion to $45 billion. By 2023, research and development accounted directly for six percent of the state's $738 billion economy according to BEA data.[6] In that same period, Massachusetts gradually increased its share of national research and development economic value added, accounting for six percent of industry value added in 2023 compared to 5.5 percent in 2012, while only just over two percent of the country's total population.

[6] U.S. Bureau of Economic Analysis (BEA), "State Annual Summary Statistics: Personal Income, GDP, Consumer Spending, Price Indexes, and Employment - 2023," 2025, https://apps.bea.gov/.

The Research and Development Ecosystem in Massachusetts

The overarching, Research and Development Ecosystem also includes those parts of the economy that benefit from federal research investment in basic research, most specifically portions of the Eds and Meds sector,[7] as well as the elements of the private sector that leverages basic scientific discovery into commercialized, cutting-edge breakthrough in manufacturing, technology, medicine, and other key areas. The research and development ecosystem described in this report starts with the highly regarded tech definition used by the Computing Technology Industry Association ("CompTIA").[8] Added to that definition are life sciences industries not included by CompTIA, such the pharmaceutical and biological product manufacturing industries. From there, UMDI added key aerospace industries, and the dedicated research and development-related industries discussed previously. These industries tend to develop and apply advanced technologies and are research and development-intensive by nature.

This group of industries includes the core industry of scientific research and development activities, dozens of sub-industries, as well as software development, computer hardware manufacturing, computer systems design, high-tech equipment sales, aerospace, life sciences, and others. In total, the research and development Ecosystem comprises 56 sub-industries categorized within the North American Industrial Classification System (NAICS). The full list of industries can be found in **Appendix B: 2022 NAICS Industry List**. Lastly, UMDI included a segment of higher education and health care that engages in research and development, defined by the BEA Satellite Accounts data mentioned in the previous section (for higher education) and the economic impact analysis UMDI completed over the summer on federal research and development dollars (for health care).[9]

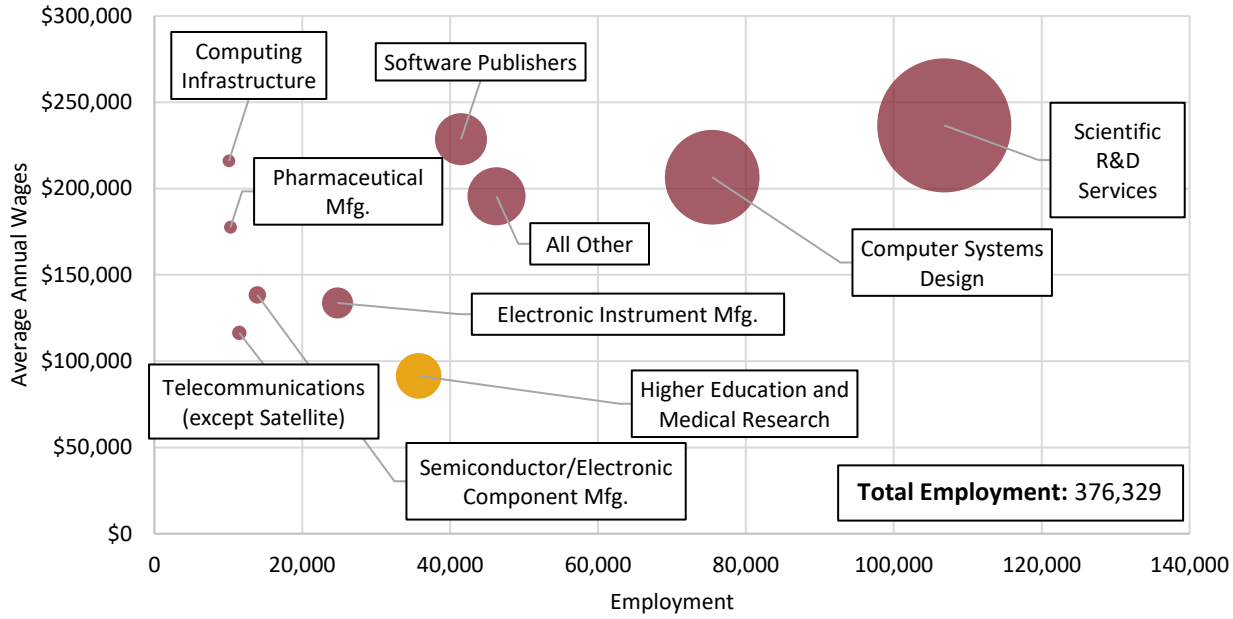
Education and healthcare were important to include in this analysis. However, unlike the 56 industries listed earlier, educational and healthcare related industries as defined by the BLS include substantial amounts of employment focused on delivery of services, rather than research. For this reason, the BEA and UMDI datasets were used to capture only the employment tied to research and development activity.

[7] Education and healthcare were important to include in this analysis. However, unlike the 56 industries listed earlier, educational and healthcare related industries as defined by the BLS include large amounts of employment focused on delivery of services, rather than research. A Bureau of Economic Analysis Dataset was used to identify the portion of education and healthcare that best fits the Research and Development Ecosystem.

[8] MassTLC uses CompTIA as foundation to analyze the performance of the Massachusetts "tech" economy.

[9] The BEA R&D satellite accounts dataset for Higher Education Institutions for 2023 (The latest available data), which captures the portion of higher education activity that is related to R&D was used for this analysis. Also included, was an estimate of the direct employment and compensation impacts of federal research funding on the health care and social assistance industries for calendar year 2024. The health care data is derived from a previous UMDI analysis of individual research funding awards in Massachusetts, by recipient, meaning it captures only the employment that emerges directly from research and development funding by the federal government.

Figure 4: Employment and Average Wages in Research and Development Ecosystem Industries at the 4-Digit NAICS Level, Bubble Size Indicates Share of Ecosystem, 2024



Source: BLS QCEW and U.S. Census Population Estimates, 2024; BEA R&D Satellite Accounts for 2023, and UMDI Analysis of Federal Wards Data for 2024

Cutting federal research funding negatively impacts research hospitals, and universities, which account for 10 percent of research and development ecosystem employment in our analysis (35,744 employees). It is these institutions which host critical early research which feeds the research and development ecosystem. In the absence of federal funding for research, these institutions would continue to operate in a service capacity, albeit in a diminished form at great expense to the state and national economies. Academic professionals interviewed for this report indicated that these cuts have a serious negative impact on training and hiring of research staff, with sharp declines in enrollment for doctoral programs across universities in the state.

In summary, Massachusetts employs just over 376,000 people in the research and development ecosystem (see **Figure 4**). The largest share of this group of industries falls under the industry title scientific research and development services (top right of **Figure 4**), accounting for 28 percent of research and development ecosystem employment (107,000 employees). This industry includes research and development in four sub-industries: nanotechnology; physical, engineering, and life sciences[10]; social sciences and humanities; and biotechnology. Biotechnology[11] is by far the largest sub-industry within scientific research and development services with over 66,000 employees, followed by

[10] While life sciences and biotechnology are often considered interchangeable terms, the Bureau of Labor Statistics has a specific definition of life sciences as part of the physical, engineering, and life sciences industry which includes research and development activities in areas such as agriculture, environmental science, biology, botany, chemistry, food, fisheries, forests, geology, health, medicine, oceanography, veterinary, and other allied subjects.

[11] The Bureau of Labor Statistics defines Biotechnology specifically as "the study of the use of microorganisms and cellular and biomolecular processes to develop or alter living or non-living materials."

physical, engineering, and life sciences with just under 36,000 employees. These two subgroups account for 95 percent of employment in the state's scientific research and development service industry.

Economic Impacts of the Massachusetts Research and Development Ecosystem

While the research and development ecosystem as defined in this report makes up about 10 percent of the Massachusetts economy's over 3.6 million jobs, it has a much larger impact when you consider the spinoff effects associated with business-to-business and consumer spending across the entire economy. To calculate these overall impacts, UMDI utilized the IMPLAN input-output model to determine the direct, indirect, and induced impacts on employment, labor income, economic activity, and taxes associated with the R&D ecosystem in the state. The 376,000 jobs in the research and development ecosystem directly create or support over $81 billion in labor income and $115 billion in value added (or gross state product) (see **Table 1**). From these direct investments, additional economic impacts are created through supply chain effects (indirect) and consumption effects (induced). Overall, the total economic impact of the research and development ecosystem supports over one million jobs, $142 billion of income, and total economic activity of $347 billion, of which $218 billion is net new and additive to gross state product, making up over a quarter of the entire state economy. This is approximately the same as the entire economies of New Hampshire and Maine combined.

Table 1: Annual Economic Contributions of the Research and Development Ecosystem in Massachusetts

Impact	Employment	Labor Income	Value Added	Output
Direct	376,300	$81.5	$115.4	$188.3
Indirect	241,100	$27.7	$43.7	$70.1
Induced	389,700	$33.2	$58.5	$88.6
Total	1,007,100	$142.3	$217.7	$347.0

Source: BLS QCEW 2024 and BEA Satellite Accounts 2023, IMPLAN, UMDI calculations
Note: Jobs rounded to nearest 100 and dollars in billions.

Total contributions to jobs and income supported directly by or through ripple effects of the research and development ecosystem account for about 28 percent of 2024 employment and 40 percent of wages in the state. Direct jobs, or those industries in the research and development ecosystem, account for 37 percent of the total impact, meaning 63 percent, or nearly two in three, of jobs created or supported by the research and development ecosystem are in businesses outside of our sector definition. For example, the research and development ecosystem supports over 50,000 jobs each in real estate, retail trade, and accommodations and food services. See **Table 6, Appendix C: Contributions to Output and Jobs by Industry** for output and employment by industry.

Figure 5: Induced and Indirect Jobs in non-R&D Industries

The indirect and induced effects of the Massachusetts R&D ecosystem (itself with 376,000 jobs) create tens of thousands of jobs in industries that are typically not thought of when considering the research economy. Specifically indirect, and induced employment totals over 60,000 in the administration and support services[12] sector, 57,000 in real estate and construction, 50,000 in food services and drinking places, 36,000 in ambulatory healthcare services[13], and 26,000 in social assistance.

[12] Industries in the Administrative and Support Services subsector group establishments engaged in activities that support the day-to-day operations of other organizations. The processes employed in this sector (e.g., general management, personnel administration, clerical activities, cleaning activities) are often integral parts of the activities of establishments found in all sectors of the economy.

[13] Industries in the Ambulatory Health Care Services subsector provide health care services directly or indirectly to ambulatory patients and do not usually provide inpatient services. Health practitioners in this subsector provide outpatient services.

Table 2: Annual Tax Contributions of Research and development ecosystem in Massachusetts, Millions

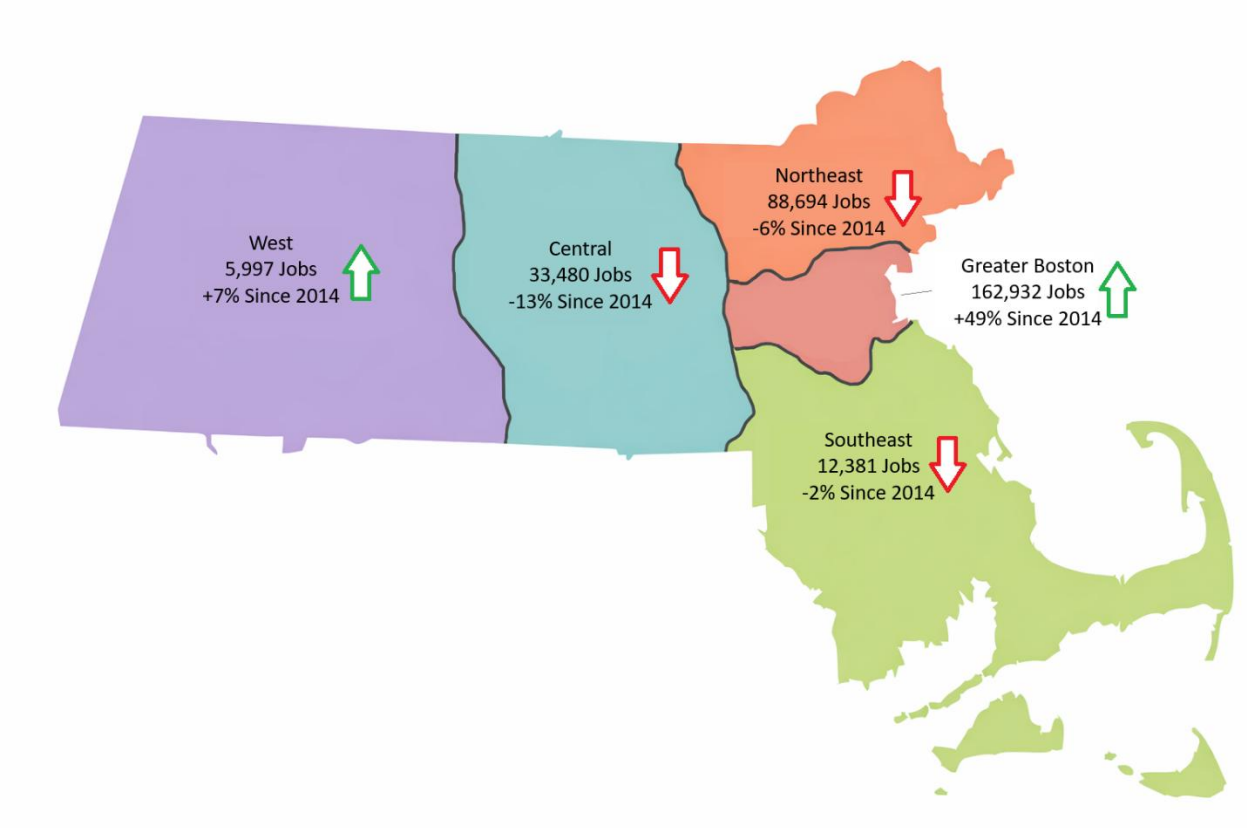
Impact	Local (M)	State (M)	Federal (M)	Total (M)
Direct	$1,512.9	$4,261.1	$18,971.8	$24,745.9
Indirect	$868.1	$1,717.0	$6,539.1	$9,124.2
Induced	$2,215.7	$2,767.4	$8,010.2	$12,993.3
Total	$4,596.8	$8,745.5	$33,521.1	$46,863.4

Source: BLS QCEW 2024 and BEA Satellite Accounts 2023, IMPLAN, UMDI calculations

The jobs, income, and business revenues shown in the above tables also create fiscal impacts through local, state, and federal taxes. Total annual state and local taxes are $13.3 billion, with $8.7 billion going to the state. To put this in context, state taxes generated by the research and development ecosystem are equivalent to over 15 percent of the $56 billion FY2024 Massachusetts budget (see **Table 2**).

