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# Nodal Economic Development: Building Life Sciences Capabilities in Gateway Cities

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Feb. 2018



MASSACHUSETTS  
LIFE SCIENCES CENTER

MassDevelopment

DUSP  
MIT

## ACKNOWLEDGEMENTS

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# EXECUTIVE SUMMARY |

This report was developed in collaboration with the Massachusetts Life Sciences Center (MLSC) and MassDevelopment, two quasi-public entities mandated to invest in the life sciences cluster and to lead economic development efforts in the Commonwealth, respectively. The two organizations share goals of sustaining the competitiveness of Massachusetts's world-class life sciences cluster while creating opportunities for all communities within the Commonwealth to contribute to and benefit from the cluster. The objectives of this study are threefold: 1) research local economic assets in Gateway Cities that could potentially connect to the life sciences cluster; 2) identify obstacles to realizing these connections; and 3) recommend policy strategies for the MLSC, MassDevelopment, and the Gateway Cities to overcome these obstacles.

This report is the product of a policy problem-based practicum course in the Department of Urban Studies and Planning (DUSP) at the Massachusetts Institute of Technology (MIT), led by Dr. Amy Glasmeier of DUSP and Teresa Lynch, founding principal of Mass Economics. It is the result of a five-month process of research conducted by a team of eight city planning graduate students.

The report begins with an explanation of our case study approach and other methods employed. A primer on the life sciences follows, which includes discussion of its history and current industry trends, as well as a general introduction to cluster theory and the geography of industries. The subsequent section introduces the concept of Gateway Cities. Next, we present two case studies of Brockton and Worcester, which begin with a discussion of their respective histories,

followed by analyses of the local economy and population, workforce, real estate, institutions, and existing life sciences activity. The report concludes with recommendations and strategies for their application in the two cities, as well as a typology to differentiate among Gateway Cities with regard to their life sciences activity and general economic development.

Brockton is a post-industrial city with a population of 95,000 that comprises large immigrant communities. About 20 miles south of Downtown Boston, Brockton is well-served by commuter rail and highway access. Its jobs and recent job growth are dominated by healthcare, and it has no major traded industries serving markets beyond the region. While Brockton's local workforce performance may lag behind the state, the city has easy access to a large and exceptionally well-educated regional labor force. Real estate is generally affordable, especially compared to the Boston/Cambridge market, and there are several parcels in the city prioritized for large-site redevelopment. In terms of existing life sciences, Brockton has a higher-than-average concentration of jobs in medical and testing laboratories, which tend to be routine and low-wage. The few life sciences companies that operate in the area are generally unaware of one another and do not feel well-connected to the regional cluster.

Worcester is another post-industrial Gateway City in the Commonwealth, but with a much larger population (180,000). Located about an hour's drive west of Boston, Worcester has a younger-than-average population, 21.5 percent of which is foreign-born. The city's economy relies heavily on the "Eds and Meds," driven by large educational institutions like the University

of Massachusetts Medical School and Worcester Polytechnic Institute, as well as major life sciences companies like Abbvie. Compared to Brockton, Worcester is further along the spectrum of life sciences cluster participation. The city's universities graduate hundreds of students in the life sciences each year, and collaborations between schools and industry have created highly successful life sciences companies. A capital-intensive downtown revitalization effort has been underway for the past two decades to attract new employers and residents. Finally, local and industry leaders have a specific vision for Worcester to center its growth in the cluster around biomanufacturing, and the Governor authorized the sale of 44 acres of state land to the local business development corporation in early 2017 to help advance this goal.

Four common themes for strategies and policy recommendations emerged across the two case studies:

- 1) Increased capacity and expertise in the life sciences**
- 2) Workforce and education for life sciences development**
- 3) Coordination**
- 4) Improved connectivity**

The implementation of these recommendations for the two cities will differ according to their contexts. Brockton will benefit from developing workforce training programs that specifically target life sciences occupations. Worcester already has an abundance of higher education opportunities in this cluster, and should instead focus on a comprehensive K-12 STEM strategic plan to expose local students to and prepare them

for careers in life sciences fields. Leaders in both Brockton and Worcester should consider creating a coordination council for the life sciences to build local capacity and execute specific promotional strategies for the former, and to implement the long-term vision of a life sciences master plan for the latter. One recommendation we would like to highlight in particular that cuts across the two case study cities is the creation of a Gateway Cities Life Sciences Fellowship program. A common refrain we heard in both Brockton and Worcester was the desire for dedicated capacity to keep abreast of trends in the life sciences and sub-industry trends in real estate and infrastructure needs. A Fellow with deep expertise in both the life sciences and real estate development can raise the profile of Gateway Cities among industry leaders and direct catalytic investment to these communities.

Finally, we urge caution before generalizing our findings and recommendations to other Gateway Cities in Massachusetts. The proposed four-part typology shows that compared to their peers, cities like Brockton and Worcester are strong candidates for policy interventions to improve their participation in the life sciences based on existing assets. While the typology can provide guidance for cities as they prioritize life sciences policy interventions, localized research and analysis is needed to address each city's unique context and assets.

We look forward to continued collaboration among the MSLC, MassDevelopment, MIT, and local leaders in Gateway Cities toward policy solutions that ensure the competitiveness of the life sciences cluster and inclusive economic development in all communities of the Commonwealth.



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# INTRODUCTION

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This report explores potential synergies between economic development in former industrial cities and the continued dynamic growth of the life sciences sector in Massachusetts through the lens of two case studies: the cities of Brockton and Worcester.

# PARTNERS AND OBJECTIVES |

This work was performed in collaboration with two partners, the Massachusetts Life Sciences Center (MLSC) and MassDevelopment.

## Massachusetts Life Sciences Center

The Massachusetts Life Sciences Center is a quasi-public entity founded in 2008 to implement the Commonwealth's Life Sciences Act, which committed the state to investing one billion dollars in life sciences innovation and job creation over ten years<sup>[1]</sup>. The MLSC is currently pursuing multiple goals simultaneously: sustaining the overall competitiveness of the world-class regional cluster, retaining vibrant life sciences nodes and corridors (such as Kendall Square and Route 128), and creating new opportunities for cities and towns that have not benefited historically from the state's strength in life sciences through major capital investments in the Commonwealth's education system and business enterprises. In June 2017, the Baker administration announced a legislative proposal to extend the MLSC's activities for another five years, with the intention of spending \$500 million on public infrastructure, research and development, and workforce training and education to support the continued development and growth of the life sciences cluster.<sup>[2]</sup>

<sup>1</sup> Bluestone, Barry, and Alan Clayton-Matthews. "Life Sciences Innovation as a Catalyst for Economic Development: The Role of the Massachusetts Life Sciences Center," 2013.

<sup>2</sup> Barker, Charlie, Kristen Lepore, and Jay Ash. "Baker-Polito Administration Proposes Life Sciences Initiative." Mass.gov. <https://www.mass.gov/news/baker-polito-administration-proposes-life-sciences-initiative> (accessed January 17, 2018).

## MassDevelopment

MassDevelopment is the quasi-public economic development authority for the Commonwealth of Massachusetts and provides a range of financing and technical assistance services for both real estate and business development. One of MassDevelopment's activities is the Transformative Development Initiative (TDI), which was created as a pilot program in 2014 to spur development in ten Gateway Cities. Gateway Cities are defined by Massachusetts law as cities with populations between 35,000 and 250,000 that have a median household income and bachelor's degree attainment below the state average<sup>[3]</sup>. Through the TDI program, MassDevelopment offers a number of services and benefits to participating cities, including technical assistance, local organizing and coordination fellows, direct equity investments in catalytic real estate projects, grants for the development of co-working spaces, and small pilot grants for local market development.<sup>[4]</sup>

Taken together, the MLSC and MassDevelopment have goals of sustaining the competitiveness of Massachusetts's world-class life sciences cluster, and creating

<sup>3</sup> Commonwealth of Massachusetts. "MA General Laws Part I, Title II, Chapter 23A, Section 3A." Malegislature.gov. <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter23A/Section3A> (accessed January 17, 2018).

<sup>4</sup> MassDevelopment. "Transformative Development Initiative." MassDevelopment.com. <https://www.massdevelopment.com/what-we-offer/key-initiatives/gateway-cities/> (accessed January 17, 2018).

opportunities for economically challenged areas to benefit from that cluster and the state policies that support it. This study is focused on the intersection of these goals and has several objectives:

- *Research and describe the local economic development challenges, opportunities, and underutilized or “hidden” assets in Gateway Cities that could potentially connect to continued growth of the state’s life sciences sector;*
- *Identify obstacles to realizing mutually beneficial connections between development of Gateway Cities and the sustained strength of the Massachusetts life sciences cluster;*
- *Recommend policy strategies and interventions by which the MLSC, MassDevelopment, and Gateway Cities could leverage their different expertise and resources to overcome those obstacles.*



# ORIGINS OF INVESTIGATION |

## The Challenge of Inclusive Economic Development

This report is the product of a practicum course in the Department of Urban Studies and Planning (DUSP) at the Massachusetts Institute of Technology (MIT). The course was developed and led by Dr. Amy Glasmeier, Professor of Economic Geography and Regional Planning in DUSP, and Teresa Lynch, the founding principal of Mass Economics, a Cambridge-based research and consulting firm.

## Policy Problem-Based Practicum

At its core, the class was about the challenge of inclusive economic development and the potential to reverse the disparity in economic outcomes—and inequality of opportunity—that is visible across the state using one of its most successful economic clusters: the life sciences. The will of political and business leaders to spread the wealth generated by arguably the state's most important economic cluster is certainly genuine, but there is currently no clear mechanism for systematically extending feasible opportunities to under- and disinvested areas. The overarching goal or policy problem

for the course was to develop strategies that sustain the competitiveness of a world-class regional cluster like the life sciences, historically concentrated in Boston-Cambridge-Route 128, while creating opportunities for economically challenged areas in other parts of the state to also benefit.

## Approach

The practicum examined the interplay of market dynamics, regional and sub-regional geographies of life sciences activity, and the availability of supply factors such as industrial land, residential housing stock, transportation assets, and skilled labor. It provided practical experience in managing planning processes, including:

- *Integrating varied data to understand and analyze a local or regional economy, develop an agenda, and communicate the case for the agenda to stakeholders;*
- *Serving as an intermediary between different stakeholders and interests;*
- *Preparing a plan that summarizes the process, analysis, plan elements, and implementation of strategy development.*

# PROJECT TEAM AND AUTHORS |

The project team consisted of three instructors, Dr. Amy Glasmeier, Teresa Lynch, and technical assistant John Fay, and eight master's students in city planning: Tiffany Ferguson, Talia Fox, Adam Hasz, Laura Krull, Haijing Liu, Andrew Stuntz, Joanne Wong, and Zhekun Xiong.

Students on the project team represented a wide range of backgrounds and interests, including architecture and design, anthropology and sociology, environmental policy, international development, transportation and land use, and workforce development.

## INSTRUCTORS

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## BACKGROUNDS

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Architecture and Design  
Anthropology and Sociology  
Environmental Policy  
International Development  
Transportation  
Land Use  
Workforce Development

# METHODS |

Much can be learned about similarities and differences across all of the Massachusetts Gateway Cities through broad comparative studies. However, local context is essential for understanding many of the challenges, assets, and opportunities in Gateway Cities. In order to develop a deeper familiarity with particular places, this research has taken a case study approach and focuses on two cities: Brockton and Worcester.

Brockton, a city 20 miles south of Boston, initially developed in the late 1800s around the shoe manufacturing industry. By the mid-1900s, most of that industry had disappeared. The city grew again in the 1960s and 70s to over 90,000 people, due in large part to suburbanization following a new highway (Route 24) and a later influx of immigrants (largely from Cape Verde), but it has continued to struggle economically. Today it is a regional center for healthcare and social services, but it lacks any traded clusters and is on a divergent trajectory from the rest of the regional economy.

Worcester is located approximately 45 miles west of Boston and is the second largest city in New England. Beginning in the late 1700s, Worcester grew as an industrial hub serving other major cities in the northeast. Worcester was an important center for industrial activities during both World Wars, welcoming waves of immigrants from Europe from the mid-1800s to mid-1900s and hitting a peak population of over 200,000 in 1950. Industrial activities and population declined in the following decades, but Worcester has been growing steadily since 1980, and currently has a population of over 183,000. The city also retains nine renowned educational

and medical institutions, including the University of Massachusetts Medical School (UMass Medical), sited in Worcester in 1965.

The two cities have similarly experienced sustained disinvestment, poverty, and unemployment following the decline of major industries, as well as significant immigration that has transformed local demographics. However, they are quite different in size, location, culture, historical industry strengths, institutional capacity, and recent development trajectory. These commonalities and distinctives make them complementary cases of Gateway Cities.

This study uses a mix of quantitative and qualitative methods to describe both the life sciences sector and the two cities (Brockton and Worcester), with a focus on identifying hidden assets and opportunities. We reviewed a wide variety of secondary reports, articles, and documents. We also developed several custom data summaries using both public and proprietary sources, including the following:

- **Demographics:** We use American Community Survey (ACS) 5-year pooled estimates to place recent demographics in Brockton and Worcester in the broader state context.
- **Employment by cluster, stage of innovation, and market area:** We use data from Mass Economics's Urban Data Platform, which utilizes the U.S. Census Bureau's County Business Patterns, Zip Code Business Patterns, and Longitudinal Employer-Household Dynamics OnTheMap data; O\*NET's occupation database; and the

Bureau of Labor Statistics's industry-occupation matrix, employment projections, and occupational employment data.

- **Hospitals:** We use American Hospital Association data to characterize the substantial hospital assets in Brockton and Worcester.
- **Research grants:** We use National Institutes of Health (NIH) funding data to evaluate financial resources available to educational and medical institutions across national life sciences clusters as compared to the Gateway Cities.
- **Life sciences patents:** We use patent data from the U.S. Patent and Trademark Office (USPTO) to characterize the innovation activity in the life sciences in Worcester.
- **Life sciences venture capital (VC) funding and investment flows:** We use CB Insights data on VC investors and deals (provided by Andrea Chegut, the Real Estate Innovation Lab, and the Samuel Tak Lee Laboratory) to

understand the flows of money related to life sciences in the private sector in Worcester.

- **Life sciences firm locations:** We use BioPharmaGuy data, supplemented manually with additional firm locations, to describe the geographic distribution of life sciences companies by specialty in the state.

We complemented these data with interviews of 62 individuals representing 48 stakeholder organizations in Brockton, Worcester, Cambridge, and Boston. We interviewed several organizations active in the life sciences sector outside of Brockton and Worcester, including a research hospital, large biotech and pharmaceutical companies, a contract research organization, a biopharma real estate developer, and an industry organization. We also interviewed many stakeholders with connections to Brockton and Worcester. The report integrates these quantitative and qualitative methods.



# PROCESS |

We developed the analyses and recommendations in this report in several phases. Throughout 2017, the instructors gathered relevant background materials, organized and enhanced several data resources, and developed initial contacts in the two case study cities.

In September 2017, the DUSP project team of instructors and students participated in a series of kick-off meetings with leadership at the MLSC and MassDevelopment, as well as with city and economic development organization staff in Brockton and Worcester. In October and November, the DUSP project team collected and synthesized secondary materials, analyzed relevant data, and conducted stakeholder interviews.

The team presented draft findings and recommendations to representatives from MLSC and MassDevelopment on December 15, 2017 to solicit feedback. Following revisions in January 2018, the team presented final recommendations on February 5, 2018 at MIT in Cambridge and released this final report.

## Life Sciences Sector Research



- **Background Research**
- *Information gathering*
- *Cluster theory*
- *Data inventory*



- **Industry Research**
- *Understanding life sciences sector*
- *Stakeholder mapping*

## Data Collection /Analysis



- **Interviews** with 62 individuals at 48 organizations in Brockton, Worcester, Boston and Cambridge:
- Government/public sector
- Community/nonprofit
- Private sector (RE, banks)
- Eds (universities, K-12)
- Life Sciences (pharma, biotech, healthcare/meds)



- **Events**
- Action Plan for Biomanufacturing in Massachusetts meeting
- Kendall square development seminars



- **Data Profiles**

## Recommendations



- **Strategies**
- Synthesize findings
- Identify opportunities
- Develop framework
- Create strategies



- **Public Presentation**



- **Final Report**



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## **LIFE SCIENCES BACKGROUND: FROM GLOBAL TO LOCAL**

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The following section presents our understanding of the current state, evolution, and history of the life sciences, in order to frame the case analyses and recommendations.



## PART A

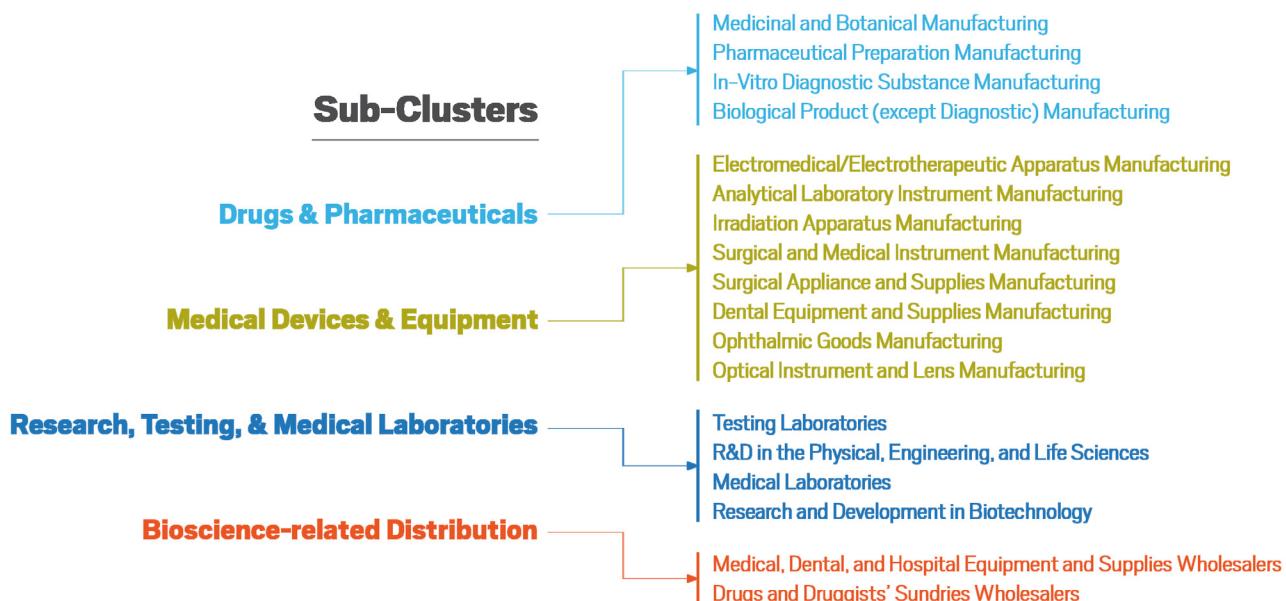
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# DEFINING THE LIFE SCIENCES

# INDUSTRIES AND SUB-INDUSTRIES |

For this report, we define the life sciences cluster as comprising 18 industries, listed by North American Industry Classification System (NAICS) code, which are arranged into four sub-clusters: 1) drugs and pharmaceuticals; 2) medical devices and equipment; 3) research, testing and medical labs; and 4) bioscience related distribution. The first two sub-clusters are manufacturing industries, the third is service

industries, and the fourth is wholesalers and distributors. These industries informed the scope of the research and enabled the team to standardize data for analysis.



Life Sciences Industry Sub-Clusters

Source: Mass Economics

# HISTORY AND TRENDS |

## Global

Many factors, including healthcare demands of an aging population and increased prevalence of chronic disease, are driving a rapid transformation in the life sciences<sup>[1]</sup>.

Biopharmaceuticals, also known as biological-based drugs, biotechnology products, or biologics, represent a growing market for large pharmaceutical companies. Globally, the sector experienced a compound annual growth rate (CAGR) of 5.6 percent in revenue between 2010 and 2016<sup>[2]</sup>. The United States (U.S.) is considered the dominant player in the life sciences, with 18 percent of global revenue from exports and 32.6 percent of total global revenue generation in 2017. Germany, France, and the UK lead the sector in the European Union (EU), which accounts for 59.4 percent of exports. Asian markets are also strong: China, Japan, South Korea, Singapore, and India are major players, each with between one and five percent of global exports<sup>[3]</sup>.

The development of biologics is complex relative to conventional, small molecule drugs

derived through chemical processes<sup>[4]</sup>. Biotech products involve live organisms and advanced cellular techniques to combine and rearrange large molecules<sup>[5]</sup>. As a result, suppliers are experiencing new constraints with regard to regulatory processes, financial investment, and physical and technical capacity for biomanufacturing. Seventy-seven percent of biologics requires mammalian cell cultures throughout the development, production, and testing lifecycle<sup>[6]</sup>. The demand for these products will reach 40 metric tons by 2020, compared to 13 metric tons in 2014<sup>[7]</sup>.

Given the large capital investments and extensive lead time required to bring these products to market, companies also face pressures to be more efficient in order to deliver higher quality products at a lower price to governments, consumers, and health insurers<sup>[8]</sup>. A continuing trend of mergers and acquisitions of startups and contract research organizations (CROs) is leading to administrative complications for larger industry players<sup>[9]</sup>. Simultaneous technological advances are

1 Deloitte. "2017 Global Life Sciences Outlook: Thriving in Today's Uncertain Market." Deloitte.com. <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/gx-lshc-2017-life-sciences-outlook.pdf> (accessed January 17, 2018).

2 IBISWorld. "Global Industry Reports: Global Biotechnology." ibisworld.com. <https://www.ibisworld.com/industry-trends/global-industry-reports/business-activities/biotechnology.html> (accessed January 17, 2018).

3 Ibid.

4 Gautam, Ajay, and Xiaogang Pan. "The Changing Model of Big Pharma: Impact of Key Trends." *Drug discovery today* 21, no. 3 (2016): 379-384.

5 IBISWorld. "Global Industry Reports: Global Biotechnology."

6 Patti, Seymour, and Dawn Ecker, "Global Biomanufacturing Trends, Capacity, and Technology Drivers: Industry Biomanufacturing Capacity Overview." bptc.com. <https://www.bptc.com/global-biomanufacturing-trends-capacity-technology-drivers-industry-biomanufacturing-capacity-overview/> (accessed January 17, 2018).

7 Ibid.

8 KPMG. "Pharma Outlook 2030: From Evolution to Revolution." KPMG.com. <https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2017/02/pharma-outlook-2030-from-evolution-to-revolution.pdf> (accessed January 17, 2018).

9 Gautam, and Pan. "The Changing Model of Big Pharma."

lowering costs and spurring innovation<sup>[10]</sup>.

Automation in the administrative and physical aspects of biomanufacturing greatly reduces errors and speeds up processes<sup>[11]</sup>. Digital devices enable independent illness prevention, management, monitoring, self-testing and diagnosis, while availability of big data facilitates communication among patients, physicians, and researchers regarding clinical trials, health records, and insurance. This dynamic, digital consumer-focused life sciences economy supports increasingly specialized therapies and treatments to meet individual patient needs<sup>[12]</sup>. This, in turn, requires improved transparency and collaborations between the scientific and business communities<sup>[13]</sup>.

Geographic trends show that markets in the Asia-Pacific biotechnology sector are strong and growing, with increasing investments in Taiwan, Singapore, Mainland China, South Korea, and India, as well as expected growth in Latin America, specifically Brazil. The bulk of investment and continual growth in biotechnology, however, has occurred in North America, particularly in the U.S.<sup>[14]</sup>, where several regions lead sector growth and innovation.

10 Mallik, Subhro. "New Frontiers of Growth in the Life Sciences Industry." *infosys.com*. <https://www.infosys.com/industries/life-sciences/white-papers/Documents/life-sciences-industry.pdf> (accessed January 17, 2018).

11 Ibid.

12 KPMG. "Pharma Outlook 2030: From Evolution to Revolution."

13 PWC Health Research Institute. "The New Health Economy." MIT New Drug Development Paradigms Initiative (NEWDIGS). 2015. "About MIT NEWDIGS." <http://newdigs.mit.edu/about> (accessed January 18, 2018).

