

# High Tech Industries in Boston

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2015



#### THE BOSTON REDEVELOPMENT AUTHORITY RESEARCH DIVISION (BRA)

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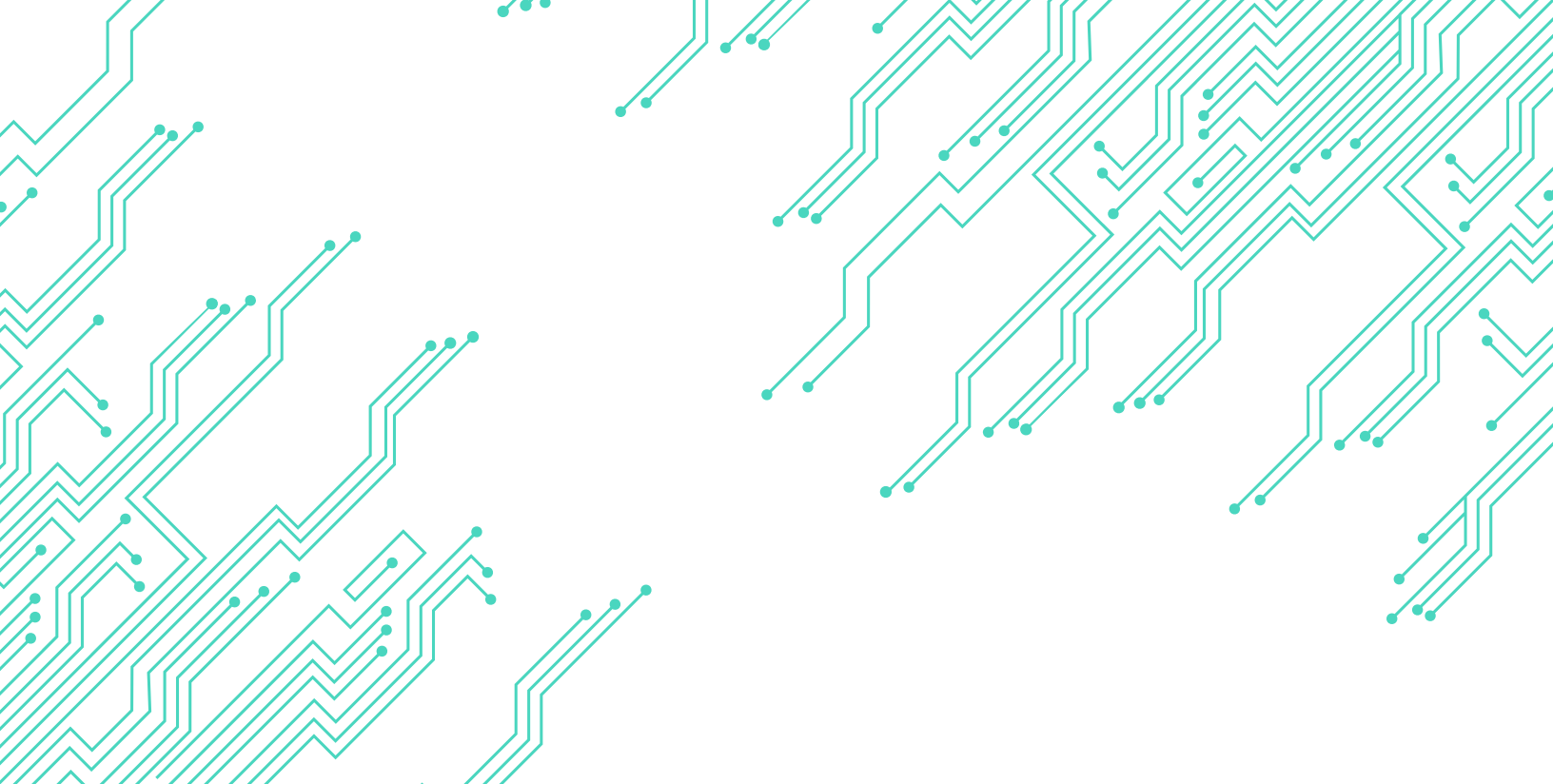
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# High Tech in Boston is **BOOMING!**

Boston is home to a strong high tech sector that has grown nine percent per year since 2010.

Boston is particularly strong in computer systems design and scientific research and development. In fact, Boston's share of employment in scientific research and development is two and a half times the national average.

Boston's success in high tech industries is based on its highly educated workforce - 55.4 percent of people who work in Boston have at least a Bachelor's degree and 24.5 percent have a Master's degree or higher.<sup>1</sup> Boston area universities

graduate over 10,000 students a year with degrees in science, technology, engineering, and math (STEM) fields to replenish the pool of talent.

Public and private sector investors recognize the strength of Boston's high tech institutions. 2014 marked the 20th consecutive year that Boston received the most National Institutes of Health (NIH) funding of any U.S. city. Boston high tech firms also closed over 100 financing deals with venture capitalists in 2014.<sup>2</sup>

These investments have paid off - in the last decade, patents issued to Boston residents have grown by 8.3 percent per year.<sup>3</sup> More importantly, investments in Boston's high tech field have led to innovations, such a bionic pancreas for patients with diabetes, which will improve our quality of life.<sup>4</sup>

Boston's high tech industries have been nurtured by supportive public policies and high tech clusters that foster synergistic innovation. Major Boston high tech clusters include the Innovation District, which provides high tech startups a place to grow, and world class centers for medical research in the Longwood Medical Area and surrounding Massachusetts General Hospital.

## Report overview

This report focuses on high tech industries, defined as those with a high proportion of their workforce in science, technology, engineering and math (STEM) occupations, a definition which aligns with much of the existing high tech research. Daniel E. Hecker

of the U.S. Bureau of Labor Statistics developed a three-tiered list of North American Industrial Classifications System (NAICS) industries that could be considered high tech based on the fraction of their workforces employed in STEM occupations. We use an

updated version of his “Level One” list to isolate the industries at the cutting edge of the Boston economy. These industries have at least 25 percent of their workforce in STEM occupations, over five times that of the average industry:



### COMPUTER AND ELECTRONICS MANUFACTURING

(NAICS 334)



### PHARMACEUTICAL & MEDICINE MANUFACTURING

(NAICS 3254)



### AEROSPACE PRODUCT AND PARTS MANUFACTURING

(NAICS 3364)



### SOFTWARE PUBLISHERS

(NAICS 5112)



### DATA PROCESSING, HOSTING, AND RELATED SERVICES

(NAICS 5182)



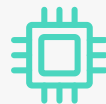
### OTHER INFORMATION SERVICES

(NAICS 5191)