Regional Changes in the Research and Development Ecosystem

Figure 6: Research and Development Ecosystem Employment by Massachusetts Region, 2024



Source: BLS and Census via Lightcast; the state is divided into regions defined by MassDevelopment
Note: Does not include University or Healthcare related R&D Jobs. Additionally, Lightcast draws employment data from a number of sources and the regions are summed from zip code level datapoints. The total of all jobs above is therefore slightly lower than the 376,329 total research and development ecosystem jobs shown previously.

Within Massachusetts, the research and development ecosystem has grown since 2014, but much of that growth is concentrated in the Greater Boston area. The Northeast region was only slightly behind Greater Boston in 2014 but saw research and development ecosystem employment shrink slightly over the ensuing decade while Greater Boston saw nearly 50 percent growth. Worcester city saw industry growth of 20 percent but was not enough to offset overall industry decline in the Central region. The Southeast region also posted a very slight decline. The West region, while the smallest in total numbers of research and development ecosystem jobs, was the only region outside of Greater Boston that saw any increase in research and development ecosystem employment between 2014 and 2024.

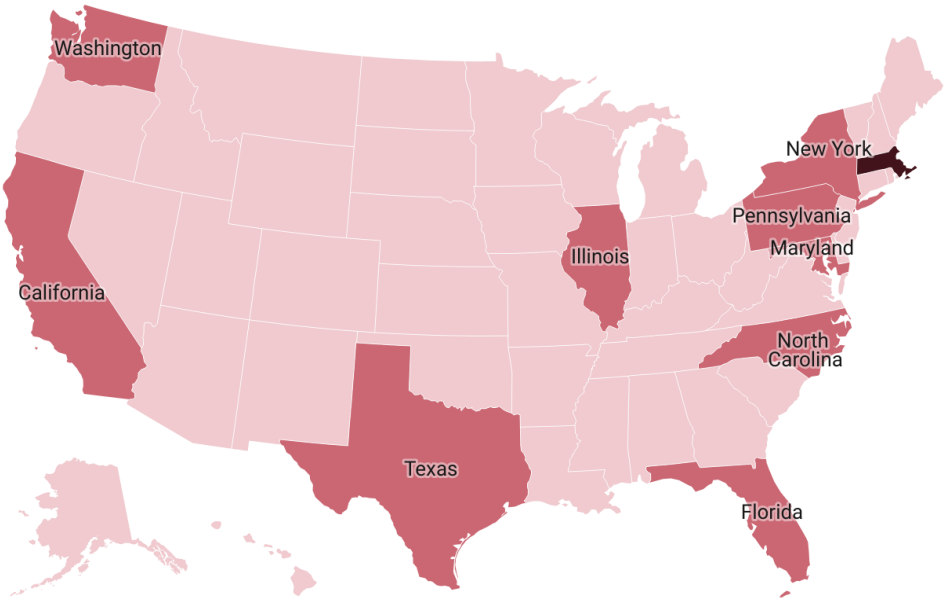
Massachusetts Compared to Competitor States

Massachusetts has an outsized impact on the research and development economy nationwide, but has numerous state competitors that are also well-developed in research and research-intensive industries. To better understand Massachusetts' competitive position, a set of nine other states was selected for benchmarking based on a combination of metrics related to innovation. The identified metrics include the following:

- Total BEA R&D Satellite Accounts Value Added, 2023
- Total COMP TIA 2025, Net Tech Employment (Industry + Occupation), 2023
- Level of NIH and NSF funding, 2023
- Level of NIH and NSF funding intensity (per capita), 2023
- Total venture capital (VC) deal value by state, 2023
- Total scientific R&D services Jobs, 2024

The states which ranked most highly based on these metrics were designated as "competitor states", as shown on the following map and in **Table 3.**

Figure 7: Map of Competitor States



Source: UMDI Analysis, Note: Created with Datawrapper

All competitor states and Massachusetts ranked in the top 10 states in at least five of the six metrics listed above. This set of states is used for comparison throughout this report.

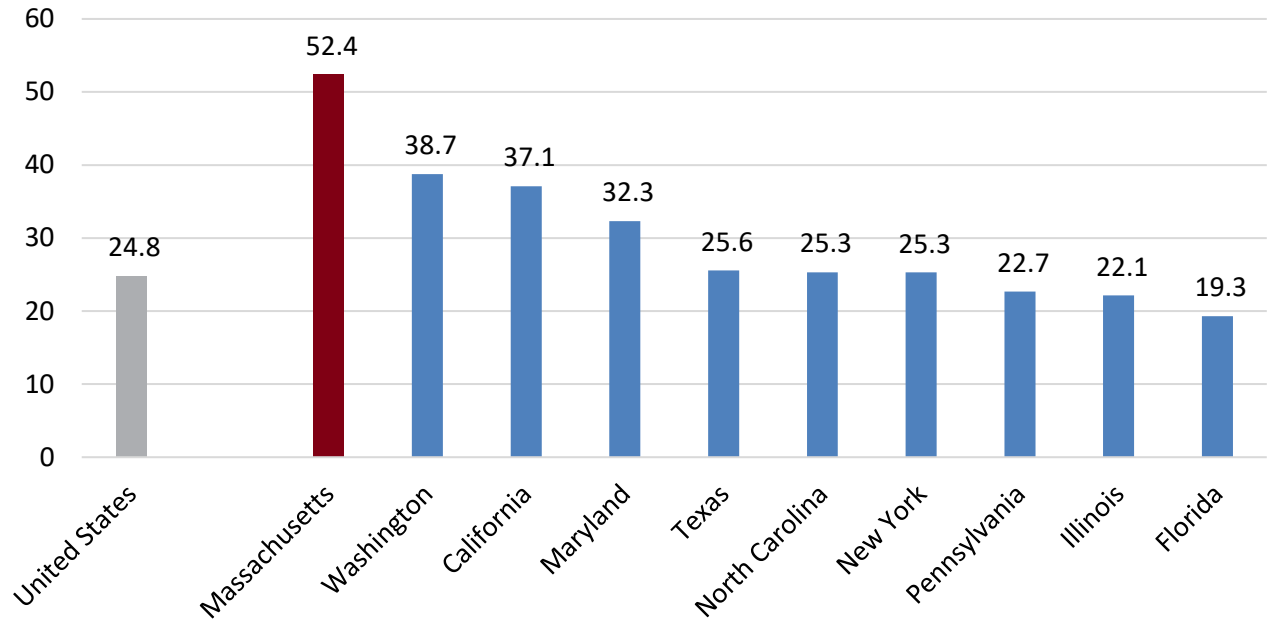
Table 3: Massachusetts' Key Competitor States in Innovation

California	Florida	Illinois
Maryland	New York	North Carolina
Pennsylvania	Texas	Washington

Source: UMDI Analysis

Massachusetts' research and development ecosystem is a quarter of the size of California's and just over half the size of Texas' despite having a fraction of the population of either state.

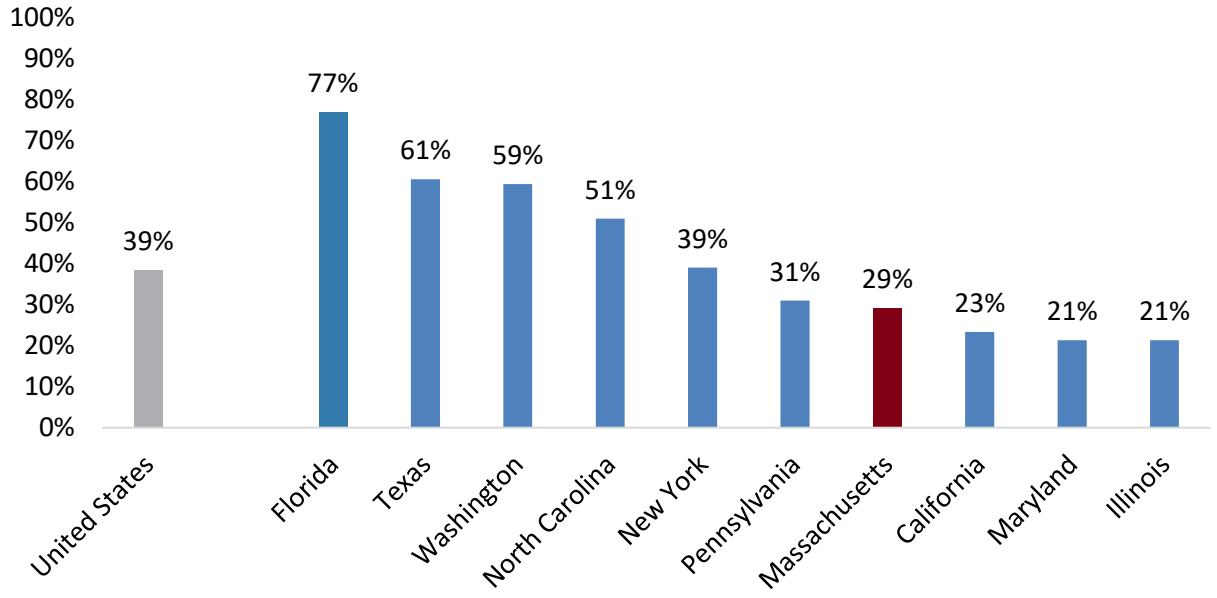
Figure 8: Research and Development Ecosystem Employment Per 1,000 Residents, Massachusetts and Competitor States, 2024



Source: BLS QCEW, BEA R&D Satellite Account .and U.S. Census Population Estimates, 2024
Note: Includes 2023, BEA R&D Satellite Accounts Data on Higher Educational Institutions. Detailed cross-state data on healthcare related research jobs was unavailable so that industry was excluded.

When looking at per capita employment, for every 1,000 residents in Massachusetts, 52 people are employed in the research and development ecosystem (**Figure 8**), the highest of any state, and Massachusetts maintains a stronger concentration in these advanced tech industries than any of its competitors. This concentration underlines how strong Massachusetts' research and development ecosystem is but also how uniquely vulnerable the state is to changes or disruptions in research funding. The Massachusetts economy for decades has benefited from its strengths in key innovation industries, but these jobs and future growth are now under pressure from any diminishment (both in terms of dollar amount and availability) of the foundational research grants from the federal government that helps catalyze the private sector elements of innovation.

Figure 9: Percent Change in Research and Development Ecosystem Employment 2014-2024



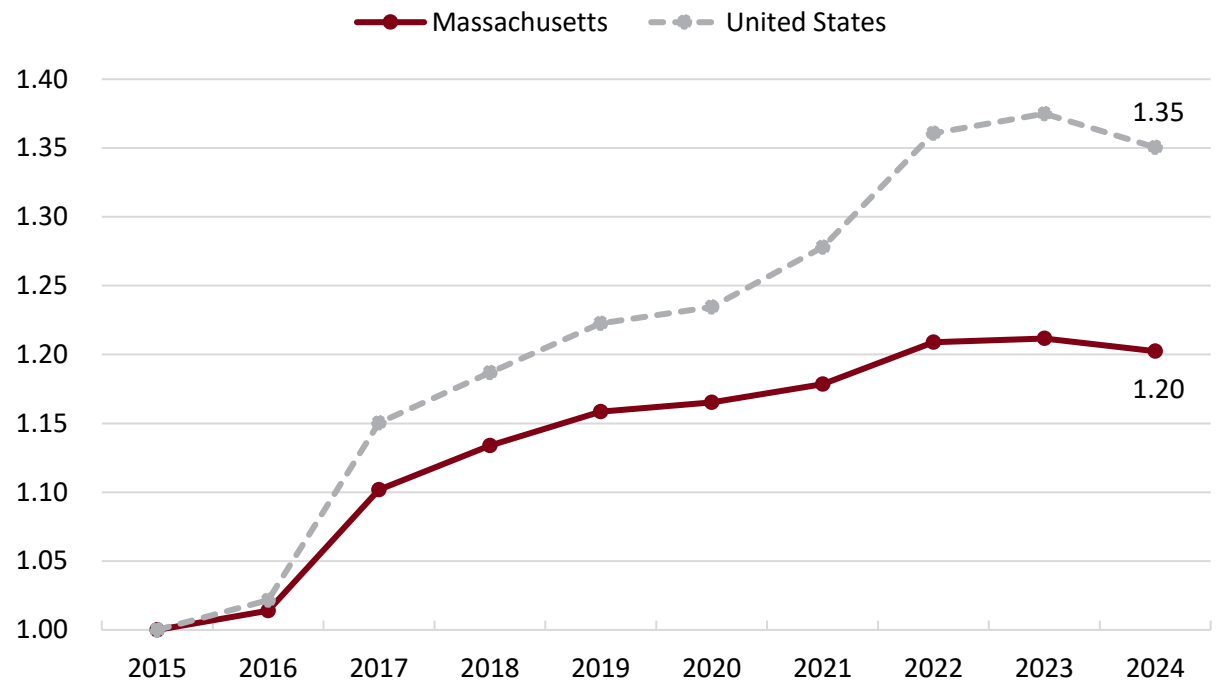
Source: BLS QCEW and BEA R&D Satellite Accounts, 2014-2024
Note: Includes BEA R&D Satellite Accounts Data for 2023 (latest available, held constant through 2024) on Higher Educational Institutions. Detailed cross-state data on healthcare related research jobs was unavailable so that industry was excluded.