14 IBISWorld. "Global Industry Reports: Global Biotechnology."

## National

The U.S. has been the world's leading innovator in the life sciences, providing as much as 70 to 80 percent of research and development (R&D) funds globally<sup>[15]</sup>. Biosciences in the U.S. have grown at a steady rate in the past two decades, despite modest cuts to employment during the recession<sup>[16]</sup>. The sector's innovative focus has made it resilient and has put the U.S. at the forefront of the market.

The U.S. biotechnology sector began with the founding of the first biotech firm, Genentech, in 1976 in San Francisco. DNA technology, also known as genetic engineering, was a key development that allowed scientists to manufacture proteins such as human insulin. Broadly speaking, genetic engineering technology has shifted the pharmaceutical industry immensely<sup>[17]</sup>. New therapies and vaccines out of the biotech field treat a variety of diseases, including cancer, diabetes, HIV/AIDS, and other autoimmune and neurological disorders.

Much of company structure and process

15 Deloitte. "2017 Global Life Sciences Outlook: Thriving in Today's Uncertain Market."

16 TECconomy and Biotechnology Innovation Organization (BIO), "The Value of Bioscience Innovation in Growing Jobs and Improving Quality of Life." *bio.org*. [https://www.bio.org/sites/default/files/BIO%202016\\_Report\\_FINAL\\_DIGITAL.pdf](https://www.bio.org/sites/default/files/BIO%202016_Report_FINAL_DIGITAL.pdf) (accessed January 17, 2018).

17 Walsh, Gary. "Protein engineering: Case studies of commercialized engineered products." *Biochemistry and Molecular Biology Education* 35, no. 1 (2007): 2-8.

in the life sciences in the U.S. derives from regulatory requirements from the Food and Drug Administration (FDA), which regulates the testing, manufacturing, and packaging of biopharma drugs to ensure their safety. Generally, the biotech industry is a high risk industry, and a low number of drugs move successfully from ideation to commercialization, stalled in part by FDA requirements.

In addition to regulatory hurdles, the biotech industry faces rising costs and financial uncertainty, particularly with a potential loss of federal funding, given a change in research priorities from the new President<sup>[18]</sup>. Because the cost of bringing a new product to market is so high, R&D funding plays a crucial role in drug development. Recent years have seen slowing growth in NIH funding and R&D spending by U.S. colleges and universities<sup>[19]</sup>. Between 2000 and 2009, total bioscience-related university R&D expenditures increased by an average of 8.1 percent each year. Since 2010, however, that amount has only increased by an average of 2.8 percent each year<sup>[20]</sup>. Recently, there has also been an uptick in bioscience VC funding, which provides an opportunity for corporations to engage in niche research. Large companies have also adapted to a shortage of federal research funds by acquiring smaller companies that have developed new research techniques.

#### Across the U.S., the life sciences sector

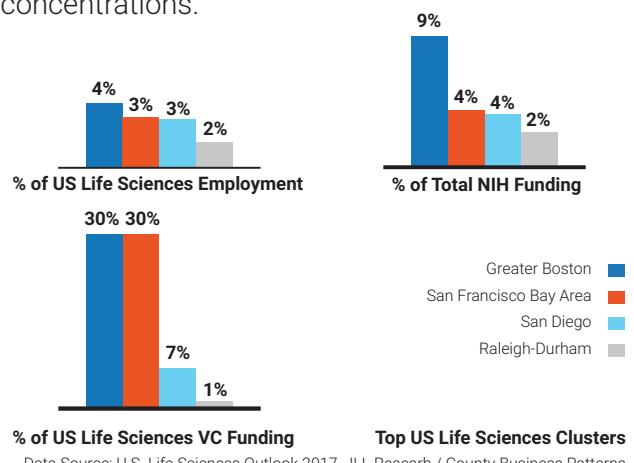
<sup>18</sup> JLL. “An Evolving Industry: Today’s Clusters Creating Tomorrow’s Breakthroughs.” us.jll.com. <http://www.us.jll.com/united-states/en-us/Research/JLL-US-Life-Sciences-Outlook-2017.pdf?e89ae5d2-1063-4ad2-b303-bac0a93f4f1f> (accessed January 17, 2018).

<sup>19</sup> Ibid.

<sup>20</sup> National Science Foundation (NSF). “Higher Education Research and Development Survey (HERD).” nsf.gov. <https://www.nsf.gov/statistics/herd/> (accessed February 1, 2018).

employs 1.66 million people in over 77,000 establishments and has been growing its employment base since the recession<sup>[21]</sup>. The industry has recovered its job losses and exceeded its previous employment peak at a faster rate than the private sector as a whole. Biosciences also have higher-than-average wages: the average wage for a U.S. bioscience worker in 2014 was \$96, compared to an average of \$51 for a job in the U.S. private sector<sup>[22]</sup>. That said, tremendous regional variation in life sciences employment exists. The Greater Boston and San Francisco Bay areas are home to four and three percent of jobs in the life sciences, respectively.

In addition to historical and political circumstances, geographic theories of industry development help to explain these regional concentrations.



<sup>21</sup> United States Bureau of Labor Statistics

<sup>22</sup> TEConomy and Biotechnology Innovation Organization (BIO). “The Value of Bioscience Innovation in Growing Jobs and Improving Quality of Life.”

## PART B

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# UNDERSTANDING THE GEOGRAPHY OF LIFE SCIENCES



# CLUSTER THEORY |

Scholars<sup>[23]</sup> have developed theories to explain the patterns of agglomeration they observe across urban centers and regions. The most prominent of these is the theory of economic clustering, commonly associated with Michael Porter<sup>[24]</sup>. According to cluster theory, businesses and other organizations (e.g., educational institutions, industry-related support services) benefit from clusters of economic activity in which the success of the individual enterprise depends on the success of the cluster as a whole<sup>[25]</sup>. We see evidence of clustering activity during periods of early and modern industrialization, through the post-World War II era of massive scientific discovery. High-tech and other activities that drive growth in advanced economies also show strong patterns of clustering across several sectors including, but not limited to, the life sciences (additional sectors include microelectronics, computers, and robotics).

While geographic proximity can play an important role in cluster development, the process of agglomeration occurs on multiple spatial and temporal scales, depending greatly on the nature of the sector. The automobile sector, for example, was a regional-scale industrial complex, historically concentrated in the Midwestern U.S. Including parts manufacturing, suppliers, and additional concentrations of automobile assembly, however, expands the cluster's geography to the southern states of Tennessee and Georgia,

## **Porter's Cluster Theory**<sup>[26]</sup>

*In the late 1990s, Harvard Professor Michael Porter developed a theory of regional competitiveness to explain how choices at the regional and sub-regional scales affect economic growth. Looking across five regions, each with distinctive clusters in pharmaceuticals and biotechnology (San Diego, California; Pittsburgh, Pennsylvania; and Research Triangle Park, North Carolina), plastics and aerospace (Wichita, Kansas), and financial services (Atlanta, Georgia), Porter identified **specialization** and **innovation** as key drivers of regional competitiveness. Specialization identifies regions that experience investments that deepen existing industry expertise, while innovation refers to increased efficiency and productivity. This regenerative cycle of investment, knowledge creation, and increased productivity features across clusters.*

## **What are key components of an innovation district?**

*Knowledge and innovation are key drivers of competitive advantage in the 21st century economy. Innovation districts thrive when there is proximity, networking, and connectivity for workers and firms.*

23 Including Alfred Marshall, Alfred Weber, and Michael Porter

24 Porter, Michael E. "The competitive advantage of nations." *Competitive Intelligence Review* 1, no. 1 (1990): 14-14.

25 Bergman, Edward, and Edward Feser. "Industrial and Regional Clusters: Concepts and Comparative Applications." WVU.edu. <http://www.rri.wvu.edu/WebBook/Bergman-Feser/contents.htm> (accessed January 19, 2018).

26 Porter, Michael E. "The competitive advantage of nations."

and even as far as Mexico and Canada<sup>[27]</sup>. More recent clusters like computers or biotechnology in Silicon Valley, California also exhibit geographic variation.

Clusters comprise districts, which are areas of specialized activities that develop around product or process experts. A popular term in industrial organization and cluster theory is “innovation district,” which the Brookings Institution defines as a geographic area where leading-edge anchor institutions and companies connect with startups, business incubators, and accelerators. Close proximity and ease of access to services can support productive interactions among these public and private actors; some innovation districts are also physically compact and transit oriented, and offer mixed-use housing, office, and retail<sup>[28]</sup>.

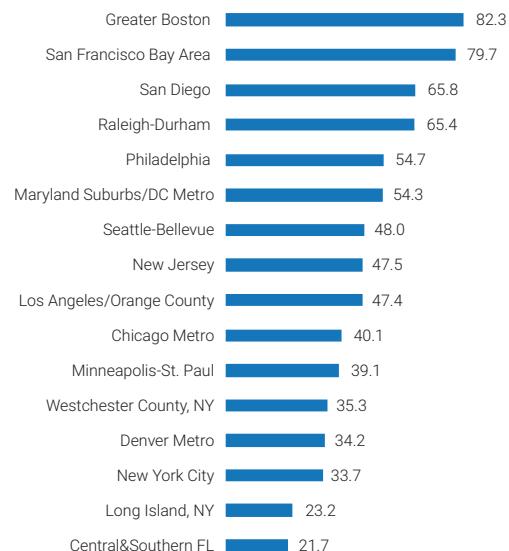
Given that many successful clusters and districts exhibit shared features, understanding their formation can help decision makers predict spatial and economic trends and propose policy interventions. At the same time, clusters are unique, emerging out of particular industry contexts, and social, historical, and political circumstances. For both of these reasons, cluster theory has been an important lens through which to consider the life sciences sector as it relates to economic development in our two case cities.

<sup>27</sup> Ibid.

<sup>28</sup> Katz, Bruce, and Julie Wagner. “The rise of innovation districts: A new geography of innovation in America.” Washington: Brookings Institution(2014).

### **What are the JLL life sciences cluster rankings?**

*The ranking includes life sciences employment centers, life sciences VC funding, total lab supply, life sciences employment growth, life sciences establishment concentration, National Institutes of Health funding in the life sciences, market occupancy rate, and asking rent. In rank order, the top geographic areas are: Greater Boston, San Francisco Bay Area, San Diego, Raleigh-Durham, and Philadelphia.*



**US Life Sciences Ranking**

Data Source: U.S. Life Sciences Outlook 2017, JLL Research

# CLUSTERING IN THE LIFE SCIENCES |

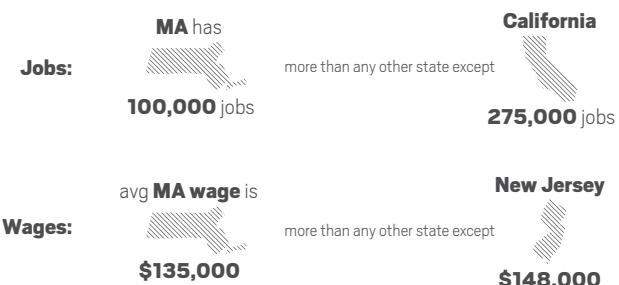
Regional life sciences clusters began to take shape in the U.S. in the second half of the 20th century as companies expanded in-house R&D programs<sup>[29]</sup>. As engines of post-World War II economic growth, major life sciences investments often involved partnerships with local governments and institutions. Many of the most successful life sciences clusters today emerged from funding that was a direct product of such collaborations.

Jones Lang LaSalle, Inc. (JLL) is a real estate investment firm that produces well-respected research on trends in life sciences activity in the U.S. Their annual Life Sciences Outlook<sup>[30]</sup> provides a useful schematic for assessing successful life sciences clusters. In 2017, according to JLL, the top U.S. life sciences clusters were Greater Boston, the San Francisco Bay Area, San Diego, and Raleigh-Durham. While each cluster is unique, boasting different types of expertise across a variety of sub-sectors, they all feature a mix of research activity, universities, and medical communities. This high concentration of institutions enables the clusters to attract and retain the top talent and funding that fuels life sciences ecosystems.

While Big Pharma previously drove cluster development, the trends in the global and national life sciences sector described above have shifted the nature of cluster development. Mid-tier companies and speciality players

are experiencing overnight growth and highly variable needs in response to promising products and treatments<sup>[31]</sup>. While still anchored in many cases by biopharmaceuticals, successful life sciences clusters thrive off of the innovative activities of startups and small and medium-sized companies, which seek environments where they can easily collaborate and access VC and institutional support.

Furthermore, the changing workforce has encouraged companies to prioritize locations that will help recruit desired talent. As they seek out amenity-rich spaces, especially in densely developed clusters with coveted lab space and facilities, companies face rising rents and space constraints.



**Comparison of Life Sciences Jobs and Wage**

Data Source: Mass Economics UDP

29 JLL. "An Evolving Industry: Today's Clusters Creating Tomorrow's Breakthroughs."

30 Ibid.

31 JLL. "Life Sciences Cluster Report: Global 2014." <https://www.jll.com/Research/2014-global-life-sciences-report-JLL.pdf?654be919-aef1-45a0-bef3-ab01d0a4ece6> (accessed January 20, 2018).

# MODEL LIFE SCIENCES CLUSTERS |

While each cluster's development is context specific, understanding successful life sciences clusters can shed light on key similarities for cities and regions looking to develop their life sciences economy. Using JLL's life sciences cluster rankings of U.S. cities, we explored two case studies: Kendall Square (Greater Boston), and Research Triangle Park (Raleigh-Durham, North Carolina). Their distinct growth models provided insight into the types of catalysts for cluster development as we thought about the life sciences in our focus cities of Brockton and

Worcester.

The life sciences sector in the U.S. thrives in some places more than others. Given that the key drivers of cluster success include research institutions, high real estate values, and other factors correlated with wealth, clusters can drive great regional and economic imbalances. Several states, Massachusetts most notably, have enacted targeted policy to manage growth both within and beyond concentrated areas.

## Research Triangle Park

At the intersection of three of North Carolina's research intensive (R1) universities and the top national healthcare organizations;

Physical space investments initiated in the 50s by three champions and key university partnerships;

Publicly-oriented, mission-enabled diverse funding options;

Gained momentum after landing government contract and federal labs.

**3** Tier 1 universities

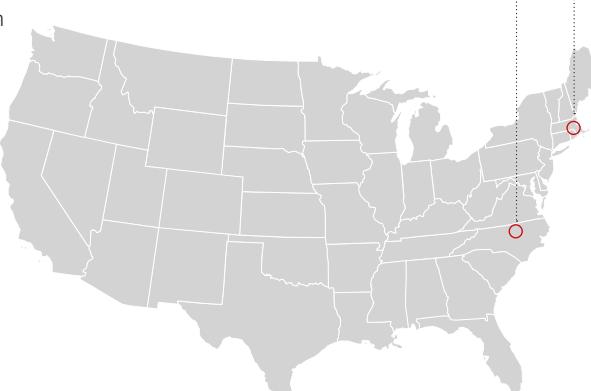
**200** employers

**12** colleges + universities

**50,000** employees

**105,000** students

**7000** acres development



## Kendall Square

Located in Cambridge, MA, began through spinoffs from MIT research in the 60s;

Started very slowly and gained momentum in the late 80s, area also fueled by immense government-funded research;

Encouragement for entrepreneurship and innovation, plus a focus on creating a mixed-use neighborhood, spurred growth in the 2000s.

### Greater Boston

**5** Tier 1 universities

**52** colleges + universities

**250,000** students

### Kendall

**13 of 16** top biopharma employers

**55,000** life sciences-related employees

**43** acre development

### Two Typical Life Sciences Models

Data Source: Mass Economics UDP / ACS

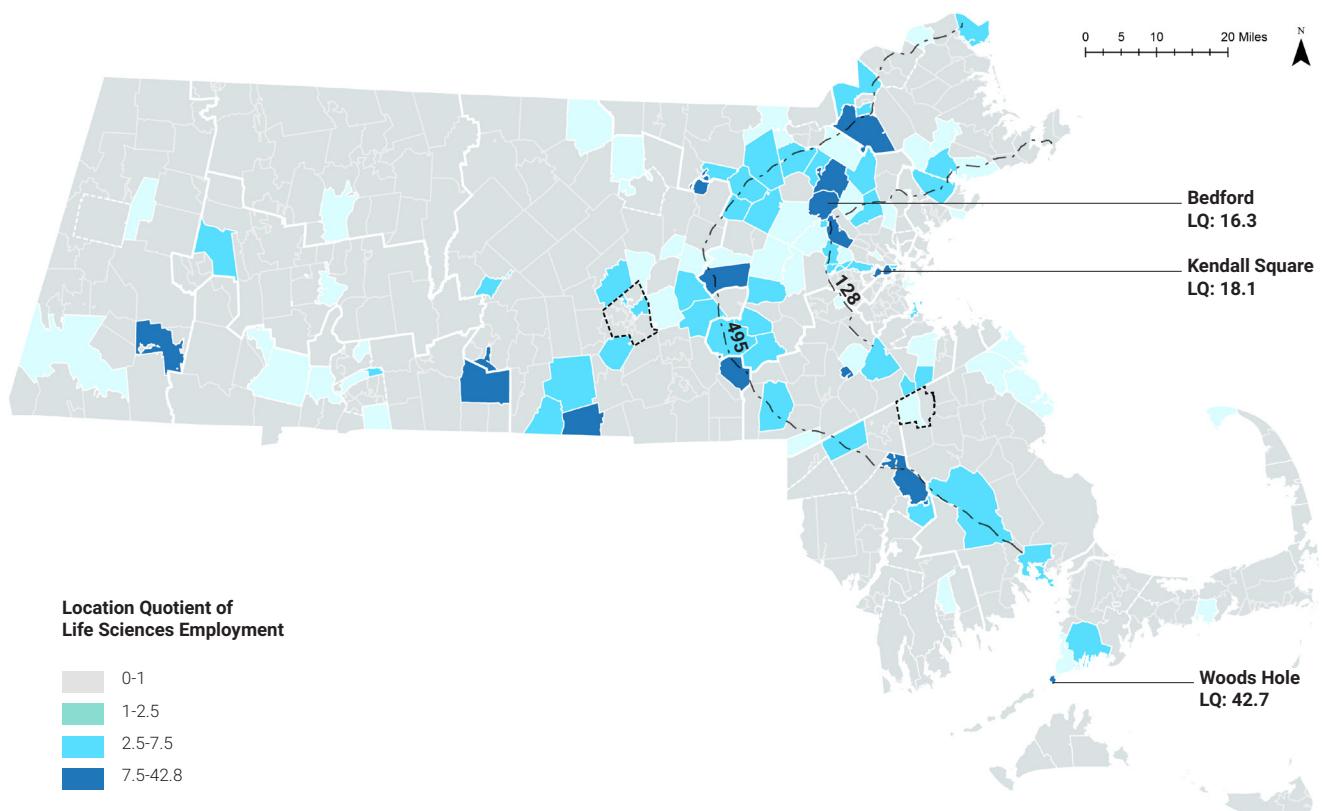
# POLICY INTERVENTION IN MASSACHUSETTS

Massachusetts was one of the first states in the U.S. to prioritize the life sciences through a targeted policy agenda. In 2006, state officials and industry leaders recognized that other regions around the country were gaining momentum in the life sciences, attracting talent, technology, and companies away from Massachusetts. The State Legislature introduced a one billion dollar investment initiative over ten years to create the Massachusetts Life Sciences Center (MLSC), an investment agency that supports life sciences innovation, education, R&D, and commercialization.

The state has approximately 100,000 jobs in the life sciences and is a national leader in venture capital, federal grants, patents, and university research. Massachusetts is known for its research, testing and medical labs, medical devices, and drugs and pharmaceuticals. The location of firms, jobs, and talent is not evenly distributed throughout the state, however, in large part because of the particular nature of the sector in Massachusetts, which thrives mainly from early stages of the industry that are skill-intensive. As demonstrated by the following

map, most activity in the life sciences occurs in Cambridge. The location quotient (LQ, relative measures of industry activity) for life sciences employment in Cambridge is 18.1, while much of the state has an LQ of less than one. In 2017, Boston/Cambridge accounted for 60.1 percent of the sector in the state, while Metrowest had 17.4 percent, and Central Massachusetts, 5.1 percent.

Furthermore, the sector requires mainly skilled workers; the cluster around Kendall Square attracts talent and firms with its hub of top-tier universities. In 2016, six percent of STEM occupations within the biopharma industry required an associate's degree or less, 64 percent a bachelor's, nine percent a master's, and 21 percent a PhD. These characteristics of the life sciences in Massachusetts exacerbate existing regional and economic disparities across the state. Several cities in particular were left out of the state's economic growth in the life sciences and other technology-focused industries during the second half of the 20th century.





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## **GATEWAY CITIES**

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In the late 19th century, cities across Massachusetts experienced an economic boom from the Industrial Revolution. Cities like Worcester, Brockton, Lowell, and Lawrence were hubs of manufacturing and built up civic wealth. Railroads connected these cities to Boston and the broader region, and the cities continued to thrive throughout much of the 20th century. After World War II, however, manufacturing began to migrate out of Massachusetts. While dense urban infrastructure and deep identities remain in these cities, most of the good-paying industrial jobs are now gone. Like many post-industrial cities around the country, "Gateway Cities" in Massachusetts have struggled to regain their vitality after losing manufacturing.

# CHARACTERIZING GATEWAY CITIES |

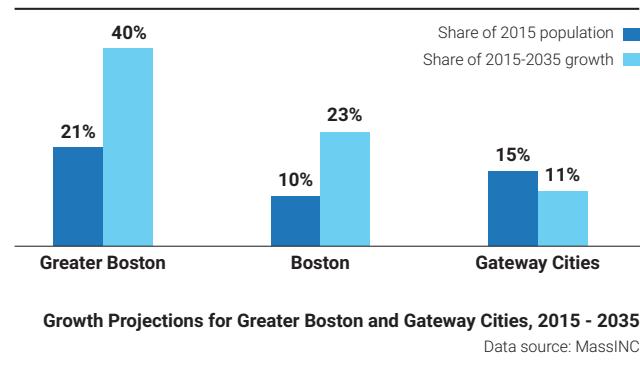
In 2008, mayors from 11 Gateway Cities launched a compact to work collaboratively to advance economic and community development. With the support of research and advocacy from MassINC, the cities persuaded the Massachusetts State Legislature to formally recognize the economic development needs of the original eleven cities<sup>[1]</sup>. In 2010, the state expanded the designation to include twenty-six cities, adopting a legal definition of “Gateway City” as “a municipality with a population greater than 35,000 and less than 250,000 with a median household income below the Commonwealth’s average and a rate of educational attainment of a bachelor’s degree or above that is below the Commonwealth’s average”<sup>[2]</sup>.

According to research from MassINC, under “business as usual” growth conditions, Gateway Cities will experience disproportionately low population growth over the next twenty years. While Gateway Cities currently are home to 15 percent of Massachusetts population, they are only expected to receive 11 percent of new growth. Greater Boston currently has 21 percent of the state’s population, but is expected to receive a full 40 percent of new growth<sup>[3]</sup>.

## ***The twenty-six Gateway Cities:***

*Attleboro, Barnstable, Brockton, Chelsea, Chicopee, Everett, Fall River, Fitchburg, Haverhill, Holyoke, Lawrence, Leominster, Lowell, Lynn, Malden, Methuen, New Bedford, Peabody, Pittsfield, Quincy, Revere, Salem, Springfield, Taunton, Westfield, and Worcester.*

Many Gateway Cities, Brockton and Worcester included, have existing rail commuter connections that are underutilized. MassINC argues that “transformative transit-oriented development” within the Gateway Cities could take advantage of this rail infrastructure and build on infill, boosting their share of future population growth and preventing additional sprawl.



1 MassINC. “About the Gateway Cities.” MassINC.org. <https://massinc.org/our-work/policy-center/gateway-cities/about-the-gateway-cities/> (accessed February 1, 2018).

2 Commonwealth of Massachusetts, “MA General Laws Part I, Title II, Chapter 23A, Section 3A.”

3 Forman, Ben, and Lindiwe Rennert. “Bending the Business as Usual Growth Curve.” MassINC.org. <https://massinc.org/2017/05/23/bending-the-business-as-usual-growth-curve/> (accessed February 1, 2018).