### ARCHITECTURAL, ENGINEERING, AND RELATED SERVICES

(NAICS 5413)



### COMPUTER SYSTEMS DESIGN AND RELATED SERVICES

(NAICS 5415)



### SCIENTIFIC RESEARCH AND DEVELOPMENT SERVICES

(NAICS 5417)

This is a restrictive list, employing between five and six percent of the national workforce. It omits

several large industries, such as telecommunications carriers, that play a crucial role in making technology

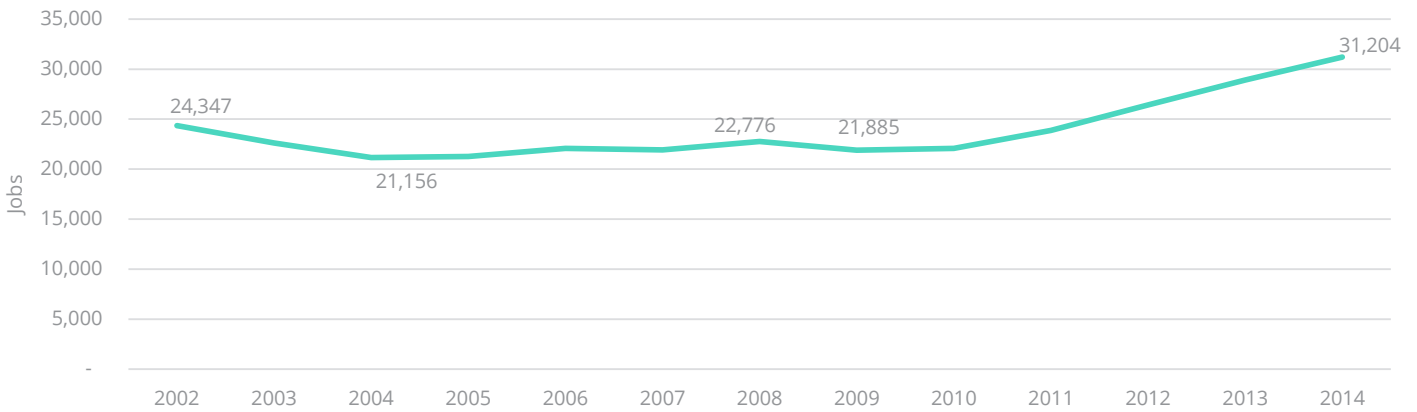
available to consumers, but who employ a smaller percentage of workers in STEM occupations.

# Boston's Growing High Tech Jobs

Since the end of the Great Recession in mid-2009, Boston has seen a period of truly remarkable growth, with the high tech sector increasing employment by around nine percent per year, adding 9,319 jobs

(FIGURE 1). High Tech employment in Boston has grown from 4.6 percent to 6 percent, as a proportion of total employment, from 2010 to 2014.

**FIGURE 1** HIGH TECH EMPLOYMENT  
City of Boston  
2002 - 2014



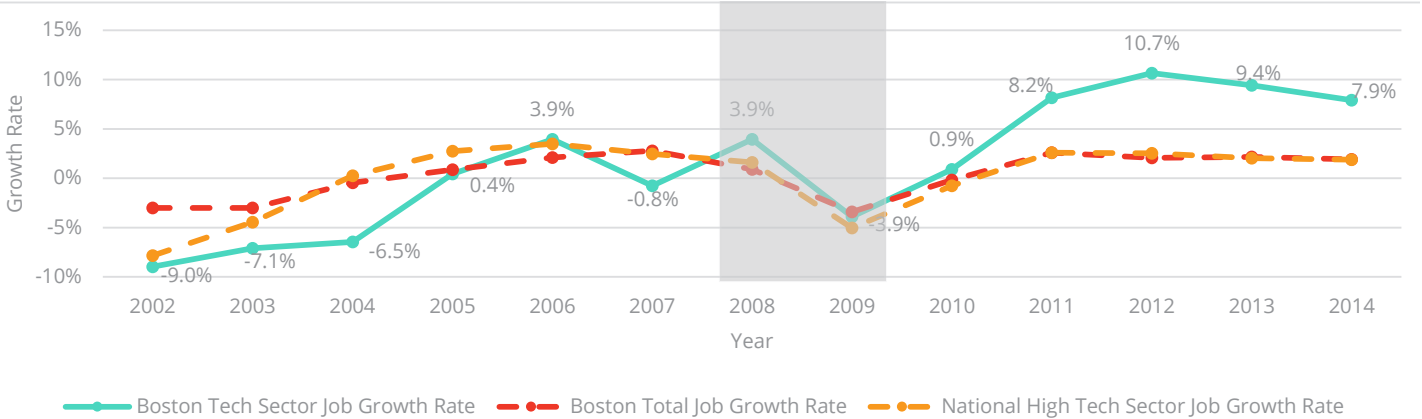
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2001 to 2014, BRA Research Division Analysis

The national tech economy has grown at an average annual rate of 2.3 percent since the end of the Great Recession (shaded grey in FIGURE 2), but this growth looks modest by

comparison to Boston's high tech growth. Boston's tech sector also outperformed the city's overall employment growth of 2.2 percent per year. The recent growth can be

attributed to specific high tech clusters in Boston, as well as the city's highly skilled labor force, which are covered in the following sections.