Over the last decade, employment in the research and development ecosystem in Massachusetts grew 29 percent, slower than the nation overall, which grew 39 percent in the period between 2014 and 2024. This was the 7th fastest rate among competitors, suggesting that while Massachusetts is far ahead on many metrics of research and development ecosystem performance, other states are gaining ground.

While Massachusetts has the highest concentration of research and development ecosystem employment as shown in **Figure 8**, Massachusetts is ranked seventh among the key competitors states for employment growth between 2015 and 2024 as shown in **Figure 9**. Between 2023 and 2024, employment fell statewide and nationally for the first time since 2015. Massachusetts offers higher salaries in the research and development ecosystem than most other states, the 3rd highest in the country and among competitor states, on average. These high salaries are not as attractive to new employees as they could be, because Massachusetts has one of the highest costs of living in the United States. Massachusetts consistently ranks second after Hawaii for the highest cost of living nationally.[14] These costs do cut into the state's overall competitiveness, making Massachusetts less attractive to research professionals and academics, domestic and international. Cost of living prevents Massachusetts from retaining its large population of college graduates. If Massachusetts cannot offer future workers in the research and development ecosystem an affordable living or adequate funding for their research, the state's competitive positioning will erode into the future.

[14] Missouri Economic Research and Information Center, "Council for Community & Economic Research (C2ER) Cost of Living Data Series," 2025, https://meric.mo.gov/data/cost-living-data-series.

Figure 10: Index of Employment in Innovation Industries, 2015-2024

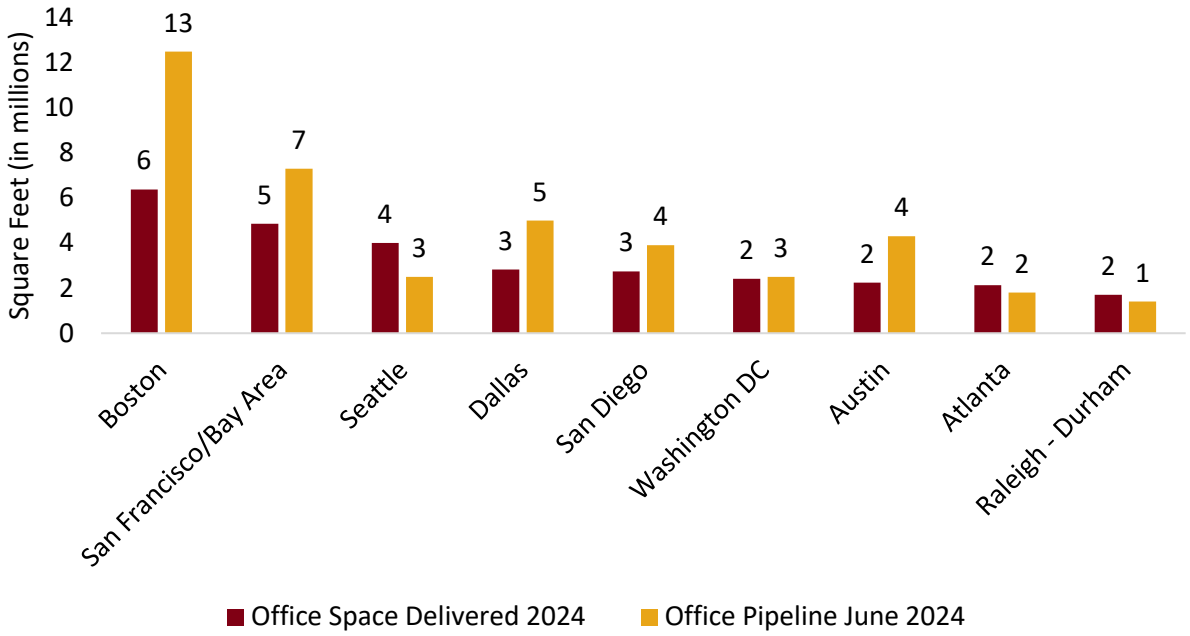


Source: BLS QCEW and BEA R&D Satellite Accounts.
Note: Includes BEA R&D Satellite Accounts Data for 2023 (latest available) was held constant through 2024

Between 2023 and 2024, employment in the research and development ecosystem fell by about four percent statewide and two percent nationally as shown in **Figure 10**. Factors contributing to this recent decline include the recent headwinds in the Massachusetts life sciences sector. MassBio, Massachusetts' life science business council, indicated that in the first half of 2025, the sector received the lowest level of venture capital since 2017 which has resulted in reduced jobs among many of its members.[15] Higher interest rates in 2024 and increasing economic uncertainty relative to earlier in the post-pandemic period have motivated many industries to cut back on staffing and to cancel planned developments. During the initial post-pandemic period and with venture capital flowing in, there may have been an over-hiring in life sciences which is now being corrected.

[15] "Massachusetts Biopharma Sees Rare Job Decline Amid Funding Constraints and Federal Uncertainty," *MassBio*, August 26, 2025, https://www.massbio.org/news/recent-news/industry-snapshot-massachusetts-biopharma-sees-rare-job-decline/.

Figure 11: Top Office Construction Markets, 2024



Source: Commercial Edge

A related trend can be seen in office vacancies and construction in the Boston area. Office vacancies are heading upwards while commercial construction volumes (including lab space) are declining in response to lower than anticipated demand. This is following a tremendous boom in the Boston market for commercial space, as shown in the figure above. Compared to other markets, Boston has built and is building far more office space, and this is reflective of the large-scale research and development activity occurring in the state though reduced demand is translating into a softening of construction. Importantly, the growth of the research and development ecosystem in Massachusetts, especially notable for life sciences in recent years, fuels other sectors like the construction industry which bring thousands of jobs to the state (for example, there are 57,000 induced and indirect jobs as shown earlier in the report in "construction and real estate" linked to the Massachusetts R&D ecosystem). Further federal disinvestment in the foundational research that supports the creation and expansion of these industries will have ramifications on other sectors of the economy, like construction, which benefit from its growth.

Federal Funding Shifts

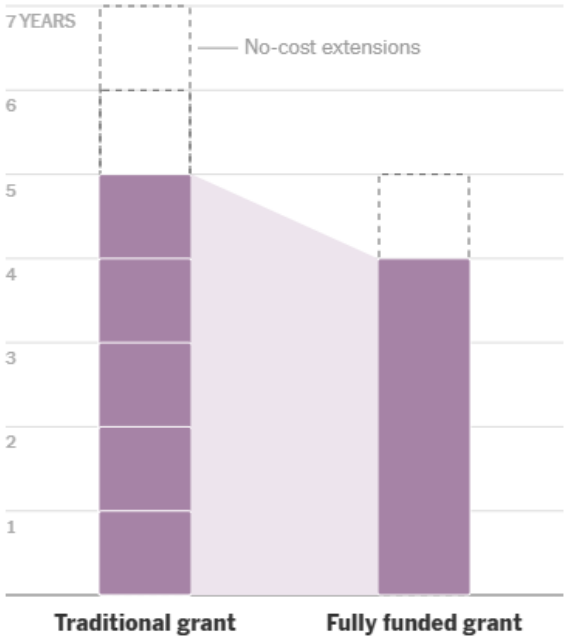
The Trump administration made cuts to research funding a major part of its FY2026 budget, proposing to cut $18 Billion from the budget of the National Institutes of Health (NIH), a nearly 40 percent reduction, $3.9 billion from the National Science Foundation (NSF), a 56 percent reduction, along with cuts to a number of other agencies including the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and the Department of Education, among others.[16] Research funding from the NIH, NSF, and DOE are particularly critical for supporting the innovation pipeline in

[16] Kritika Agarwal, *White House Proposes Steep Cuts to Science and Education Funding* (Association of American Universities (AAU), 2025), https://www.aau.edu/newsroom/leading-research-universities-report/white-house-proposes-steep-cuts-science-and-education.

Massachusetts. The Department of Defense's proposed budget includes a billion dollar increase in science and technology spending compared to FY2025, but it is unclear how that spending's distribution may change between states. Additionally, the proposed budget includes $30 million in spending cuts related to diversity, equity, and inclusion (DEI).[17] Prior to FY2026, the Trump administration's actions around federal funding have already had negative impacts on research and development.

Changes to grant distribution have had a negative impact on research. NIH grants nationally were 41 percent below their 10-year average dollar amount as of summer 2025. Over the following months, the amount of grant money awarded increased, nearing the 10-year average but that money was distributed across a smaller number of grants.

Figure 12: Change in Grant Timing, 2025



Source: The U.S. Is Funding Fewer Grants in Every Area of Science and Medicine, New York Times, Dec. 2, 2025

Additionally, as seen in **Figure 12**, the NIH was awarding grants for five-year periods with two years of no-cost extensions. The new administration constrained grants to four years, with a single year of extension. While on the surface this could seem like a modest change, in practice this means researchers have less time to spend their grant funds and less money annually, on average. For example, the change in funding mechanisms for UMass Chan Medical is translating into a roughly 15 percent reduction of research support.[18] National Science Foundation (NSF) grants follow similar patterns.[19]

[17] United States Department of Defense, *Defense Budget Overview FY2026 Budget Request* (United States Department of Defense, 2025), https://comptroller.war.gov/Portals/45/Documents/defbudget/FY2026/FY2026_Budget_Request_Overview_Book.pdf.

[18] https://www.statnews.com/2026/02/20/states-fill-nih-funding-gap-trump-cuts/

[19] Aatish Bhatia et al., "The U.S. Is Funding Fewer Grants in Every Area of Science and Medicine," The Upshot, *The New York Times*, December 2, 2026, https://www.nytimes.com/interactive/2025/12/02/upshot/trump-science-funding-cuts.html.

An additional new burden placed on researchers and their host institutions are the changes to indirect costs. NIH, for example, capped the indirect rate on its grants at 15 percent. Traditionally, indirect costs are typically almost 30 percent of the grant funding[20] and are used to fund infrastructure, facilities, and activities that support research (e.g., building and equipment maintenance, administrative staff, etc.). In short, indirect costs reflect reimbursement for expenses that are shared across multiple federal projects.[21] There has been progress made towards reversing this policy change. In early 2026, Congress passed a package of bills to increase funding for the National Institutes of Health, reversing Trump's budget cuts into a $415 million increase. Included in that package was language blocking the Administration from limiting indirect costs.[22]

The presidential budget proposal for FY2025 would have cut funding for scholarships and fellowships by 65 percent compared to FY2024, sharply reducing financial support that enables graduate students and early researchers to pursue STEM careers. Postdoctoral fellowships would face an even steeper 91.4 percent cut, severely limiting advanced training and mentored research opportunities at a critical career stage.[23] While the threatened large-scale slashing of research budgets did not transpire as feared, the disruptions caused by these proposals have created great uncertainty especially for early-career researchers. Looming research funding battles (e.g., for FY2027) add to the unpredictability and further undermine confidence.

There have also been considerable delays in the awarding of grants. The first delays took place in January 2025 in response to executive orders from the Trump administration with agencies like the NSF freezing payments to grantees.[24] More recently, the extended government shutdown prevented agencies like the NSF from awarding grants for over a month.[25] There is also uncertainty about the future availability of grant funding given these cuts. Researchers have hesitated to apply for grants given the proposed budgetary cuts for 2026, further delaying potential research.[26] A pervasive sense of uncertainty, compounded by the federal funding cuts, is effectively slowing or halting research momentum and preventing new research from starting.

[20] Office of The Director, National Institutes of Health, "NOT-OD-25-068: Supplemental Guidance to the 2024 NIH Grants Policy Statement: Indirect Cost Rates," February 7, 2025, https://grants.nih.gov/grants/guide/notice-files/NOT-OD-25-068.html.

[21] Kathryn Palmer, "Details of Trump's Budget Cuts Alarm Researchers," Inside Higher Ed, June 3, 2025, https://www.insidehighered.com/news/government/science-research-policy/2025/06/03/new-details-trumps-budget-cuts-alarm-researchers.

[22] Chris Serres, "Congress Rebukes Trump Research Funding Cuts, Easing Fears in Massachusetts," *The Boston Globe*, February 4, 2026.