Since Massachusetts adopted its definition of Gateway Cities, MassDevelopment has provided much of the Commonwealth's support to Gateway Cities. In August 2014, MassDevelopment launched its "Transformative Development Initiative" (TDI) to support place-based development within Gateway Cities<sup>[4]</sup>. TDI city participants are eligible to receive technical assistance, full-time TDI fellows for

local organizing and coordination, direct equity investments in catalytic real estate projects, grants for the development of coworking spaces, and small pilot grants for local market development. The TDI aims to concentrate a critical mass of investment and activity within a particular area to catalyze new privately-funded economic development. The TDI program can potentially serve as a means of supporting the life sciences within Gateway Cities.

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<sup>4</sup> MassDevelopment. "Transformative Development Initiative."

# SHARED CHALLENGES FOR GATEWAY CITIES

Behind the above indicators that the Commonwealth uses for classifying Gateway Cities is a set of similar structural, financial, and socio-political challenges.

## Resources, Capacity, and Perceptions

Research from MassINC indicates that the Commonwealth made capital investments of \$3.3 billion in Gateway Cities between FY 2009 and FY 2013. Over half of this investment was used to improve the competitiveness of state school research and teaching facilities; less funding was targeted toward community building infrastructure such as affordable housing and neighborhood revitalization. The analysis also indicates that real estate markets had difficulties rebounding after the Great Recession; while total assessed real estate value in Boston grew 28 percent, total assessed value in the Gateway Cities declined by two percent between 2011 and 2015.<sup>[5]</sup>

Many Gateway Cities, due to limited staff capacity, struggle to develop and maintain coordination across government agencies and often lack access to information or data needed to make informed decisions<sup>[6]</sup>. Additionally, civic infrastructure, including organizational networks, non-governmental resources, and community

engagement<sup>[7]</sup>, varies widely. Survey results from several Gateway Cities indicate shared problems, including limited civic engagement, residential access to decision-making processes, and trust in municipal leadership. Analysis from MassBenchmarks also suggests that even cities with a rich or adequate supply of resources like foundation assets, nonprofits, and institutional or interpersonal connections may not realize their potential because of commonly-held perceptions from community members regarding the unavailability and inaccessibility of those resources<sup>[8]</sup>.

## Observed Challenges and Connections to the Life Sciences

Through this practicum, we had the opportunity to interview many civic leaders in Brockton and Worcester to discuss life sciences-oriented economic development. We were impressed by and grateful for the time and goodwill provided by these stakeholders, who care deeply about their cities and are committed to positive change. Successful development in a globally-competitive industry like the life sciences is very difficult, however. As we will describe in the case studies, there are many areas in which Brockton and Worcester would benefit from stronger state support.

Our interactions with leaders in Brockton and Worcester revealed similar challenges facing the two cities. Through our conversations, we noted disparities in resident and outsider perceptions,

<sup>5</sup> Hodge, Dan et al., "Rebuilding Renewal: An Analysis of State Investment in Gateway Cities and a Work Plan for Delivering Transformative Development." Gateway Cities innovation Institute. <https://2gaiaelifzt2tsfgr2vil6c-wpengine.netdna-ssl.com/wp-content/uploads/2016/05/Rebuilding-Renewal.pdf> (accessed February 1, 2018).  
<sup>6</sup> Mallach, Alan, Ben Forman, and Margaret Keaveny. "Transformative Redevelopment: Strategic State Policy for Gateway City Growth and Renewal." MassINC.org. <https://massinc.org/research/transformative-redevelopment/> (accessed February 1, 2018).

<sup>7</sup> Dawicki, Colleen. "Civic Infrastructure in Gateway Cities." massbenchmarks.org. <http://www.massbenchmarks.org/publications/issues/vol15i1/5.pdf> (accessed February 1, 2018).  
<sup>8</sup> Ibid.

which appear to influence how effectively each city presents its achievements and potential. Both cities had insular governance structures that failed to incorporate the involvement of immigrant and minority populations. And while the cities exhibited some cooperation across agencies or institutions, they often lacked the capacity to collaborate or coordinate effectively toward a broader shared vision.

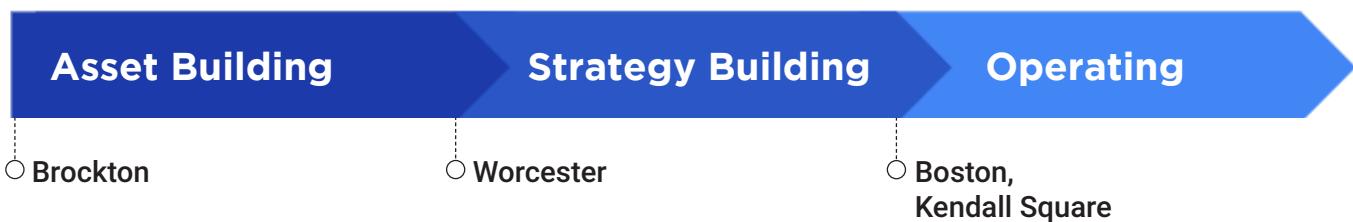
Representatives of life sciences companies and institutions in the Greater Boston area expressed reservations about locating too far from the core of sector activity in Cambridge or in places like Brockton that might not understand their facility and resource needs. Indeed, we noted a lack of specialized sector expertise in our case cities that might attract those companies and promote real estate development. Furthermore, despite strong leadership on the part of the Workforce Investment Boards (WIB), few programs focused on life sciences sector jobs in both cities.

Finally, we understand that transportation infrastructure is critical to a successful life sciences ecosystem; connectivity among different players can be a potential competitive advantage against other regions with life science clusters<sup>9</sup>.

As detailed in the case studies below, internal transportation infrastructure can be strengthened. Existing assets that connect the cities to the Kendall-Boston cluster and other states, such as the Worcester Regional Airport, Commuter Rail, and state highways, are underutilized but have the potential to provide great value.

As we thought about the successful life sciences clusters relative to Gateway Cities, we recognized that they had built up strong assets and developed clear strategies to achieve successful operation. While none of the Gateway Cities has yet reached the operating stage of a full-fledged life sciences cluster, we learned early on in our research that some are farther along in terms of this life sciences development trajectory than others. Cities such as Brockton are still in a stage of identifying and assigning value to their local assets, while cities like Worcester have several institutions, funding sources, and jobs in the life sciences already but are still working on a clear life sciences strategy and public identity.

The framework shown below provided a basis for understanding the case studies, especially as we began to build the following data profiles for Brockton and Worcester.



<sup>9</sup> MBTA. "Connecting with Our Economic Future." [mbta.com](http://old.mbta.com/uploadedfiles/About_the_T/Panel/ABetterCity-LifeSciencesReport.pdf). [http://old.mbta.com/uploadedfiles/About\\_the\\_T/Panel/ABetterCity-LifeSciencesReport.pdf](http://old.mbta.com/uploadedfiles/About_the_T/Panel/ABetterCity-LifeSciencesReport.pdf) (accessed February 1, 2018).



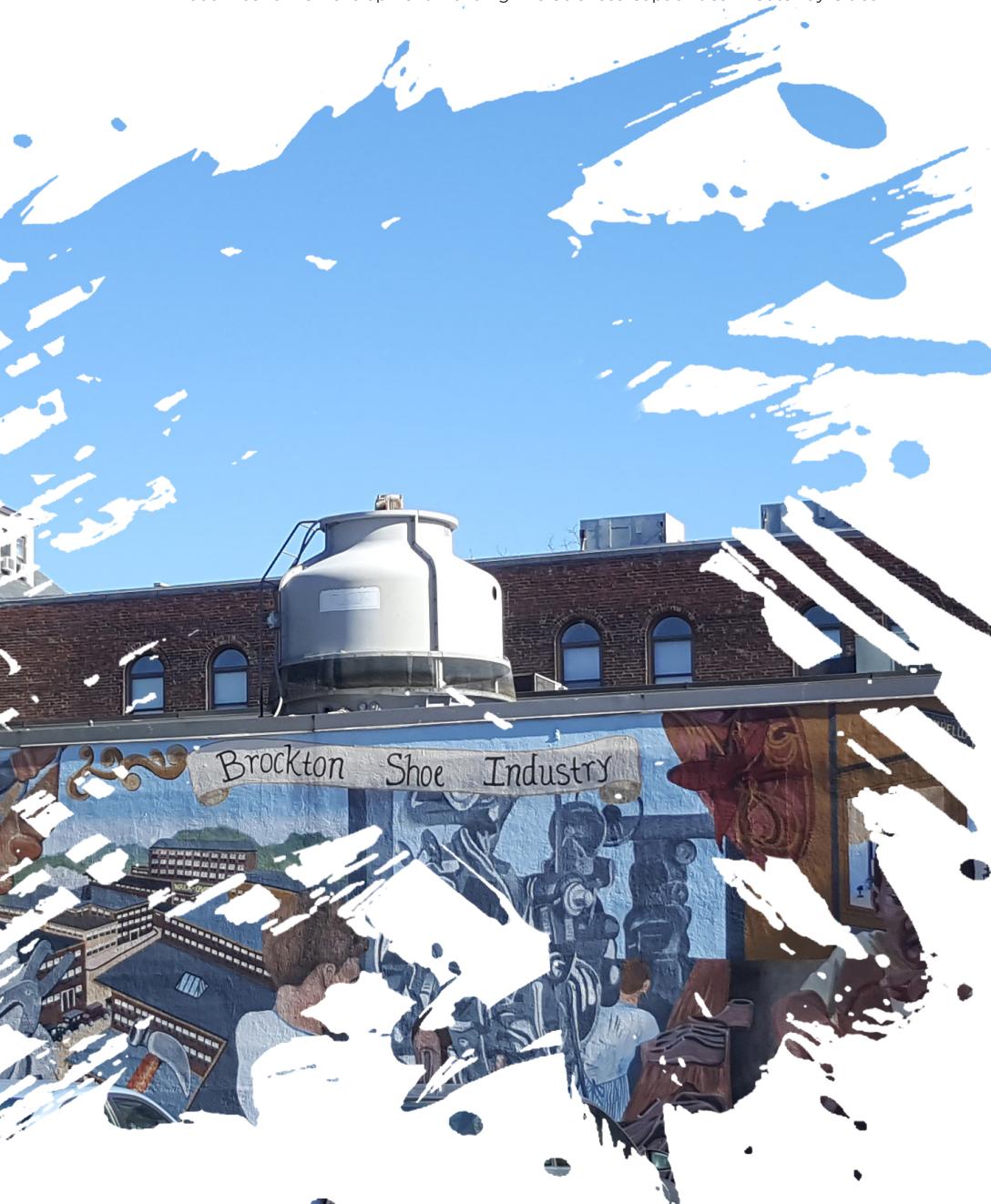
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# **CASE STUDIES**

## **BROCKTON & WORCESTER**

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This section presents our research on the current state, challenges, and strategy insights regarding the life sciences sector in both cities.



## PART A

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# BROCKTON

# HISTORY AND SELF-PERCEPTION |

Major changes in Brockton's past provide helpful context for the opportunities and challenges the city faces today. A timeline of Brockton's history highlights three significant phases that emerged from secondary research and local stakeholder interviews<sup>[1]</sup>:

- **"Shoe City" (late 1800s - early 1900s):**

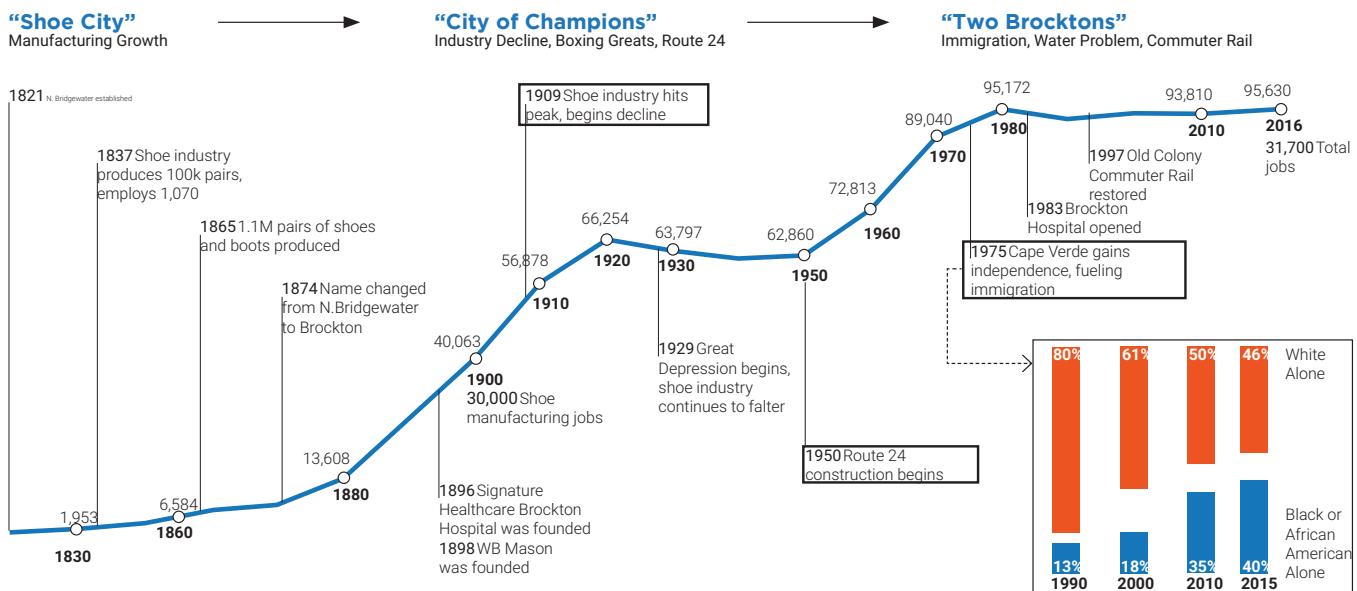
Brockton developed initially as a shoe manufacturing hub in the late 1800s and early 1900s. Rapid growth in employment drove growth in population. In 1900, there were about 40,000 residents and 30,000 shoe manufacturing jobs.

- **"City of Champions" (1920s - 1980s):**

Several related shifts took place from the 1920s through the 1980s. After growing

around the shoe manufacturing industry, Brockton lost nearly all of its shoe factories. As the city started to lose its industry identity, it became known as the "City of Champions" for its athletics, especially local football and boxing greats Rocky Marciano and Marvin Hagler. Brockton also suburbanized after Route 24 was built in 1951. Its population grew at a time when other Gateway Cities were shrinking, but local employment did not keep pace; Brockton has about as many jobs today as in 1900, even though its population has more than doubled.

- **"Two Brocktons" (1970s - present):** Finally, beginning in the 1970s but accelerating in the 1990s and 2000s, emigration from Cape Verde and Haiti shifted Brockton's residential



1 Collins, Edward, and McCormack John. "Trends in Brockton: Population Trends." umb.edu. <http://www.ablueprintforbrockton.com/wp-content/uploads/2016/04/Population-Trends-report-FINAL-5-4-16.pdf> (accessed February 1, 2018).

Population Change in the History of Brockton (1830-2016)

Data source: ACS

demographics from nearly all white to majority non-white. The rapid change in the last three decades has shaped the face of Brockton today and has resulted in certain social, economic, and political divisions among long-time residents, immigrants, and the city.

These strands of history were evident in our interviews with local stakeholders. Four major themes emerged from those interviews related to Brockton's self-perceptions, aspirations, and position in the region.



**Access vs. Isolation:** While Brockton has easy access to many resources both locally and in Greater Boston, stakeholders often function in isolation and do not connect to one another or the regional economy.



#### **Existing Workforce vs. Desired Jobs:**

There is a perceived disconnect between the training level of the existing labor force inside Brockton

and the ability to attract quality jobs from outside Brockton in high-skill industries like the life sciences.



#### **Opportunities vs. Action:**

Interviewees typically described Brockton as an attractive place to locate businesses, but many scratched their heads about how Brockton can look so good on paper but still have trouble "closing deals" to attract life sciences and other companies.



**Old vs. New Brockton(s):** Many stakeholders commented on the divides between older, white residents who wield the most institutional and economic power and the immigrant community leaders and young white professionals who are gaining influence.

These themes run through Brockton's economy, workforce, real estate, and institutions, which we describe in the next section.

# BACKGROUND |

We took a broad-based, exploratory approach to identify potential “hidden assets” that would connect local development in Brockton to the regional life sciences cluster. In this section, we describe Brockton along several dimensions by highlighting key facts, trends, opportunities, and challenges.

Economy

We used County Business Patterns data for 2009 and 2015 to explore employment trends by industry in Brockton, adjacent counties (Plymouth, Norfolk, and Bristol), and the state.

**Brockton's jobs and recent job growth are dominated by healthcare.** The city contains three hospitals and a wide range of other local health services, which combined to account for 39 percent of Brockton's jobs in 2015, about twice the share of surrounding counties and the state. Strong job growth in healthcare resulted in net job growth of five percent citywide from 2009 to 2015. Manufacturing still also plays an important role in Brockton's economy, representing seven percent of local jobs. While a few local companies can be traced directly to Brockton's shoe manufacturing past, about half of the city's manufacturing jobs today are in a growing concentration of food manufacturers.

## Largest Job Gains

#### **Healthcare and Social Assistance**

Management of Companies & Enterprises

Retail Trade

## Wholesale Trade

## Largest Job Losses

---

Professional and Technical Services

Arts, Entertainment, and Recreation

Information

#### **Other Services For Public Admin**

Change Brockton	% Change		
	Brockton	Adjacent Counties	MA
+2,040	+20%	+21%	+13%
+460	+110%	+22%	+10%
+330	+7%	+6%	+7%
+280	+30%	+3%	+4%
-850	-58%	+17%	+10%
-220	-52%	+8%	+10%
-210	-43%	-2%	+12%
-160	-10%	+11%	+4%

### Job Gains and Losses by Sector, 2009-2015

Data source: County Business Patterns / Mass Economics UDP

Looking across industries, **Brockton is on a divergent trajectory from the regional economy.** Brockton's largest job losses from 2009 to 2015 were in higher-wage industries that had double-digit growth in the surrounding counties or the state (such as professional services, arts and entertainment, and information). While Brockton's growing concentration in healthcare has offset those losses, Brockton is exchanging jobs in "traded" industries like professional services, which serve national markets, for healthcare jobs that almost exclusively serve nearby cities and towns. As a result, **Brockton has no major traded industry concentrations serving markets beyond the region.** While Brockton is located within a booming regional economy boasting several major traded clusters (including life sciences), Brockton's economy is somewhat isolated and localized.



**Neighborhood, Regional Traded Employment and Location Quotient, 2015**  
Data source: County Business Patterns / Mass Economics UDP

## Workforce

Brockton's local workforce—residents who are employed or seeking employment—perform worse than the state average in terms of **unemployment and wages**, both overall and within each industry sector<sup>[2]</sup>. Educational attainment level in Brockton also lags behind the state and the average for Gateway Cities<sup>[3]</sup>. Many residents face substantial obstacles to finding stable housing, furthering their education, and securing good jobs. These obstacles were a frequent theme of our stakeholder interviews. Brockton is known as a hub for social services as well as healthcare, and many local assistance organizations are focused on residents with the greatest need. This extends to the primary workforce development organization in Brockton, the Brockton Area Workforce Investment Board (BAWIB), which views its chief goal and mandate as serving local residents who are the least well-off and preparing workers to meet the expected labor needs of local businesses.

This very local workforce development focus stands in contrast to Brockton's exceptional access to jobs and workers as part of the **Boston metro area**. Brockton has multimodal transportation connections to Downtown Boston—by car on Route 24, by commuter rail via three stops on the MBTA Middleborough/ Lakeville Line, and by local bus (the Brockton Area Transit Authority) and rapid transit (the MBTA Red Line). These connections provide

<sup>2</sup> Collins, Edward, and McCormack John. "Trends in Brockton: Population Trends." wp-content/uploads/2016/04/Econ-Trends-report-FINAL-5-4-16.pdf.

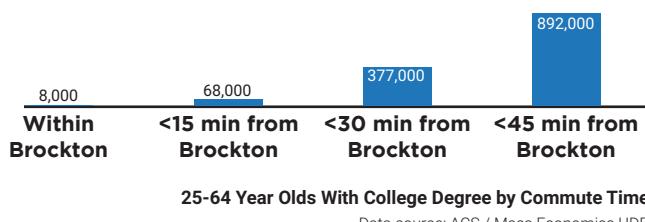
<sup>3</sup> U.S. Census Bureau, 2011-2015 American Community Survey 5-year estimates, 2015. <http://factfinder2.census.gov>

Brockton residents with very good physical access to employment centers in Boston. In terms of proximity to the life sciences cluster activity, it is possible to commute from Downtown Brockton to Kendall Square by commuter rail in one hour and for less than \$300 per month. These vital connections to the rest of the Boston area are visible in commute flow data, which shows that about half of Brockton's workers commute at least 10 miles away to the north or northwest of Brockton.

	<b>Time</b>	<b>Cost</b>
<b>Driving</b>	1h05min - 2h10min	\$197 Operating \$633 Total
<b>Commuter Rail to Red Line</b>	57 min	\$263 w/out BAT \$298 w/BAT
<b>Brockton Area Transit to Red Line</b>	1h38min	\$145

**Commute Time and Cost**  
**Downtown Brockton to Kendall Square, AM Peak**  
Data source: Google Map / MBTA / BAT / AAA

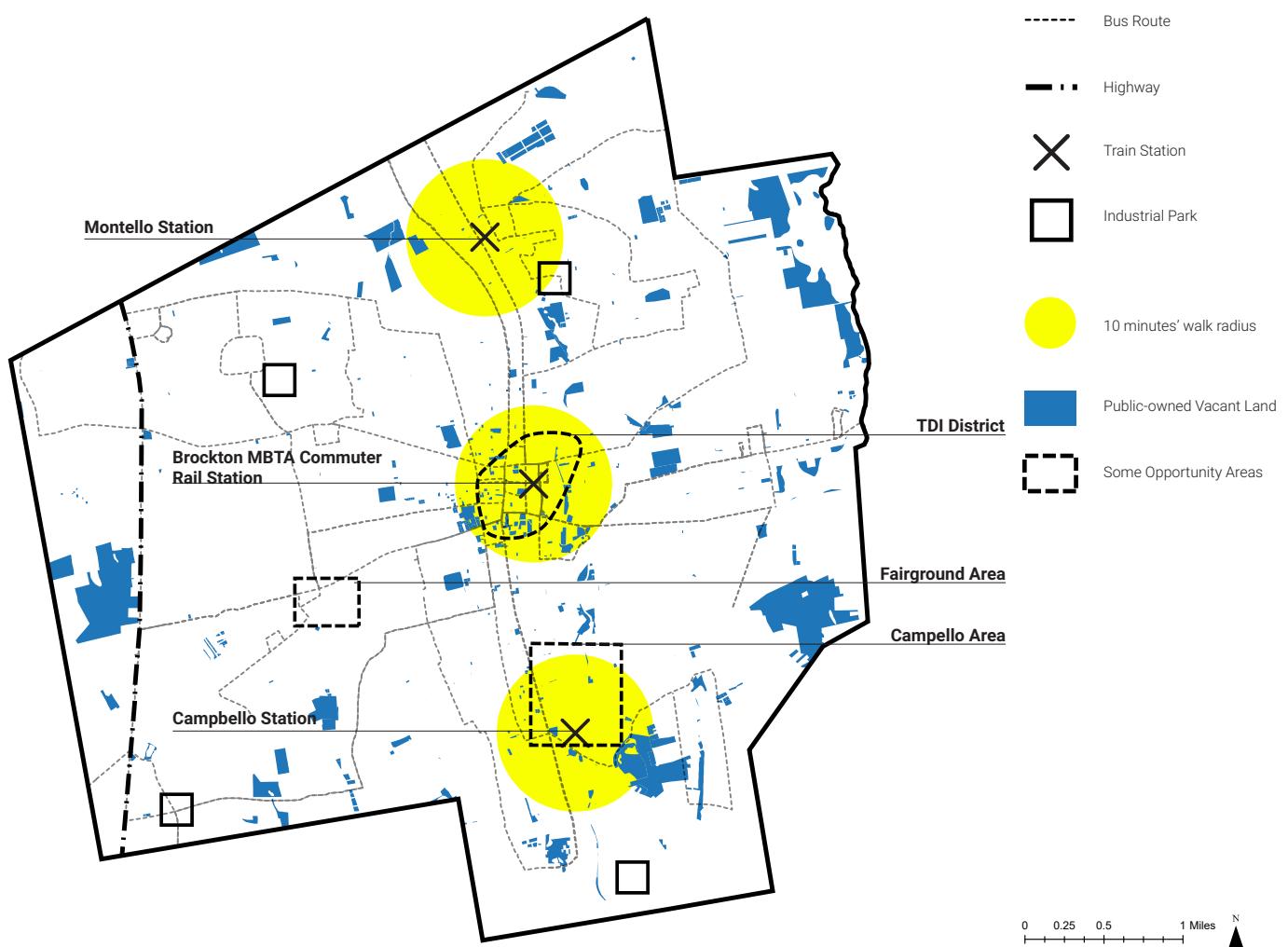
For employers deciding where to grow or locate their businesses, access to a regional workforce should be much more important than education level or skills of the local workforce. From this perspective, Brockton is also **easily accessible to the large and exceptionally well-educated greater Boston metro area workforce**, with **377,000 college-educated workers living within a 30-minute commute** of Brockton.



