Greater Boston Workforce Planning Blueprint

Draft for Public Comment

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UMASS DONAHUE INSTITUTE
Economic & Public
Policy Research

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Introduction

Regional Planning Team. Describe the different partner organizations brought together to be a part of the Regional Planning Team (K-12 District, Vocational Technical School, Community College, State University, Workforce Development Board, Massachusetts Office of Business Development, Regional Economic Development Organization, Regional Planning Authority, and more).

See Appendix C: Stakeholders' Group on page 52 for a list of all meeting attendees and their organizations.

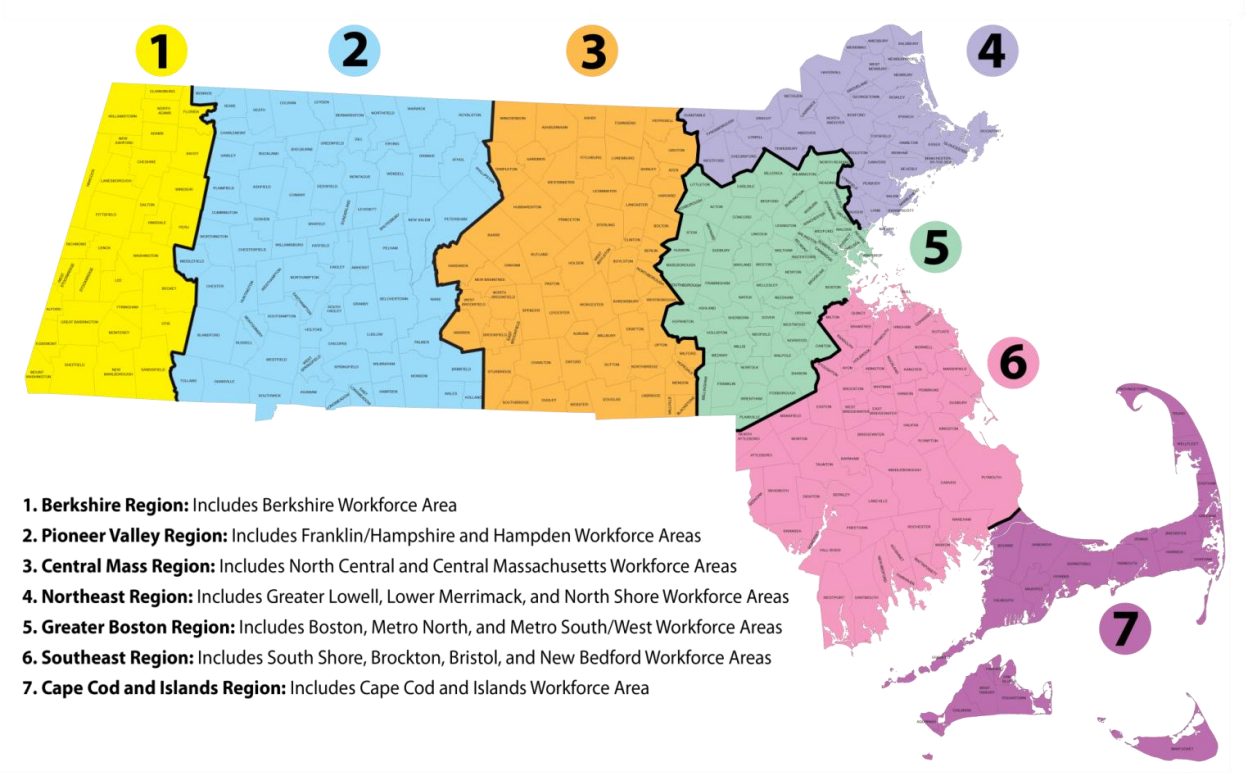
Regional Planning Process. Describe your region's process to develop Labor Market Blueprint.

The Workforce Skills Cabinet, comprised of the Secretaries of Education, Labor and Workforce Development, and Housing and Economic Development, initiated a regional planning process that convened regional workforce, education, and economic development entities. The overarching goal of this process is to identify critical labor supply gaps in the region and suggest strategies to close them.

The following blueprint follows the template provided by the Commonwealth to all regions undertaking this exercise. We have retained the structure of that template for ease of navigation and comparability against other blueprints.

Massachusetts is divided into 16 Workforce Development Areas (WDA), which were combined into seven larger regions for this workforce planning exercise. This blueprint discusses results of the labor supply analysis for the Greater Boston region (Region 5 in Figure 1), which includes the three WDAs of Boston, Metro North, and Metro South/West. The respective workforce development boards (WDBs) of each WDA led this project. They are Boston Private Industry Council (PIC), the Metro North Regional Employment Board (MNREB), and Partnerships for a Skilled Workforce (PSW), respectively. The three WDBs selected and convened a group of regional stakeholders for five meetings to spread information about the project, solicit ideas, and obtain consensus on plans for the region.

Figure 1. Map of Workforce Planning Regions



To aid them in this process, the Greater Boston region engaged the UMass Donahue Institute (UMDI) for data collection, meeting facilitation, and assistance in crafting the final blueprint.

Business Engagement. Describe how the Team engaged business to develop the blueprint, including the number of businesses engaged, the industries businesses associate with, and the format of engagement the team employed.

In addition to those already among the stakeholder meetings, the team conducted key informant interviews with employers relevant to our priority industries and occupations. The goal of these conversations was to better understand the challenges and opportunities of doing business in the region and the career pathways potential workers.

Where are we now?

Regional Context

Describe critical trends in population change in the next decade that will have an impact on the workforce.

Table 1. Populations Projections by Workforce Development Area (WDA)

WDA	Census 2010	2015	Projection 2020	Projection 2025	Projection 2030	Projection 2035	2015 - 2035
Metro North	801,345	834,263	*865,439*	*891,683*	*912,379*	*930,230*	12%
Boston	651,185	687,946	*723,955*	*752,038*	*772,380*	*791,888*	15%
Metro South/West	956,365	975,425	*994,693*	*1,011,327*	*1,025,602*	*1,035,763*	6%
Total	**2,408,895**	**2,497,634**	***2,584,087***	***2,655,048***	***2,710,361***	***2,757,881***	**10%**

Source: UMass Donahue Institute Vintage 2016 Population Projections. June 2016.

The UMass Donahue Institute's Population Estimates Program produces the official town-level population projects for Massachusetts. Using these data, we developed the projections shown in Table 1. From 2015 to 2035, the population of Greater Boston is expected to grow by 260,247 people, with 60 percent of that growth, or 157,414 occurring by 2025. This is equivalent to 10 percent growth by 2035 and 6 percent by 2025. All three WDAs are predicted to grow with Boston leading the way with 15 percent (or 104,000) by 2035 and Metro South/West with the least at 6 percent (or 60,300). For comparison, the state is expected to add 526,600 people for 8 percent growth by 2035, which means roughly half of net state-wide growth will be in Greater Boston.

Table 2. Population Projections by Age Cohort

Greater Boston	Census 2010	2015	Projection 2020	Projection 2025	Projection 2030	Projection 2035	2015 - 2035	Mix Change 2015 - 2035
Under 19	539,781	553,749	*559,789*	*566,915*	*571,249*	*574,554*	4%	-1%
20 to 34	555,928	533,390	*531,598*	*527,421*	*530,832*	*538,825*	1%	-2%
35 to 54	677,076	693,586	*717,200*	*744,787*	*759,271*	*763,520*	10%	0%
55 to 69	401,586	440,836	*456,298*	*450,906*	*446,346*	*459,523*	4%	-1%
70 and over	234,524	276,073	*319,202*	*365,019*	*402,663*	*421,459*	53%	4%
Total	**2,408,895**	**2,497,634**	***2,584,087***	***2,655,048***	***2,710,361***	***2,757,881***	**10%**	

Source: UMass Donahue Institute Vintage 2016 Population Projections. June 2016.