**FIGURE 2** EMPLOYMENT GROWTH RATE  
Boston and U.S. High Tech Sectors  
2002 - 2014



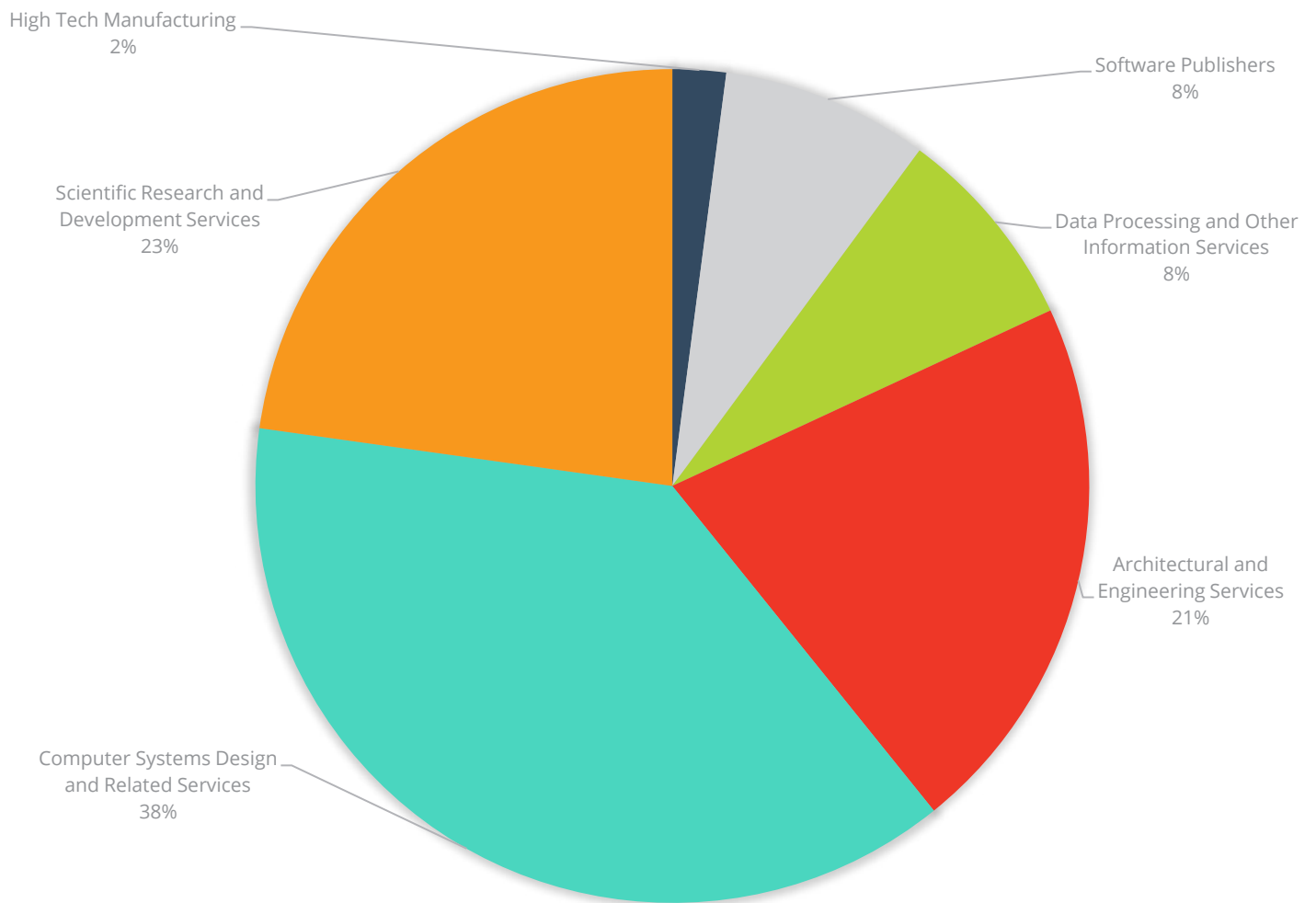
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, BRA Research Division Analysis

## Boston's High Tech Sector Specialization

This strong growth has been particularly concentrated in two sectors. Computer Systems Design has seen employment more than double since 2010, adding 6,145 jobs. Software Publishing has added another 1,527 workers, increasing its size by 158 percent over the four year period.

Other large area tech industries have continued their strong presence in Boston. Scientific Research and Development and Architectural and Engineering Services combine to make up 44 percent of Boston's high tech sector, which is just shy of three percent of the city's total workforce (**FIGURE 3**).

**FIGURE 3** PERCENT OF BOSTON'S HIGH TECH SECTORS  
Percent Share of High Tech Employment  
2014



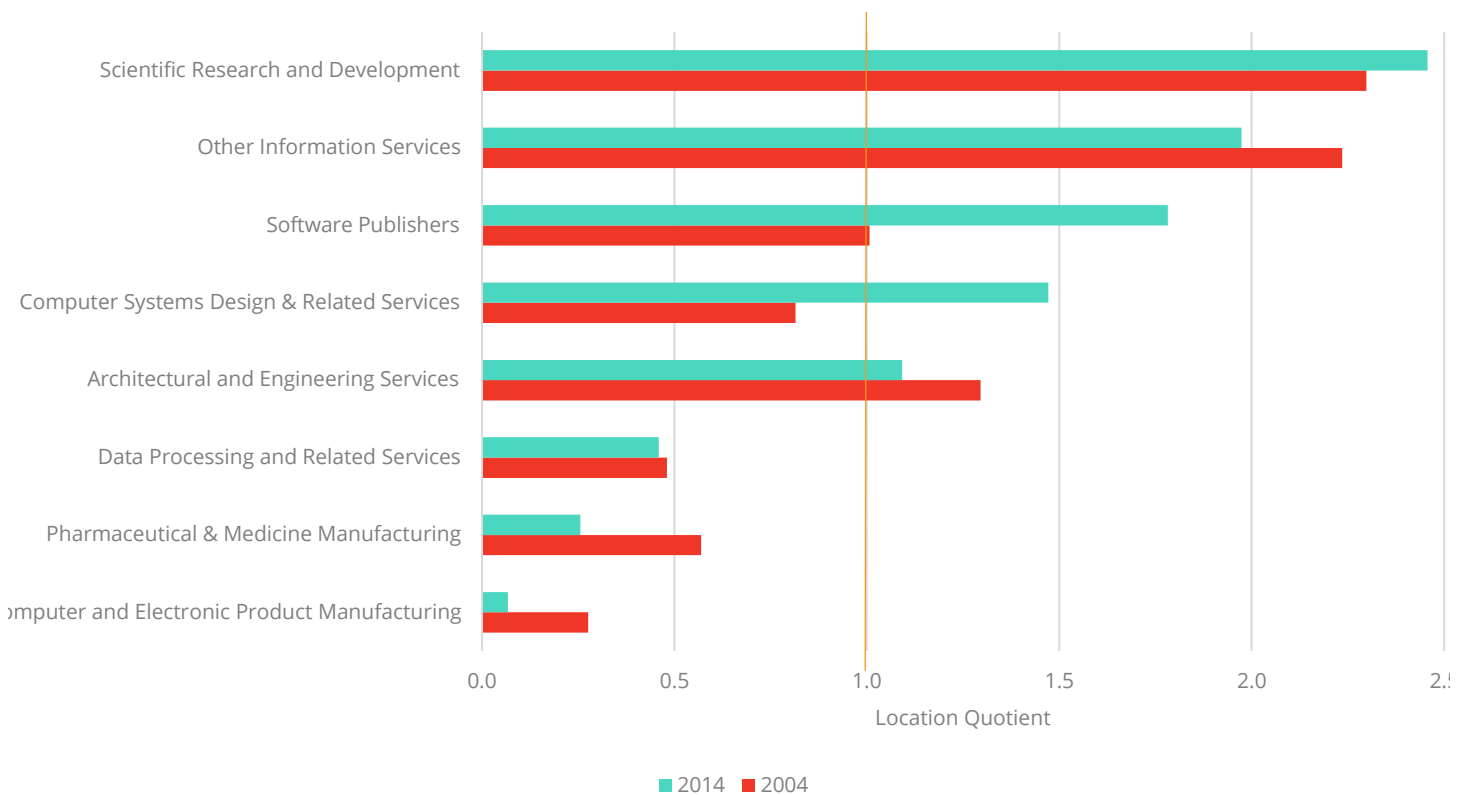
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2001 to 2014, BRA Research Division Analysis