## Real Estate

Given its proximity to downtown Boston (about 20 miles), Brockton offers both residents and businesses **inexpensive properties, good utility rates, and opportunities for redevelopment**. In October 2017, the City of Brockton released a new master plan, which identified eight "opportunity areas" within Brockton for targeted future development. Several of these sites have already had preliminary market analyses, including three areas prioritized for large-site redevelopment—the Good Samaritan site near Exit 18 on Route 24, the CSX railroad site near downtown, and the Brockton Fairgrounds Area southwest of downtown.

Brockton has moderate residential property taxes but one of the highest commercial property tax rates of cities and towns in southeastern Massachusetts. While this could potentially be an obstacle to business growth and real estate development, the impact is moderated by relatively low land values in Brockton. Local businesses and other stakeholders we interviewed did not identify the tax rate as a primary obstacle to doing business in Brockton.



#### Potential Developable Land in Brockton

Data source: MassGIS Level 3 Assessors' Parcel Mapping dataset / A Blueprint for Brockton

## Existing Life Sciences

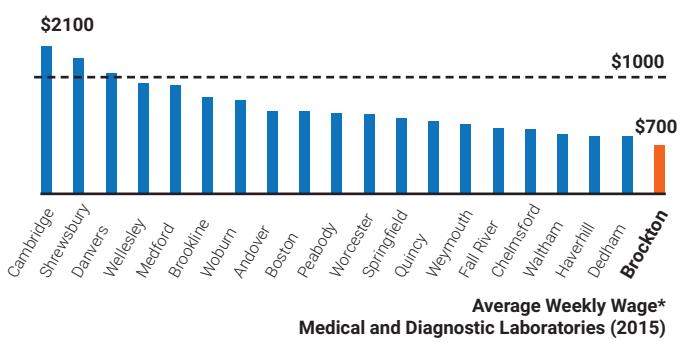
Focusing on the life sciences, Brockton has a relatively high number of jobs in research, medical, and testing laboratories. **Brockton's 2015 life sciences employment (840 jobs) and location quotient (1.5) are near the top of the Gateway Cities.**

	<b>Jobs (2015)</b>	<b>Growth (2009-2015)</b>	<b>Location Quotient (2015)</b>
Research, Testing, & Medical Laboratories	680	-50	2.7
Drugs & Pharmaceuticals	80	+80	1.3
Bioscience-related Distribution	70	+10	0.5
Medical Devices & Equipment	10	-	0.1
<b>Total Life Sciences</b>	<b>840</b>	<b>+40</b>	<b>1.5</b>

**Brockton Life Sciences Jobs (2015) and Trends (2009-2015)**  
Data source: County Business Patterns / Mass Economics UDP

However, this laboratory subcluster includes a wide range of jobs, from R&D bench scientists in wet laboratories to technicians performing routine sample drawing for healthcare delivery. The local life sciences and healthcare stakeholders we interviewed suggested that **most of the laboratory jobs in Brockton are routine, low-wage healthcare jobs**, such as phlebotomists drawing blood at patient service centers. The most ubiquitous laboratory company in Brockton, Quest Diagnostics, collects samples for primary care physicians,

hospitals, and long-term care facilities in Brockton; however, they deliver the samples to their regional laboratory in Marlborough to actually perform testing. This is consistent with state data on average wages for jobs in medical and diagnostic laboratories, which shows wages in Brockton at the bottom of a wide range across cities and towns in Massachusetts.



\* Newton is an outlier, which has an average weekly wage of 5938.

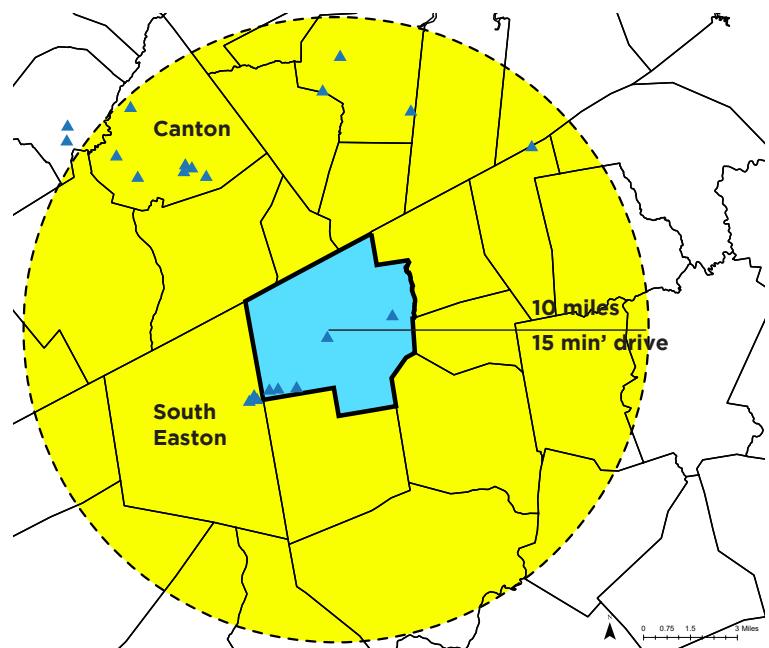
Beyond medical laboratories, Brockton has a small number of jobs in the other life sciences subclusters. It is not possible to directly connect those aggregated industry job numbers to specific companies, but we identified several companies operating in or adjacent to life sciences that are located in Brockton or just over the border in South Easton. **The presence of these companies suggests that life sciences activity in Brockton is feasible**, and those we interviewed touted many of the locational advantages discussed above. However, the same **companies are generally unaware of each other and do not feel well-connected to the regional life sciences cluster.**

## Brockton

Companies	Main Activity
Lyne Laboratories	Develop and manufacture generic pharmaceuticals (liquid, semi-solid, powder)
Amphenol Alden Products	Develop and manufacture medical interconnects and cable assemblies
ACE Surgical Supply	Supply dental surgical instruments and supplies
Quest Diagnostics	Collect samples for medical laboratory testing
US Laboratories	Mobile testing services and medical laboratory testing
Boston Clinical Laboratory	Collect samples for medical laboratory testing

## South Easton

Companies	Main Activity
Pressure Biosciences	Develop devices for laboratory research sample preparation
Pharmasol	Contract pharmaceutical development and manufacturing (aerosol, liquid, semi-solid)
Korsch America	Supply and service tablet compression machinery for pharmaceutical manufacturing



Existing Life Sciences Companies in the Region

Data source: MassGIS Level 3 Assessors' Parcel Mapping dataset

## Institutions

Many institutions tie together the strands of Brockton's economy, workforce, real estate, and existing life sciences activity. Our research and interviews suggested five important groups of institutions with varying degrees of internal cohesion and interaction:

- A group of highly collaborative **economic development organizations** in Brockton is co-located downtown. The City of Brockton recently hired a small planning staff, who led the development of a master plan for the city but have limited capacity in reaching out to or supporting stakeholders. Brockton 21st Century Corporation (B21) and Brockton Redevelopment Authority (BRA) are both active in real estate and business development. The Metro South Chamber of Commerce is a business membership organization with many connections in the local business community. The Brockton Area Workforce Investment Board (BAWIB) sponsors a local Career Center and runs a number of workforce development programs. Finally, as part of Brockton's TDI district, MassDevelopment supports a TDI Fellow in Brockton who works closely with City staff, economic development organizations, and the downtown business community.
- There are several active **community organizations** in Brockton, such as the Cape Verdean Association of Brockton and the Brockton Interfaith Community. While the Cape Verdean community is increasingly active in local politics, the Cape Verdean

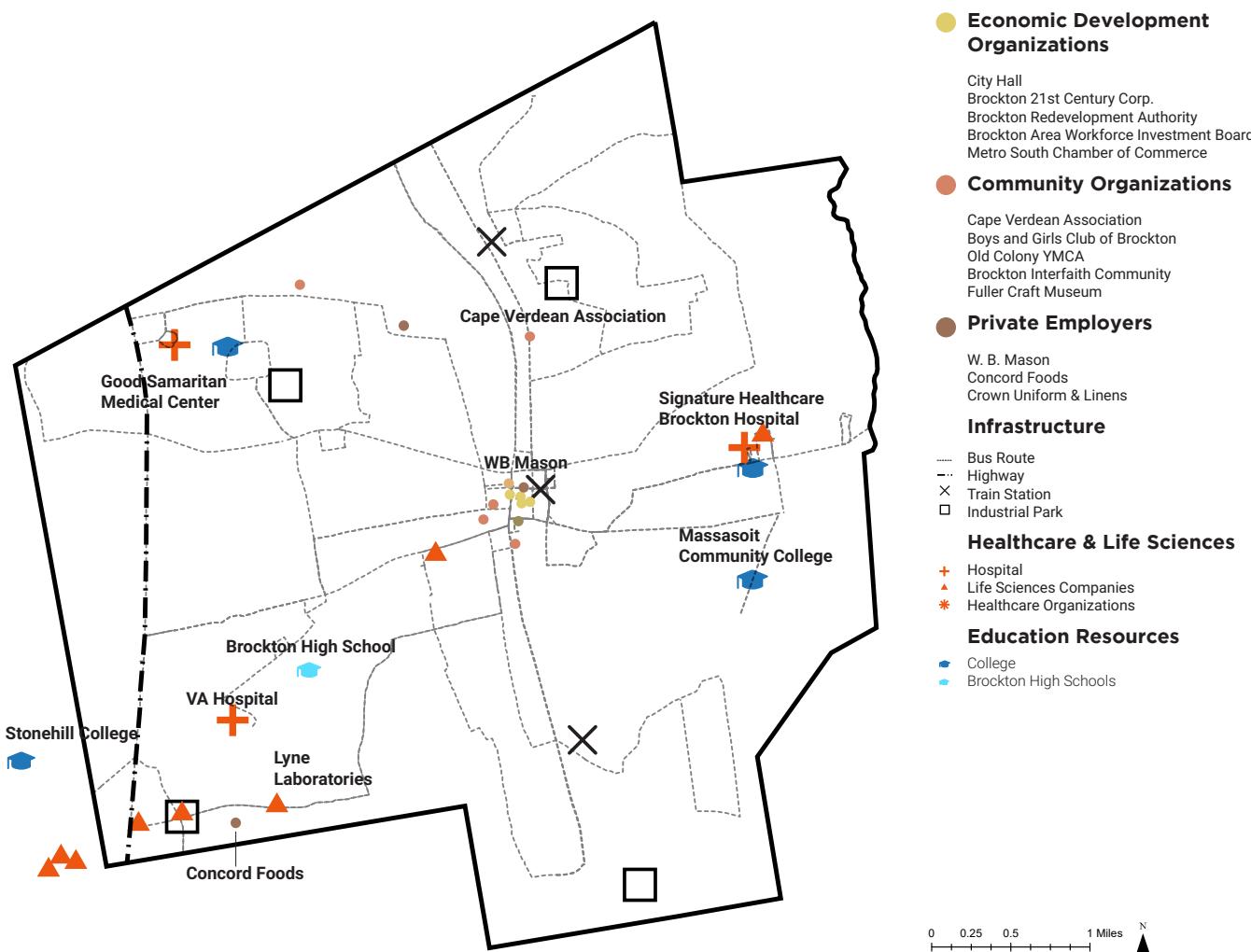
Association and other community groups do not appear to interact extensively with the economic development organizations. One Cape Verdean non-profit leader indicated that many members of the Cape Verdean community interact with different organizations and media compared to other Brocktonians, such as the Cape Verdean Association of Brockton, two Cape Verdean cable programs, a Cape Verdean political organization, the Consulate of Cape Verde in Quincy, and local churches.

- **Healthcare organizations** are anchor institutions in Brockton, but they collaborate mostly on an as-needed, opportunistic basis. Brockton's three hospitals—Good Samaritan Medical Center, Signature Healthcare Brockton Hospital, and the Veterans Affairs (VA) Hospital—are top employers in the city, and the Brockton Neighborhood Health Center (BNHC) is the largest employer in the Brockton's downtown area. All of the healthcare organizations in the city are part of the Greater Brockton Health Alliance, which is mainly active around coordination of grants involving multiple healthcare organizations. While Good Samaritan and Brockton Hospital are in some ways competitors, BNHC is viewed as particularly collaborative, actively pursuing grants and seeking partners for projects that bring the hospitals and other healthcare providers together. BNHC is also active in economic development; its CEO, Sue Joss, is the former chair of the Metro South Chamber of Commerce, and BNHC recently collaborated with Vicente's Supermarket to develop a new grocery store and health center in an economically depressed neighborhood.

- Several other **major private employers** in Brockton play important roles in economic development both through direct investments in Brockton and their influence on policy making. Employers include W.B. Mason, which is headquartered in Brockton; Crown Uniform and Linen, which moved to a new commercial laundering facility in Brockton in 2014;<sup>[4]</sup> and HarborOne Bank, which is also headquartered in Brockton. However, the working relationship between local companies and public sector is sometimes strained. Several businesspeople recently convened an informal group called The Brockton Partnership to advance policy goals somewhat independently of City Hall and local politicians.
- Finally, Brockton's **education organizations** are large employers and key players in local economic development. Brockton High School (BHS) has had a dramatic improvement in performance since the 2000s<sup>[5]</sup>, and it has developed academic pathways geared toward workforce development (including a biotechnology / STEM pathway). There are also several higher education organizations in or near Brockton: Massasoit Community College (a two-year college in Brockton proper), Stonehill College (a private four-year college just over the border in Easton), and Bridgewater State University (the nearest university, eight miles south of Brockton). Brockton's schools coordinate regularly on programs such as high school pathways, certificate training programs, and student transfers.

<sup>4</sup> Business Wire. "Crown Brockton Facility Nears Completion." [businesswire.com](http://www.businesswire.com/news/home/20140718005738/en/Crown-Brockton-Facility-Nears-Completion). <http://www.businesswire.com/news/home/20140718005738/en/Crown-Brockton-Facility-Nears-Completion> (accessed November 27, 2017).

<sup>5</sup> Dillon Sam, "4,100 Students Prove 'Small Is Better' Rule Wrong." [Nytimes.com](http://www.nytimes.com/2010/09/28/education/28school.html). <http://www.nytimes.com/2010/09/28/education/28school.html> (accessed Novemer 27, 2017)



Geographical Location of Major Institutions in Brockton

Source: BioPharma Guy

## PART B

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# WORCESTER



# HISTORY AND SELF-PERCEPTION |

Like Brockton, Worcester's history follows a trajectory of explosive industrial growth and suburbanization (and a subsequent decline in population growth), and the city has served as a destination for several waves of immigrants. These major phases in Worcester's history provide important context for understanding what is possible for the city and its surrounding suburbs. We organize key eras in Worcester's history<sup>6</sup> into the three categories below.

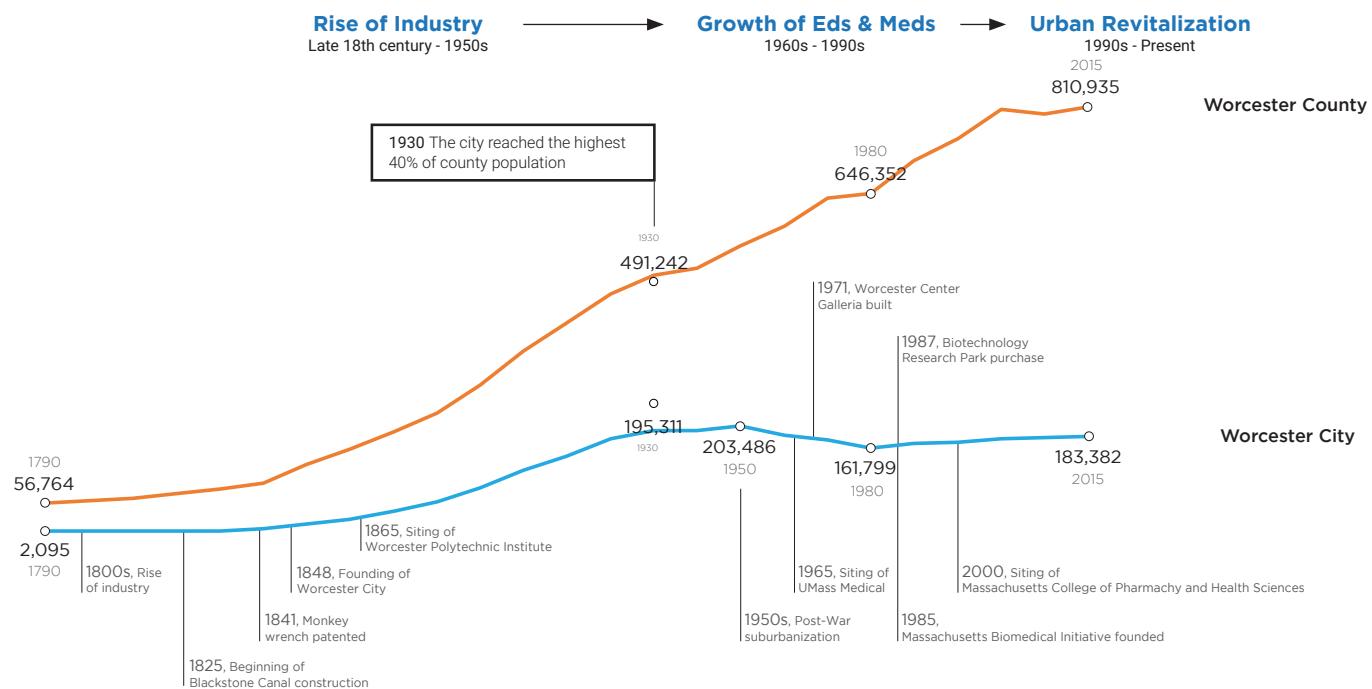
- Rise of Industry (late 1800s - 1950s):**

Worcester was established as a town in 1722, and a city in 1848. The construction of the Blackstone Canal and opening of the Worcester and Boston railroads in the early

1800s catalyzed major industrial activity in the 19th Century. Companies based in Worcester manufactured a wide variety of products for the region and country, including textiles, paper, wires, and wheels, as well as military supplies during both world wars. This manufacturing economy attracted a wave of immigrants, especially from Europe, fueling population growth.

- Growth of Eds and Meds (1960s - 1990s):**

The city's population peaked in 1950, and like most American cities, Worcester saw significant population decline post-World War II. As suburbanization pulled people out of the city, the city lost much of its manufacturing industry due to the availability



6 Worcester Historical Museum. "Worcester History." [worcesterhistory.org](http://www.worcesterhistory.org/worcesters-history/). http://www.worcesterhistory.org/worcesters-history/ (accessed February 3, 2018)

of cheaper labor in the U.S. and overseas. The concentration of Eds and Meds institutions, triggered by the siting of UMass Medical School in 1965<sup>[7]</sup>, has provided slow but steady growth for the city. Today the city is the second largest in New England, with a population of just over 180,000, according to the 2015 Census<sup>[8]</sup>.

- ***Urban Renewal and Revitalization (1990s - present):*** To combat suburbanization-induced urban decline, Worcester first deployed urban renewal capital to redevelop parts of its downtown in the 1960s and 70s. Those efforts did not succeed as intended for the most part, and the city has taken a different approach<sup>[9]</sup>. The latest round of funds deployed in 2017 will support housing, retail, and commercial space, as part of efforts to create a more walkable and vibrant downtown core.

Throughout our interviews, we heard several stories about Worcester that reflected the city's changing history. Similar to the Brockton case, we grouped our impressions into four themes that reflect self-perceptions, aspirations, and position in the region:



***Reality vs. Perceptions:*** We observed a discrepancy between city and industry leaders' perceptions of Worcester's readiness for major

activity in the life sciences, which impedes the city's ability to develop its own, distinct life sciences cluster.



***Neglect for the commons:*** Despite the presence of prominent Eds and Meds institutions, a high-performing technical high school, and a higher education consortium (HECCMA), these and other powerful organizations fail to realize their joint potential to address citywide concerns including, but not limited to, K-12 and STEM education.



***The "collaborative gene":*** While representatives of economic development organizations celebrated Worcester's ability and willingness to collaborate toward a shared development vision, other individuals questioned whether or not these collaborations accurately reflect Worcester's present reality, the needs of the population, and the latent potential across its many diverse communities.



***Innovation without infrastructure:*** Interviewees highlighted exciting research developments, real estate investments, and neighborhood revitalization, but they also lamented the lack of social, civic, and physical connectivity in both the city and the region.

<sup>7</sup> UMass Medical School. "About UMass Medical School." [umassmed.edu](http://umassmed.edu). <https://www.umassmed.edu/about/worcesterhistory/> (accessed February 3, 2018)

<sup>8</sup> U.S. Census Bureau, 2011-2015 American Community Survey 5-year estimates, 2015.

<sup>9</sup> The City of Worcester. "CitySquare." [worcesterma.gov](http://worcesterma.gov). <http://www.worcesterma.gov/city-square> (accessed January 23, 2018).

# BACKGROUND |

Similar to the Brockton case, we developed an understanding of Worcester's economy, demographics, institutional capacity, and existing life sciences assets through exploratory quantitative and qualitative analysis.

## Economy and Population

We used ACS and County Business Patterns data for 2009 and 2015 to understand employment and other demographic trends in Worcester.

**Worcester's main industries are healthcare and social assistance and educational services.** Nearly half of the population (46 percent) works in the two industries. Post-recession, the economy has relied heavily on Eds and Meds, seeing 70 percent job growth in educational services and five percent job growth in healthcare and social assistance. As

in many Gateway Cities, many of these jobs in healthcare and social assistance likely provide social assistance to disadvantaged and aging populations. Moreover, as a Gateway City, Worcester has a high unemployment rate relative to the rest of the state. The city also, however, saw substantially higher gains in the Eds sector post-recession than the state.

**Worcester has a younger average population than the state and nation**, due to the presence of nine universities and colleges. Students may not stay in Worcester after graduation, however, depending on the institution. Interviewees suggested that private universities and colleges such as Assumption, Becker, Clark, Holy Cross, Worcester Polytechnic Institute (WPI) and others attract an international student clientele from across the country, whereas schools such as Worcester State and Quinsigamond Community College, and even UMass Medical, were more likely to turn out graduates who stayed in the city or the county.