Again relying on UMDI's population projections, we examined the predictions for population by age. As is the trend elsewhere in Massachusetts and New England, the Greater Boston region is expected to age over time. Over 50 percent of net growth by 2035 will be in those 70 and over. The pattern is the same for 2025. On a positive note, the cohort with the next largest change is in those aged 35 to 54, the prime labor force participation years. Nevertheless, the population of the future will include both a larger share and greater absolute numbers of people over the age of 70. This shift in population will result in fewer workers as a share of total population, which could stymie economic growth, while also creating more demand for goods and services disproportionately consumed by the elderly such as health care.

Describe critical trends in regional demographics that will have an impact on the workforce, e.g. age, education, etc.

Table 3. Key Demographic Attributes, Greater Boston

Demographic Attributes	2000	2010	2016
Race & Ethnicity	**2000**	**2010**	**2016**
White, Not Hispanic	75.0%	69.1%	66.6%
Black, Not Hispanic	8.5%	9.1%	9.5%
Asian, Not Hispanic	6.0%	8.3%	9.5%
Other, Not Hispanic	3.1%	3.4%	3.1%
Hispanic	7.3%	10.0%	11.3%
Nativity	**2000**	**2010**	**2016**
Native Born	81.7%	79.0%	77.5%
Foreign Born	18.3%	21.0%	22.5%
Educational Attainment (25 or older)	**2000**	**2010**	**2016**
Less than High School	13.1%	9.8%	8.9%
High School	22.5%	21.8%	19.5%
Some College	20.5%	18.8%	18.1%
BA	23.8%	25.8%	27.2%
Grad or Professional Degree	20.1%	23.9%	26.4%

Source: 2000-2010 US Census, 2006-2010 American Community Survey, 2011-2016 American Community Survey

The demographic trends shown in Table 3 highlight three broad changes occurring in Greater Boston: increasing diversity, growth in foreign-born workers, and higher educational attainment. These trends combine to create demand for culturally-appropriate training and services for immigrants while also raising the standard for which workers should be trained. These challenges and opportunities are elaborated on elsewhere in this document.

Describe past and current high-level industry trends affecting workforce needs (i.e. growing, declining, emerging industries).

Using EOLWD data, since 2001, average monthly employment…

... in utilities is down 21.9%
... in manufacturing is down 40.3%
... in professional and technical services (legal services, accounting, architecture, information management, advertising, veterinary) is up 24.9%
... in educational services is up 19.3%
... in health care and social assistance is up 47%
... in arts, entertainment, recreation is up 53.1%
... in accommodation and food services is up 38.1%

These trends reflect the shift in employment away from production and manufacturing toward services and will necessitate retraining of current workers and revamping training programs for new workers.

Describe critical trends in occupational employment history in the region (i.e. growing, declining, emerging occupations).

We have defined *growing* occupations as those with rates of growth greater than or equal to 175 percent of the average rate of growth in the region from 2006 to 2016. During that time, the average rate of growth in occupation-based employment is 13.9 percent so occupations with employment growth of 24.3 percent or more are considered "growing" (i.e. 13.9% average * 1.75 = 24.3% floor for notable growth).

- Computer and mathematical occupations
- Community and social service occupations
- Legal occupations
- Food preparation and serving related occupations
- Personal care and service occupations

Declining occupations are defined as those whose rate of growth is negative during the 2006 to 2016 time period.

- Office and administrative support occupations
- Farming, fishing, and forestry occupations
- Construction and extraction occupations
- Installation, maintenance, and repair occupations
- Production occupations

Emerging occupations are defined as those whose share of total occupation-based employment grew significantly between 2011 and 2016. In this case, those occupations whose share of total employment grew by over one percent are considered "emerging".

- Management occupations grew its share from 6.9 percent to 9.2 percent of total employment.
  - Management occupations also meet the criteria for "growing" occupations in that they grew by over 25 percent between 2011 and 2016.
- Missing the mark by only 0.09 percent was computer and mathematical occupations which grew from 5.5 percent to 6.4 percent of total employment.

What are the top three challenges facing the region's business and industry over the next five years?

The Greater Boston region has benefited from strong growth over the past decade but it does not remain without challenges, some of which stem from that very growth. Below are the main business challenges we heard from our stakeholders.

The availability of trained and prepared labor

As of November 2017, the unemployment rate in Massachusetts was 3.6 percent. The Greater Boston region is below 3 percent. In this environment, employers can expect to have some difficulty in filling positions as there is little excess supply of labor. However, beyond what can be expected from low unemployment, businesses are having trouble finding candidates with the right mix of education, experience, aptitude, and skills.

Our stakeholder meetings suggested a few possible causes for the misalignment. First, the nature of work is changing and with it so is the nature of entry-level jobs. Employers are expecting more from workers entering the market than was previously the case. Second, job postings have education requirements that are sometimes independent of skill requirements such that some candidates who are capable of doing the job do not meet the posting's requirements. Third, the available pool of labor includes many members who are not job-ready, be it as a result of sub-optimal numeracy, customer-service skills, or broader "soft skills" such as understanding workplace behavior, employer expectations, and the like.

The costs of turnover and retraining

Similarly to the above challenge, low employment and the fast-changing nature of work is creating problems retaining and retraining staff. When unemployment is low, employees who are dissatisfied or eager for change have an easier time finding new work, while employers have a harder time making counteroffers to induce workers to stay. This turnover then requires employers to seek out workers in a tight labor market or hire from within. In either case, search and training costs are added to the costs of lost productivity caused by the vacancy. Furthermore, in the case of an internal hire, one vacancy is simply traded for another: the internal hire fills one vacancy while creating another.

Even without unusual turnover, employers are still faced with the cost of retraining workers to keep abreast of the latest skills and technology. Keeping knowledge fresh while minimizing business disruptions has always been on the minds of business owners but as the pace of technological change quickens and the nation's industry mix shifts toward services, employers are facing greater pressure.

Transportation and housing

Almost from the beginning of this process, our stakeholders highlighted the dual challenge of transportation and housing. They are tightly intertwined. As housing costs rise, workers seek homes further from employment centers which in turn puts greater strain on the transportation network. Simultaneously, as commutes become more arduous, housing nearer to employment centers becomes more attractive and thus more expensive. As it stands, the mismatch between the location of jobs and housing and the difficulty in commuting between the two has become a key business challenge. A corollary to this challenge are local land use regulations that discourage density, new construction, and certain business uses.

What are the top three opportunities related to business and industry in your region over the next five years?

Below are the main business opportunities we heard from our stakeholders. Their overarching theme is the largely positive economic environment within which we seek to address a few critical labor supply gaps.

Greater Boston is a strong region

Greater Boston is the economic engine of the state. Employment and population are strong and growing. In some ways, the region's housing and transportation problems are a symptom of this strength: weak regions do not have soaring home prices and traffic jams. Greater Boston's employment has grown by 11 percent since 2011. The state's has grown by 9 percent. Both have weathered the Great Recession better than many other regions and states. Adding to this strength is the growth of opportunities throughout the region, not merely in the City of Boston, which adds welcome diversity of place to the economic environment. Supporting private enterprise is a dynamic non-profit sector that is accustom to working with businesses to provide valuable services to the community at-large.

Massachusetts is top in competitiveness

Massachusetts has remained at the top of many lists of state competitiveness and looks set to continue its strength in technology and biomedical research, industries which are concentrated in the eastern part of the state. The state is a large recipient of federal research dollars and has a well-developed venture capital ecosystem. Local and state governments that are increasing open to business expansion. The region is well-situated within and well-connected to one the most populated areas of the country with good highway, freight, water, and air access. Many of the region's communities have the amenities that today's workers demand such as culture, entertainment, walkable cityscapes, and access to outdoor recreation. A strong economy, regional amenities, and the openness of state and local governments continue to heighten the region's attractiveness to businesses and workers.