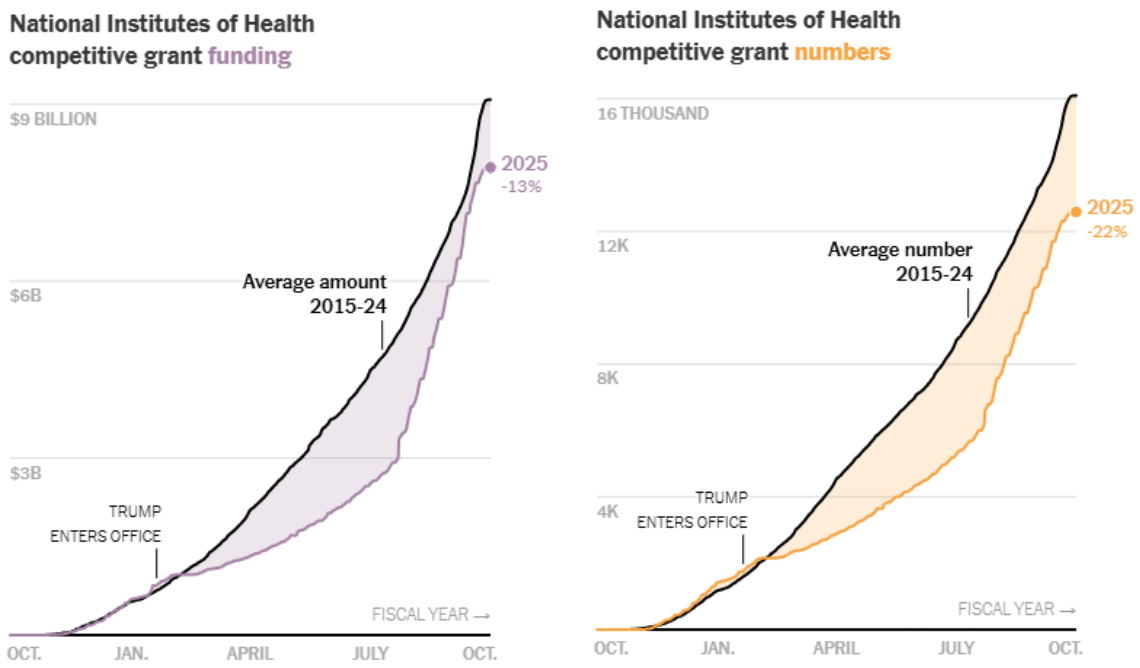
[23] Palmer, "Details of Trump's Budget Cuts Alarm Researchers."

[24] Jonathan Lambert, "National Science Foundation Freezes Payments in Response to Trump's Executive Actions," Science, *NPR*, January 31, 2025, https://www.npr.org/2025/01/31/nx-s1-5282162/scientists-grants-frozen-trump-executive-actions-dei-deia.

[25] U.S. National Science Foundation, "Resumption of Operations at NSF | NSF," November 17, 2025, https://www.nsf.gov/resumption-operations.

[26] Demetre Daskalakis, "Despite Trump Chaos, NSF Avoided Feared Dip in Research Financing," *Science*, November 27, 2025, https://www.science.org/content/article/despite-trump-chaos-nsf-avoided-feared-dip-research-financing.

Figure 13: Change in the Dollar Amount and Number of NIH Grants, October 2024 to October 2025



Source: The U.S. Is Funding Fewer Grants in Every Area of Science and Medicine, New York Times, Dec. 2, 2025

The current administration is prioritizing fewer, larger grants. This puts pressure on researchers, increasing competition for funding and requiring that researchers concentrate spending in a shorter period. Every area of research and development is experiencing negative impacts from these grants. Additionally, targeted grant cancellations for the use of words related to diversity, equity, and inclusion have occurred. The net result of these changes is that in 2025 NIH awarded 25 percent fewer new grants.[27]

Fewer and shorter grants means that researchers have fewer opportunities to participate in research. New researchers must compete against more seasoned researchers for a smaller pool of projects. Without funding, today's young researchers may not have the opportunity to become the next generation of innovators in future decades. This is a long-term loss for both Massachusetts and the United States.

[27] Bhatia et al., "The U.S. Is Funding Fewer Grants in Every Area of Science and Medicine."

In Massachusetts, as of October, 15th, 2025 out of 7,388 NIH grants[28] active at some point in 2025, the federal government has terminated one percent, equal to about $35.5 million in lost funding.[29] [30] Ten percent of these Massachusetts' grants were terminated by the federal government at some point in 2025, but reinstatements brought back most of that award funding. In the next fiscal year, this funding is again at risk in keeping with the Trump administration's proposed budget.[31] A May 2025 report on NSF grant terminations found that the state had lost $53 million in grant funding from that agency.[32]

Even as this study reaches publication (March 2026), considerable uncertainty in federal funding for research remains. Funding cuts announced in early 2025 may or may not come to fruition and there are early signs of funding returning to a semblance of normalcy. Even if this occurs, however, it is still far from certain that funds will be distributed as appropriated by congress, or according to established protocols. The innovation process can take years to decades and the combination of uncertainty and a lack of confidence for consistent future funding is disruptive to ongoing efforts in the research pipeline for Massachusetts investigators.

[28] Massachusetts had the third highest number of grants after California (11,358) and New York (7,921).

[29] Emma Mairson, *Grant Witness: Weekly Terminated NIH Grants Report* (2025), https://grant-witness.us/reports.html.

[30] About ten percent of the 7,388 grants were terminated at some point in time, but that share fell as most were reinstated.

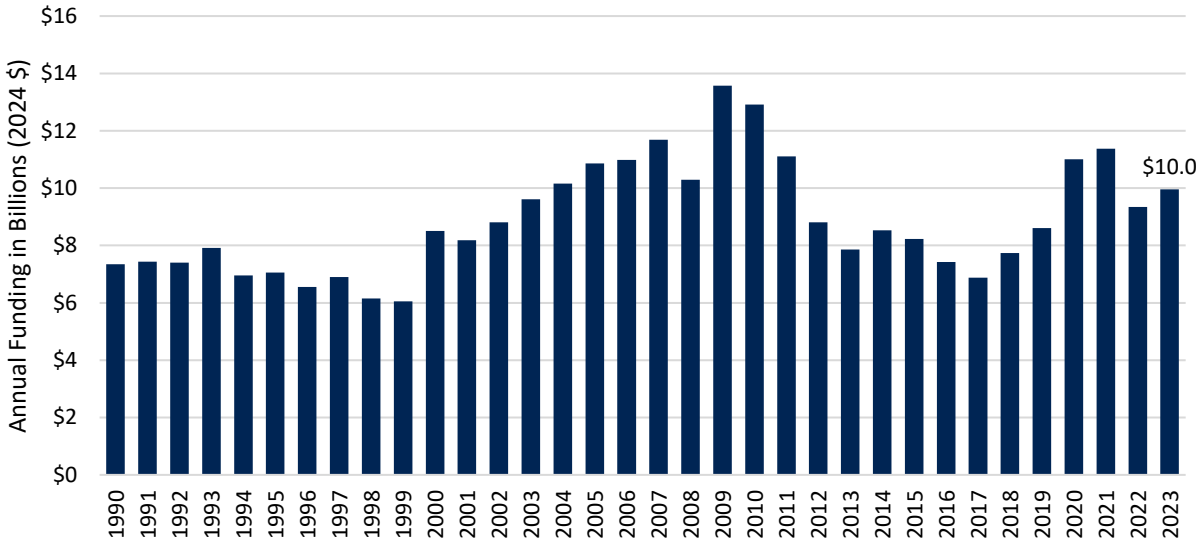
[31] Demetre Daskalakis, "Despite Trump Chaos, NSF Avoided Feared Dip in Research Financing"; To Extend the SBIR and STTR Programs, and for Other Purposes., H.R.5100 (2025), https://www.congress.gov/bill/119th-congress/house-bill/5100.

[32] Grant Witness, "NSF Summary: What Programs Are Being Terminated?," Grant Witness, May 7, 2025, https://grant-witness.us/nsf-summary-2025-05-07.html.

Research Funding Trends

Massachusetts' universities, hospitals, and other research institutions are leaders in securing federal research funding. Massachusetts received approximately $10 billion dollars in federal research obligations in 2023 from all sources (as shown in **Figure 14**), down from a recent 2021 peak of about $11.4 billion. Among the fifty states, Massachusetts ranked fourth in total federal research funding in 2023, following California, Maryland and Virginia. Note that Massachusetts attracts higher levels of federal research dollars than several substantially more populous states including New York, Texas, Pennsylvania, and Illinois.

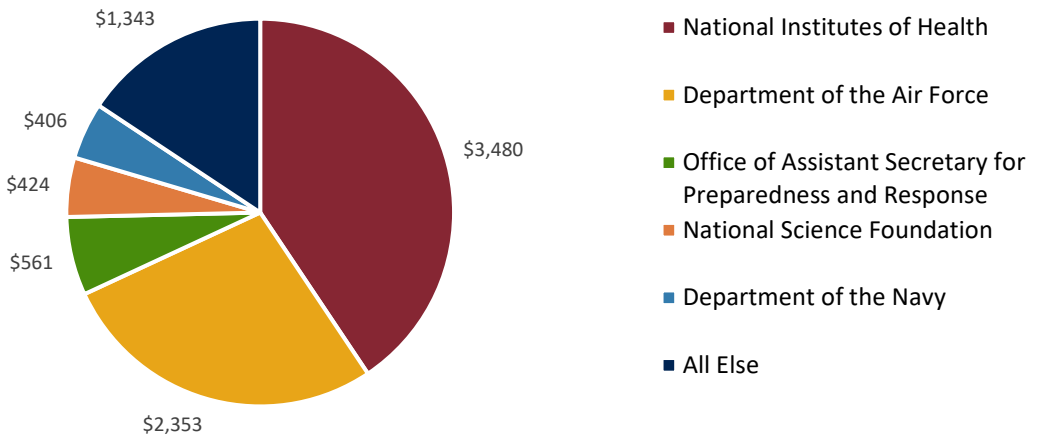
Figure 14: Total Federal Research and Development Obligations to Massachusetts, 1990-2023



Source: National Science Foundation Indicators; Bureau of Labor Statistics, Consumer Price Index, adjusted to 2025 dollars.

Federal funding is awarded by numerous federal agencies. The largest single agency funder in Massachusetts is the National Institutes of Health (as shown in **Figure 15**), followed by the Department of the Air Force.

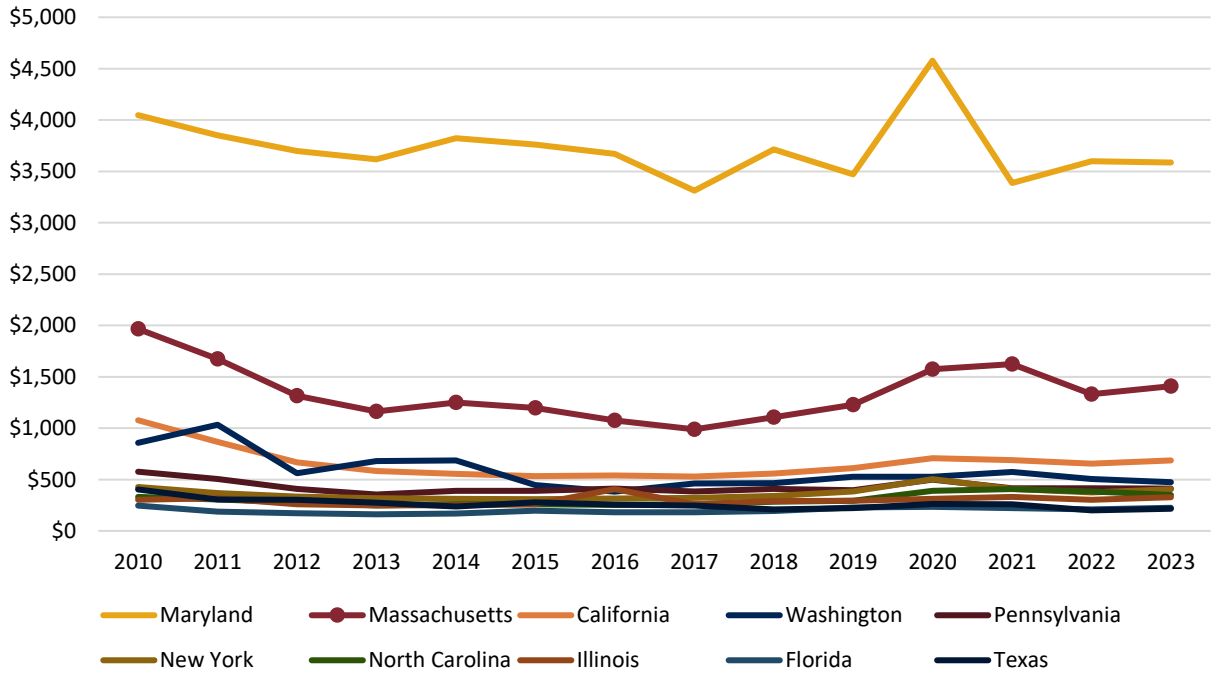
Figure 15: Federal Research Funding in Massachusetts - Top Awarding Agencies in 2024



Source: UMass Donahue Institute customized data queries and aggregations from USAspending. Note: The Office of Assistant Secretary for Preparedness and Response is now the Administration for Strategic Preparedness and Response.

On a per capita basis, Massachusetts is the fourth largest recipient of federal research and development funding nationwide, behind Maryland, New Mexico, and Virginia, and second among the designated competitor states. Maryland takes the lead on an overall and per capita basis due to the high concentration of Department of Defense related funding focused around Washington D.C.