## Boston's High Tech Employment compared to the U.S.

A location quotient is a relative measure of industry concentration: a location quotient above 1.0 means the local employment concentration in a specific industry is greater than the national average. For example, the location quotient of 2.5 for Scientific Research and Development means the percent of the city's employment in that industry is two and a half times the national average. The figure below (FIGURE 4)

shows the concentration of high tech jobs in Boston relative to the national average for 2004 and 2014. The concentration of software publishers in Boston since 2004 has increased the most, due to the explosive growth of this industry in Boston over the last four years. High tech services are thriving in Boston, where urban density is seen as an amenity for businesses reliant on high end human capital.

**FIGURE 4** LOCATION QUOTIENTS OF HIGH TECH SECTORS  
Boston Compared to U.S.  
2004 - 2014



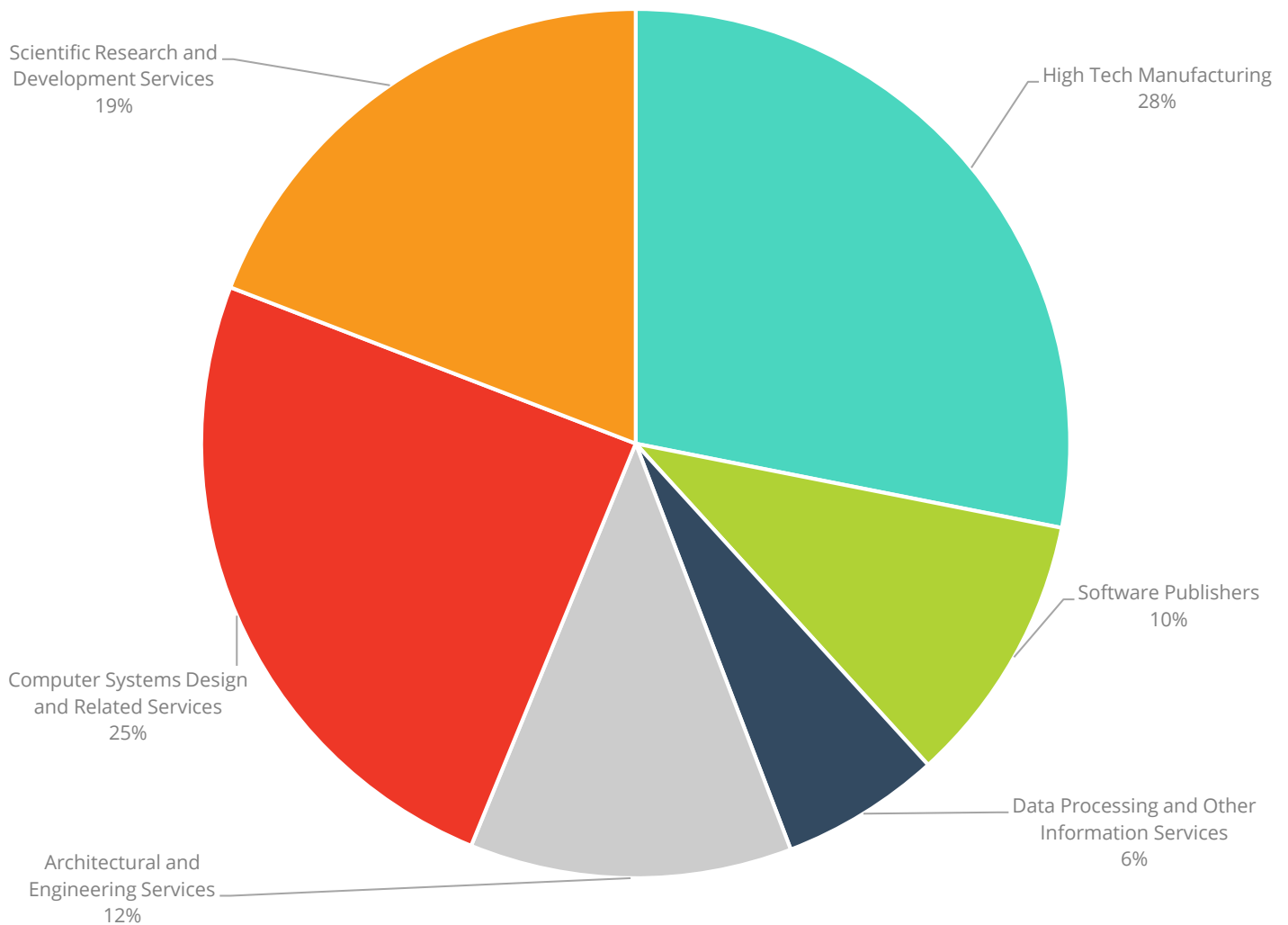
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, BRA Research Division Analysis

## High Tech Employment in the Boston Metropolitan Area

High tech manufacturing makes up a larger share of the Greater Boston economy (FIGURE 5), and employs more than 25 percent of the high tech workforce in the metropolitan area. This area includes urban inner ring communities, as well as suburban areas such as the Route 128 Corridor, long

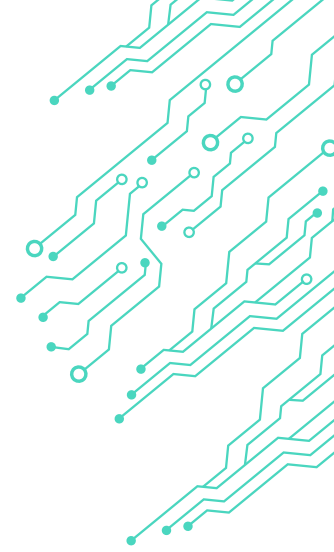
a hotbed of computer hardware and pharmaceutical manufacturing. These manufacturing firms benefit from their proximity to Boston's high tech services. Boston's integration in this regional cluster provides firms located in the city with direct access to cutting edge producers and their products.