High-quality education system

Another key factor in the Commonwealth's continued competitiveness is the strength of its human capital. Massachusetts benefits from one of the most educated populations in the country, a fact built upon high quality education from kindergarten through college and beyond. The National Assessment of Educational Progress (NAEP) tests 4th and 8th graders on reading, math, and science. Massachusetts student outperform their peers on nearly every measure. If they head to college in the state, students benefit from a selection of world-class colleges and universities. Outside the formal education sector, Massachusetts has expanded apprenticeships beyond their traditional sectors of construction and manufacturing to health care and IT. The state is taking the lead in providing job-driven training through employers.

Industry Demand Analysis (NAICS)

What top three industries are most important to the region's economic success and why?

Using the regional labor market data tool and employment data available from the Executive Office of Labor and Workforce Development (EOLWD), the regional planning team identified two industries that are most important to the region's economic success. They are:

- NAICS 62: Health Care and Social Assistance
- NAICS 54: Professional and Technical Services

These two sectors are the two largest in terms of employment in the Greater Boston region with 271,000 jobs in health care and social assistance and 214,000 in professional and technical services. They also rank 1st and 2nd based on employment level change from 2001 to 2016, with health care and social assistance adding 85,463 jobs and professional and technical services increasing by 41,205 jobs. Combined, they accounted for over 485,000 jobs in the region in 2016, representing 30 percent of all payroll employment in Greater Boston.

A few other industries also had strong employment growth over this 15-year time period. The arts, entertainment, and recreation industry grew at a faster pace over this time period but is only about one-tenth the size of these two industries. Accommodation and food services increased employment substantially with the fourth highest growth rate. Educational services ranked fifth, with an 18 percent employment increase and remains a large source of employment in Greater Boston. Construction employment levels in 2016 are below those of 2001 but this industry has grown considerably over the past several years as it recovered from a severe economic recession that resulted in the loss of many construction jobs in the region.

Table 4. Employment Change by Major Industry Sector, Greater Boston, 2001-2016

NAICS Code	Industry	2001	2016	% Change 2001 to 2016
71	Arts, Entertainment, and Recreation	18,911	28,941	53%
62	**Health Care and Social Assistance**	**185,547**	**271,010**	**46%**
72	Accommodation and Food Services	96,820	132,864	37%
54	**Professional and Technical Services**	**172,831**	**214,036**	**24%**
61	Educational Services	136,077	160,205	18%
53	Real Estate and Rental and Leasing	24,314	26,034	7%
55	Management of Companies and Enterprises	36,372	38,970	7%
81	Other Services, Ex. Public Admin	49,048	52,562	7%
56	Administrative and Waste Services	90,454	92,260	2%
44-45	Retail Trade	126,632	127,453	1%
23	Construction	61,970	56,890	-8%
92	Public Administration	70,059	64,445	-8%
52	Finance and Insurance	113,972	103,861	-9%

NAICS Code	Industry	2001	2016	% Change 2001 to 2016
51	Information	70,416	61,639	-12%
48-49	Transportation and Warehousing	57,681	49,626	-14%
42	Wholesale Trade	62,151	52,228	-16%
22	Utilities	5,686	4,450	-22%
31-33	Manufacturing	131,963	78,729	-40%

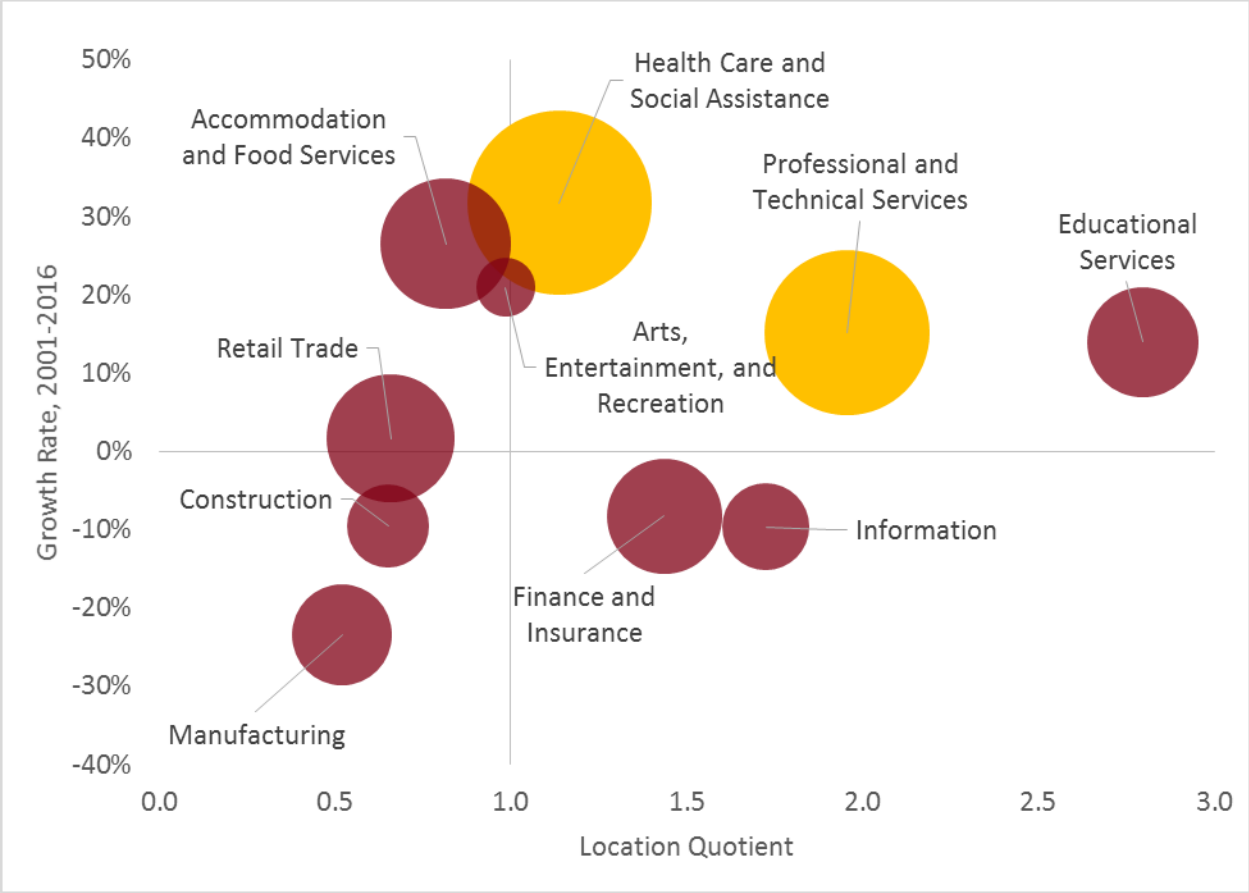
Source: Massachusetts Executive Office of Labor and Workforce Development (EOLWD), ES-202 Employment Series, 2001 to 2016, Annual Averages

To assess each of the above industry sector's importance to the region's economic success, we calculated location quotients (LQ). LQ is a measure quantifying the relative concentration of a particular industry within a regional economy.[1] LQ is calculated by dividing a sector's regional share of employment with its share of national employment. In other words, it is sectoral employment in the region divided by total employment in the region over the same calculation at the national level. An LQ of 1 means that the regional and national economies are equally specialized in a certain industry. An LQ of greater than 1 implies that the region has higher employment or is more specialized in that industry relative to the national average. An LQ of less than 1 implies that the industry is less important to the region. The amount above or below 1 is the percentage difference, e.g. 1.05 is 5 percent greater and 0.95 is 5 percent less than the national concentration, respectively.

For our regional analysis, we combined the LQ analysis with overall employment levels and employment growth to compare industries in the region. The size of the bubbles on the chart represents each industry sector's relative employment size. The analysis shows that Professional and Technical Services has a LQ in Greater Boston of 1.96, meaning that its employment is twice the national average. It also implies that this industry is export-oriented and brings significant wealth back to the region. The Health Care and Social Assistance sector has a LQ of 1.14, meaning that employment in this sector was 14% greater than the national average. Both industries are in the upper-right quadrant of the graph because of their LQ ratios greater than 1 and positive employment growth since 2001.