Figure 16: Per Capita Federal Research and Development Obligations, Competitor States

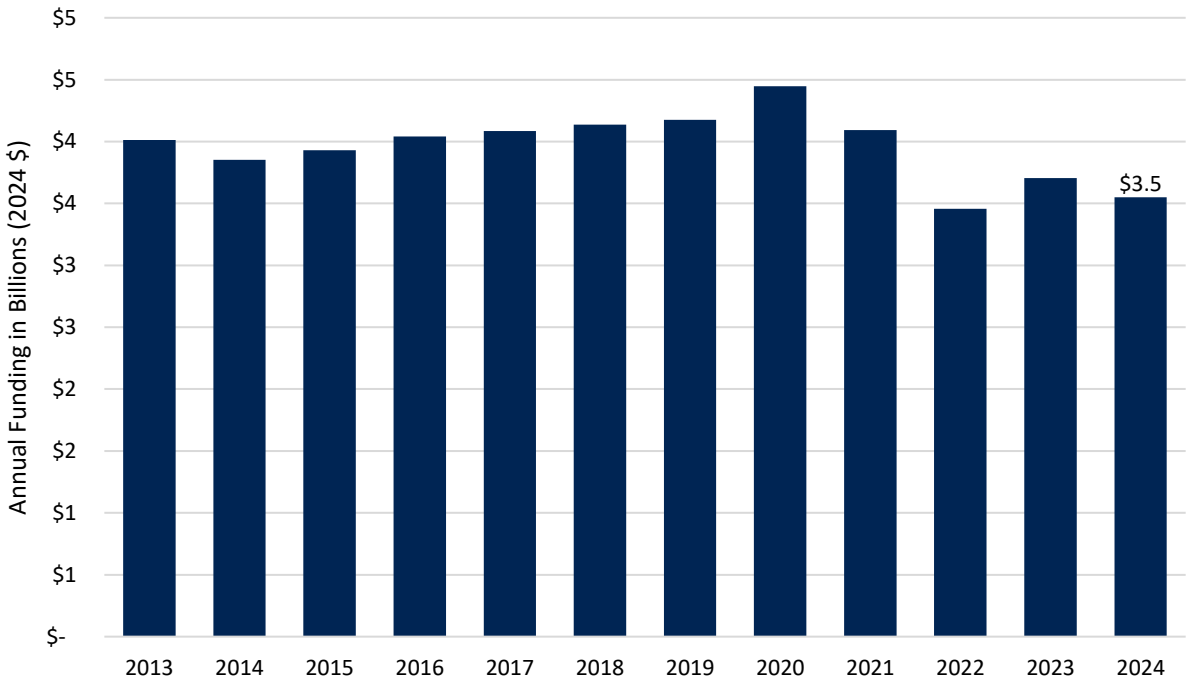


Source: National Science Foundation Indicators; U.S. Census Bureau, Population Estimates; Bureau of Labor Statistics, Consumer Price Index, adjusted to 2025 dollars.

The elevated per capita values are reflective of an agglomeration of advanced innovation taking place in Massachusetts. The agglomeration of activities present in Massachusetts supports dense hubs (like the state's biotech cluster) that boost innovation through knowledge spillovers, specialized labor pools, shared infrastructure, and collaborative synergies between universities, firms, and institutions, leading to higher productivity, faster R&D, and more robust economic growth.

Massachusetts has key advantages in areas of federal research funding, particularly NIH funding, especially for a state of its size. The Commonwealth's federal funding from the NIH peaked at over over $4 billion in 2020, before slowly declining and stabilizing around $3.5 billion during the 2022 to 2024 period (see **Figure 17**). In total, Massachusetts ranks third in total NIH research and development obligations, following California and New York.

Figure 17: Massachusetts NIH Funding, 2013-2024



Source: National Institutes of Health; Bureau of Labor Statistics, Consumer Price Index, adjusted to 2025 dollars.

Per capita, Massachusetts is by far the largest recipient of NIH funding nationwide, receiving nearly $500 dollars per capita in 2024. Maryland is the second largest recipient on a per capita basis, receiving almost $400 per person. These grants fund crucial medical research at Massachusetts hospitals. For example, the top funded NIH grant in Massachusetts in 2025 went to Brigham and Women's Hospital to fund a team of researchers, labs, and health organizations working together to explore whether sequencing a newborn's entire genome could be added to the routine screening tests babies already receive at birth, with the goal of catching treatable genetic conditions as early as possible.[33]

[33] Robert C. Green, "Feasibility of Genomic Newborn Screening Through Public Health Laboratories," *NIH Research Portfolio Online Reporting Tools (RePORTER)*, Grant No. 1OT2OD040029-01, Brigham and Women's Hospital, National Institutes of Health, Fiscal Year 2025, accessed March 20, 2026, https://reporter.nih.gov/project-details/11329454.

On a per capita basis, Massachusetts was also the number one recipient of Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) program funding, which remained stable across the 2013-2024 period (about $460 million in total in 2024). Massachusetts was well ahead of any competitor states on a per capita basis, attracting just over $60 in funding per capita, compared to $24 in second place California.

In late 2025, however, awards were paused awaiting congressional reauthorization of the program. A bill is pending U.S. Senate approval for reauthorization, extending both the SBIR and STTR Programs (and as of this writing, a short-term resolution appears to have been met).[34] However, the uncertainties have already caused some damage. Early data suggests a sharp national decline in awards due to the pauses in funding. Five months into the current federal fiscal year, only 154 SBIR and STTR awards have been recorded nationwide, compared to annual totals of well over 6,000 in prior years. SBIR/STTR grant funding is particularly important for early-stage, high-risk research that can ultimately benefit the country through breakthroughs in such areas as defense and health technologies. A key example from FY2025 is Linguistic Inc, which received an award to finalize an AI-powered learning tool that helps adult immigrants and non-native English speakers learn the language while also training for jobs in fields like healthcare. Starting from a basic question-and-answer app used by a few hundred students, they have already developed a smarter system that adapts to each learner's level and field of interest and supports over 100 languages, and they plan to use the SBIR award to make it even more effective and widely available.[35]

In Massachusetts, just 22 grants have been listed so far for FY2026, versus more than 500 annually in previous years. If these figures from the SBA and participating agencies are up to date, the drop represents a dramatic contraction in funding, one that could be catastrophic for many small businesses. The impact is likely to be especially severe in metropolitan Boston, where awards are typically concentrated and where small firms, who often lack a dedicated advocacy voice, are sensitive to disruptions in cash flow.

The U.S. Senate's recently unveiled compromise legislation to reauthorize the SBIR/STTR programs through September 2031 addresses concerns about companies receiving excessive awards while resolving foreign ownership and cybersecurity issues. The bill also introduces a new "Strategic Breakthrough" award pathway with up to $30 million in matching funds per company, sets limits on proposal submissions, and expands support for commercialization assistance. If passed, awards numbers could recover towards previous years, though 2026 totals will almost certainly be the lowest in recent history.[3637]

[34] Molly Brogran, "Agreement Reached to Restart SBIR, STTR Innovation Programs," *National Small Business Association*, February 25, 2026, https://www.nsbaadvocate.org/post/nsba-sbtc-press-agreement-reached-to-restart-sbir-sttr-innovation-programs.

[35] Victoria Pu, "Personalized and Context-relevant English Lessons with AI (Pace AI) to Advance Adult Learners in Integrated Education and Training (IET) Workforce Opportunities," *Small Business Innovation Research (SBIR) Award Database*, Award No. 91990025C0102, Phase II, Linguistic Inc., U.S. Department of Education, Fiscal Year 2025, accessed March 20, 2026, https://www.sbir.gov/awards/220101.

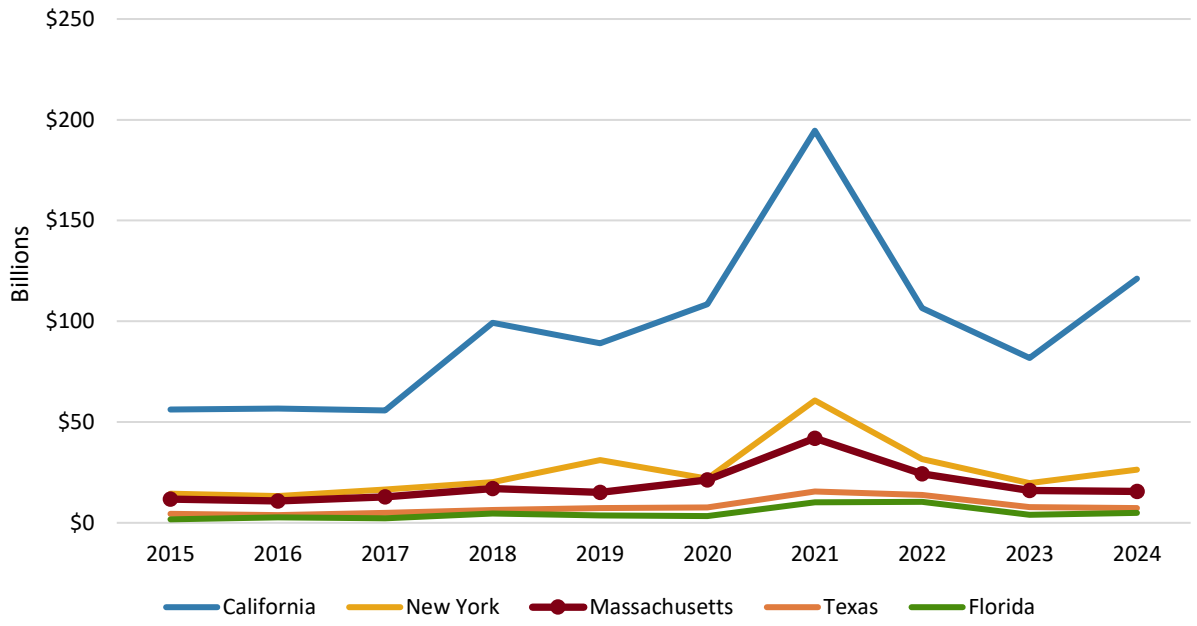
[36] Mark Skinner, "Compromise on SBIR Reauthorization Released; Congressional Votes Expected Soon," *SSTI*, February 25, 2026, https://ssti.org/blog/compromise-sbir-reauthorization-released-congressional-votes-expected-soon.

[37] H.R.4777 - 119th Congress (2025-2026): INNOVATE Act (2026), https://www.congress.gov/bill/119th-congress/house-bill/4777/text/ih.

Venture Capital Funding

Venture capital becomes a crucial funding stream, particularly for research-driven innovations in the later stages of their development and commercialization processes. Massachusetts has a well-developed venture capital ecosystem which is a critical resource for growing and scaling-up innovative companies within the state.

Figure 18: Venture Capital Totals for Top 5 Competitor States, 2015-2024

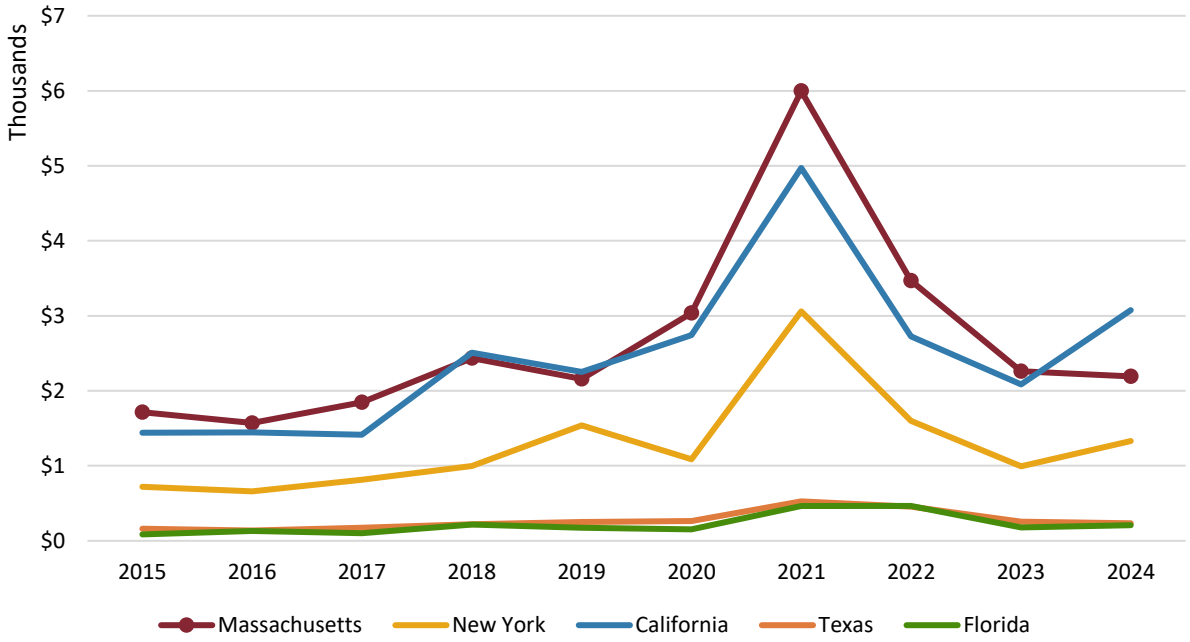


Source: Pitchbook NVCA Venture Monitor Summary; Consumer Price Index, adjusted to 2025 dollars.

Without the venture capital to enable further commercialization and growth, Massachusetts' strengths, like a strong network of universities and research institutions and ample lab space, would not be catalyzed to the same degree. California receives the most venture capital funding by far, unsurprising considering its large population combined with the presence of significant tech hubs like the Bay Area, Los Angeles, and San Diego. Massachusetts ranks third among the comparison states, behind New York but ahead of Florida and Texas. All states saw a spike in venture capital investment in 2021 due to zero interest rates and federal stimulus designed to combat the effects of the COVID-19 pandemic, before declining in 2022 and 2023 as interest rates rose.[38] Funding began rising again in 2024, driven by funding for artificial intelligence (AI) technologies, concentrated largely in California and New York. Preliminary data for 2025 show VC funding grew in Massachusetts but also that both California and New York are pulling further ahead. Until about a decade ago, Massachusetts consistently ranked second, behind California, in VC funding but the growing strength of the New York City research and development ecosystem has firmly placed New York as the number two state for venture capital in recent years.