**FIGURE 5** METRO-BOSTON'S HIGH TECH SECTORS  
Percent Share of High Tech Employment  
2014



Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, BRA Research Division Analysis





# Boston's High Tech Talent:

The single greatest driver of Boston's High Tech Economy is talent.

The Boston area is a leader in terms of educational attainment. Among comparable metropolitan areas, residents of the Boston metropolitan area rank fourth in the nation for the percentage of the population with at least a Bachelor's degree at 43.4 percent.<sup>5</sup> The labor force that works in Boston has an even higher level of educational attainment – 55.4 percent have at least a Bachelor's degree and 24.5 percent have a Master's degree or higher.<sup>6</sup> Almost a quarter of Boston area residents with a Bachelor's degree majored in a STEM field.<sup>7</sup> These residents provide a pool of talent to fuel the area's High Tech Economy.

The Boston area is home to world class colleges and universities that annually replenish the pool of talent. Area universities such as Boston University, Northeastern, Harvard, Boston College, UMass Boston, Tufts, Suffolk, Bentley, and Massachusetts Institute of Technology (MIT) enroll over 150,000 students a year.<sup>8</sup> Many of these students are trained in STEM fields directly relevant to high tech employment. Thirty-two area colleges awarded 5,940 Bachelor's Degrees, 3,594 Master's

Degrees and 1,269 Doctorates in STEM fields in 2013.<sup>9</sup>

This annual influx of graduates provides opportunities for local high tech firms to hire recent graduates entering the labor force. Boston prides itself on attracting and retaining students and young adults, and leads the nation in the percentage of its population that is between the ages of 20 and 34, with 34 percent.<sup>10</sup> The City established the Mayor's ONEin3 Council to give residents ages 20-34 a greater voice in shaping the present and future of the city.



## A Center for Regional Research and Innovation:

Tomorrow's high tech innovations are built upon today's cutting edge research performed by local companies, universities and hospitals.

The Greater Boston area boasts a wealth of world class research institutions pushing the frontiers of knowledge in a variety of fields including cancer

research, cloud storage, robotics, and nanotechnology. Proximity to and collaboration with researchers from institutions like MIT and Massachusetts

General Hospital help Boston companies innovate and stay on the leading edge.

### Health and Medical Research

Massachusetts received \$2.4 billion dollars in research funding from the National Institutes of Health (NIH) in FY2014, allocated among almost 5,000 awards. Massachusetts led the country in NIH funding per capita at \$359 – almost five times the national

average. For the 20th consecutive year, Boston received the most NIH funding of any U.S. city in 2014. Forty-six Boston institutions received 3,521 NIH awards for more than \$1.7 billion in funding. The top Boston recipients of NIH funding are in the table below.

**TABLE 1 TOP BOSTON RECIPIENTS OF NATIONAL INSTITUTES OF HEALTH FUNDING**  
By Funding in Millions of Dollars  
FY 2014

ORGANIZATION	AWARDS	FUNDING
Massachusetts General Hospital	778	\$350 million
Brigham and Women's Hospital	564	\$323 million
Harvard Medical School	386	\$194 million
Children's Hospital Corporation	305	\$127 million
Harvard School of Public Health	184	\$126 million
Dana-Farber Cancer Institute	210	\$123 million
Boston University Medical Campus	233	\$113 million
Beth Israel Deaconess Medical Center	241	\$111 million

Boston shares its metropolitan area with other centers for scientific and medical research. Cambridge boasts premier research centers, particularly at Harvard, MIT, and in Kendall Square. In FY14, Cambridge institutions received 565 NIH awards for \$331 million in funding. One example of collaboration between institutions in Boston and Cambridge is the Broad Institute, which brings together researchers from Harvard, MIT, and five Harvard-affiliated hospitals located in Boston.

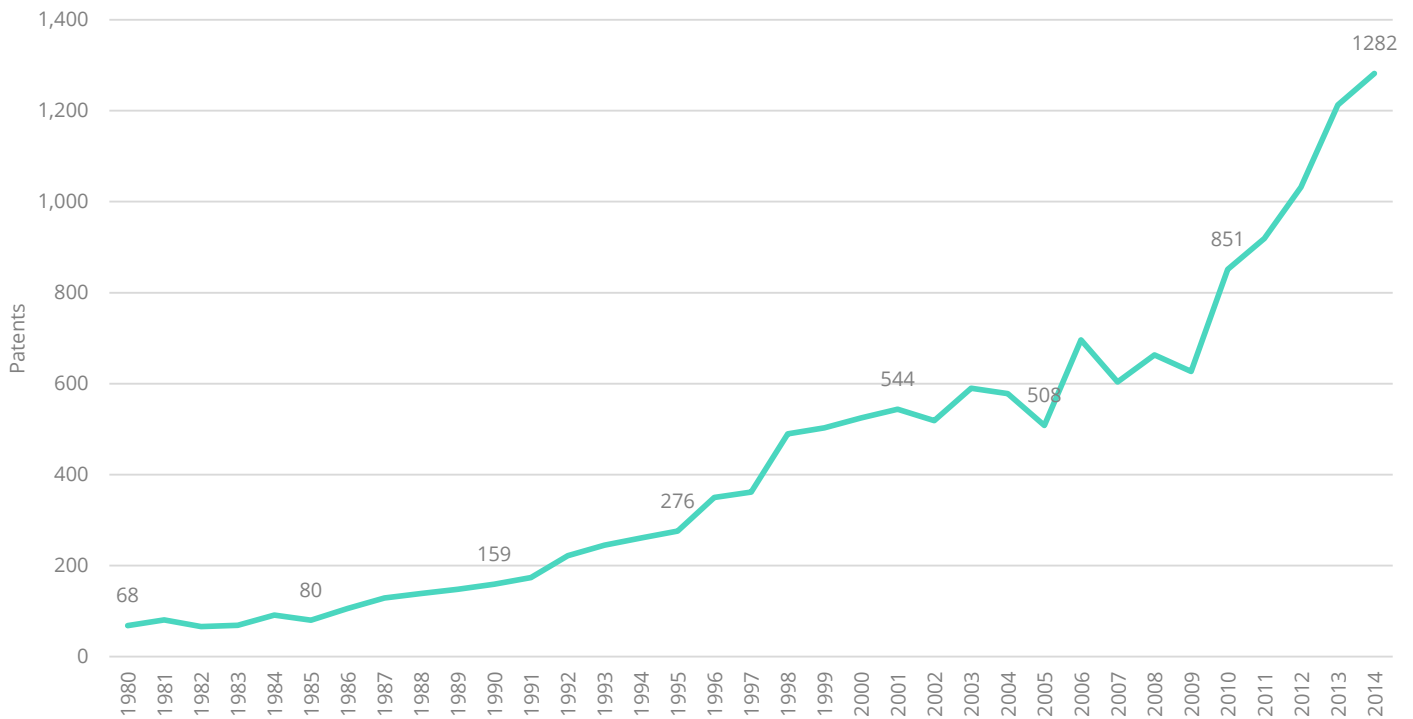
Source: National Institutes of Health "NIH Awards by Location and Organization FY2014,"  
BRA Research Division Analysis

## Patents awarded for Innovative Products and Technologies

Innovative research in the Boston area pays off in new patentable technologies. The U.S. Patent and Trademark Office grants 20-year property rights to the inventor of a new and useful process, machine, manufacture, or composition of matter.<sup>11</sup> In the last decade, patents issued to Boston residents have grown by 8.3 percent per year (**FIGURE 6**).