### Largest Job Gains

Educational Services  
Healthcare and Social Assistance  
Admin and Support & Waste Mgmt. and Remediation Services  
Accommodation and Food Services  
Wholesale Trade

Change Worcester	% Change		
	Worcester	County	MA
+4,160	+70%	+44%	+13%
+1,470	+5%	+7%	+13%
+810	+25%	+7%	+8%
+290	+5%	+4%	+12%
+160	+7%	+1%	+4%

### Largest Job Losses

Finance and Insurance  
Manufacturing  
Transportation and Warehousing  
Information  
Arts, Entertainment, and Recreation

-1580	-24%	-7%	-13%
-1400	-19%	-2%	-8%
-540	-22%	-2%	+7%
-460	-21%	+20%	+12%
-180	-14%	+7%	+10%

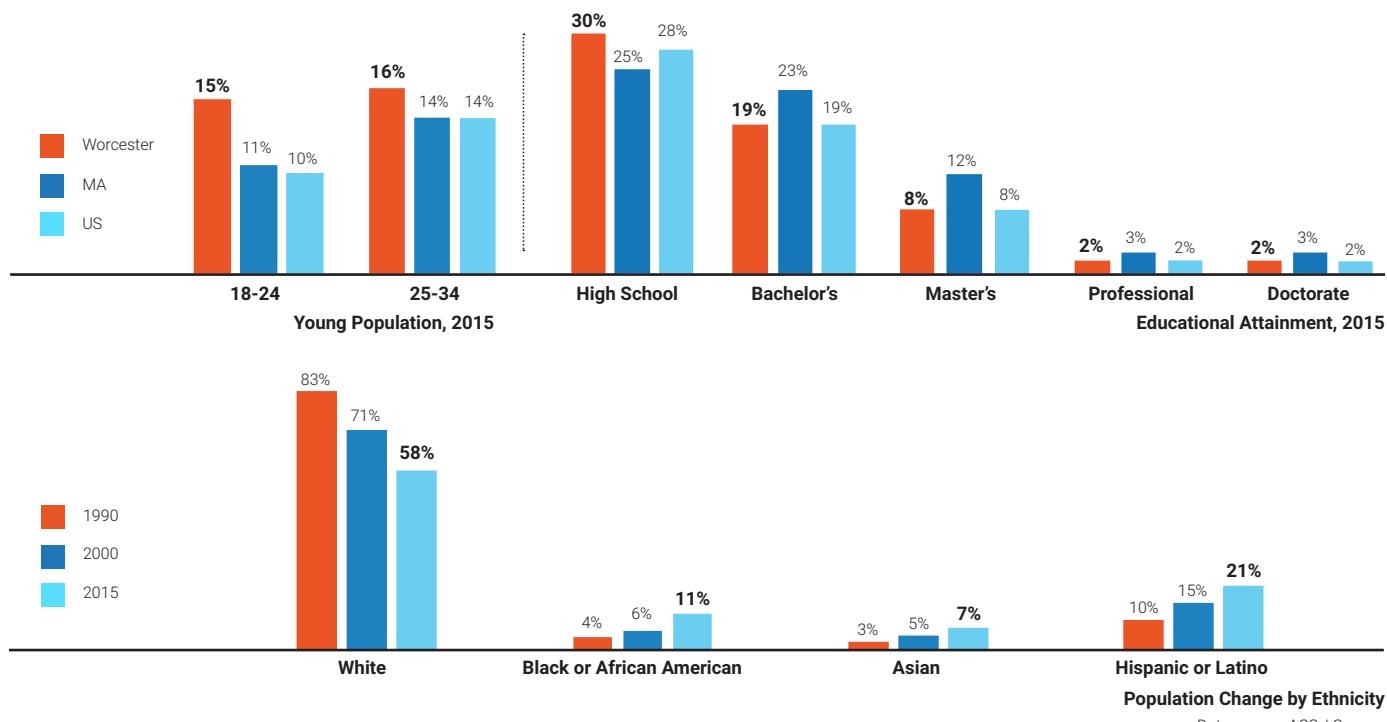
Job Gains and Losses by Sector, 2009-2015

Data source: County Business Patterns / Mass Economics UDP

**Worcester's educational attainment rates are lower than the state's.** A higher proportion of Worcester's population has only a high school diploma compared to Massachusetts (30 versus 25 percent), while a smaller proportion has a Bachelor's or Master's degree compared to Massachusetts (19 versus 23 percent).

**Over the past few decades, the ethnic makeup of the city has shifted:** in 1990, 83 percent of the population was Caucasian<sup>[10]</sup>, compared to 58 percent Caucasian in 2015<sup>[11]</sup>. Worcester's legacy of welcoming immigrants continues to this

day. While foreign-born populations emigrated primarily from Europe in the 19th and early-mid 20th centuries, Worcester's newer waves of immigrants are Dominican, Vietnamese, and Ghanaian<sup>[12]</sup>. The city was also the state's leading destination for refugees from 2007 to 2012: refugees represented 6.6 percent of the population. Furthermore, **the fifth of Worcester's population that is foreign-born<sup>[13]</sup> plays an important role in the economy**, with a higher rate of employment and labor-force participation than its native counterpart.



10 U.S. Census Bureau, 1986-1990 American Community Survey 5-year estimates, 1990.

11 U.S. Census Bureau, 2011-2015 American Community Survey 5-year estimates, 2015.

12 Ibid.

13 Fábos, Anita, Maya Pilgrim, Muinate Said-Ali, Joseph Krahe, and Zack Ostiller. "Understanding Refugees in Worcester, MA." (2015).

## Institutions

Worcester has significant institutional capacity in the education, medical, and life sciences sectors. Community groups carry out primarily neighborhood-based work, while government agencies and the private sector drive much of the city's economic development efforts.

- Several ***educational institutions*** exist in Worcester. The city has nine universities and colleges, including: Assumption, Becker College, Clark University, College of Holy Cross, Massachusetts College of Pharmacy, Quinsigamond Community College, UMass Medical School, Worcester State University, and WPI. The colleges and universities represent a wide range of programs, degrees, and student populations. A **Higher Education Consortium of Central Massachusetts** (HECCMA) exists, but at the time of study, it was experiencing administrative capacity and leadership issues. Worcester also has an **acclaimed vocational-technical high school**, Worcester Technical High School, which has been recognized nationally as a model for contemporary technical high schools.
- In terms of the life sciences, Worcester has two major hospitals: St. Vincent Hospital and UMass Memorial. **Several major life sciences companies** have invested in facilities, including Abbvie, BlueSky Bioservices (recently acquired by LakePharma Inc.), and Charles River

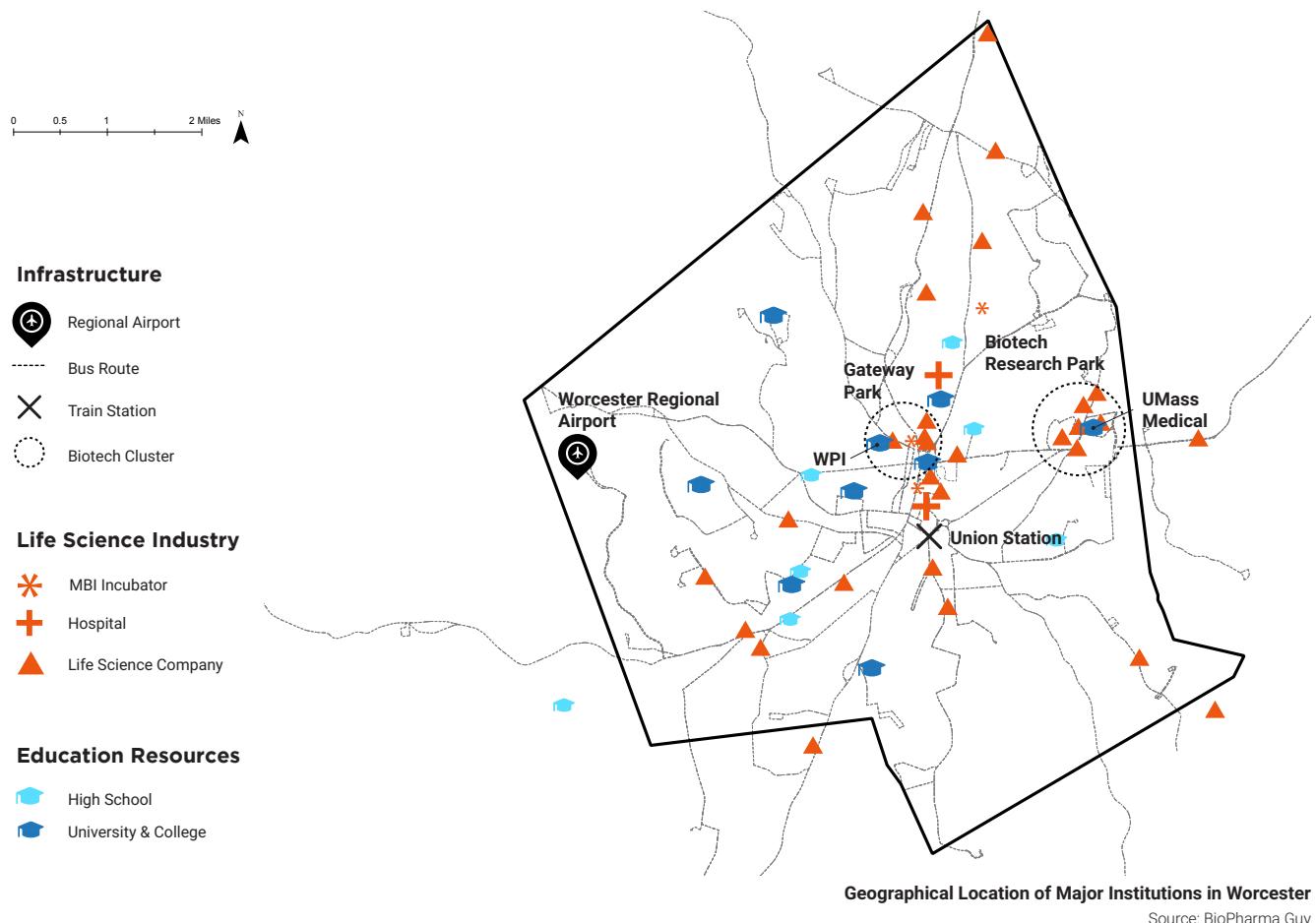
Laboratories. Massachusetts Biomedical Initiatives (MBI), a biotech incubator that partners with WPI and participates in economic development efforts related to the life sciences, has three locations. **These medical and educational institutions are for the most part dispersed throughout the city**, the biotech clusters at Gateway Park and Biotech Park being the most notable exceptions.

- ***Community organizations*** include Worcester Community Action Council (WCAC), the Worcester Refugee Assistance Program (WRAP), and the YMCA of central Massachusetts. These groups serve the city's low-income and minority populations, addressing issues like affordable housing, health and wellness, and financial independence. Groups including Action! Worcester and the Worcester Common Ground Community Development Corporation engage in advocacy and local entrepreneurial efforts. Given the city's increasing racial, ethnic, and religious diversity, a number of religious and cultural organizations also serve particular immigrant and minority communities, including the Southeast Asian Coalition, CENTRO (Centro Las Americas), and African Community Education (ACE). On the one hand, the city obviously benefits from the presence of such groups. On the other, some interviewees suggested that Worcester lacks a strong well-funded civic infrastructure. This hampers communities' ability to advocate

for their needs and influence insular governance structures which, it was noted time and again, were not ethnically diverse or representative.

- While several **economic development organizations** exist throughout the city, the Economic Development Coordinating Council (EDCC) has led major planning efforts in Worcester. Founded in 2012 as part of an effort to form a joint vision for development, the EDCC comprises leaders of the Worcester Regional Chamber

of Commerce, the Worcester Business Development Corporation, and MBI, as well as the City Manager. Beyond the EDCC, Worcester has a transit authority that manages the city's bus system (WRTA), and local Workforce Investment Board (WIB) that connects residents to training opportunities and regional employers. The Central Massachusetts Regional Planning Commission (CMRPC) operates out of Worcester, though it primarily focuses on regional initiatives.



## Downtown Revitalization

Over the past two decades, the city has prioritized an ambitious and **capital intensive downtown revitalization effort**. The city dedicated over two billion dollars in public and private funds to commercial and residential real estate, as well as to the arts and entertainment industries. The Hanover Theatre, part of MassDevelopment's TDI district, was one of the initial projects implemented as a way to bring people back to the downtown.

This most recent wave of revitalization follows a less successful urban renewal project in the late 1960s that demolished downtown buildings to build a mall, the Worcester Galleria<sup>[14]</sup>. The mall slowly lost stores, and by the early 2000s, it was half vacant. The city made plans to tear it down for a mixed-use urban development. In 2015, leaders began developing a 20-year downtown revitalization plan, with the goal of providing an environment that “offers new opportunities to underperforming properties, connects people and places, and capitalizes on Worcester’s unique location and characteristics”<sup>[15]</sup>. The redevelopment zone includes approximately 118 acres and 380 properties.

A key initiative in the downtown revitalization plan is the CitySquare project, which will occupy the footprint of the late Galleria. The first new building was an over 200,000 square foot office building for Unum, or Paul Revere Life Insurance, followed by an expansion of the St. Vincent

Hospital campus, and an AC Hotel by Marriott. The Mercantile Center is the final development in the project and includes a lease to UMass Memorial for almost 100,000 square feet of office space<sup>[16]</sup>.



**365**  
new housing units upon project completion



**\$2 Billion**  
redevelopment investment



**2.3M sf**  
commercial / residential space upon project completion



**1,300**  
new jobs anticipated

### Worcester Downtown Revitalization Plan

Source: The City of Worcester

14 The City of Worcester. “CitySquare.”

15 The City of Worcester. “Downtown Worcester Urban Revitalization (URP) Plan.” [worcesterma.gov/development/wra](http://www.worcesterma.gov/development/wra) (accessed January 23, 2018).

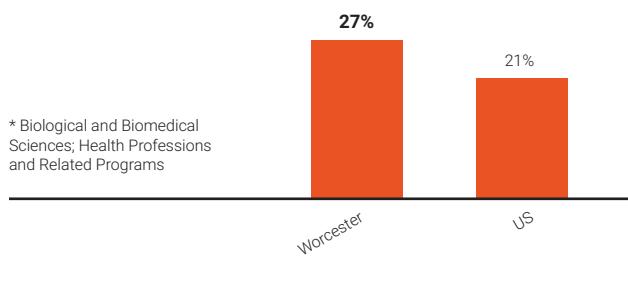
16 The City of Worcester. “CitySquare.”

## Life Sciences in Worcester

**Worcester has significant human and institutional capacity in the life sciences**, in part due to its manufacturing history, many academic institutions, proximity to the Greater Boston cluster, and relatively low cost of living. Worcester's life sciences assets span the categories of education and employment, real estate, and funding.

### Education and Employment

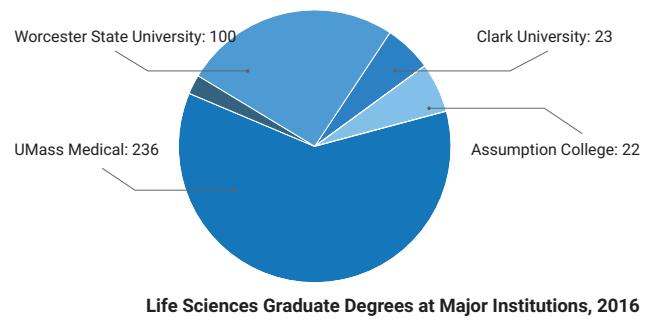
We compared degrees in the life sciences from Worcester's universities to national averages using National Center for Education Statistics Data. In 2016, the city's universities granted nearly 400 life sciences related degrees<sup>[17]</sup>. **This number of graduates in the life sciences far exceeds demand**; with life sciences job growth at an annual rate of one percent, we calculated an estimated 130 new jobs<sup>[18]</sup>. Additionally, the percentage of graduate degrees granted in the life sciences is higher in Worcester than in



17 National Center for Education Statistics (NCES)

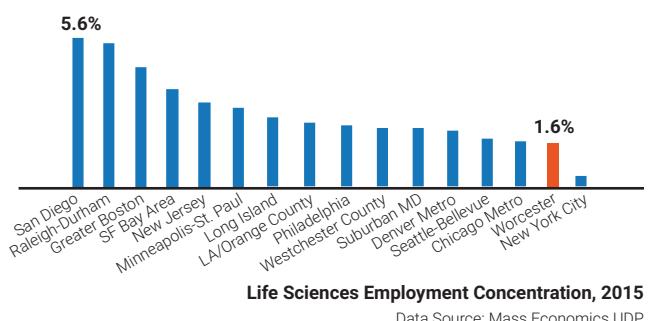
18 Mass Economics Urban Data Platform (UDP)

the U.S. Across specific degree programs in Worcester, UMass Medical produces the highest number of graduate degrees in the life sciences, with Worcester State second.



The city is also training its youth in life sciences, with a **biotechnology program at Worcester Technical High School (WTHS)**. Industry-education partnerships connect universities with life science companies. Notable collaborations include MBI and WPI, and WTHS and LakePharma.

While there are plentiful opportunities for life sciences education, Worcester has a modest number of jobs in the life sciences. With an LQ



of 1.0, Worcester has neither an advantage, nor a disadvantage in the life sciences. The city shows a strong 2.0 LQ for research, testing and medical labs, likely due to key institutions like UMass Medical. Comparing this LQ to life sciences LQs in several other cities, we observe that San Diego, Research Triangle, and Boston outperform Worcester. We also see, however, that Worcester does not lag far behind Chicago metro, Seattle, Denver, and Maryland.

	<b>Jobs (2015)</b>	<b>Growth (2009-2015)</b>	<b>Location Quotient (2015)</b>
Research, Testing, & Medical Laboratories	1390	+70	2.0
Drugs & Pharmaceuticals	10	+10	0.06
Bioscience-related Distribution	50	+30	0.1
Medical Devices & Equipment	10	+10	0.04
<b>Total Life Sciences</b>	<b>1460</b>	<b>+120</b>	<b>1.0</b>

#### **Worcester Life Sciences Jobs (2015) and Trends (2009-2015)**

Data source: County Business Patterns / Mass Economics UDP

## **Real Estate**

Community leaders and company representatives in Worcester are championing a

vision for a future in life sciences that focuses on biomanufacturing. Developing space for biotech and biomanufacturing has been a crucial component of this strategy. One property in particular, known as Biotech Park, is a prominent asset. Abbvie, a large pharmaceutical research and development company, occupies several buildings on the property. UMass Medicine also occupies five buildings within the park, and has current biotech tenants, as well as new tenants moving in (biotech company Mustang Bio has leased space through 2026)<sup>[19]</sup>.

In January 2017, Governor Baker authorized the sale of 44 additional acres of state land at Biotech Park to the WBDC, to further develop biomanufacturing activities<sup>[20]</sup>. The site has space for 350K sf and is projected to produce at least 500 new jobs, although it is not yet clear who will be moving in. A deal with LakePharma, a California-based biologics company that bought Worcester-based Blue Sky BioServices, fell through.

Gateway Park is another example of real estate partnership to support the life sciences. A joint venture between the WBDC and WPI, Gateway Park transformed an underutilized area for a variety of academic, research, and commercial enterprises, and was completed in 2010. The facility now houses MBI, which offers startup incubator space for biotech companies in

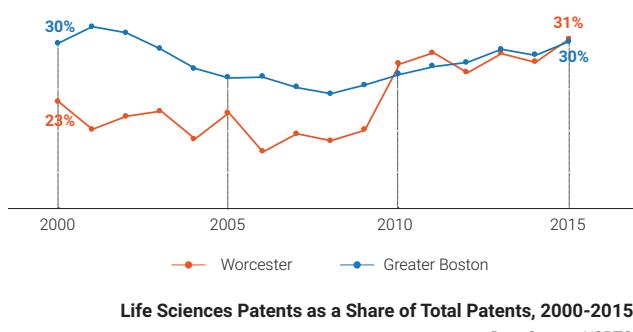
19. Comeau, Zachary. "NY Biotech Leases UMass Science Park space." wbjournal.com. <http://www.wbjournal.com/article/20171030/NEWS01/171039995/ny-biotech-leases-umass-science-park-space> (accessed February 3, 2018)

20. Nicodemus, Aaron. "WBDC Named Developer for Bio-manufacturing Site in Worcester." wbdc.com. <http://thewbdc.com/wbdc-named-developer-for-bio-manufacturing-site-in-worcester/> (accessed February 3, 2018)

Massachusetts<sup>[21]</sup>.

## Funding

We analyzed data from the USPTO, understanding that in the life cycle of ideation to commercialization, patents are indicative of successful translational research efforts. In the life sciences, many new drugs or products are born through innovative research at academic institutions, transferred to start-ups or collaborations between academics and industry leaders, and then sold to larger companies to scale up operations. In 2015 alone, Worcester had 197 life science-related patents. Furthermore the percentage of life science patents has increased over the past 15 years.



With its many stages of testing, research, and clinical trials, drug development is extremely expensive. Often, large research universities will seek government grants and industry sponsorships to support their work. Institutions

in Worcester receive a small share of total NIH funding (0.6 percent), most of which is awarded to UMass Medical. Of the \$250 dollar million portfolio at UMass Medical, NIH funds over half (\$150 million), and life sciences companies provide \$75 million in funding for clinical trials.

	Total Funding	Awards
Biomedical Research Models	\$527,800	2
Clark University	\$450,900	1
Microbiotix, Inc	\$4,175,500	9
Nirogynne Therapeutics, LLC	\$300,000	1
Signablock, Inc	\$224,700	1
UMass Medical	\$152,964,400	328
WPI	\$4,107,600	13
Zata Pharmaceuticals, Inc.	\$587,900	1
<b>Total</b>	<b>\$163,338,800</b>	<b>356</b>

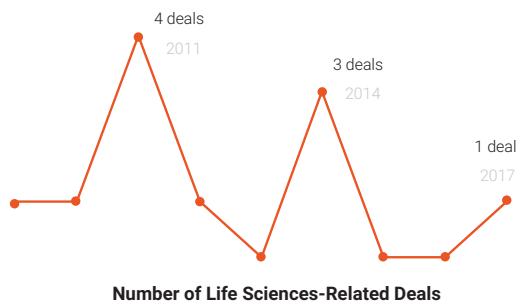
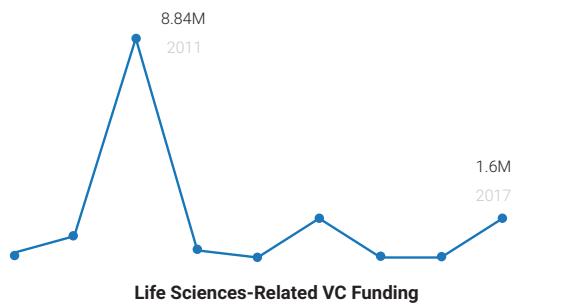
### Worcester NIH Funding Awardees, 2017

Data source: NIH

According to CB Insights, Worcester based entities have seen some VC funding activity. While the deals are relatively small on average, cities that have major deals are all much more populous and well-known than Worcester. The existence of some deals is better than none, but also raises the question of how to build and expand on the success of the companies

21 MBI. "MBI's History of Commercializing Science & Creating Jobs." massbiomed.org. <http://www.massbiomed.org/about-mbi/history/> (accessed February 3, 2018)

that have benefitted from these investments. The three biggest deals were in electronics/semiconductors, internet software, and drug discovery.



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**Worcester VC Funding, 2009-2017**  
Data source: CB Insights



## PART C

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# RECOMMENDATIONS

As discussed in earlier sections, major innovations in genetic sequencing, computer programming, and internet connectivity, and more recently, the growth in biopharmaceuticals, have played a crucial role in the expansion of the various life sciences sub-industries; Where companies ultimately choose to locate corporate offices, manufacturing facilities, and research outfits is not necessarily straightforward, however. There is no life sciences economic development handbook, and there is no guarantee that if a region follows any series of predefined steps, it will be successful in growing a vibrant cluster resembling any that are already high performing.

But we have learned from looking side by side at industry trends and the pre-existing assets in our two case cities that there are critical steps each place can take to strengthen and leverage the assets they already have. Serendipity aside, places like Greater Boston and Research Triangle Park are rich in institutional assets working in concert with one or more organizational bodies helping to facilitate intra-organizational cooperation and external brand-building and advocacy. Given the projected growth in employment across many life sciences sub-industries, this is an especially good time for cities to be thinking about aligning workforce, education, and business attraction strategies

toward a singular strategic end. The most modest outcome of the recommendations that follow might be that Brockton and Worcester are able to galvanize area stakeholders behind a vision that is shared, inclusive, and cross-cutting.