[38] Office of the New York State Comptroller, Venture Capital Investment in New York City, Report 13-2026, October 2025, https://www.osc.ny.gov/files/reports/osdc/pdf/report-13-2026.pdf

Figure 19: Venture Capital Per Capita for Top 5 Competitor States, 2015-2024

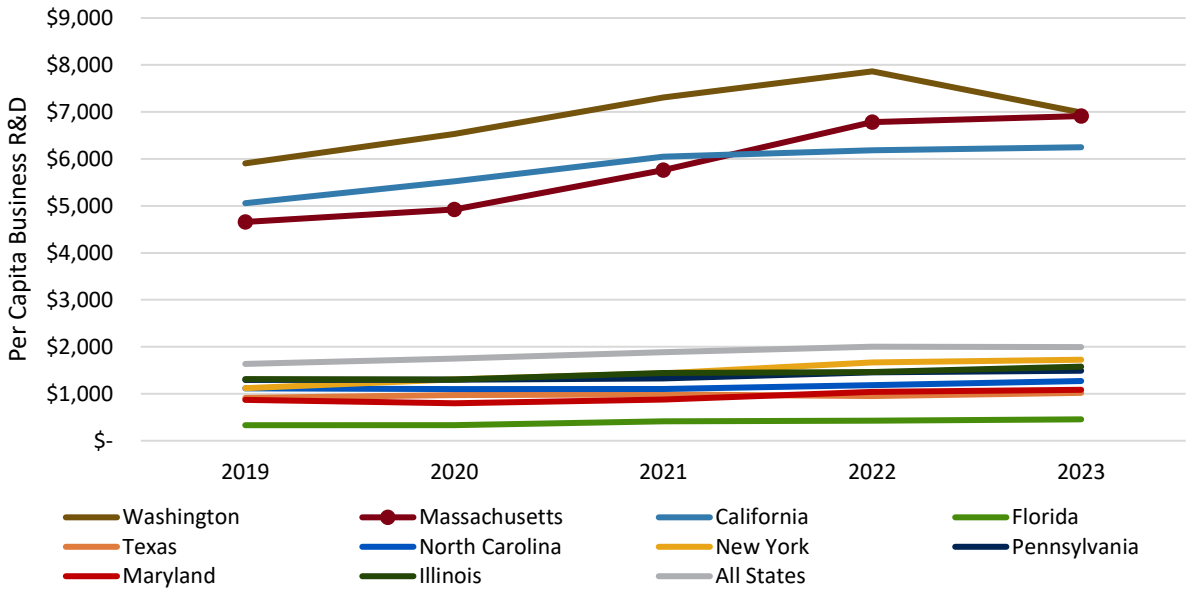


Source: Pitchbook NVCA Venture Monitor Summary; U.S. Census Population Estimates Program; Consumer Price Index, adjusted to 2025 dollars.

When looking at per capita venture capital spending, as compared to total venture capital, California and Massachusetts are neck and neck, with **Figure 19** showing Massachusetts leading between 2020-2023 but being surpassed by California in 2024. New York is in the third-place position, with Texas and Florida trailing far behind. Again, the concentration of venture capital in Massachusetts is a competitive advantage and reflective of the research intensity and resulting industry development taking place in the state.

Private Business Funding for Research and Development

Figure 20: Business R&D Per Capita, Competitor States and U.S. (All States), 2019-2023



Source: NSF National Center for Science and Engineering Statistics; Consumer Price Index, adjusted to 2025 dollars.

The scale of business spending on R&D in Massachusetts is substantial ($49 billion in 2023) and reflects industry recognizing the state as an effective location for transforming ideas into marketable products and services. Massachusetts ranks third in the country in total business spending on R&D, only behind California (a world-leading tech center) and the state of Washington (home of large research-intensive companies like Microsoft, Amazon, and Boeing). The high level of early-stage federal funding for R&D taking place in Massachusetts works through the innovation continuum, helping to establish the state's leadership role in business research and the development of innovative industries.

While California holds a massive lead in total private business funding of R&D, with nearly $245 billion invested in 2023, when looking at per capita private business funding, Massachusetts surpassed California in 2022, and is only barely behind first-place Washington (see **Figure 20).**

Mobility of International and Domestic Researchers

Along with a steady supply of funding, research and development is dependent on access to talented researchers, a resource that is also under threat. Nationwide, scientists, and researchers referred to the summer of 2025 as a "summer of despair" for STEM education, where widespread federal cuts to STEM education and research funding have resulted in canceled grants and halted training programs, reducing opportunities for students and early-career scientists and weakening the STEM talent pipeline. Sharp reductions at NSF and NIH, including major cuts to STEM education programs, are disrupting workforce

development efforts and increasing the risk that researchers, especially early-career scientists, leave the United States to pursue stable funding and career opportunities elsewhere.[39]

International Researchers

Massachusetts has been a magnet for attracting international research talent. As federal cuts to research and development continue and uncertainties persists, the United States will gradually cease to be an attractive place for the world's most talented researchers. Federal visa programs are a primary means of attracting international talent in a range of areas, including in research and development. Given the concentration of educational and medical institutions in the state, the federal research dollars, and the research and development sector in the state more broadly, it is little surprising that Massachusetts is a top state for attracting visa talent.

The J-1 visa is a common avenue for research professionals and academics. The purpose of the J-1 visa is to promote the exchange of ideas, to form connections and provide enrichment between the U.S. and other countries. While the J-1 visa is not specifically limited to people involved in research and development, since 2015, research scholars have been the third largest category of J-1 visas, behind summer workers and college students. Over 270,000 J-1 visas for research scholars have been provided nationwide since 2015, including 24,000 in the 2023-2024 program alone. In 2024, Massachusetts was the second ranking (despite being only the 16th most populous state) destination state for J-1 visas for research scholars, short-term scholars, and college professors.[40] Over 4,500 of these visas entered the state in the 2023-2024 program year. More than one in every 10 J-1 visa recipients in these categories went to Massachusetts.[41]

Table 4: Top 10 Destination States for Research-related J-1 Visas, by type, 2023-2024

Research Scholar		Short-term Scholar		Professor	
California	4,248	California	2,701	California	82
Massachusetts	**2,855**	**Massachusetts**	**1,662**	**Massachusetts**	**68**
New York	2,368	New York	1,514	New York	63
Texas	1,376	District of Columbia	688	Texas	43
Illinois	1,170	Pennsylvania	597	Illinois	42
Pennsylvania	1,114	Illinois	570	Ohio	27
Maryland	893	Texas	545	Michigan	24
Florida	842	Michigan	457	Georgia	22
North Carolina	717	Florida	415	Pennsylvania	21
Minnesota	635	Indiana	381	New Jersey	19

Source: BridgeUSA Facts and Figures 2015-2024

J-1 visas, like all other visas, are vulnerable to increasing restrictions by the federal government. In early 2026, visa issuances to residents of 75 different countries were paused, with the federal government

[39] Lisa Guernsey and Shalin Jyotishi, "A Summer of Despair for STEM Education," *New America* (September 22, 2025), https://www.newamerica.org/education-policy/edcentral/summer-of-despair-for-stem-education/.

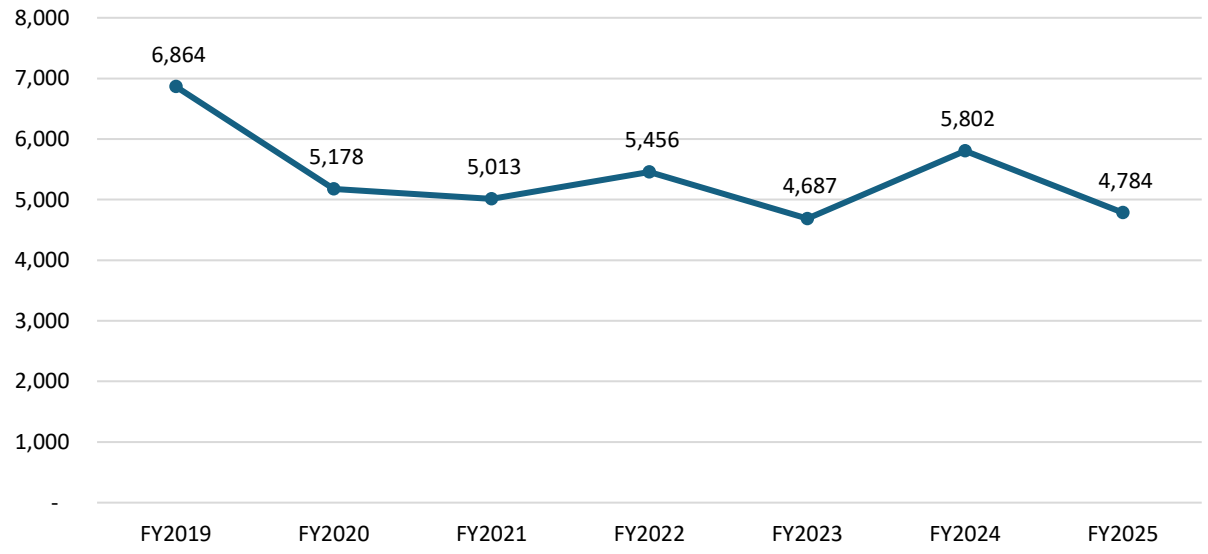
[40] Massachusetts is also the second largest destination for J-1 summer worker visas, and the third largest destination for J-1 college students. J-1 visas are also issued for "specialists" who are defined as "experts in a field of specialized knowledge or skills who provide opportunities to increase the exchange of ideas with American counterparts." Massachusetts is not in the top 20 states for specialists, with Washington D.C. receiving by far the largest number, 481 in 2023-2024, followed by California, which received 81.

[41] U.S. Department of State, "Facts and Figures 2015-2024," *BridgeUSA*, 2024, https://j1visa.state.gov/facts-and-figures-2015-2024/.

stating the restrictions reflected countries whose residents, as immigrants, according to a State Department, "take welfare from the American people at unacceptable rates."[42] The list includes countries like Brazil, the fourth largest origin for research and short-term scholars on J-1 visas in the nation.

Another source of research professionals in the United States is the H1-B visa, which is designed to allow employers to hire skilled foreign workers in specialty occupations. In FY2025, there were 4,784 new H1-Bs issued in Massachusetts, representing a decline of 18 percent compared to FY2024. A recent peak in H1-B visas, 6,864, was reached in FY2019. Nearly half of H1-B visa holders work in the professional, scientific, and technical services industry sector, meaning a decline in H1-B admissions will hit the research and development ecosystem particularly hard.[43]

Figure 21: Number of H1-B New Employment Approvals, Massachusetts



Source: U.S. Citizenship and Immigration Service, H-1B Data Hub

In FY2025, Massachusetts was ranked 7th for H1-B approvals for new employees, out of all U.S. states. The top employers of people with these visas include several educational and medical firms engaged in research as shown in **Table 5**. UMass Chan Medical School, for example, received 99 H1-B visas for new applicants. The linkages between Massachusetts' professional services, high tech, medical, and academic sectors with international talent are clear.

[42] Monica Pitrelli, "U.S. Freezes New Immigrant Visas for 75 Countries: See the Full List," CNBC, January 14, 2026, https://www.cnbc.com/2026/01/15/us-stops-immigrant-visas-for-75-countries-see-the-full-list.html.

[43] Lauren Edmonds and Andy Kiersz, "2 Charts Show Which Industries Employ the Most H-1B Workers and How Much Those Roles Typically Pay," Business Insider, September 20, 2025, https://www.businessinsider.com/which-industries-employ-h1-b-visa-holders-charts-2025-9

Table 5: Top 10 Massachusetts Employers by H1-B New Employment Approvals, FY2025.

Employer	New Employment Approvals
Boston Consulting Group	242
Fidelity	169
Harvard University	110
Massachusetts General Hospital	102
Randstad Digital	101
UMass Chan Medical School	99
Massachusetts Institute of Technology	99
Dana-Farber Cancer Institute	98
Brigham And Women's Hospital	94
Children's Hospital Corporation	81

Source: U.S. Citizenship and Immigration Service, H-1B Data Hub

H1-B visas are commonly used by immigrants from countries like Brazil and Nigeria[44], which are targets of the recent visa restrictions, and it remains to be seen what impact the visa restrictions will have on the supply of these workers in Massachusetts.

Both these visa programs, J-1 and H1-B, help bring in international talent to the U.S. research and development industry. While available data does not yet show a decline in these visas, if saddled with further restrictions, this talent pipeline will divert their talents to competing nations and slowly, if not more abruptly, shut down.

Other countries are actively expanding their visa programs around research and development. China has implemented a new "K-visa" visa aimed at younger STEM talent and their "Qiming Program" provides generous cash bonuses and housing subsidies for scientists. Germany, the United Kingdom, and Japan all offer visa programs that are not conditional on a specific job offer. Promising talent can move to these countries and capitalize on new opportunities. This level of flexibility can be attractive to scientists. The European Union has implemented a 500-million-euro program called "Choose Europe for Science" targeting researchers from abroad. [45] Canda recently announced a 12-year, $1.7 billion dollar investment in attracting international research talent including $134 million to be spent in the next three years on PhD students and post-doctoral researchers.[46]

U.S. Domestic Researchers

Competitor states are quickly developing new initiatives designed to attract researchers, including the $3 billion Dementia Prevention and Research Institute of Texas (DPRIT), approved by voters in a ballot measure, which authorizes $3 billion in state surplus funds to be awarded over 10 years to Texas-based researchers for work in Alzheimer's, Parkinson's, and other diseases.[47] Another recent example is the

[44] U.S. Customs and Immigration Service, *Characteristics of H-1B Specialty Occupation Workers FY2024* (U.S. Customs and Immigration Service, 2025), https://www.uscis.gov/sites/default/files/document/reports/ola_signed_h1b_characteristics_congressional_report_FY24.pdf.