Boston and the Boston metropolitan area account for more than a quarter of all the patents issued in Massachusetts in the last decade. The top classifications for patents issued to Boston residents are medicine and computing.<sup>12</sup> Massachusetts' residents are issued the most bioscience patents per capita of any state.<sup>13</sup>

**FIGURE 6** U.S. PATENTS Issued to Boston Residents 1980 - 2014



Source: USPTO Patent Full-Text and Image Database, 1970-2014, BRA Research Division Analysis



## Local Investment:

With a storied history dating back to the “Massachusetts Miracle” of the 1980s, the Greater Boston venture capital (VC) community continues to be among the nation’s leaders in financing investment in high tech firms.

In an industry characterized by volatility, Massachusetts has emerged as a beacon of consistency, reliably ranking among the top three states in number of venture capital deals and dollars of investment with roughly 10 percent of the nation’s overall share.

Massachusetts VC investment, like the national industry as a whole, enjoyed a particularly strong year in 2014. Deal volume rose 4.5 percent year-over-year, while dollars invested rose 53 percent on the strength of several very large deals, including \$200 million to Intarcia Therapeutics who recently relocated their headquarters to Boston’s Innovation District. This represents the third largest deal ever closed in life sciences.<sup>14</sup> As a whole Massachusetts companies closed 396 funding deals for \$4.7 billion over the course of 2014.

While biotech led the way in overall funding, software ranked first in the share of deals, accounting for 37.1 percent of deals in 2014 and 30.4 percent over the five period starting in the first quarter of 2010. Biotech accounted for 22.2 percent of the 2014

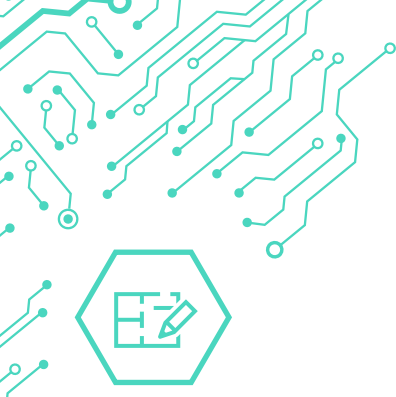
deals, followed by medical devices, IT services, and the industrial and energy sectors. These same industries accounted for the highest shares of funding over the last five years, though biotech’s 36.2 percent over five years led the group followed by software at 21.7 percent, medical devices, the industrial and energy sector and IT services.

The size and volume of deals is a tribute both to the innovative power of local companies, and to the robust community of local Venture Capital firms. Entrepreneur.com includes 17 Boston firms in their “VC 100” list of top early stage venture capital firms, including Boston-based Spark Capital in their top 25. This strong financing presence meant that 68 percent of Massachusetts’ seed rounds over the period from 2010 through 2013 were able to find local financing.<sup>15</sup> Massachusetts VC firms closed 45 percent of their deals in 2013 with in-state companies, suggesting that location is important.<sup>16</sup>

Drilling down within the region, the locus of activity seems to be moving towards downtown. Suburban hubs

along Route 128 such as Waltham and Burlington continue to pull in substantial investment, but the biggest numbers come from Boston and Cambridge. The number of VC deals completed by companies within the city of Boston rose from 66 to 97 between 2012 and 2013, and then again to 103 in 2014, about 30 percent of the area’s total deals.<sup>17</sup>

This urbanization of tech in the Boston area is consistent with patterns from a recent national level ZIP code analysis performed by, researcher and urban theorist, Richard Florida that show an increasing tendency of venture capital firms to invest in companies located in urban cores. His list of top Boston area ZIP codes by VC investment cited three located in Boston (the Innovation District and two ZIP codes covering the Back Bay).



## Infrastructure:

Boston's success in high tech industries has been encouraged by supportive city and state policies and investment.

In 2014, the Mayors of Boston, Cambridge, Quincy, Somerville and Braintree announced the creation of the Life Sciences Corridor along the Massachusetts Bay Transit Authority (MBTA) Red Line.<sup>18</sup> This area is home to over 450 life sciences companies, including the largest biopharmaceutical companies in the world: Biogen, Sanofi-Aventis, Novartis, Pfizer, Johnson & Johnson's Innovation Center, Merck & Co, Vertex Pharmaceuticals, Glaxo Smith Klein, Boston Scientific, and Haemonetics among others. The corridor also has a highly skilled labor force and world-renowned hospitals, colleges, and universities.

The city of Boston, along with neighboring towns of Cambridge and Quincy, was awarded the highest rating (Platinum) as a BioReady Community. The Massachusetts Biotechnology Council (MassBio) recognized Boston's supportive public infrastructure projects, expedited permitting policies, by-right zoning, pre-permitted biotech sites, and planned area developments.<sup>19</sup> These public policies facilitate research in Boston.

The state of Massachusetts also supports life science research. The Massachusetts Life Science Initiative provides for \$1 billion in state investment over the ten-year period 2007-2017 to further support life science research in Massachusetts. Some recent grants include the following:

- UMass Boston and Dana Farber/Harvard Cancer Center for the Center for Personalized Cancer Therapy; and
- Grants to five Boston high schools for science equipment and supplies.<sup>20</sup>

The following section provides a more detailed description of the major high tech and innovation centers growing in Boston. The infrastructure investments in these areas of the city create opportunities for additional growth and support the high tech economy. The innovation centers highlighted below are Boston's Innovation District, Roxbury and the South End, Longwood Medical Area, and the Charlestown and the West End.

## The Innovation District

*Former Boston Mayor Thomas M. Menino began an initiative to transform 1,000 acres of the South Boston waterfront into the Innovation District - an urban environment that fosters innovation, collaboration, and entrepreneurship.*

The Innovation District is nestled between Boston's transportation gateways: abutting historic Boston Harbor, adjacent to Logan International Airport, and at the nexus of two major interstate highways. It contains the largest tract of underdeveloped land in the city of Boston, and is an area with opportunity for growth, a strong existing knowledge base, and the ideal location for producing new ideas, services and products.