We believe the following recommendations are key to broadening and strengthening each city's capacity to envision a life sciences ecosystem suitable for where it has been historically and where it might go. For Brockton, this means **locating, building and strengthening assets and positioning them to be leveraged strategically much further down the line**. For Worcester, this means taking the assets they have (which have been built and strengthened over time) and **building strategies and operational plans to catalyze and accelerate innovation and growth**.

Four themes discussed below that unify our strategies and recommendations are:

- 1) Increased capacity and expertise**
- 2) Workforce and education**
- 3) Coordination**
- 4) Improved connectivity**

# INCREASED CAPACITY AND EXPERTISE

STRATEGY

1

Deep industry expertise is crucial to a compelling and viable cluster development strategy. While we have been referring to the “life sciences” throughout this report, this shorthand obscures the vast specializations that feed into the “sector” and the pace at which the industry is constantly evolving. Furthermore, the life sciences comprises multiple sub-industries that all have different profiles. Without dedicated local capacity to keep abreast of trends and sub-industry real estate and infrastructure needs, it is difficult to fashion a targeted business attraction strategy. For this recommendation, we propose

a **Gateway Cities Life Sciences Fellowship program.**

While both Brockton and Worcester have some capacity to identify potential opportunities to expand and cultivate broad economic growth, they both lack deep life sciences expertise, which ultimately hampers their ability to target investments internally while also raising the profile of those investments among industry site selectors. This recommendation cuts across both cities, but in sharply different ways.

## BROCKTON

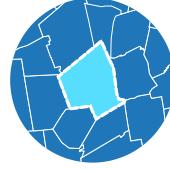
**Invest in  
Real Estate Expertise**



Create a Gateway Cities Life Sciences Fellow

## WORCESTER

**Invest in Sector  
and Real Estate Expertise**



Create a Gateway Cities Life Sciences Fellow

## BROCKTON

### Invest in Real Estate Expertise

#### *Create a Gateway Cities Life Sciences Fellow*

This strategy is responding to the “Access vs. Isolation” story we heard. One interviewee referred to the “BioReady” rankings that the Massachusetts Biotechnology Council (MassBio) gives to cities, based on their zoning practices and infrastructure capacity, in order to help biotech companies find sites. This stakeholder believes that Brockton can improve the way it manages the real estate component of business attraction.

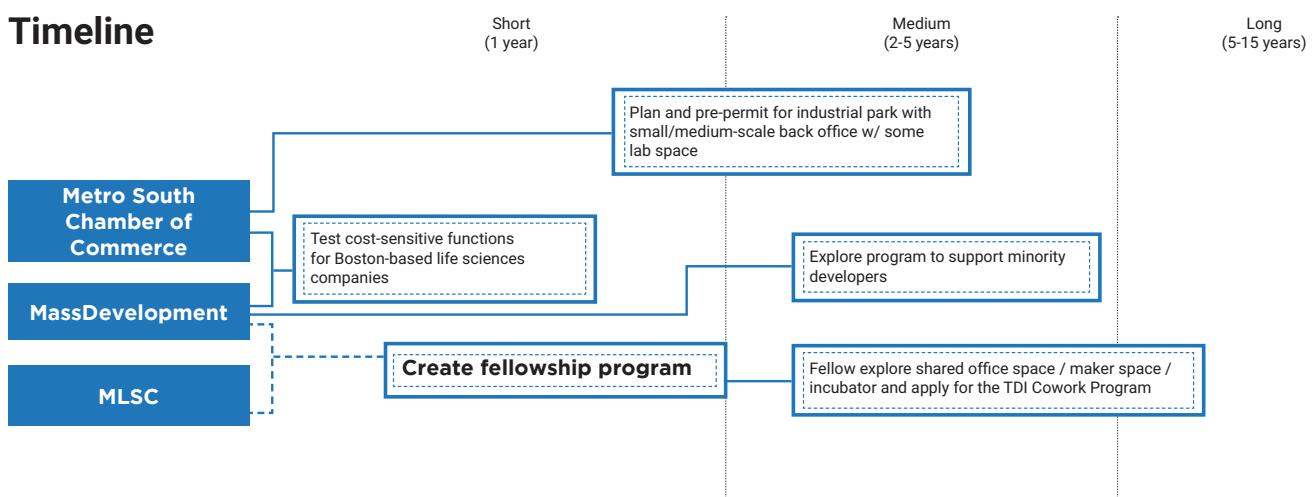
Ninety-eight percent of Brockton’s land has been developed, and is mostly positioned for reuse. There are several large sites that everyone in Brockton repeatedly referred to, such as the Brockton Fairgrounds, the CSX rail site, as well as future potential sites in the Good Samaritan Medical Center area and the Westgate Mall across the highway. The planning department and local leaders have big visions for these sites, but they are still in early stages of planning and analysis.

Our key takeaway is to create a Life Sciences Real Estate program fellow, who will

- **Research and document particular real estate sites for target uses**
  - Work with coordinating council (to be discussed in strategy three), go to their meetings and provide insights;
  - Network with life sciences site selectors to learn about needs (not to sell sites).
- **Help shepherd properties through rezoning and pre-permitting processes**
  - Focus on sites with potential: see Blueprint for Brockton “Opportunity Areas”;
  - Devise strategies to attain Bio-Ready Platinum ranking from MassBio.

Other than those large sites, there are also smaller industrial parks in Brockton that can be repurposed for a range of uses, including lab space. City officials should also **promote Brockton as a place for back offices of companies in Boston/Cambridge**. Another initiative could be a program to support minority and new developers, who may not have the capital to tackle large sites, but who may find some of the smaller projects suitable for getting started in an otherwise insular real estate industry. Lastly, we would also like to explore adding more shared spaces and equipment to increase the innovation capacity of the local economy.

## Timeline



## Worcester Invest in Sector/Real Estate Expertise

### Create a Gateway Cities Life Sciences Fellow

In speaking with economic development agents across Worcester, we heard a fervent conviction that Worcester was ready and positioned to receive new businesses, especially in the life sciences and biomanufacturing. Many shared the belief that Worcester's locational advantage (proximity to Boston), interconnectedness to the famed Route 128 corridor, and lower cost of living relative to Greater Boston would lead to a seemingly inevitable uptick in population and new businesses. This optimistic and favorable self-perception stood in sharp contrast to industry affiliates, who dismissed the idea that Worcester was within a feasible proximity to capture the activity driving innovation and commercialization in and around Kendall Square. This recommendation responds to the "Perception vs. Reality" story we heard.

While there are commuter rail links and a direct highway route between the two places, neither method guarantees a commute shorter than one hour. As described by one informant, Kendall Square is unique precisely because of the proximity and high density of ecosystem actors, which enables individuals to work most of the day while also having the option to walk a short distance to meet at universities, with faculty for recruiting, with companies, or with VC investors.

Furthermore, the dominant specialization in Kendall Square is in pharmaceuticals, according to one informant who expressed that there were other specialities for which Greater Boston has a comparative disadvantage, like medical and imaging device technology and biomanufacturing, both of which are space-intensive. We heard from several industry informants that the key to unlocking Worcester's potential was not in bolstering its proximity to Boston, but in **developing its own unique specialization based on its current assets**, available developable land, and local research

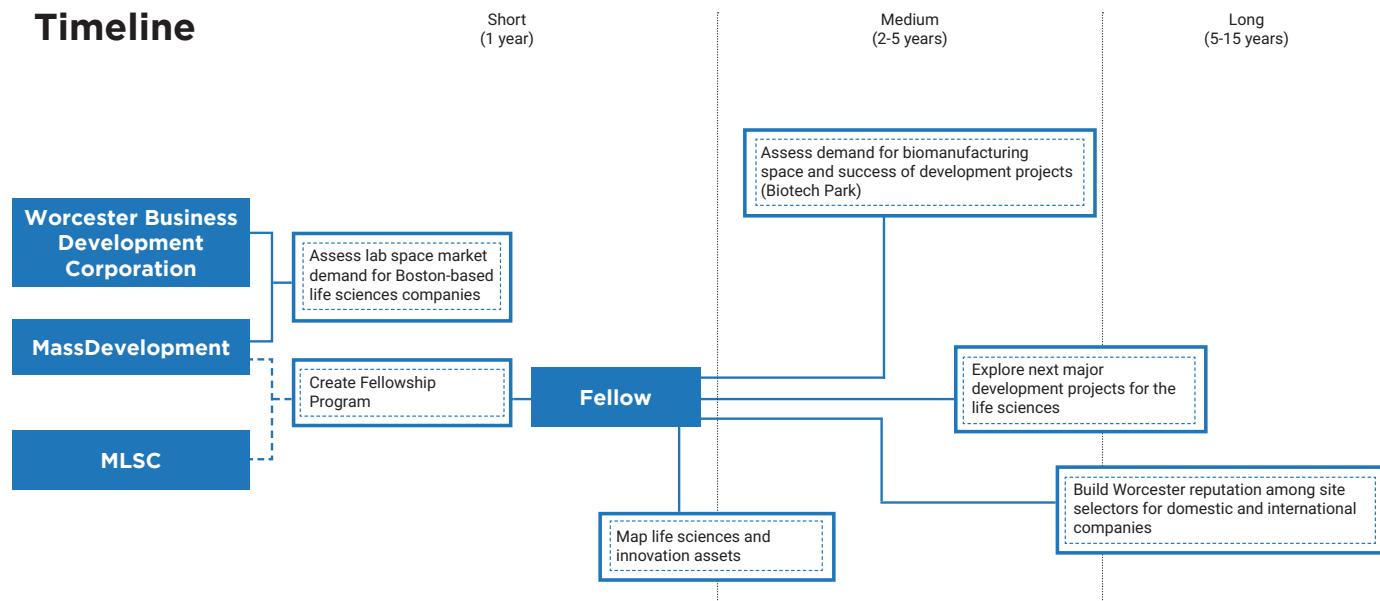
and business specializations.

This may very well be the path Worcester is on with respect to the recent investments in real estate and biomanufacturing-ready space. Thus, our key takeaway to address the gap between perspectives is to accelerate the energy behind biomanufacturing real estate with more focused, dedicated, and expert capacity. The Fellow would:

- **Act as an informed liaison between Worcester stakeholders and professionals across the life sciences**
  - Devise short and long term strategies for engaging statewide and national industry associations, to stay abreast of current trends across various sub-clusters, with a lens toward opportunities for development in Central Massachusetts.

- **Research and document particular real estate sites and other regional assets**
  - Collaborate with the Central Massachusetts Regional Planning Commission to expand Worcester's purview to surrounding areas of opportunity and growth that might link with life science supply chains, especially agriculture economies and projected transportation infrastructure investments;
  - Network with life sciences site selectors to learn about sector needs; and
  - Conduct mapping of the current innovation ecosystem and regional assets, including incubator and makerspaces, arts and creative businesses, and innovation resources and research centers across the universities.

## Timeline



# WORKFORCE & EDUCATION

STRATEGY 2

Given that one of the original criteria for Gateway Cities relates to levels of educational attainment, no economic development strategy can ignore the investments needed to create opportunity for present day residents. Additionally, MLSC's prioritization of workforce and education investments over the next five years stands to be a powerful catalyst for bringing disparate actors together to collaborate in transformative ways. Within each city, we found highly capable and passionate organizational leaders across the spectrum of workforce training organizations, K-12, postsecondary, and industry who we

believe, with the right incentives, might be willing to work together in order to collectively affect the landscape of opportunities available to students and jobseekers, especially the most vulnerable. To that end, this recommendation aims to galvanize limited resources and capacity toward cultivating STEM employment pipelines and a community wide awareness about opportunities in this evolving industry. Across both case cities, there is an opportunity to rally the community around a new and more focused aspiration that aligns with the employment opportunities the cities hope to expand and attract.

## BROCKTON

### Augment Local Workforce Planning



Develop workforce training targeting regional life sciences occupations

## WORCESTER

### Encourage Nine-Postsecondary Institutional Alignment



Cultivate a STEM educational pipeline that fosters collaboration and community investment across Worcester Public High Schools and higher educational institutions.

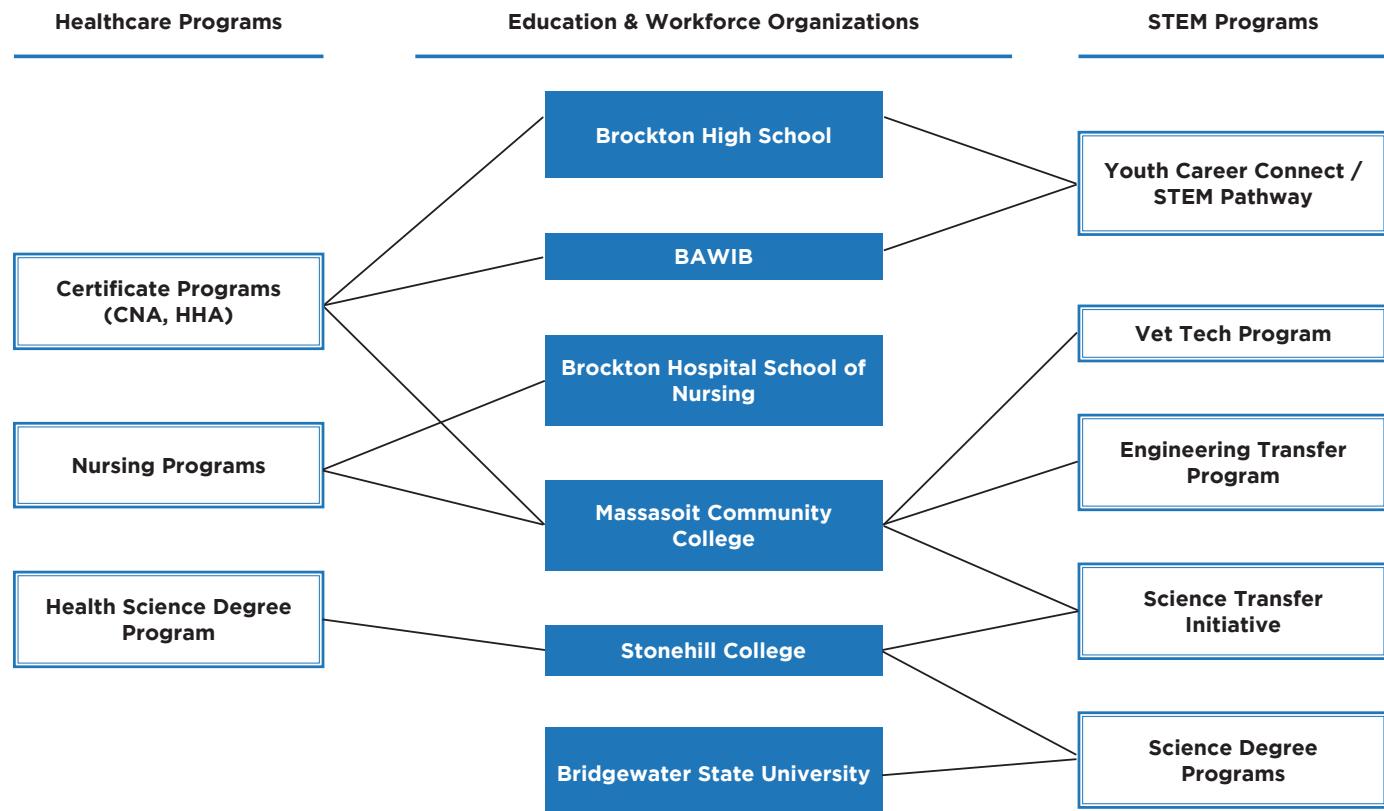
## BROCKTON Augment Local Workforce Planning

*Develop workforce training targeting regional life sciences occupations*

This strategy responds to the story of a reactive, rather than proactive, workforce development plan within Brockton. Our interviewees recognized that there was **a great opportunity for workforce development in the life sciences**, but they also acknowledged that there are few existing programs focused on life sciences training in the Brockton area.

Brockton stakeholders have demonstrated their ability in the healthcare sector, where strong connections exist between the local schools and workforce development efforts. Brockton High School, BAWIB, and the Brockton Hospital School of Nursing all offer certificate programs.

For more advanced training, Massasoit Community College, Stonehill College, and Bridgewater State University offer degrees in the health sciences. These degree offerings are further supported by STEM programs that engage local high school and college students, including a STEM Pathway program and a Vet Tech program. This composite of programs



provides Brockton students with a clear and widely-used pipeline toward work in the healthcare sector. The range of health science connections is shown below.

In contrast, Brockton organizations do not provide programs with support for workforce development in the life sciences. Thus, the path to access higher-paying jobs in the life sciences industry remains unclear.

We recommend that Brockton develop a **workforce training program that specifically targets life science occupations**. This training should be proactive and driven by industry forecasts for future employment needs. Such a training program could be designed for entry-level life sciences positions that require educational attainment at or below an associate's degree. Two examples of these types of jobs include "document control specialist" and "laboratory technician," both of which have median starting salaries of \$40,000.

Workforce development in Brockton can also build on existing regional partnerships, such as the Southeastern Massachusetts Advanced Manufacturing Consortium. In the short-term, BAWIB can also refer job-seekers to existing training programs in the area, such as the Biotech Manufacturing training at Quincy College

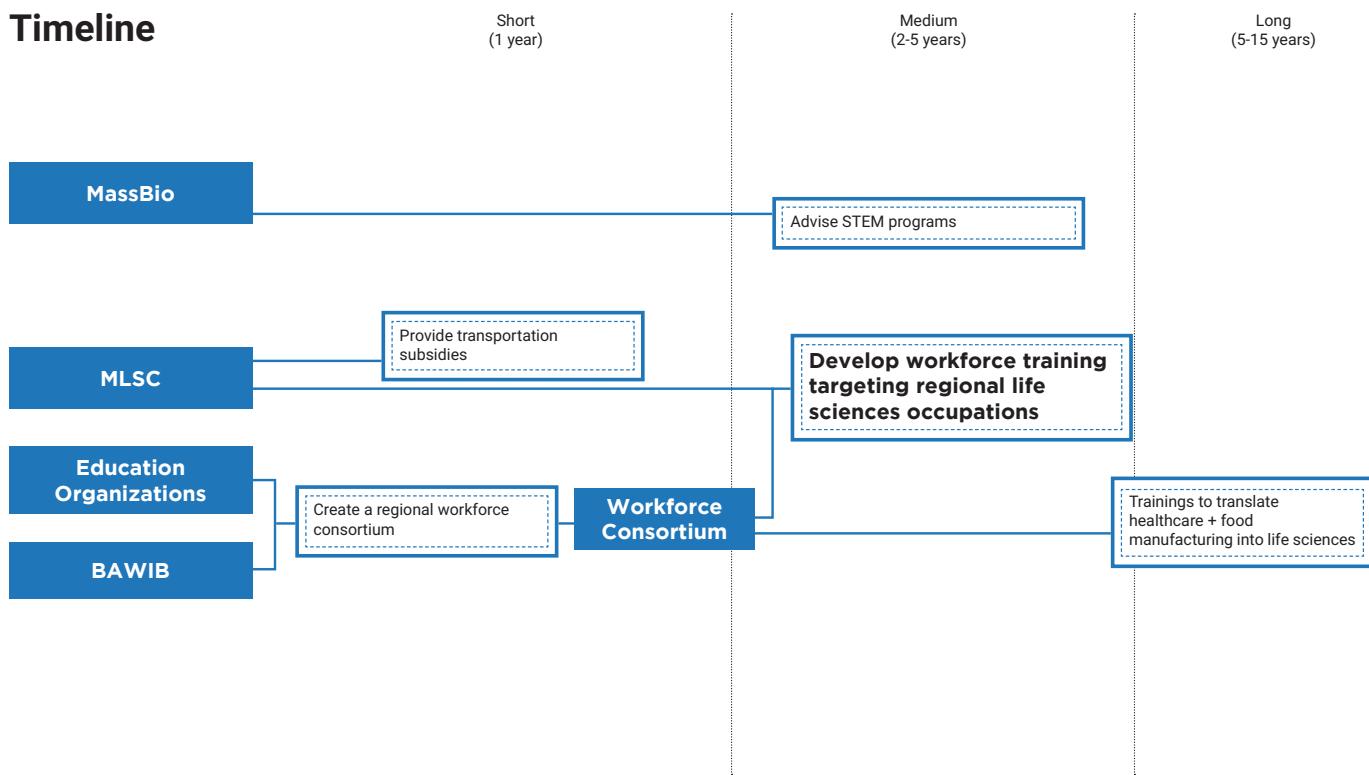
and phlebotomy trainings in Stoughton and Fall River. In the longer term, BAWIB can seek to emulate the successful model of the North Shore Life Sciences Consortium, which led to rapid growth in life sciences employment in Peabody.

We have several other recommendations for improving access to life sciences jobs in Brockton:

- Direct job seekers to the **new MLSC online map of life science opportunities**;
- Consider offering **transportation subsidies for students wishing to pursue life science internships in Boston or elsewhere outside of Brockton**;
- Connect life science companies with local Brockton STEM programs to **provide industry advice** and guidance in creating a helpful life science curriculum;
- In the longer-term, **develop a training program for healthcare workers** looking to transition into select occupations like lab technician that require similar skills.

A timeline with our recommendations assigned to various stakeholders is included below.

## Timeline



## Worcester Nine-Postsecondary Alignment

*Cultivate a STEM educational pipeline that fosters collaboration and community investment across Worcester Public High Schools and higher educational institutions*

Worcester is unique among the Gateway Cities because of its concentration of higher educational institutions. Several interviewees described each college as having a distinct personality and operating quite independently of

the others. One person remarked that “Worcester is not a college town, but a city with a lot of colleges,” suggesting not that Worcester should strive to become a college town, but that there is no strong place-based identity shared across the schools. While there are some exceptions to this rule, overall there appeared to be limited sustained collaboration across institutions, as well as with the city, surrounding neighborhoods, or community organizations. In conceptualizing a way to better leverage these assets, we turned our attention to another critical education asset in Worcester, the public school system.

In any mention of Worcester Public Schools (WPS), we heard great pride and celebration of the high-performing vocational technical school, Worcester Technical High School (Worcester Tech), but very little of the rest of the school system. It is the third largest school district in the state by enrollment, although it is nearly tied for second with Springfield, with each district having just over 25,000 students. Hispanic/Latino students make up about 43 percent of the student population<sup>[22]</sup> and among the selected populations the state tracks, for 54 percent, English is not the first language. Furthermore, 34 percent are considered English language learners, 76 percent are high needs, and 57 percent are economically disadvantaged<sup>[23]</sup>. These statistics reflect the demographic shifts that have been occurring over several decades in Worcester. They pose an important challenge, not only for public school administrators and staff, but also for the community (parents, neighborhoods, civic organizations, and surrounding educational institutions). To cultivate a STEM educational pipeline, we recommend these stakeholders seek opportunities for synergistic actions that foster nine-postsecondary alignment and interdependent coordination among the colleges toward this objective.

The Worcester Public Schools are currently undergoing a strategic planning process for the first time since 1992<sup>[24]</sup>. The time is ripe to

facilitate alignment between the future of K-12 education in Worcester and a life sciences-oriented economy, an alignment that requires a new era of transformative coordination among disparate institutions. Public education and local human capital are among the most fundamental common pool resources of any place. A thriving economy in a place like Worcester will require that local institutions tend to this commons. Potential action items are provided below to provoke further conversation around what can come of a more synergistic and mutually reinforcing relationship between the WPS and area colleges.

- Allocate capacity to **classifying life sciences assets across the colleges**. This would involve not simply taking an inventory, but really analyzing programs and faculty interest areas, to find where there may be overlap or complementary opportunities with WPS.
- Build the capacity of the schools, students, and career counselors to understand and access life sciences through a **short professional development training program for school counselors**.
- **Bolster college student internship program** opportunities for placements within WPS. Conversely, **create a paid summer internship and research program for high school students**.

<sup>22</sup> Massachusetts Department of Elementary and Secondary Education. “School and District Profiles.” mass.edu. <http://profiles.doe.mass.edu/> (accessed January 31, 2018).