[1] Rob Sentz, Understanding Location Quotient, EMSI, October 14, 2011.

Figure 2. Sector Strength in Greater Boston: Location Quotient and Employment Change, 2001-2016



Source: Boston Private Industry Council, based on analysis of 2001-2016 industry employment data for Massachusetts and U.S. Health Care and Professional and Technical are shaded in yellow to reflect that they are identified as priority industries.

What three industries currently face the most significant workforce development challenges?

Based on our review of the labor market data presented above and the labor demand and supply data provided by EOLWD, the Health Care and Social Assistance and Professional and Technical Services sectors face the most significant workforce development challenges. Each of these sectors has experienced substantial growth and is projected to grow over the next 10 years. This growth will lead to increased demand for new workers, who will require substantial skills and training.

Occupational Demand Analysis (SOC)

What are the top occupations or occupational groups in which the region is facing the most significant employee shortages? Utilize the regional occupational list that ranks 3, 4 and 5 star occupations for the region and determine those with significant shortages based upon the "supply" data for the region, input from business, organizations and other input.

The regional labor market data tool was used to identify the occupational groups that appeared to face the most significant employee shortages based on projected employer demand and supply of new workers from postsecondary schools and unemployed populations. The tool identified 207 occupations that met the 4 or 5 star criteria established by EOLWD with nearly half projected to experience some degree of worker shortage at current degree projection levels.

To narrow down this list to find the occupations or occupational groups facing the most significant projected shortages, we calculated the number and share of occupations within each group that were projected to be under-supplied. Computer and mathematical occupations and health care practitioner and technical occupations (requiring a sub-BA degree) ranked among the top in terms of intensity of the projected worker shortages. Management, business and finance operations, and community and social health care also showed high shares of occupations that are projected to face similar shortages.

The computer and mathematical occupation group has 15 occupations. Of them, 13 or 87 percent were identified as being under-supplied by the labor market tool and all of them were 4 or 5 star occupations. Several of these occupations rank among the top in the number of job postings on the Conference Board's Help Wanted Online database for the Greater Boston labor market area.

In health care, worker shortages are projected for occupations requiring less than an associate's and up through doctorate and professional degrees.[2] Nursing had the greatest projected demand for workers over the next ten years. However, there were several technician occupations that required more than a high school diploma but less than a bachelor's degree identified as being under-supplied. Most of these occupations are categorized as 3 or 4 stars. National research has also shown that employers are experiencing difficulty hiring for these health care "mid-skill" occupations [3]

[2] The data tool had limited information on the supply of graduates with professional/doctoral degrees.

[3] Harry Holzer, "Job Market Polarization and U.S. Workers Skills: A Tale of Two Middles", Brookings Economic Studies, April 2015.

Table 5. Computer and Mathematical Occupations

Occupation Group/ Title	Educational Requirement	Median Wage
Computer and Information Analysts (SOC: 15-1120)		
Computer Systems Analysts	Bachelor's degree	$89,177
Information Security Analysts	Bachelor's degree	$87,671
Software Developers and Programmers (SOC: 15-1130)		
Computer Programmers	Bachelor's degree	$96,084
Software Developers, Applications	Bachelor's degree	$106,444
Software Developers, Systems Software	Bachelor's degree	$113,992
Web Developers*	Associate's degree	$79,864
Database Administrators and Network Architects (SOC: 15-1140)		
Database Administrators	Bachelor's degree	$82,250
Network and Computer Systems Administrators	Bachelor's degree	$86,693
Computer Network Architects	Bachelor's degree	$115,694
Computer Support Specialists (SOC: 15-1150)		
Computer User Support Specialists*	Some college, no degree	$60,892
Computer Network Support Specialists*	Associate's degree	$78,221

Table 6. Health Care Occupations

Occupation Group/ Title	Educational Requirement	Median Wage
Health Diagnosing and Treating (SOC 29-1000)		
Respiratory Therapists	Associate's degree	$72,186
Health Technologists and Technicians (SOC: 29-2000)		
Medical and Clinical Laboratory Technicians	Associate's degree	$38,920
Dental Hygienists	Associate's degree	$85,307
Cardiovascular Technologists and Technicians	Associate's degree	$78,211
Diagnostic Medical Sonographers	Associate's degree	$84,805
Nuclear Medicine Technologists	Associate's degree	$76,856
Radiologic Technologists	Associate's degree	$73,065
Magnetic Resonance Imaging Technologists	Associate's degree	$85,609
Veterinary Technologists and Technicians	Associate's degree	$46,208
Licensed Practical and Licensed Vocational Nurses	Postsecondary nondegree award	$55,133
Medical Records and Health Information Technicians	Postsecondary nondegree award	$46,976
Nursing, Psychiatric, and Home Health Aides (SOC: 31-1000)		
Nursing Assistants*	Postsecondary nondegree award	$29,960
Other Healthcare Support Occupations (SOC: 31-9000)		
Medical Assistants*	Postsecondary nondegree award	$37,674

Our industry interviews suggest that radiological technologists form the base of a career ladder that extends toward the specialized imaging fields, namely computed tomography, sonography, magnetic resonance imaging, and mammography. If so, our initiatives may focus on strengthening the pipeline for certification as a radiological technologist while retaining the other fields as options for the worker's advancement. We intend to further discuss this approach with our existing health care stakeholders. Simultaneously, we intend to discuss the health care consortium's outlook on the current and future demand for radiological technologists and their various specializations to help improve the targeting of future initiative.

Which occupations offer a "career pathway" for workers to move to higher skills and wages, especially workers starting at entry-level? (Add 1 or 2 star occupations not included above that are entry-level yet important because of a career pathway or cluster.)

The occupations marked with an asterisk in Table 5 and Table 6 offer potential career pathways to move to higher skilled occupations. In health care, the medical assistant and nursing assistant occupations provide entry-level pathways. In the computer and mathematical occupations, all of the occupations are 4 or 5 stars, however jobs are available in each of the shaded occupations for individuals with less than an associate's degree. Interviews with employers that hire for these health care and computer occupations confirm that, especially now with low unemployment, employers are hiring applicants for entry-level positions with lower educational attainment than before and/or taking a more active role in training.

In the healthcare fields there are a number of one- and two-star occupations that can provide entry into these industries and put an individual on a career pathway that can lead to further advancement. The following occupations are typical entry level positions that can lead to career pathways in the healthcare sectors.

- Medical records clerk
- Receptionist
- Patient transporter
- Dietary aide
- Patient registrar
- Radiology film clerk
- Food service assistant
- Environmental services assistant

While there are no one- or two-star occupations in computer and mathematical occupations, the following entry-level occupations are those that typically serve as entry points to career pathways that can lead to four- and five-star occupations:

- Data entry/office software user
- Business software specialist
- Business data specialist
- Computer support technician
- Help desk technician
- Database technician
- Quality assurance tester
- Business publications specialist

Workforce Supply

What are the top three broad labor supply challenges facing the region over the next five years based on the existing workforce in the region (e.g. retirement and aging of population, low high school graduation rate, education or workforce skills of existing labor pool, limited language proficiency, etc.)?

Below are the main labor supply challenges we heard from our stakeholders.

Accommodating foreign-born workers

New England is aging at a faster rate than the rest of the nation. As a result, natural growth (births minus deaths) is falling. Not immune from these trends, Greater Boston has relied on domestic and international migration for its population growth. Since 2000, nearly 30 percent of labor force growth in the region has been from foreign-born workers; at the state level the number is over 80 percent. Because of this inflow, the unique needs of foreign-born workers has become a labor force challenge with impacts on the ability of businesses to fill vacancies.

The challenge is two-fold: streamlining the process of translating and transferring the foreign credentials of immigrants and providing sufficient English language education for those who do not speak English well. Those immigrants who arrive with training and language skills, such as engineers or medical workers, often cannot begin work in their fields without considerable effort including relicensing, exams, and other barriers. For those needing language courses, the shortage of space in existing English language classes is especially acute and its impacts are felt throughout the economy. Census data suggests the ability of foreign-born workers to speak English well is often the difference between earning below average wages or those on-par with native-born workers. As workers realize their full productivity, their economic contribution grows both by reducing their reliance on public services and by increasing their consumption, homeownership, entrepreneurship, and tax payments.