The city of Boston's Economic Development and Industrial Corporation (EDIC) owns the Boston Marine Industrial Park (BMIP) a 191-acre site on the South Boston Waterfront. Tenants include a variety of industrial and commercial uses, including

research facilities. The City's stewardship of this land has allowed the development of the research and technology cluster in the South Boston Waterfront. The Boston Marine Industrial Park hosts small scale high tech manufacturing, a new innovation workshop attached to a recently announced AutoDesk office, and an array of small manufacturing firms located in the Innovation and Design Building. In addition, BMIP is also home to MassChallenge, an annual \$1 million global startup competition and accelerator.<sup>21</sup>

In the three years since the initiative began, the area has grown rapidly. From 2010-2013, the South Boston Waterfront added about 100 new businesses and 15,000 new jobs.<sup>22</sup> Over 30 percent of businesses

in this area are in professional, scientific, and technical services. Many of the new businesses are small startups that share space in co-working spaces and incubators. Technology companies in the Innovation District include Immunitics, Inc. which develops diagnostic tests for diseases and pathogens, Invicro, LLC which creates imaging techniques for drug discovery and development, and Skulpt, Inc which develops technology to quantify muscle health. The South Boston Waterfront is home to Vertex's Pharmaceuticals' new 1.1 million square foot office and laboratory space.<sup>23</sup> In contrast to the large hospitals and universities in other parts of the city, the South Boston Waterfront is becoming the place for high tech companies to congregate.





## Roxbury and the South End

*Venture Café opened a gathering space in Roxbury for innovators to collaborate and share ideas, similar to Venture Café's District Hall, which is located in the Innovation District.*

This new space, the Roxbury Innovation Center, opened fall 2015 in Dudley Square's Bolling Building (Figure 8). The Roxbury Innovation Center, is a 3,000-square-foot business incubator to encourage collaboration, bold thinking, and new business development. The Bolling Building is also the new headquarters of the Boston Public Schools, and includes 18,000 square feet of street-level space for business or nonprofit use. The South End is home to Boston University's BioSquare Research Park, a 2.5 million square foot biomedical research park featuring the National Emerging Infectious Diseases Lab and fully built biotechnology start-up space.<sup>24</sup>



## Longwood Medical Area

*The Longwood Medical Area is Boston's world famous medical campus with over 46,000 scientists, researchers and staff, and over 21,000 students.<sup>25</sup>*

Longwood Medical Area is an epicenter of health care and medical training and research. Brigham and Women's Hospital has the largest medical research program in a cluster that includes Harvard Medical School, Harvard School of Public Health, Children's Hospital, Dana-Farber Cancer Institute, Beth Israel Deaconess Medical Center, and Joslin Diabetes Center. The Longwood Medical Area continues to grow – in 2014 the Longwood Center opened, adding an additional 350,000 square feet of R&D space in Boston's strongest life sciences cluster.<sup>26</sup>





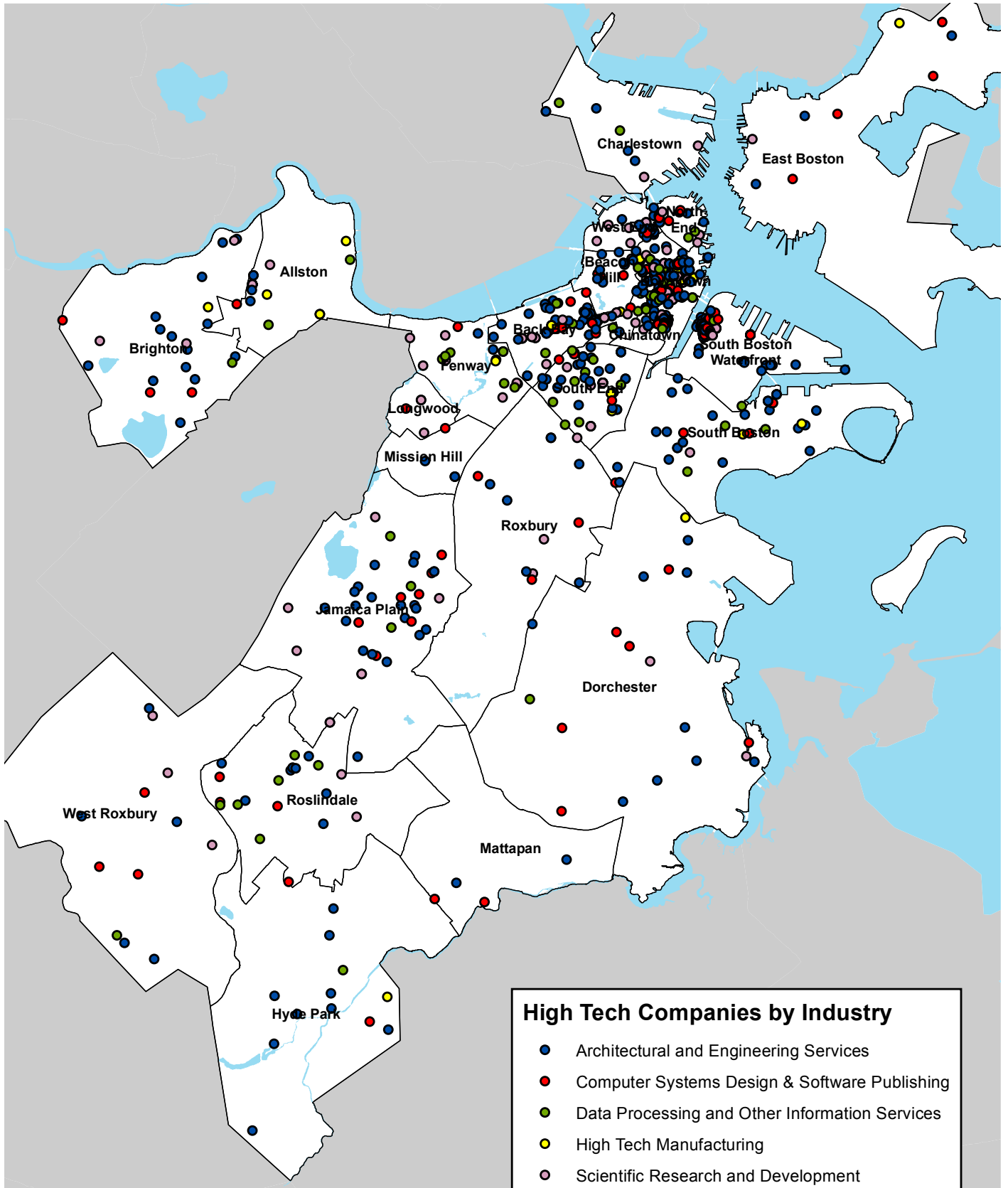
## Charlestown and the West End

*Massachusetts General Hospital (MGH) is the leading medical research center in Boston with 778 NIH research grants in FY2014, the most of any Boston institution.<sup>27</sup>*