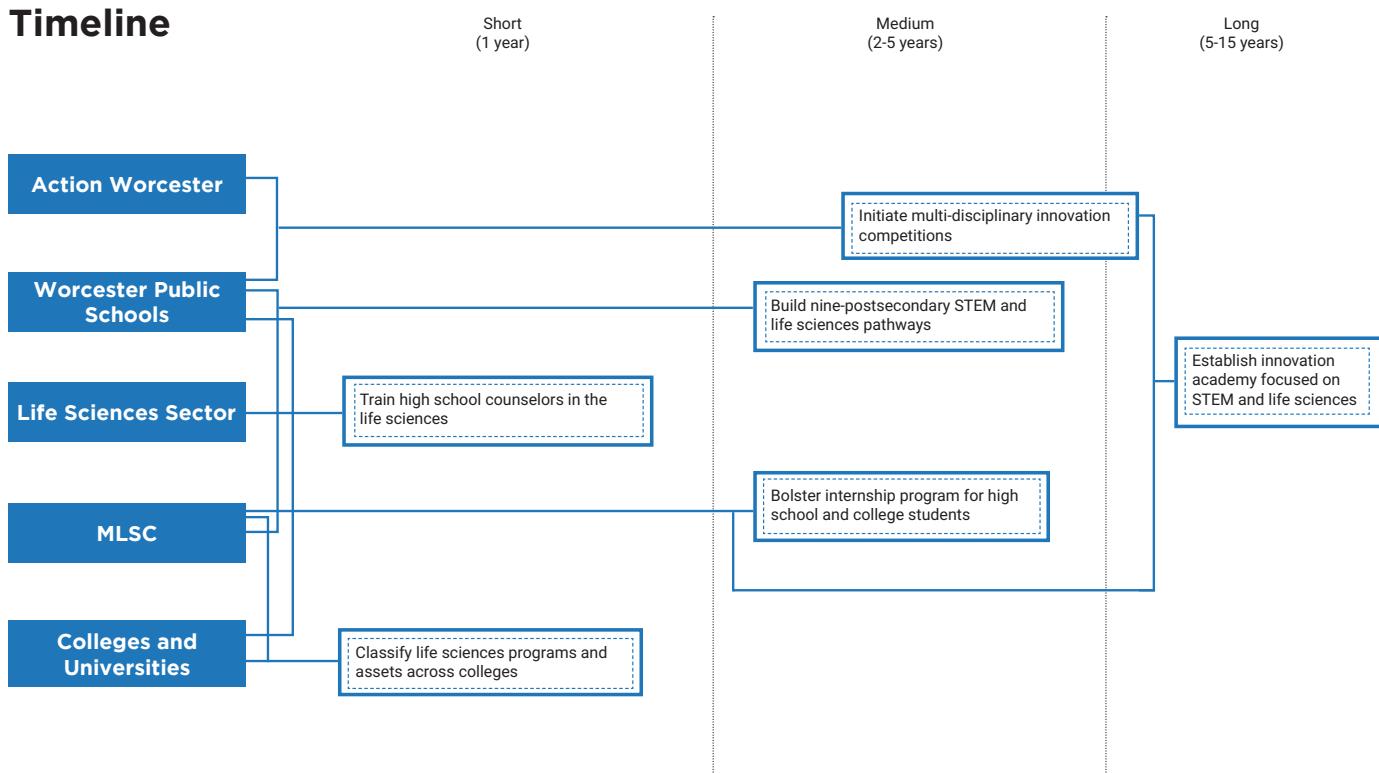
<sup>23</sup> Ibid.

<sup>24</sup> Worcester Education Collaborative. “A Strategic Plan for the Worcester Public School.” wecollaborative.org. <https://www.wecollaborative.org/strategicplan/>. (accessed January 31, 2018).

- Bring young people into the innovation ecosystem while also exposing them to the possibilities in STEM and life sciences by creating **an innovation academy for high school students**.
- Create competition and challenge programs that incentivize and mobilize interdisciplinary **student teams to generate innovative solutions to WPS defined challenges**. Teams could have WPS students with staff, industry leaders, and academics serving as mentors.
- Create a plan of action in conjunction with current WPS strategic plan that includes a commitment to **expanding nine-postsecondary credit-bearing and credential pathways** in STEM or life sciences fields especially.

A timeline that demonstrates the stakeholders involved in this strategy follows.

## Timeline



# COORDINATION |

STRATEGY **3**

Rallying disparate actors with sometimes competing or divergent interests is difficult work. It is even more difficult when the objective is long ranging and requires sustained collective buy-in over time. In each case city, we heard stories about many efforts to do such things on big and small scales, as well as the subsequent failures and successes, contention, dissolution, or expiration of these efforts. In order for the case cities to rally around a comprehensive economic development vision, sustained and broad-based buy-in are central, as is the creation of an entity to manage and carry forward the vision of the collective.

This recommendation asserts that each case city needs to create an organizational entity that is not merely the sum of its parts. The entity should also assume a semi-independent function, with an internal coordination mandate and an external marketing and advocacy mandate. Akin to organizations like Kendall Square Association and Research Triangle Foundation, activities such as marketing and communications, local economic development advocacy, and stakeholder engagement are strategically taken up by an organization that is somewhat insulated from the churn of political administrative change and the capacity and resource challenges that stifle more informal and good-will driven coordination efforts.

## BROCKTON

### Create Coordination Council



Create new coordinating council for life sciences in Greater Brockton

## WORCESTER

### Create Life Sciences Master Plan and Coordinating Body



Create independent coordinating organization and embark on a participatory planning process for the life sciences

## BROCKTON Create Coordination Council

*Create new coordinating council for life sciences in Greater Brockton*

This strategy responds to the story of missed opportunities. Our interviewees in Brockton were usually very quick to identify things that make Brockton an attractive place to do business. The motivation for this strategy is the recognition of all that Brockton already has going for it, in terms of **locational advantages, low cost, some existing life sciences activities, and proximity to major players**. But ultimately, there still seems to be a lack of awareness of these great factors.

According to stakeholders in Brockton, the key challenge is a lack of coordinating capacity across local leaders, as well as a lack of connections to industry outside of Brockton.

Our key takeaway is to create a new coordinating council for life sciences in Greater Brockton. The goals for this council are to:

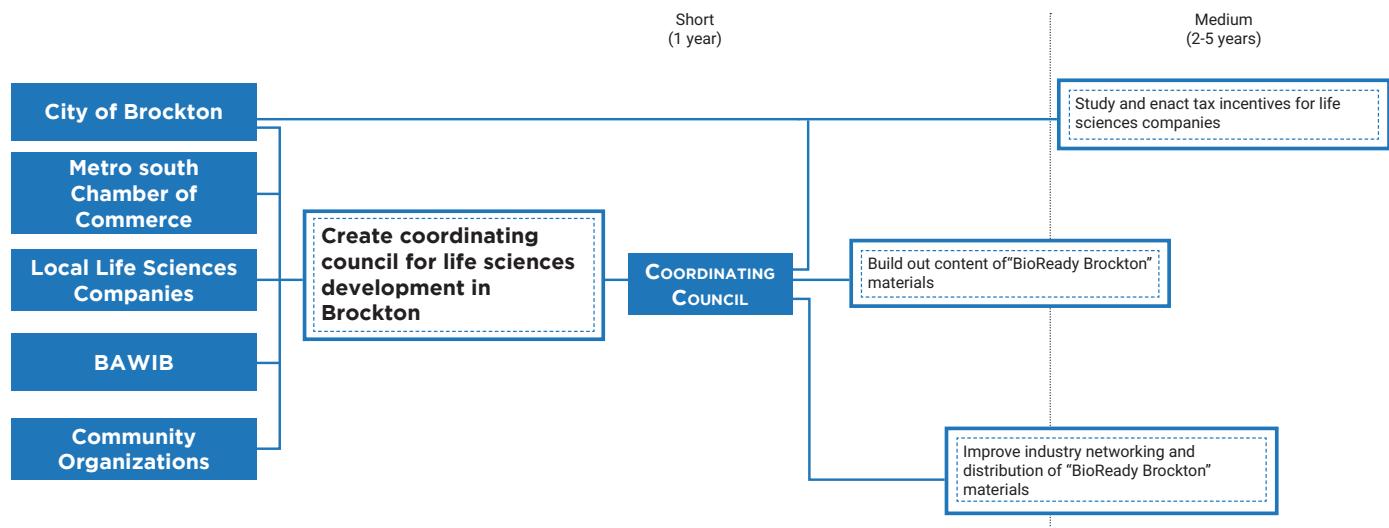
- **Build capacity** for industry-targeted economic development;
- **Develop a unified life sciences promotional strategy** based on local and regional strengths; and
- **Coordinate execution** of promotional strategies and specific company deals.

We imagine that the Chamber of Commerce would convene this council, given its central role in the regional economy. Local life sciences companies will lend their industry knowledge and share their experiences with prospective companies looking to site in Brockton. Workforce

and community organizers will assist with getting local buy-in and identifying labor market trends. Brockton Partnership is a collection of private business leaders who are interested in economic development but have largely excluded public sector representation because of past conflicts. We think they add valuable expertise and competencies to this group. **It is also important to increase networking opportunities and strengthen connections** with partners who can help direct life sciences traffic into Brockton, as well as study tax incentives targeting life sciences companies. Although the particular details of this broad recommendation were out of scope for our project, the coordinating council would have the expertise to determine this.

- **Locational Advantages**
  - 1 hour from Kendall Square by car or transit
  - 892,000 college-educated workers within 45 minutes
  - Diverse local workforce
- **Low Cost**
  - Inexpensive land and office space
  - Gas rates 26 percent below MA average
  - Commercial electricity rates 47 percent below MA average
  - Three large sites identified by the city for redevelopment
- **Existing Life Sciences Activities**
  - Several existing local life sciences companies
  - Ten miles from Canton life sciences concentration
  - Convenient to southeast MA advanced manufacturing
- **Proximity to Major Players**
  - Access to major local community health cluster
  - Existing local food manufacturing cluster
  - Local community college & private college
  - Nearby state university
  - Seat of regional WIB and Chamber of Commerce

## Timeline



## **Worcester Create Life Sciences Master Plan**

*Create independent coordinating organization and embark on a participatory planning process for the life sciences*

This strategy responds to the story about Worcester's inclination toward collaboration, or the "collaborative gene," as it was referred to by one informant. There was great pride in the creation of the Economic Development Coordinating Council (EDCC), and its success was cited time and again. Even individuals in Brockton had taken notice and expressed an aspiration to cultivate this collaborative capacity locally. The EDCC is indeed an important coordinating entity and its lean membership undoubtedly gives its partners an unprecedented agility to strategically respond to economic development opportunities. At the same time, based on our interviews and analysis, in order for the EDCC to lead and sustain the city's progress toward a focused life sciences development agenda, the organization will need to expand its limited membership to include a broader set of partners whose interests extend beyond those currently represented on the EDCC.

While Brockton sees the importance of having a loosely formed coordinating council similar to Worcester, we see an opportunity and necessity for Worcester to take this coordination function one step further. Interviewees commented that Worcester's governance and economic development agenda was historically insular, narrow, and lacking in broad representation of community members and research partners. We heard a story about collaboration on

the one hand and exclusion on the other; the celebratory narrative about Worcester's downtown revitalization was seen by some interviewees as a short-sighted celebration of market-led development that would encourage gentrification and lead to further exclusion of the area's economically vulnerable, especially its immigrant populations. These historical divisions and sentiments about circumscribed governance and the lack of diversity and authentic engagement are difficult to tackle, yet imperative to address. Some of these sentiments derive from interpersonal politics between individual actors, and others are indicative of structural inequality. Worcester is in a unique position to chart a new and vital future that capitalizes on this ongoing revitalization by creating a vision to guide this development toward shared prosperity where more communities can benefit. This requires thinking creatively about ways to solicit more voices across the community in order to synthesize that information into a set of actions to be taken up by a formal organization. Our recommendations include:

- **Assemble Worcester visioning advisory council** of partners across civil society, public education, higher education, business, public sector, and the life sciences industry, to scope objectives and outcomes for a life sciences innovation economy.
- **Appoint an intermediary organization to facilitate ongoing planning and engagement processes** while also drawing heavily on the work being done by the Life Sciences Fellow. The organization would cultivate cooperative efforts among relevant parties to enliven local knowledge and perspectives about the industry and make known available local

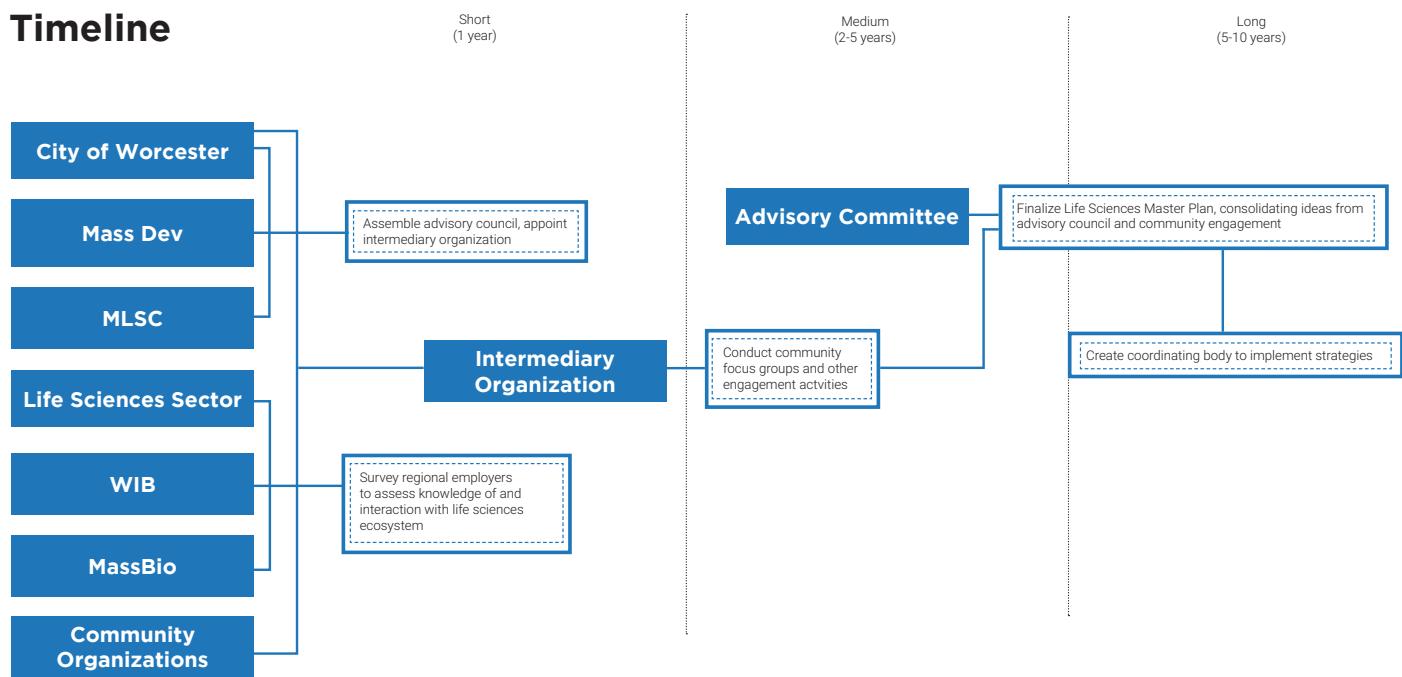
physical and infrastructural assets.

- **Survey of regional businesses to assess their knowledge of and interaction with the life sciences ecosystem**, which will provide important input regarding ideas for integrating existing businesses into the ecosystem. Here, the Life Sciences Fellow can play a coordinating role.
- Leverage organizations like the Worcester Innovation Lab to **conduct community focus groups and networking sessions to solicit more ideas** about the prospects for collaboration around formulating objectives and outcomes community members might want to see from a life sciences-based economic development agenda. Groups like college students, parents of WPS students, and community social service organizations are crucial to engage to further broaden the scope of the resulting plan.
- **Consolidate ideas** from the visioning council, business survey, and community focus groups into a set of actions that foster further research, development, explication, and engagement, with the goal of identifying promising opportunities for collaborative experimentation aimed at supporting life sciences-related industry development.

- Eventually, **create an organization that can implement** strategies for further cultivating a life sciences ecosystem that is rooted in place (per the community engagement process), sensitive and responsive to stakeholder needs (per the advisory council), and imaginative about what is possible to achieve in the region from a life sciences point of view (per the Fellow's mapping of innovation ecosystem assets).

Apart from the planning and engagement work leading up to creating an organization, there is also a great variety of programming and facilitation the organization can take the lead on to stimulate activity across the innovation ecosystem. Through programming and networking, Worcester can begin to realize its unique specialization, which can only be discovered through ongoing intersectional innovation—that is, problem solving that occurs at the nexus of local business and industry specializations and the innovation ecosystem. Incentives like challenges and competitions will be key to catalyzing people's comfort working together across sectors and developing a regional orientation towards innovation and problem-solving.

## Timeline



# IMPROVED CONNECTIVITY

STRATEGY **4**

This final set of recommendations is a reflection on the strength of ties between key organizations and institutions. While previous strategies have addressed the need for deeper cooperation, collaboration, and coordination among certain groups, this recommendation is intended to further synthesize the previous three with a targeted focus on social and physical connectivity. The connective tissue that binds together individuals, organizations, and institutions will need to be nurtured and, in many cases, tended to with care and nuance given the embryonic nature of these interrelationships. The ability to actualize an economic development agenda that produces equitable outputs across stakeholders is an ambitious feat that not many places can claim to have achieved. However,

we believe that the state's insistence on this approach to nodal economic development is a powerful influence as both a resource and a mechanism for bringing people together in unconventional ways. It is in that spirit that this final recommendation proposes a bridge-building ethos (figuratively and literally) as one way to build up each city's ability to leverage that connectivity toward economic prosperity.

For this strategy, we focus on improving processes that facilitate interorganizational exchange in Brockton. For Worcester, we focus on strategic investments in physical infrastructure that extend the city's reach far beyond its downtown corridor to potentially global nodes of life sciences activity.

## BROCKTON

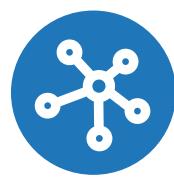
### **Improve Processes & Strengthen Relationships**



Workforce planning leads to strong connections among education, community organizations, economic development organizations, and the life sciences sector.

## WORCESTER

### **“Reimagine” the Transportation System**



Reduce physical and social distances among life sciences companies, institutions, and neighborhoods through improved infrastructure; emphasize major regional assets like Union Station and the Worcester Regional Airport.

## BROCKTON Improve Connections

*Workforce planning leads to strong connections among education, community organizations, economic development organizations, and the life sciences sector*

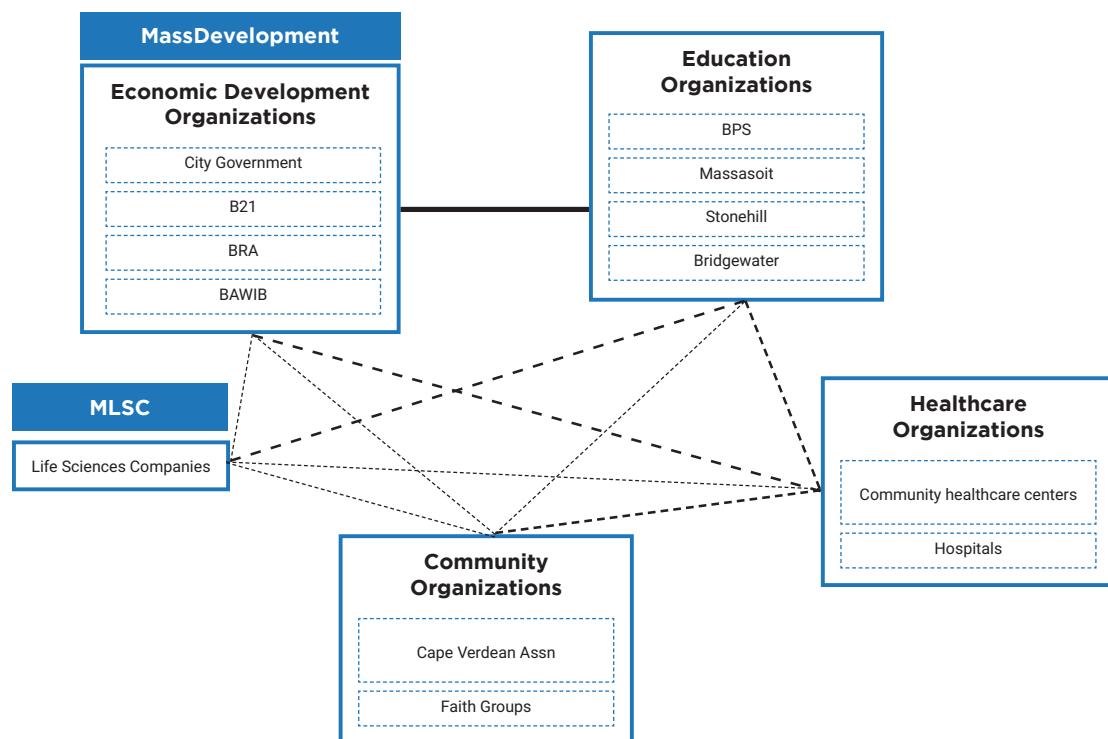
This final strategy brings together the previous three recommendations. **Improved internal processes and strengthened relationships among organizations** will aid Brockton in implementing the proposed framework. During several interviews, we heard references to “Old Brockton,” the old-guard of Brockton leadership that has been historically resistant to change and closed to newcomers like Brockton immigrant communities and young professionals. For

Brockton to succeed, it will need processes that are inclusive and empowering for all stakeholders.

To illustrate this strategy, we created a diagram showing our perception of the existing relationships within Brockton. As shown below, economic development organizations like the Brockton City Government and BAWIB currently have a strong connections to education organizations like Brockton Public Schools and Massasoit Community College. However, the Brockton economic development sector has weak ties to the life sciences sector and to community organizations like the Cape Verdean Association. **Our strategies are meant to turn weak dashed lines into solid strong lines, creating the conditions necessary for inclusive life science development.**

### Status Quo

- Strong connections
- - - Moderate connections
- Weak connections



Our first recommended strategy ("Invest in Real Estate Expertise") will primarily strengthen the connections between Brockton economic development organizations and the life sciences sector. This is because tailoring real estate offerings for life science companies would by necessity require expertise in the life sciences, which can only be provided to Brockton through support from an organization like the MLSC.

This strategy also could be implemented in a way that fosters inclusion and support for community organizations. If the MLSC or another organization provided mentorship and support for accessing capital to minority or immigrant developers, the wealth built through new real estate development would have a greater impact

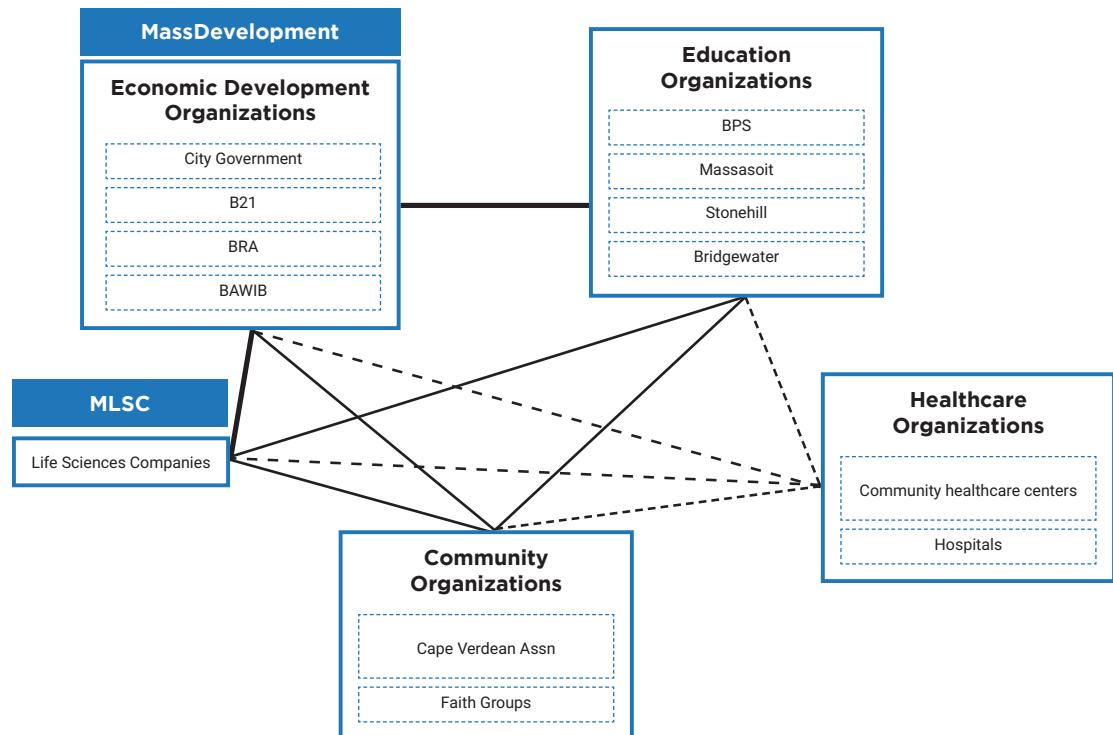
within the City of Brockton.