Higher average educational attainment

A greater share of the population of Massachusetts has a college degrees than in any other state. While an admirable achievement and part of our attractiveness to businesses, it also provides a challenge to those in the labor force without one. The main way that this impacts workers is by creating a higher bar for employment. For example, if some occupation does not necessarily require a four-year degree but most workers in that occupation have one then the competitive reality in the marketplace is that those workers who wish to work in that occupation should consider a four-year degree. The concern for those in education and workforce development is that workers with sufficient skills for a job will still be uncompetitive relative to other jobseekers without higher levels of educational attainment. If that is the case then the level of training, and its corresponding investment of time and money, will need to be increased, which reduces the number of people who can obtain it.

Proficiency in mathematics

As has been a common theme in this blueprint, the nature of work is changing. The occupations that are growing and undersupplied almost universally require both high levels of numeracy and some amount of training beyond high school. However, large numbers of high-school graduates are unprepared for

college-level math. Subpar math ability either leads students to not pursue in-demand fields that they otherwise would enjoy or requires them to spend time, money, and financial aid eligibility on remedial coursework. Both are unnecessary obstacles to training more workers for undersupplied occupations.

What are the top three labor supply opportunities facing the region over the next five years based on the existing workforce in the region?

Below are the main labor supply opportunities we heard from our stakeholders.

Higher labor force participation for older workers

While the aging workforce is creating one set of labor supply problems via retirements, older workers are also entering encore careers rather than ceasing work entirely. Whether due to better health, financial concerns, or simply personal preference, the labor force participation rate of older workers has been increasing. This change provides a new source of skilled workers available for firms and can temporarily help ease shortages in occupations suited to the skills and capabilities of older workers. Taking advantage of this human capital will require employers to adjust their preconceptions about older workers and actively work to recruit such employees.

A concentration of partners

Though only one of the seven regions organized for this planning exercise, Greater Boston is home to a third of the Commonwealth's population and nearly half (47%) of its jobs. While this size produces challenges that are discussed later, it also confers advantages. The region is home to many communities, businesses, workers, colleges, school districts, regional planning organizations, transportation systems, and nonprofits. Each of these organizations have an existing set of programs and, crucially, a programmatic infrastructure that can be leveraged for region-wide priorities such as those outlined in this blueprint.

Attraction of domestic and international migrants

Though this blueprint focuses of labor shortages, broadly Greater Boston has witnessed strong labor supply growth, especially relative to other regions in the state, which, on net, have lost population. As with many cities, this growth has been fueled by both domestic migrants (in-state and out-of-state residents) and those from abroad. Without migrants, Greater Boston could not have sustained its economic gains. Domestic migrants typically move for employment opportunity and regional attractiveness, which Greater Boston has. International migrants also come for jobs or school but also tend to prefer places where they know someone. Openness to immigrants in the past allows Greater Boston to continue to attract them in the future.

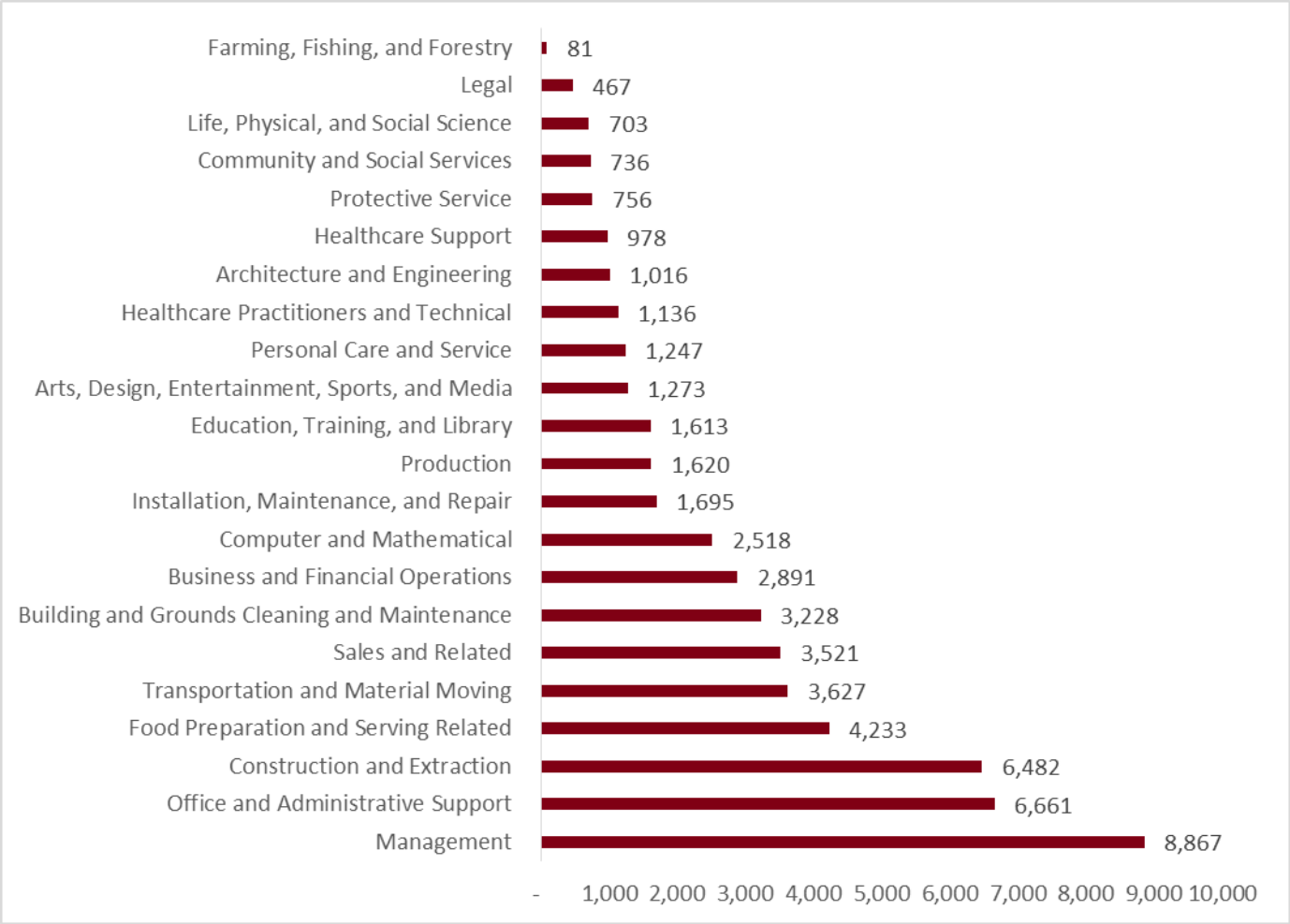
Based upon UI Claimant population, what is the region's largest supply of unemployed workers by job type?

The state provided each region with a unique count of unemployment insurance claimants. In Greater Boston in 2016, there were 55,345 unique uninsured claimants. The occupations of these claimants are displayed in Figure 3.

The highest number of claimants were managers with nearly 8,900 claimants in 2016. General and operations, sales, and marketing managers had the highest number of claimants within management occupations. Office and administrative support, construction, food preparation and serving, and transportation and material moving followed management in number of claimants. Several of these occupations, especially construction, have seasonal layoffs which partly explains why they rank near the top. There are also a substantial number of temporary and part-time occupations within these clusters.

On the opposite end, there were relatively low numbers of unemployed claimants in healthcare practitioner and technical and healthcare support, particularly when considering the employment levels in those fields in this region, with healthcare being the largest industry sector. Life, physical, and social sciences and community and social service occupations ranked in the bottom five in terms of unemployment claimants.