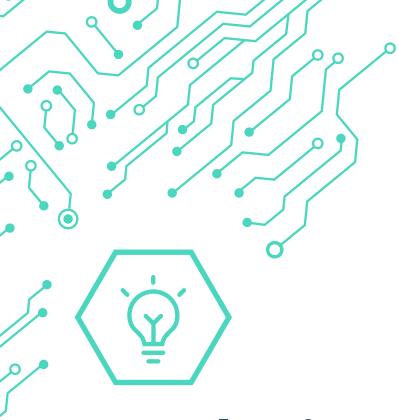
MGH has large research facilities in the West End, Charlestown, and Cambridge with 6,000 researchers and almost one million square feet devoted to research.<sup>28</sup> MGH researchers were issued 86 U.S. patents and 172 international patents in FY 2014. Additional research institutions in this area include Massachusetts Eye and Ear Infirmary, Schepens Eye Research Institute, Spaulding Rehabilitation Hospital, and MGH Institute for Health Professions. The former Charlestown Navy Yard provides waterfront medical and research space whose tenants include the MGH Clinical Research Center.



Photo by: Peter Vanderwarker



Source: InfoUSA, 2013



## Conclusion:

Boston's high tech industries are growing rapidly – average annual growth exceeded nine percent since 2010.

Computer systems design is both the largest and fastest growing of Boston's high tech sectors, more than doubling since 2010 to 38 percent of all high tech employment. Scientific research and development accounts for 23 percent of Boston's high tech employment – two and a half times the national average. Important factors for Boston's success in high tech industries include the following:

- A highly educated workforce that is replenished annually with graduates of Boston's world-class universities;
- Powerhouses of medical research such as Massachusetts General Hospital and the Longwood Medical Area;
- Private and public investment in high tech research and innovation; and
- Incubators for high tech startups such as the Innovation District, the Roxbury Innovation Center, and BioSquare Research Park.

Boston's high tech industries provide over 30,000 jobs for our talented workforce, as well as services and innovations that help to create a better quality of life in Boston and beyond.

## End Notes

- <sup>1</sup> U.S. Census Bureau, 2009-2013 American Community Survey, Public Use Microdata Sample (PUMS), BRA Research Division Analysis
- <sup>2</sup> CB Insights, "The 2014 U.S. Venture Capital Year in Review: Financing and Exit Analysis" January 2015
- <sup>3</sup> USPTO Patent Full-Text and Image Database, 1970-2014
- <sup>4</sup> National Institutes of Health, "Bionic Pancreas" <http://www.nih.gov/news/health/jun2014/niddk-15.htm>
- <sup>5</sup> Residents age 25 and over. U.S. Census Bureau, 2009-2013 American Community Survey, BRA Research Division Analysis
- <sup>6</sup> U.S. Census Bureau, 2009-2013 American Community Survey, Public Use Microdata Sample (PUMS), BRA Research Division Analysis
- <sup>7</sup> U.S. Census Bureau, 2011-2013 American Community Survey, BRA Research Division Analysis
- <sup>8</sup> Integrated Postsecondary Education Data System (IPEDS) & University Accountability Ordinance data, BRA Research Division Analysis
- <sup>9</sup> IPEDS, BRA Research Division Analysis
- <sup>10</sup> U.S. Census Bureau, 2009-2013 American Community Survey, BRA Research Division Analysis
- <sup>11</sup> United States Patent and Trademark Office; <http://www.uspto.gov/patent>
- <sup>12</sup> January 1, 2004 to March 18, 2015
- <sup>13</sup> Battelle/BIO State Bioscience Jobs, Investments and Innovation 2014 <https://www.bio.org/sites/default/files/Battelle-BIO-2014-Industry.pdf>, p. 46
- <sup>14</sup> Price Waterhouse Coopers, "Biotech Funding Surges," February 2015, [pwc-moneytree-biotechnology-medical-devices-q4-2014.pdf](http://www.pwc.com/moneytree-biotechnology-medical-devices-q4-2014.pdf)
- <sup>15</sup> CB Insights, "68% of Boston's Seed Investments see Local Investor Participation," June 5, 2014, <https://www.cbinsights.com/blog/massachusetts-seed-startups-local-investors/>
- <sup>16</sup> BetaBoston, "Boston VCs backing more companies close to home," 3/11/2104, <http://www.betaboston.com/news/2014/03/11/boston-vc-data-venture-capital-funding-new-york-san-francisco/>
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- <sup>18</sup> Cambridge Community Development Department, "Life Sciences Corridor" [http://www.cambridgema.gov/~media/Files/CDD/EconDev/Biotech/life\\_sciences\\_brochure\\_2014.ashx](http://www.cambridgema.gov/~media/Files/CDD/EconDev/Biotech/life_sciences_brochure_2014.ashx)
- <sup>19</sup> MassBIO, "BioReady Communities," [http://www.massbio.org/economic\\_development/bioready\\_communities](http://www.massbio.org/economic_development/bioready_communities)
- <sup>20</sup> Massachusetts Life Sciences Center, "2014 Annual Report" <http://www.masslifesciences.com/wp-content/uploads/2014-Annual-Report-FINAL.pdf>
- <sup>21</sup> MassChallenge, "Accelerator Model" <http://masschallenge.org/accelerator/model>
- <sup>22</sup> U.S. Census Bureau, Zip Business Patterns, <http://censtats.census.gov/cgi-bin/zbpnaic/zbpsect.pl>
- <sup>23</sup> Vertex, "Working Here: Massachusetts" <http://careers.vrtx.com/location/massachusetts/>
- <sup>24</sup> Biosquare, <http://www.biosquare.org/welcome/welcome.html>
- <sup>25</sup> MASCO, "Longwood Medical and Academic Area Fact Sheet 2013"
- <sup>26</sup> 2015 Boston Bond Report, Selected Demographic and Economic Information, p. 11
- <sup>27</sup> National Institutes of Health "NIH Awards by Location and Organization FY2014," BRA Research Division Analysis
- <sup>28</sup> "Facts at a Glance" <http://www.massgeneral.org/research/about/facts.aspx>