[45] Glass, "America Is Losing Scientists. Here's a Solution."

[46] The Editorial Board, "Losing PhD Students Means Losing the Future," *Boston Globe*, February 5, 2026.

[47] Jennie Erin Smith, "Dementia Researchers Cheer Texas Voters' Approval of $3 Billion Funding Initiative," *Science*, November 7, 2025, accessed March 20, 2026, https://www.science.org/content/article/dementia-researchers-cheer-texas-voters-approval-3-billion-funding-initiative.

Illinois Quantum and Microelectronics Park (IQMP) is a first-of-its-kind campus for quantum scale-up and other related quantum and advanced microelectronics research and development. IQMP received $500 million in funding from the Illinois legislature and has already attracted established tenants like IBM and DARPA, as well as numerous quantum startups and researchers.[48] Finally, California has proposed the $23 billion California Foundation for Science and Health Research, explicitly designed to counter disruptions in federal funding, and operate as a general funding mechanism much like current SBIR/STTR and NIH grants.[49] These types of initiatives being promulgated by competitor states raise the risk for Massachusetts to lose researchers and future technology development to areas where key investigators can see clear funding support.

Other countries that are incentivizing research talent attraction are also beginning to draw U.S. talent. Scientific employers in Switzerland and Australia have identified an increase in applications from U.S. researchers.[50] A March 2025 survey by the journal Nature found that 75 percent of surveyed U.S. scientists were considering moving abroad.[51] Nature also found a 32 percent increase in the number of U.S. applicants for positions abroad in early 2025, compared to the same period in the year before. A Boston Globe survey found that one in six surveyed NIH researchers in Massachusetts had lost staff to other countries.[52] Prominent U.S. researchers such as California-based Fields Medal winning mathematician Terrence Tao, have expressed uncertainty about remaining in the U.S. after having funding frozen or cut.[53] This is accelerated by the reductions in funding and a decline in the number of admissions of PhD candidates in U.S. schools. The University of Pennsylvania[54] and UMass Chan Medical School[55] are two major universities that have rescinded PhD admissions in response to cuts to research funding. The Boston Globe reported that in the previous school year, UMass Chan school accepted 73 PhD students, but in the current school year, accepted only 13, after withdrawing many offers to students in response to funding cuts. The UMass Chan chancellor, Michael Collins, anticipates a larger PhD class next year but that it will still be below average because of declines in federal grant funding.[56] An interview, conducted with a UMass official, identified two faculty members who left campus because there was no longer a clear path forward for them in the United States to develop their technology. The interview also identified that China was a major draw for scientists looking for better opportunities.

[48] Office of Governor JB Pritzker, "Gov. Pritzker Breaks Ground on Illinois Quantum and Microelectronics Park (IQMP)," *IQMP News*, September 30, 2025, accessed March 20, 2026, https://iqmp.org/news/gov-pritzker-breaks-ground-on-illinois-quantum-and-microelectronics-park-iqmp/.

[49] University of California, "UC Sponsors SB 895 to Place a $23 Billion Bond to Fund Scientific Research in California on the November Ballot," *University of California Press Room*, March 5, 2026, accessed March 20, 2026, https://www.universityofcalifornia.edu/press-room/uc-sponsors-sb-895-place-23-billion-bond-fund-scientific-research-california-november.

[50] Nisha Gaind et al., "US Brain Drain: Nature's Guide to the Initiatives Drawing Scientists Abroad," *Nature* 641, no. 8065 (2025): 1077–79, https://doi.org/10.1038/d41586-025-01540-y.

[51] Alexandra Witze, "75% of U.S. Scientists Who Answered Nature Poll Consider Leaving," *Nature* 640, no. 8058 (2025): 298–99, https://doi.org/10.1038/d41586-025-00938-y.

[52] Kay Lazar et al., "How Trump Administration Funding Cuts Put Massachusetts Research at Risk," *The Boston Globe*, February 11, 2026.

[53] Stephanie Sy et al., *Top Researchers Consider Leaving U.S. amid Funding Cuts: "The Science World Is Ending,"* PBS NewsHour, 2025, https://www.pbs.org/newshour/show/top-researchers-consider-leaving-u-s-amid-funding-cuts-the-science-world-is-ending.

[54] Isha Chitirala and Finn Ryan, "Penn to Reduce Graduate Admissions, Rescind Acceptances amid Federal Research Funding Cuts," The Daily Pennsylvanian, February 21, 2025, https://www.thedp.com/article/2025/02/penn-graduate-student-class-size-cut-trump-funding.

[55] Madeline Ashley, "Federal Funding Cuts Disrupt Medical Schools," *Becker's Hospital Review*, March 14, 2025, https://www.beckershospitalreview.com/finance/federal-funding-cuts-disrupt-medical-schools/.

[56] The Editorial Board, "Losing PhD Students Means Losing the Future."

Expanding the availability of visas and providing more funding to sustain and add to research capacity, will help the U.S. attract and retain scientific talent, avoiding a brain drain. Massachusetts' leadership position in research and development means it has proportionately more to gain from the restoration of, and future improvement to, the talent pipeline.

Interview Findings on the Importance of Federal R&D Funding

The UMass Donahue Institute interviewed 15 professionals across the innovation industry and economic development in the state. The interviews were with individuals across a range of roles in ecosystem including startup founders, academics, research funding professionals, public policy makers, and representatives from industry groups. These conversations have identified several themes about the threat of research funding cuts to the Massachusetts economy.

The Importance of Early-Stage Funding

Interviews confirmed that federal funding supports early-stage research that private industry would not engage in due to the increased level of risk. This means that federal funding supports research which may not have a payoff for years and sometimes decades. The proposed cuts may not have an immediate impact on active research but 10 years from now, there will be a shortage of new startups and new innovations because of this disruption. The early-stage research supported by federal funding, plants the seeds for future growth, which is especially important to the innovation-based economy of Massachusetts.

Massachusetts Key Strengths

Massachusetts has been a leader in life sciences research but also excels in material sciences, defense technology, clean energy, and AI driven innovation. Innovation in these spaces is often tied closely to university campuses across the state. Interviewees identified many examples of innovative startups that still depend on a strong research ecosystem. Massachusetts researchers have formed innovative startups such as Myrias Optics, which produces precision optics quickly using innovations from the founders work at UMass and Florrent, which produces super capacitors which can be used to improve electric grid reliability. Both startups benefited from a decade or more of research. A large part of Massachusetts' private industry depends on a steady flow of innovations from public and private university campuses across the state.

In addition to companies highlighted in interviews, several advanced firms were identified with strong ties to federal funding. AeroShield is a materials science company spun out of research at the Massachusetts Institute of Technology (MIT), where CEO Dr. Elise Strobach invented its ultra-clear silica aerogel for use in insulating windows. AeroShield has developed a breakthrough aerogel material that is more transparent than glass, twice as insulating as air, and extremely lightweight. Another example is Delavie Sciences, a Massachusetts-based skincare company that spun out of NASA-funded basic research into extremophile bacteria on the International Space Station. Alnylam Pharmaceuticals, based in Cambridge, Massachusetts benefitted from licensing patented innovations from MIT, the Whitehead Institute for Biomedical Research, and the University of Massachusetts Medical School in the early 2000s. One of their most important acquired patents "Tuschl-1" was developed with funding from the National Institutes of Health.[57] The company has grown steadily, developing advanced RNA Interference-based medical treatments and expanding the company's physical footprint int the state, opening a high-

[57] Thomas Tuschl et al., RNA SEQUENCE-SPECIFIC MEDIATORS OF RNA INTERFERENCE, European Patent Office Patent EP1309726A2, filed March 30, 2001, and issued October 11, 2001.

tech manufacturing facility in Norton, Massachusetts in 2025. Alnylam's treatments target specific genes, deactivating them, which means they can target specific diseases with pronounced effect.[58] More than 20 years after those early patents, which were supported by government funding, Alnylam is still growing in Massachusetts. Such early research is important to fund because its economic and social impact may not be felt for many years, but once it comes to fruition there can be incredible positive impacts on society. For MIT, alone, federally funded research over the years has made key contributions in numerous areas beyond life sciences, including defense, aerospace, computing, energy, and emissions-reducing technologies.

Interviews identified that Massachusetts has an edge on providing its own capital for research. The state created the first publicly funded venture capital fund in 1946 through the American Research and Development Corporation (ARD).[59] Building on that history, Massachusetts continues to have a network of publicly supported organizations that help innovation find financial support, such as Mass Life Sciences Center, the Mass Clean Energy Center (Mass CEC), and Mass Ventures. One interview identified an out-of-state firm that was attracted to Massachusetts because of the abundance of services available to startups in the state. Additionally, state-supported programs like the Massachusetts Technology Transfer Center have been successful in helping firms commercialize their innovations. These kinds of public support offerings for innovation help startups build on the early-stage support received from federal sources of research and development funding. State proposals to add further funding for research and development such as the $400 million dollar Massachusetts Discovery, Research, and Innovation for a Vibrant Economy (DRIVE) act are intended to counteract federal reductions and signal the state's ongoing support for research and development. Interviews, however, indicated that state funding alone is unlikely to be an adequate replacement for billions in federal funding that could be at risk. State-sponsored programs for technology development and enterprise scaling does send a positive message to businesses that Massachusetts supports their growth.

Massachusetts Vulnerabilities

The ability of Massachusetts to retain its college graduate population is important to maintaining future competitiveness on the domestic and international stages. Interviews identified the tendency of that population to move out of state after graduation as a serious issue, and data from U.S. Census Population Estimates shows that domestic outmigration from Massachusetts is largely (75%) driven by 25–34-year-olds. Attracting and retaining federal funding and providing more opportunities for graduates in the state is a means of retaining this population. Interviews identified that countries like France, Canada, and Germany, and other U.S. states (sensing that Massachusetts researchers have become unmoored due the federal R&D funding cuts), are actively recruiting on campuses in Massachusetts and can offer attractive funding. The threat of losing talent due to federal funding cuts cannot be understated as Massachusetts has an incredible competitive advantage in talent.

Research and development require real estate and energy, both of which are expensive in Massachusetts. Interviews identified that different firms need different kinds of physical space to work,

[58] Alnylam, "About Alnylam® Pharmaceuticals," Alnylam, 2025, https://www.alnylam.com/about-alnylam.

[59] Melissa Banta, "ARD - Georges F. Doriot: Educating Leaders, Building Companies," *Harvard Business School Baker Library Historical Collections*, n.d., accessed January 28, 2026, https://www.library.hbs.edu/hc/doriot/innovation-vc/ard/.

some firms need only office space, while others need manufacturing or wet lab[60] space. The high cost of real estate and utilities in Massachusetts (among the highest in the country[61]), mean that firms may start up in-state, then scale up elsewhere. For example, North Carolina attracted nearly $11 billion in life sciences industry investments in 2024, alone.[62] Federal support on the research side reduces the overall financial burden on firms, which frees up more resources for other expenses such as real estate and utilities expenses. Electro Magnetic Applications (EMA), interviewed for this report, had a federal research grant in hand, and then was able to work with the City of Pittsfield to find an additional half a million dollars in funding that supported acquiring office and lab space. EMA has been able to grow in the city since that time. Without federal support covering the research side of the equation, it will be that much harder for firms like EMA to find additional funding and pay for space in an expensive state like Massachusetts.

Future Research and Development Opportunities

Interviewees see climate technology (climatetech) as an area still full of potential for growth in the state despite opposition from the current federal administration. The Massachusetts Secretary of Economic Development, Eric Paley, highlighted climatetech as one of the top three industry clusters in Massachusetts with innovations occurring in scalable industrial applications such as lightweight metals for electric vehicles. Another interview identified the state's strength in areas like energy storage and building decarbonization. Massachusetts is well positioned to advance in this area and has entities like MassCEC that can guide and support firms working in that sector.

Meanwhile, the governor has launched the Strategic Hub for Innovation, Exchange and Leadership in Defense (SHIELD) initiative, amplifying state support for defense-related procurement and innovation which may help counterbalance cuts to climate innovation at the federal level.[63] Quantum computing is another potential growth area for the state. Google recently acquired Atlantic Quantum, a Massachusetts-based MIT spinoff.[64] Federal funding will be vital for the state to continue to grow in these areas. AI continues to be a potential growth area with 18 percent of Massachusetts businesses using the technology as of January, 2026 similar to the U.S. rate of uptake.[65] Interviews identified that while Massachusetts is at a disadvantage for developing data centers which require vast amounts of land and electricity, the state has strengths in AI-related software development and applying the technology to existing strengths such as revaluating existing data for new innovations in areas such as medical research.

While the state is expensive to live in, quality of life is extremely high. Multiple interviews highlighted that research and development firms can attract people because of the high quality of life in the state,

[60] University Lab Partners defines a wet lab as one where chemical reagents or biological matter can be analyzed and tested physically, the alternative, a dry lab focuses more on applied or computational analyses via the creation of computer-generated models or simulations.

[61] U.S. Energy Information Administration (EIA), "Electric Power Monthly," December 2025, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

[62] https://www.ncbiotech.org/news/north-carolina-booked-over-10-billion-life-sciences-investments-2024

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[64] Matt Swayne, "Atlantic Quantum Joins Google Quantum AI," *The Quantum Insider*, October 3, 2025, https://thequantuminsider.com/2025/10/03/atlantic-quantum-joins-google-quantum-ai/.