Figure 3. Number of UI Claimants by 2-Digit SOC category, Greater Boston, 2016

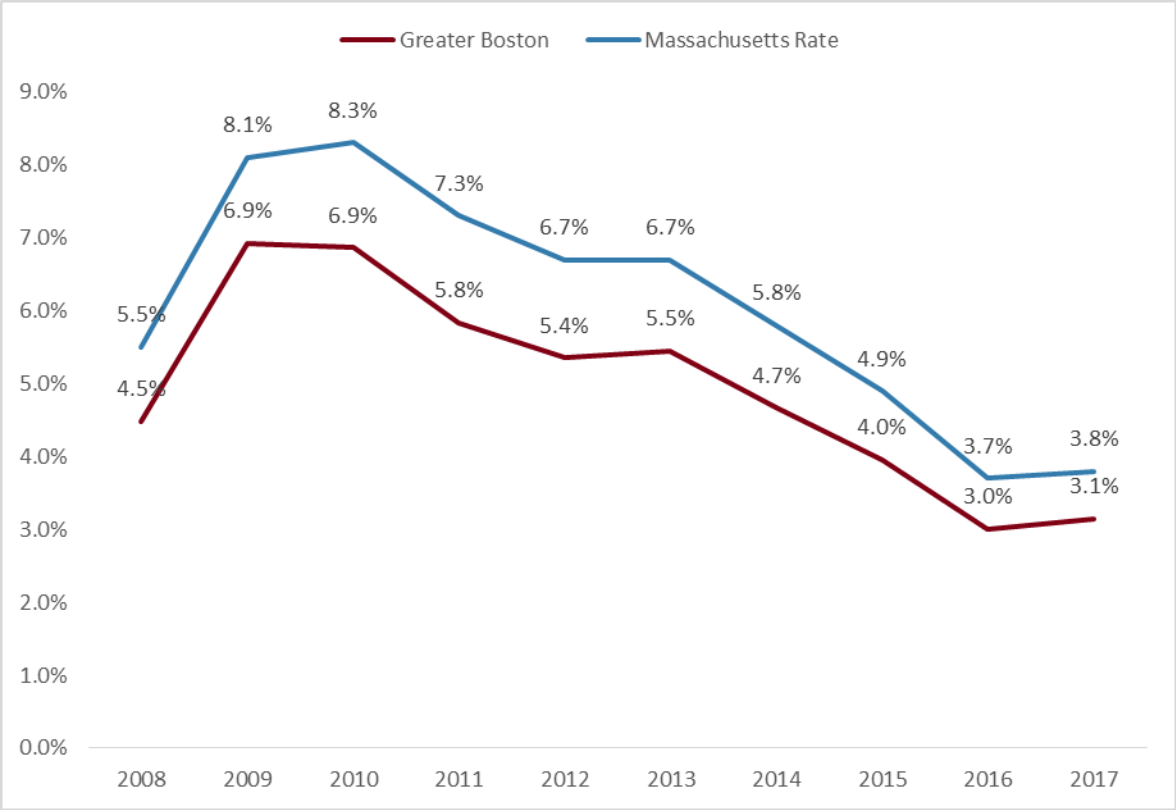


Source: Massachusetts Executive Office of Labor and Workforce, UI Claimant Data, 2016

What are the characteristics of unemployed and under employed workers in the region?

The Greater Boston region is currently experiencing very low rates of unemployment. The unemployment rate for Greater Boston (the three workforce development areas) has fallen to 3% during 2016 and 2017, down from nearly 7% in 2010 and 2011 following the Greater Recession. Unemployment in Greater Boston is also below the statewide average (3.1 percent vs. 3.8 percent in 2017).

Figure 4. Trends in Unemployment Rates of 16 and Older workers in Greater Boston and Massachusetts, 2008-2017



Source: Local Area Unemployment Statistics (LAUS)

However, the Greater Boston labor market is characterized by disparities in unemployment rates of workers across age, race-ethnicity, and educational attainment. To understand differences in unemployment rates, we examined county-level unemployment data from the American Community Surveys for 2012-2016 (5-year average). The five year ACS file has a large sample size that allows for comparing subgroups of the population. We analyzed the findings for Suffolk and Middlesex counties because they represent many of the cities and towns in the Greater Boston workforce region. Below are key findings.

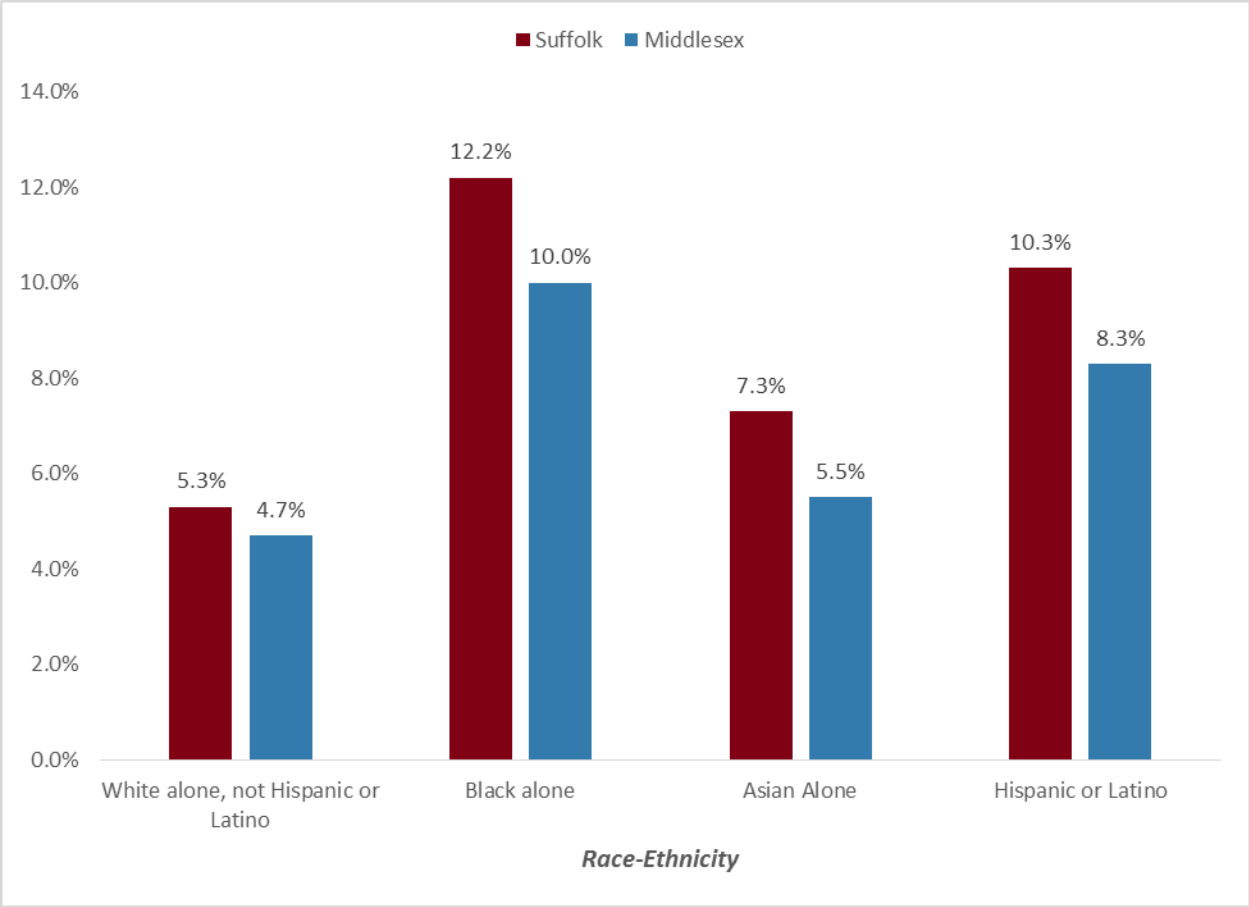
Age

In both Suffolk and Middlesex counties, unemployment rates were highest for teens (16-19) and young adults (20-24 years of age). In Suffolk County, the teen unemployment rate was 25.9 percent, more than three times the rate for all workers 16 and older during the 2012-2016 period.