Our second recommended strategy ("Augment Local Workforce Planning") will further strengthen relationships between Brockton economic development organizations, the education sector, community organizations, and the life sciences sector. Effective life sciences workforce training will necessarily involve changing the STEM curriculum in Brockton-area schools, and providing local employees with life sciences skills will require strong coordination between economic development groups and community organizations.

Finally, with our third recommended strategy ("Create Coordination Council"), ties will become

## Proposal

- Strong connections
- - - Moderate connections
- Weak connections

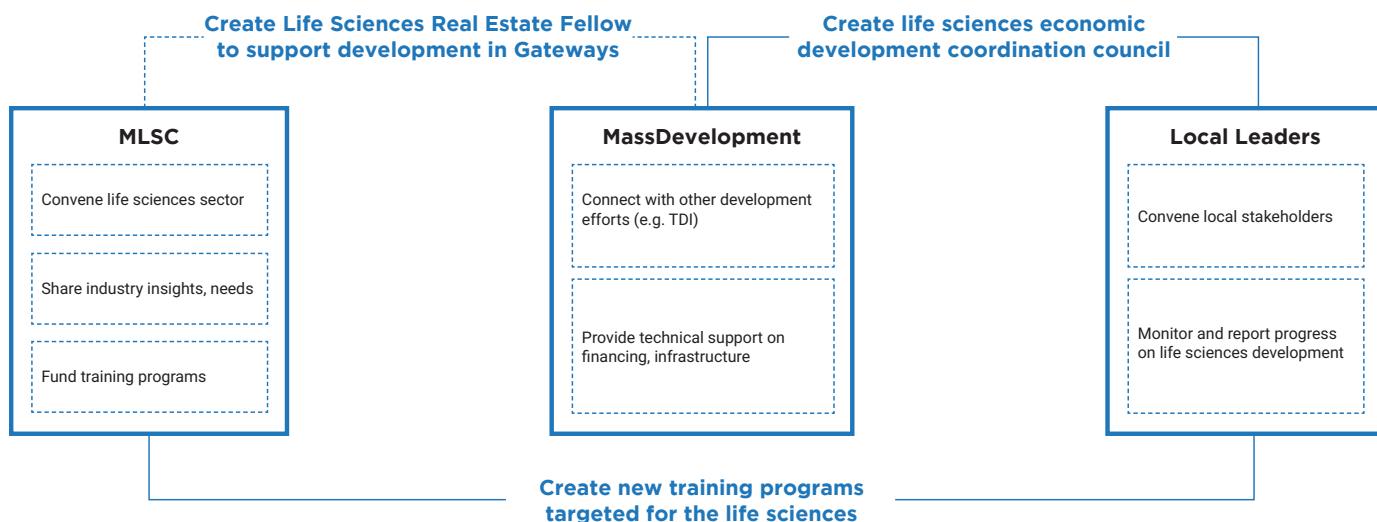


stronger among Brockton economic development groups, the life sciences sector, and community organizations. If the life sciences council is designed and operated in an inclusive manner, this strategy will also improve relationships between organizations within Brockton immigrant communities and education organizations like Brockton Public Schools.

Throughout the implementation of all of our recommended strategies, we believe that **intentional engagement with the Brockton immigrant community is critical in order to achieve inclusive and robust economic development**. This will require communication and advertising of life sciences opportunities through culturally-specific channels, such as the leadership of community organizations, local newspapers, and multilingual materials. It is also critical to ensure that immigrant communities are represented on the regional life sciences coordinating council and integral to the design of a life sciences workforce development

curriculum. One way to accomplish this is by inviting first or second generation immigrant educators at Brockton High School or elsewhere to be part of designing the new STEM education modules. Brockton immigrant leaders can likely recommend additional actions to achieve success in outreach to their communities.

In the diagram below, we sum up the actions needed from the three report stakeholders. The MLSC should help convene the life sciences sector and provide support funding, particularly for a real estate fellow focused on the Gateway Cities. MassDevelopment should help connect life sciences work with other development efforts through TDI, while also providing technical support for financing and new infrastructure. Finally, leaders in Brockton should convene local stakeholders and monitor progress for the new life sciences training programs and the life sciences economic development coordination council.



## Worcester “Reimagine” the Transportation System

*Reduce physical and social distances among life sciences companies, institutions, and neighborhoods through improved infrastructure; emphasize major regional assets like Union Station and the Worcester Regional Airport.*

Our final strategy responds to the “Innovation without infrastructure” story we heard. Across our many interviews, we heard countless tales of exciting research, motivated students, and community partnerships. At the same time, many individuals lamented the physical isolation of major institutions and neighborhoods and lack of reliable bus service. They also noted the necessity of owning a car in order to get around easily. While the city is already investing in increased commuter rail connections to Boston, we feel that the city has the opportunity to think more pointedly and creatively about internal connections. This would facilitate mobility and exploration on the part of city residents, and help cultivate a deeper understanding of Worcester’s many identities. And given the major recent investment in efforts to make Worcester a more walkable and livable city, connections to bring people downtown are complementary to Worcester’s existing plans, and will enhance its vision.

This strategy is the culmination of the previous three in that it requires a longer-term investment, as well as a significant amount of cooperation

to gain buy-in from major players, clear visioning and coordination among them, and inclusive processes. Importantly, this fourth strategy also **requires Worcester to think about the way its life sciences sector shapes Worcester’s relationship to the rest of the region and the nation.** One of our interviewees mentioned the transit-oriented development planning currently occurring in cities like Grafton and Shrewsbury, which also have major life sciences assets. As the second largest city in New England and with goals to put itself on the map in terms of life sciences, Worcester should be thinking similarly, in order to combine transportation access with life sciences sector development.

The WRTA has recently made changes to its service. In 2014, it moved operations to a central transfer hub (Union Station), and re-routed every route downtown<sup>[25]</sup>. In 2015, the WRTA did a Regional Transit Plan, with some key recommendations including crosstown routes, increasing headways of key bus routes and increasing service on weekends for some routes. WRTA should continue to work towards these recommendations. The plan, however, only looked at the region as it is today, and did not include projections. Some priority development areas (PDAs) identified by the Central Massachusetts Regional Planning Commission (CMRPC) are included in the transit market demand analysis, but many industry development areas such as Biotech Park were not included on that list.

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<sup>25</sup> WRTA. “Regional Transit Plan.” [therta.com/wp-content/uploads/2015/07/E.-Chapter-3.pdf](http://www.therta.com/wp-content/uploads/2015/07/E.-Chapter-3.pdf) (accessed February 2, 2018)

Worcester as a city has changed, and the transportation network needs to be adjusted to more effectively serve the city and region to meet its current and future needs. To “reimagine” the transportation network is therefore to encourage an exercise in thinking beyond the existing system: What type of transportation network would best serve Worcester’s current and future populations? How can new connection serve the life sciences and other sectors including the general public that are or will be central to Worcester’s economy? Importantly, what populations are not being served by the current system?

The reimagined transportation network should focus on workforce and employment needs. Small changes, such as aligning bus times to universities with when classes let out can make transit a more viable option for students. Additionally, better understanding workforce transportation needs, rather than only using indicators such as employment density and population density in identifying demand levels, can improve effectiveness. For example, many nurses in hospitals may need more off-peak service, while hospital administrative staff may need peak service, yet both would be identified in the same sector and employment density area. The city’s transportation network should better support the Eds and Meds workforce on which it relies so heavily.

Transit agencies like the MBTA have used partnerships and pilots to test new service

options for higher cost, low-performing routes and transportation options. The MBTA partnered with Lyft and Uber to offer night service discounts as it ends late night service<sup>[26]</sup>. Partnerships can be effective for routes or times that are less productive and have low revenue hours. As of 2014, the WRTA system did not meet its system wide productivity target<sup>[27]</sup>. Given that the WRTA receives up to 75 percent of its funding from the state and had to increase fares in the last year, it is expected that the agency will continue to need to use cost-saving methods to make ends meet<sup>[28]</sup>. New funding options could include development and real estate charges like a parking tax, or dedicated transportation revenues like a tire tax. Additionally, the Federal Transit Administration (FTA) offers standard grants for urbanized and rural areas, as well as new funding options such as public transportation innovation, and the Mobility on Demand Sandbox Demonstration program. These opportunities could offer one-time funding to do a redesign of the bus network, or to test innovative approaches to improving transit access.

Worcester also has a major regional airport that is currently underutilized. We heard from interviewees that they considered their local airport to be Logan International, a 90 minute drive away with traffic, versus Worcester Regional Airport, a 15 minute drive from downtown. The Massachusetts Port Authority’s purchase of the airport from the city in 2010 and the state’s subsequent investment in new

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<sup>26</sup> Lyft. “Late Night Lyft Line in Boston.” [lyft.com](https://blog.lyft.com/posts/late-night-lyft-line). <https://blog.lyft.com/posts/late-night-lyft-line> (accessed February 3, 2018).

<sup>27</sup> WRTA. “Regional Transit Plan.”

<sup>28</sup> Ibid.

sensing technology to allow landings in variable weather conditions have resulted in flight service expansion, including recently announced JetBlue service to JFK<sup>[29]</sup>. Additional service expansion is planned, further extending the airport's reach to other major east coast metro areas<sup>[30]</sup>. With planned flight increases, it is crucial that the city determine how this major asset could be leveraged for both commercial and industry purposes.

We propose, therefore, that **Worcester should reimagine its transportation system** for its future, building off of the increased expertise and life sciences planning processes from previous strategies. Specifically, the city, in partnership with major regional planning and transportation players like Massachusetts Port Authority (MPA), CMRPC, and WRTA, should undertake a major assessment and planning effort to **understand the current system and to identify potential opportunities for increased connections**.

Specific considerations and actions inclusive of the multiple transportation modalities in the city-region would include:

- Conduct survey or other research effort to **determine demand for changes and to gauge current population needs** related to transportation;
- Consult with industry representatives to **consider life sciences sector needs**, like storage and transportation for time-sensitive

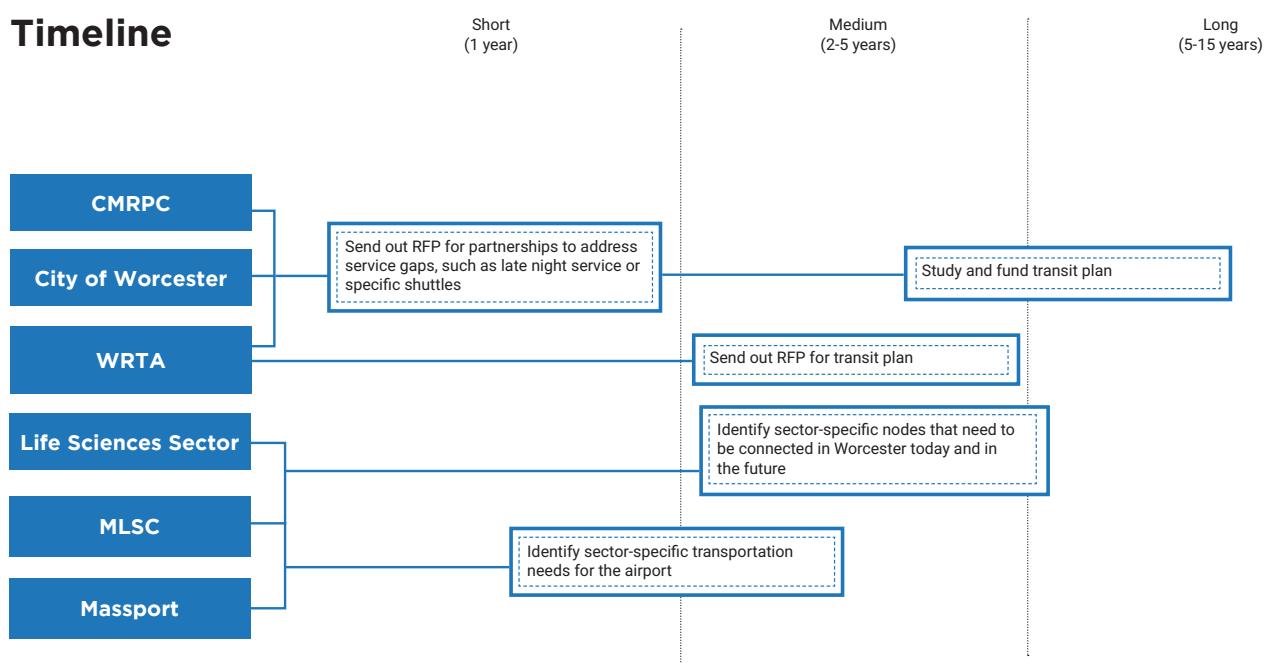
<sup>29</sup> Hanson, Melissa. "JetBlue flights from Worcester Regional Airport to New York will begin in May." [masslive.com](http://www.masslive.com/news/worcester/index.ssf/201712/jetblue_flights_from_worcester.html). [http://www.masslive.com/news/worcester/index.ssf/201712/jetblue\\_flights\\_from\\_worcester.html](http://www.masslive.com/news/worcester/index.ssf/201712/jetblue_flights_from_worcester.html) (accessed February 3, 2018).

<sup>30</sup> Foskett, Steven. "Director says Worcester airport ready for takeoff." [telegram.com](http://www.telegram.com/news/20171018/director-says-worcester-airport-ready-for-takeoff). <http://www.telegram.com/news/20171018/director-says-worcester-airport-ready-for-takeoff> (accessed February 3, 2018).

samples or live organisms;

- Redesign routes to **introduce bus connections to key nodes**, including major educational and medical institutions, neighborhoods, and the downtown, as well as major outward hubs, like Worcester Regional Airport and Union Station;
- **Connect life sciences institutions** to one another with a **life sciences-specific shuttle**; partner with life sciences companies and institutions to **provide transportation options for high school and college students** with internships;
- **Partner with TNCs or use other ridesharing options to offer service at off-peak times**, such as late night or weekends, when routes are less productive but service is still important; and
- Encourage **partnerships between hospitals and healthcare systems** and **TNCs** for non-emergency rides for patients and providers. If the city of Worcester and the WRTA already have built those relationships, hospitals like UMass Medical and St. Vincent's could benefit in the long run.

## Timeline





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# TYPOLOGY

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# TYPOLOGY |

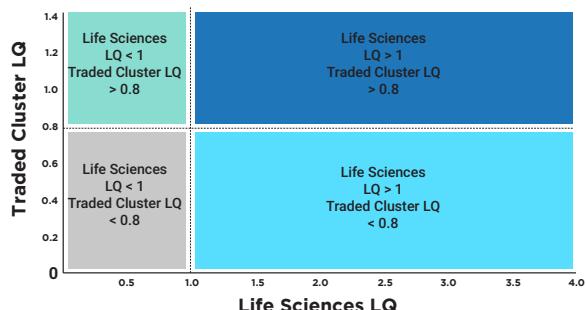
While the scope of this project only included Brockton and Worcester as case study cities, we devised a typology to help generalize our analysis and recommendations across the spectrum of Gateway Cities, according to the following two measures:

- *Traded cluster location quotient, and*
- *Life sciences location quotient.*

Location quotients (LQs) are indicators of how concentrated a particular economic activity is in a geography (e.g., city or region), relative to another geography (e.g., nation). An LQ above one indicates specialization, i.e., more cluster jobs than would be expected in an economic area of its size. These are linear measures—an LQ of 1.8, for example, indicates that an area has 80 percent more activity (e.g., jobs) than other similarly-sized economic areas. To assess and compare the general economic composition of the 26 Massachusetts Gateway Cities, we looked at each city's traded cluster LQ, which measures how much of the city's employment is based in industries that produce goods or services demanded by national and global markets. For instance, biopharmaceutical companies serve customers well outside Massachusetts, and its employees would be counted toward a city's traded cluster LQ, whereas employees of a local barber shop would not. Traded industries tend to have higher average wages and productivity than non-traded industries, and are dependent on demand for goods beyond their local context. A higher traded cluster LQ suggests greater economic connections beyond the regional economy. The three Gateway Cities with the highest traded cluster LQs are Attleboro (1.26), Taunton (1.09), and Worcester (1.04), and those with the lowest are Quincy (0.25), Brockton (0.32), and Salem (0.35).

To more specifically assess and compare the life sciences activities in Gateway Cities, we calculated each city's life sciences LQ. The three Gateway Cities with the highest life sciences LQs are Peabody (3.5), Methuen (2.8), and Lawrence (1.9), while those with the lowest are Holyoke (0.0), Lynn (0.1), and Revere (0.1).

A four-part typology of Gateway Cities vis-a-vis their traded industries and specific life sciences activities emerges when the two LQs are plotted against one another. Thresholds of 0.8 for traded cluster LQs and 1.0 for life sciences LQs were employed per industry practice, but can be adjusted. The primary intention of the typology is to guide the prioritization of policy interventions in these cities.



Cities with varying life sciences and traded cluster LQs require different policy interventions. This typology begins to operationalize these differences and map them onto corresponding policy directions. While the schematic here provides a starting point to broadly categorize recommended strategies for Gateway Cities, further research and analysis will be needed to understand the realities of each geography for more effective, tailored solutions.

### High Life Sciences LQ & High Traded Cluster LQ

Cities in this category, which includes Worcester, already have relatively concentrated life sciences activity, as well as existing infrastructure for export industries. These solid fundamentals mean that additional life sciences investment in these cities can be catalyzed with strategic collaboration and shared resources.

*Priority: High*

*Cities: Taunton, Worcester*

### High Life Sciences LQ & Low Traded Cluster LQ

Cities in this category, which includes Brockton, have existing (traded) life sciences activities but beyond that, their economies are focused on local and regional market activities. These cities demonstrate good potential for growth in the life sciences cluster but likely need to develop capabilities and assets—e.g., real estate expertise, network connections—to expand traded cluster activity.

*Priority: Medium*

*Cities: Brockton, Fitchburg, Lawrence, Methuen, Peabody, Quincy, Westfield*

### Low Life Sciences LQ & High Traded Cluster LQ

Cities in this category have little life sciences activity but enjoy a high traded cluster LQ in other sectors. Policy interventions should focus on identifying opportunities and developing capabilities in the life sciences.

*Priority: Medium*

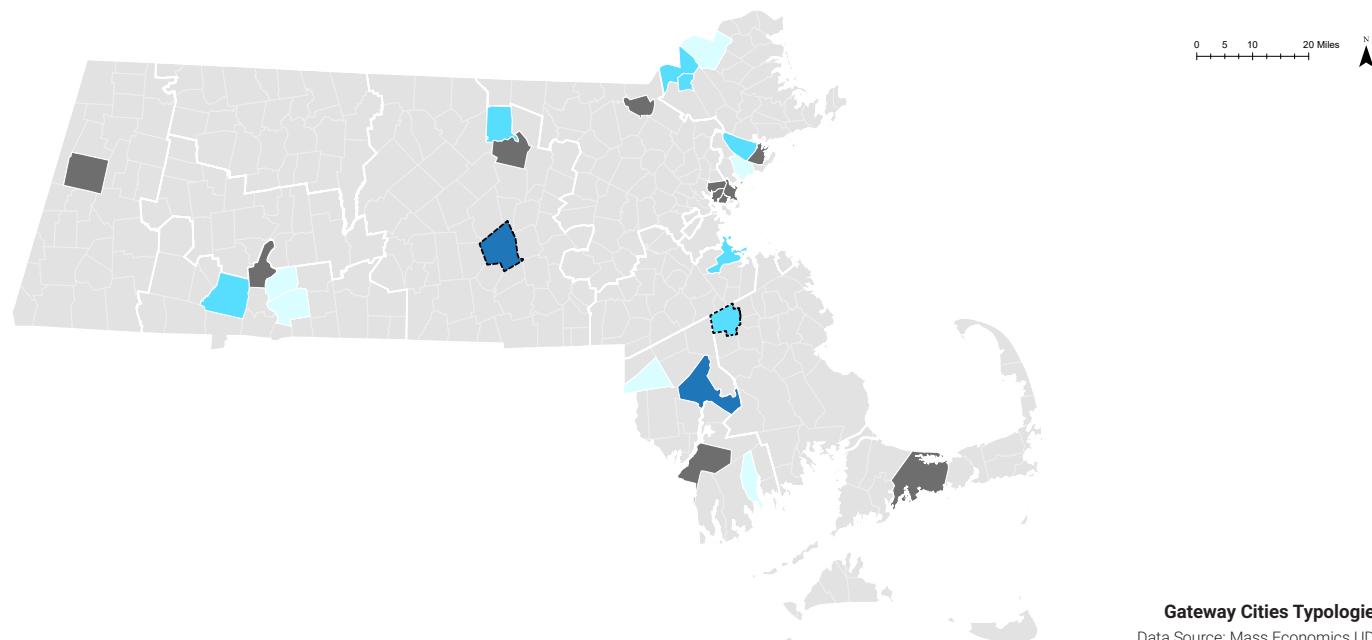
*Cities: Attleboro, Chicopee, Haverhill, Lynn, New Bedford, Springfield*

### Low Life Sciences LQ & Low Traded Cluster LQ

Cities in this category have few sectors in the life sciences and relatively few traded industries. This suggests that basic infrastructure for economic development and export industries might not be in place, and that general asset-building in business attraction and real estate development should precede investments in specific life sciences capabilities.

*Priority: Low*

*Cities: Barnstable, Chelsea, Everett, Fall River, Holyoke, Leominster, Lowell, Malden, Pittsfield, Revere, Salem*





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# **CONCLUSION**

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# CONCLUSION |

Massachusetts is a global leader in the life sciences, thanks to world-class institutions, an abundance of a research and supporting workforce, and intentional policy interventions to spur innovation and retain talent. The life sciences sector is expected to continue its tremendous growth, built on cutting-edge research and technology and operationalized in geographic clusters around the world and in the U.S. The Massachusetts life sciences cluster has been a main driver of this growth over the past few decades, but it has done so by focusing its investments and policy interventions primarily within a few miles of Kendall Square. Leveraging assets in and directing targeted investments to Gateway Cities have the dual effect of encouraging inclusive economic growth outside the Boston/Cambridge area and further extending the competitive advantage of the Commonwealth beyond the ideation phase of innovation.

In this report we have demonstrated that the Gateway Cities—exemplified by the case studies of Brockton and Worcester—are poised

to participate more fully in the life sciences because of their assets in housing, workforce, and real estate. Combined with intentional investment and effective management, these assets can strengthen the life sciences cluster in Massachusetts and improve economic development for these post-industrial cities. Through our study of and conversations with stakeholders in Brockton and Worcester, we understand that Gateway Cities may share some similar characteristics, but they are largely products of different forces, experience different realities, and therefore require further research to determine the most effective policy interventions.

We are grateful to the communities of Brockton and Worcester that have welcomed our research team and shared their insights and passion with us. We look forward to the leadership of the MLSC and MassDevelopment in rallying the coalition of diverse and talented stakeholders in the Gateway Cities, not only to grow the life sciences industry, but also to improve economic resilience and enrich the quality of life in the Commonwealth.



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