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including excellent public schools. Later career professionals, who are interested in settling down, are drawn to Massachusetts towns. Directing those firms towards lower cost parts of the state, such as Central and Western Massachusetts, may also promote economic development in areas with more developable land and lower costs while allowing firms to make a strong case for why prospective new hires should either stay or move to Massachusetts. Regional innovation centers such as Pittsfield's Berkshire Innovation Center and the Worcester-based Massachusetts Biomedical Initiative are boosting development of the research and development industry locally, beyond Greater Boston. This suggests a path forward for startup firms if they can continue to secure research funding.

Conclusion

The Massachusetts economy plays a critical role within the greater U.S. economy, as one of the most important generators specialized knowledge and innovation. The state's innovation ecosystem is unique with universities, businesses, medical institutions, and non-profit organizations coming together to form an agglomeration with mutually reinforcing interactions that set technology development, advancement, and commercialization in motion. Thanks to this dynamic, Massachusetts is at the forefront in making breakthroughs that create industry growth, whether in life sciences, clean energy, semiconductor machinery, or defense (among many others), that are foundational for the state's economy and continued growth. Innovation and the industries it seeds are critical engines for stimulating investment and as seen in this report, providing jobs for people residing in Massachusetts. The jobs coming from innovation are not just in industries directly associated with tech like medical equipment, radars, and robotics, but also in industries like construction that benefit from the expansion and scaling of businesses that have Massachusetts research at their roots.

While the Massachusetts innovation ecosystem continues to possess globally recognized university, medical, and business assets, many taking decades to develop, the system is now under threat by federal uncertainties in research funding support. As explained in this report, federal research dollars from agencies like the National Institutes of Health, the National Science Foundation, the U.S. Department of Energy, and others provide the initial catalyst for research taking place at the state's universities to launch from initial inception and move along a multi-year pathway towards commercialization. The federal funding is fundamental to support a virtuous cycle of innovation that would not take place otherwise, because businesses see early-stage research as too risky for their investment dollars. Businesses do take the helm to bring innovation to the finish line and into production, but it is the federal research funding that begins the process to allow this to happen.

The federal research funding cuts announced in 2025 and the uncertainties they created also translate negatively to Massachusetts' ability to retain the talent that leads the state's innovation development and growth. A lack of confidence in sustained federal funding for research has already pushed some university investigators to move their laboratory work overseas. Other countries and even other states (sensing that Massachusetts researchers are unmoored) are incentivizing these types of re-locations. Federal visa policies are further exacerbating Massachusetts' ability to attract talent. The state has traditionally been a magnet for highly educated talent from overseas, but this has been curtailed by federal restrictions promulgated over the past year. Massachusetts benefits by being a melting pot for advanced researchers, both domestically and worldwide, to come together and make technological breakthroughs in a range of fields. The state remains and will continue to be a nexus of innovation, but it is confronting threats that will erode the types of advantages that have carried the state forward for decades.

On the policy side, the threats can be mitigated, notably if federal policies that run counter to a thriving innovative ecosystem are reversed or rescinded. Early signs in 2026 are encouraging, notably with NIH funding returning to more normal levels, including a return of higher overhead coverages on grants. Massachusetts can also continue to redouble its efforts to actively support innovators and show that they can scale-up and prosper in the state. Recent state investments in life sciences, clean energy, and

other supports for its entrepreneurial ecosystem have successfully laid the groundwork for growth in Massachusetts and similar initiatives will need to be targeted to accelerate the state's momentum and keep it on the vanguard developing new technologies and the industries that sprout from them.

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Appendix A: The IMPLAN Economic Impact Model

IMPLAN

UMDI used the widely used IMPLAN input-output model to estimate the economic impacts of the research and development activities. IMPLAN is a platform that combines a set of extensive databases, economic factors, multipliers, and demographic statistics with a highly refined modeling system that is fully customizable. Together, software and data can help gain insights into an industry's contributions to a region, quantify the impact of a shock on an economy, examine the effects of a new or existing business, model the impacts of expected growth or changes, or study any other event specific to the economy of a particular region.

The model identifies direct impacts by sector, then develops a set of indirect and induced impacts by sector.

- Direct Effects: Direct effects are the immediate result of direct spending. Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond economically to these purchases.
- Indirect Effects: Indirect impacts stem from local industries' purchases of inputs (goods and services) from other local industries. These purchases are also known as intermediate expenditures.
- Induced Effects: Induced effects are caused by household spending on consumption.

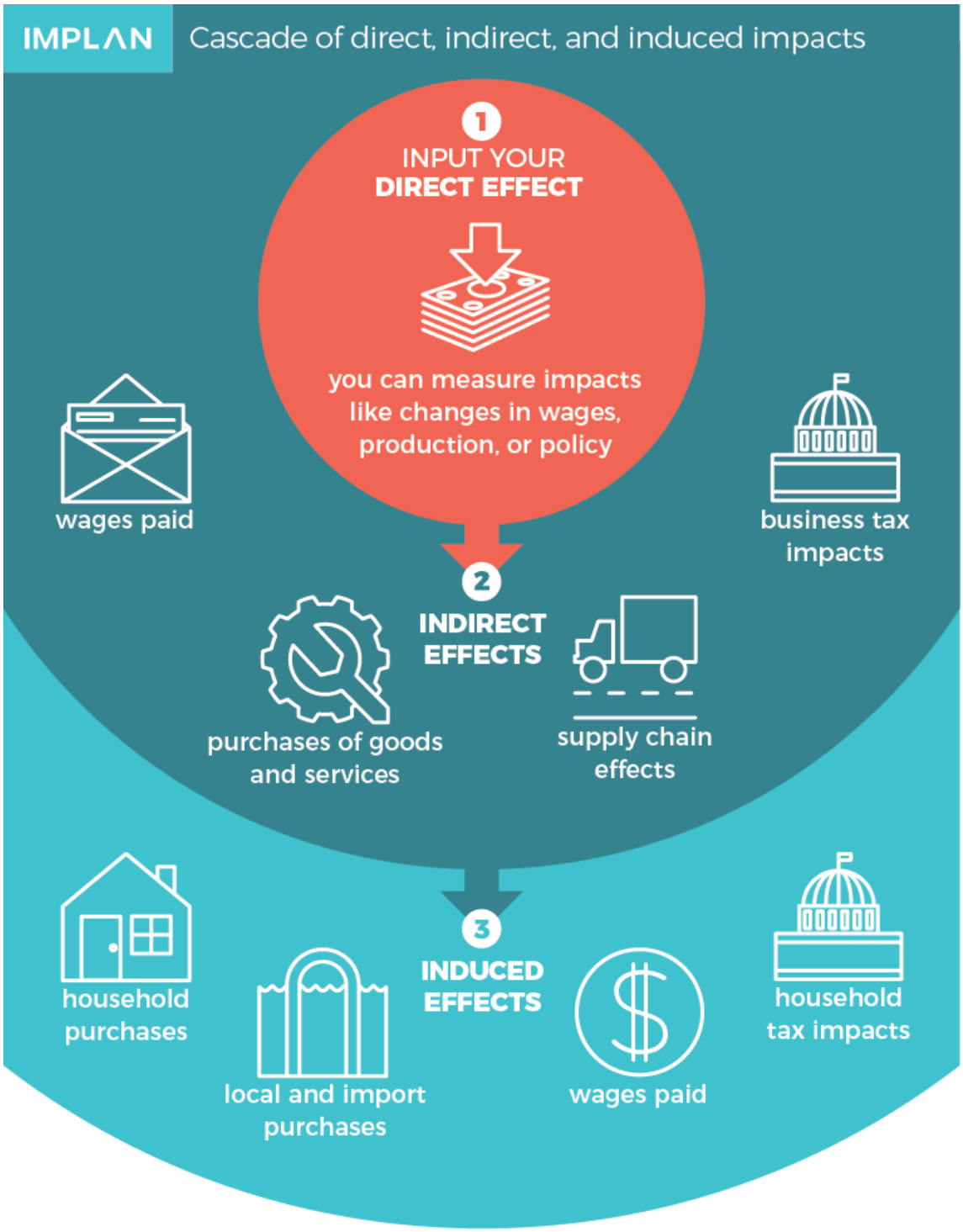
For example, say a tech firm hires employees and develops a new product that is sold by that firm, to consumers. These are direct effects of research and development activities. That same firm may buy some of their materials from a local supplier, say electronic components. That direct spending from that supplier would allow the supplier to hire more staff and expand their operations. These are indirect effects. Finally, those working at the firm take their wages home and buy goods and services. That spending reflects induced effects. This cycle of spending continues to work its way backward through the supply chain, with each round of impacts getting smaller, until all money leaks from the local economy by way of imports, taxes, and profits, which do not generate additional impacts locally.

IMPLAN does not assume that all input purchases are made from local businesses. The proportion of local vs. non-local purchases varies by commodity and is built into the IMPLAN system.

The IMPLAN models account for commuting patterns. Therefore, induced impacts will only reflect the spending of wages from residents. IMPLAN removes payroll taxes, personal taxes, and savings before allowing the remainder to be spent on goods and services. IMPLAN also accounts for imports and does not assume that all purchases of goods and services are made within the study area.

Figure 22 on the following page visually depicts how the IMPLAN model works.

Figure 22: Depiction of IMPLAN Model



Source: IMPLAN

Appendix B: 2022 NAICS Industry List

NAICS Code	NAICS Title
325411	Medicinal and Botanical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing
333242	Semiconductor Machinery Manufacturing
334111	Electronic Computer Manufacturing
334112	Computer Storage Device Manufacturing
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing
334210	Telephone Apparatus Manufacturing
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing
334290	Other Communications Equipment Manufacturing
334310	Audio and Video Equipment Manufacturing
334412	Bare Printed Circuit Board Manufacturing
334413	Semiconductor and Related Device Manufacturing
334416	Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing
334417	Electronic Connector Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing
334419	Other Electronic Component Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus 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
334517	Irradiation Apparatus Manufacturing
334519	Other Measuring and Controlling Device Manufacturing
334610	Manufacturing and Reproducing Magnetic and Optical Media
336411	Aircraft Manufacturing
336412	Aircraft Engine and Engine Parts Manufacturing
336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing
336414	Guided Missile and Space Vehicle Manufacturing

NAICS Code	NAICS Title
336415	Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing
336419	Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing
339112	Surgical and Medical Instrument Manufacturing
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
513210	Software Publishers
516210	Media Streaming Distribution Services, Social Networks, and Other Media Networks and Content Providers
517111	Wired Telecommunications Carriers
517112	Wireless Telecommunications Carriers (except Satellite)
517121	Telecommunications Resellers
517410	Satellite Telecommunications
517810	All Other Telecommunications
518210	Computing Infrastructure Providers, Data Processing, Web Hosting, and Related Services
519290	Web Search Portals and All Other Information Services
541511	Custom Computer Programming Services
541512	Computer Systems Design Services
541513	Computer Facilities Management Services
541519	Other Computer Related Services
541690	Other Scientific and Technical Consulting Services
541713	Research and Development in Nanotechnology
541714	Research and Development in Biotechnology (except Nanobiotechnology)
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)
541720	Research and Development in the Social Sciences and Humanities
611420	Computer Training
811210	Electronic and Precision Equipment Repair and Maintenance

Appendix C: Contributions to Output and Jobs by Industry

Table 6: Contributions of the R&D Ecosystem to Output and Jobs, Including Multiplier Effects, by Industry

Industry	Employment	Output (M)
Professional, Scientific, and Technical Services	268,252	$112,486
Health Care and Social Assistance	104,908	$17,255
Information	100,823	$63,944
Manufacturing	73,279	$47,396
Administrative and Support and Waste Management and Remediation Services	61,621	$8,425
Retail Trade	53,561	$6,350
Real Estate and Rental and Leasing	51,797	$16,303
Accommodation and Food Services	50,786	$6,344
Educational Services	50,561	$6,933
Finance and Insurance	42,614	$15,328
Other Services (except Public Administration)	40,156	$16,538
Transportation and Warehousing	35,301	$4,724
Wholesale Trade	26,613	$13,497
Arts, Entertainment, and Recreation	21,626	$2,599
Management of Companies and Enterprises	14,361	$4,375
Construction	5,266	$1,154
Public Administration	2,105	$418
Utilities	1,765	$2,781
Agriculture, Forestry, Fishing and Hunting	1,692	$98
Mining, Quarrying, and Oil and Gas Extraction	50	$20
Total	**1,007,137**	**$346,966**

Source: IMPLAN, UMDI Analysis
Note: Includes all direct, indirect, and induced employment and output

Appendix D: About the UMass Donahue Institute

Established in 1971, the UMass Donahue Institute is a public service, research, and economic development arm of the University of Massachusetts. Our mission is to foster healthy communities and support economies that alleviate poverty and promote opportunity. In collaboration with partner organizations and clients, we carry out our mission through research, education and training, capacity building, and direct services to strengthen our collective impact. We serve clients in the public, non-profit, and private sectors in the Commonwealth and throughout the nation and the world. For more information, www.donahue.umass.edu.

The Institute's Economic & Public Policy Research (EPPR) group provides clients in Massachusetts, New England, and beyond with impartial analyses on economic and other policy matters. EPPR is at the front lines of action-oriented public policy research examining the social determinants of health and work, as well as broad issues of economic opportunity, community vitality, inequality, and upward mobility. Featuring mixed methods research approaches including economic modeling, population projections, geospatial analysis, surveys, interviews, focus groups, and secondary data analysis, EPPR helps clients make informed decisions about strategic policy, planning, and investment priorities. Since 2003, EPPR has been the officially designated State Data Center for Massachusetts and serves as the state's liaison to the Population Division of the U.S. Census Bureau. Additionally, EPPR produces *MassBenchmarks*, an economic journal that presents timely information on the performance and strategic direction of the Massachusetts economy.