Race-Ethnicity

Unemployment rates in both counties varied substantially across race-ethnicity. In Suffolk and Middlesex Counties, the unemployment rate of Black workers exceeded that of White, Non-Hispanic workers by ratios greater than 2:1 (Figure 5). Hispanic/ Latino workers also experienced higher rates of unemployment compared to White workers.

Figure 5. Unemployment Rates in Suffolk and Middlesex Counties by Major Race-Ethnic Group, 2012-2016

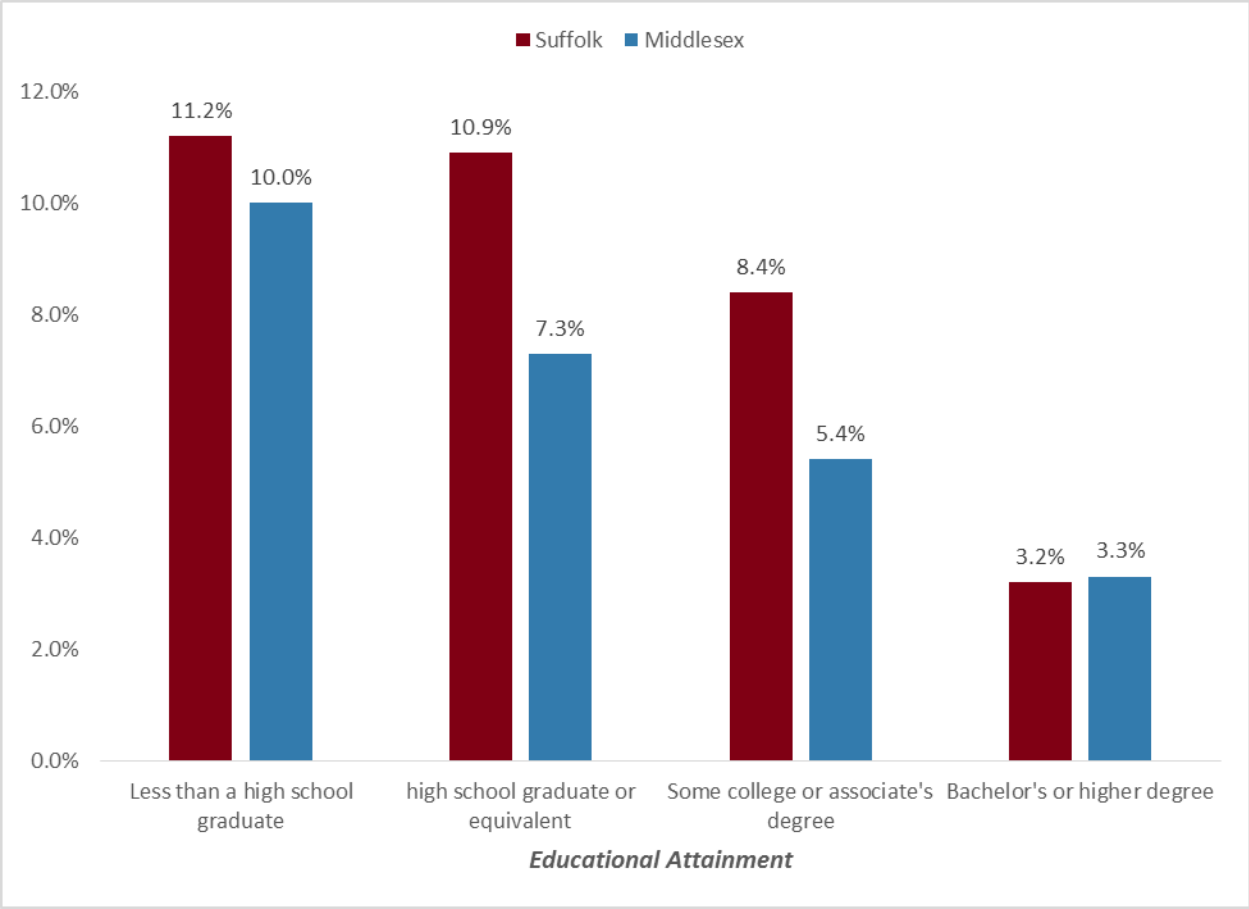


Source: American Community Surveys, 2012-2016

Educational attainment

Unemployment rates in the region fall with increased levels of educational attainment. Due in part to a large number of high-skilled jobs in Suffolk and Middlesex Counties, the unemployment rate over the 2012-2016 time period for workers with a bachelor's degree or degree was only 3.2 and 3.3 percent compared to 10 to 11 percent for those without a diploma or its equivalency. Unemployment rates for high-school graduates were 10.9 percent in Suffolk County and 7.3 percent in Middlesex County, considerably higher than the rate for those with a bachelor's degree or higher.

Figure 6. Unemployment Rates in Suffolk and Middlesex Counties by Educational Attainment, 2012-2016



Source: American Community Surveys, 2012-2016

Describe the universe of the region's existing pipelines of new workers (credentials) across public and private secondary and post-secondary institutions.

- **Highest and lowest number of new graduates by credential/CIP?**

The U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS) collects information on the credentials conferred by public and private colleges and universities. We analyzed postsecondary credentials awarded by institutions located in the Greater Boston region. During 2016, there were 40,451 graduates from institutions located in the area. The Greater Boston region has a large number of four-year private and public colleges. The share of new graduates in 2016 with a bachelor's degree was 78 percent, with the balance of graduates split evenly at 11 percent each between associate's degrees and postsecondary certificates. A breakdown of the fields of study by type of degree appears in Appendix B: Fields of Study in Greater Boston.

- **How does retention of graduates in your region influence supply?**

Due to being home to a large number of private and public universities and colleges, the Greater Boston region experiences a wave of in-migration of college students. Many of the students that attend school in this region will stay to work after earning their degree. As a result, the region is a net importer of college educated workers.

On the other hand, the region does lose a substantial amount of the students that come here to earn a postsecondary credential. Two earlier studies by the Boston Consulting Group in 2003 and World Class Cities Partnership in 2013 that tracked the retention patterns of graduates through alumni surveys from a subset of institutions in the Greater Boston region estimated that about 50 percent leave the region after earning a degree.

Despite the high share of graduates that leave the region, Greater Boston still ranks very high on measures of the 25-34 year-old workforce that have a college degree. The region is clearly one of the best educated regions in the U.S. If job market conditions continue to improve, then there are opportunities to retain more of the students that migrate to Boston to attend colleges and universities in the area.

Where do we want to go?

Criteria for Priority Industries/Occupations

The regional kick-off meetings with the WSC suggested a number of foundational criteria to prioritize industries and occupations, including existing job openings, jobs with low barriers to entry, jobs that lead to career pathways, and occupations with high demand (current openings, short/long term projections), and self-sustaining wages.

STATE CRITERIA

- High employer demand
- Talent Gaps (Ratio of Supply to Demand)
- High demand and high wage (4-5 Star Occupations)
- Career Pathways

REGIONAL CRITERIA

What additional criteria are important to your Regional Planning Team?

- Intensity of projected under supply: a high share of all the occupations in an occupational group (i.e., Computer and Mathematical) are projected to be under-supplied.
- Occupations require some postsecondary credentialing but less than a master's
- Opportunities for people with barriers
- Support industries that are important for the region's economic competitiveness

Priority Industries and Occupations

List your 2-3 priority industries by 2-digit NAICS. Where you choose to prioritize an industry that does not fit neatly into a 2-digit NAICS code (i.e. creative economy), note where it would best fit (i.e. Arts and Recreation) and describe the portion of the 2-digit industry you are prioritizing. For each selection, write a brief justification of your choice.

- NAICS 62: Health Care and Social Assistance – The largest industry in terms of employment and ranks near the top in terms of growth from 2001 to 2016, both in Greater Boston and in each of the three workforce development areas that comprise Greater Boston. The LQ analysis supports the notion that this sector is crucial for our region's economic competitiveness. Job projections demonstrate that employment is expected to continue to grow, which will present workforce challenges, but also opportunities.

- NAICS 54: Professional and Technical Services – The second largest industry in terms of employment and ranks near the top in terms of growth from 2001 to 2016, both in Greater Boston and in each of the three workforce development areas that comprise Greater Boston.

The LQ analysis indicates that this sector is crucial for the region's economic prosperity. It has grown considerably over the past 16 years and is projected to grow over the next 10 years. Firms in these industries, specifically those that employ technology workers, will face challenges in finding talent to support future growth because of the labor supply, housing, and transportation issues referenced in this blueprint.

List 3 to 5 priority occupations or occupational groups by SOC code (4-8 digit, as necessary). Include a short description justifying the choices. In building the list regions should consider:

- **The list of top 4 and 5 star occupations identified in the previous section (green)**
- **Occupations that are part of a career pathway (but maybe lower stars) and;**
- **A further prioritization of those occupations on the list experiencing a constricted "supply" of workers or new graduates with necessary skills (credentials, degrees, apprenticeships etc.) for occupations.**

The specific occupations that are being prioritized were listed in the previous section. At the 5-digit level, they mostly fall under these 7 groups below.

- Computer and Information Analysts (SOC: 15-1120)
- Software Developers and Programmers (SOC: 15-1130)
- Database Administrators and Network Architects (SOC: 15-1140)
- Computer Support Specialists (SOC: 15-1150)
- Health Technologists and Technicians (SOC: 29-2000)
- Nursing, Psychiatric, and Home Health Aides (SOC: 31-1000)
- Other Healthcare Support Occupations (SOC: 31-9000)

Industries and Occupations – Critical but not Prioritized. (OPTIONAL) If the team would like to describe industries and occupations that are notable in your region but not prioritized during this regional prioritization process, please list them here with a description of what makes the industry/occupation significant.

The regional planning team discussed several industries and sectors of the economy that are critical to the region because of current and projected growth, the size of the industry and its importance to the region, and because it represents a growing cluster of industries and/or occupations (i.e. Creative Economy). However, many of these sectors were not chosen as the focus of this exercise because they do not meet our regional criteria, are not macro-regional issues, or are cyclical. While not prioritized here, these sectors are the subject of initiatives within one or more of the WDBs.

The following industries were not prioritized in this blueprint, but are critical to the region.

- Hospitality
- Construction
- Finance
- Creative economy
- Life sciences
- Advanced manufacturing
- Retail

Assets

For each of the selected priority industries and occupations (purple section), articulate existing assets and gaps in capacity.

Credential Asset Mapping Tool. For priority industries and occupations that require credentials, use the Credential Asset Mapping Tool in Attachment 1 to demonstrate assets and gaps for each priority industry and occupation.

See Appendix A: Credential Asset Mapping Tool on page 31.

Non-Credential Asset and Gap Analysis. For priority industries and occupations that do not require a credential, describe what existing assets in the region can meet the employer demand, and where systemic gaps prevent meeting employer demand.

Per our regional criteria, all our selected occupations require a credential beyond high school.

Vision, Mission, Goals

Vision. State 2-5 things that you hope will be true in your region in 10 years through the lens of education, workforce development, and economic development to address the priority industries and occupations identified in the Blueprint. Consider questions such as "Which industries will thrive?" and "What are the living standards and educational levels of your population?"

The Greater Boston region will have clearly defined pathways from K-12 to higher education aligned to regional priority industries, to which all residents, especially vulnerable and disadvantaged groups, have access.

- This results in the Greater Boston region having sufficient, well-prepared, and well-educated workers in high demand fields earning livable wages.
- This allows all employers, including small employers, to find the necessary talent, space, and land use policies to thrive and grow.

Mission. State what each set of core partners has agreed to do in order to achieve your vision. What will educational partners do? What will economic development partners do? What will workforce development partners do? (For example: Our education partners will focus resources on expanding career awareness and exposure, as well as the quantity and variety of education programming in priority industries X, Y, and Z. Please note these are broad mission statements rather than specific strategies, below).

Our mission is to achieve our vision by coordinating the numerous education, industry, and workforce development efforts within our region through an ongoing working group that will focus on:

- Aligning workforce development and education (K-12 and beyond) to be responsive to the labor market by reducing skill gaps in ever-evolving high-demand fields
- Leveraging existing training programs or implementing new culturally-appropriate programs that will ensure consistency of work readiness skills in our workforce
- Influencing business and policy decisions to enact system changes that will allow underrepresented segments of our population to achieve better employment outcomes in order to address inequality in the state
- Connecting employers with appropriate housing for their workforce via transportation

Goals. Describe your shared goals for 2018, 2020, and 2022. Note that goals listed here should be those that need participation of players from multiple entities and across two or three of the systems for accomplishment.

In the space below, we have highlighted the goals that we hope will address the business and labor force challenges and priority supply gaps that were discussed previously. Because in many cases the initiatives required to achieve these goals will be in addition to existing programs, the availability of resources is a primary constraint on the goals' achievability and realism.

By 2018, we will…What new programs, initiatives, or policies would you like your team to enact or create related to your priority industries and occupations?

- Inventory current capacity for education and training for health care and IT occupations
- Develop spatial representation of priority sectors and occupations to match with workforce analysis and education
- Create a dashboard that identifies and tracks critical data points
- Use inventory, spatial representation, and dashboard to set quantitative targets for 2020 and 2022

By 2020, we will…What results will those initiatives and/or programs and policies achieve? For example, how many new workers will enter the workforce; will there be reductions in labor shortages, or what industries will see stabilization?

- Our targets for 2020 will be interim measures of our 2022 goals

By 2022, we will…What are the longer-term results that you will achieve by those initiatives and/or programs and policies? For example, how many new workers will enter the workforce; will there be reductions in labor shortages, or what industries will see stabilization?

- Increase the number of job seekers trained to enter priority occupations or pathways
- Reduce the labor supply gap in priority occupations
- Increase the number of postsecondary grads in programs that align with priority occupations
- Increase access to dual enrollment programs for suburban districts and at-risk students
- Reduce the share of high school grads unprepared for college math
- Increase the number of seats available in English language classes

How do we get there?

Shared Strategies

Continuous Communication. How often and in what way will you meet to review progress towards shared goals and make course corrections?

- Larger committee will meet quarterly starting in early 2018
- Sub committees/groups will meet as-needed based on assignments from quarterly meetings
- Convene Super Region of those who identified IT and health care, especially neighboring regions of Northeast, Southeast, and Central with which we share a labor market
- Established and consistent communication and partnerships between workforce development, education, and economic development with a continuous feedback
- Re-assess membership of Greater Boston Workforce Planning Committee
  - Decide who is needed to fulfil goals? Who is missing?
  - Get more even representation across Education / Economic development / Workforce development
- Setup an on-line portal (such as Base Camp) to support efficient communication across committee members
- Increase involvement of professional associations and K-12 (Mass MTA, Collaboratives, etc.)
- Convene separate committee/meeting to make transportation connection, include all 5 secretaries (add HHS and Transportation)

Shared Measurement Systems. What data and measurement systems will you rely on to support shared understanding of how well you are meeting your goals and making progress towards a shared vision?

We have identified regional coordination as a critical element of our ability to succeed in achieving our goals as a region. Because our region is so large and contains many overlapping initiatives, the first aspect of creating a shared measurement systems is to connect all the right voices by continuing and building upon the structure we created to complete this planning exercise. As a result, the current plan for building and maintaining these systems is to use the continuous communication objectives outlined above to achieve the objectives below.

- Prioritize and refine each goal and assign responsibility for leading the effort
- Connect planning committee's efforts to existing sector initiatives being implemented by cities, towns, and other planning organizations
- Revisit, revise, and renew goals and strategies through ongoing meetings so we remain nimble

- Develop communications for targeted outreach to municipal economic development which is the ultimate level at which labor supply and demand initiatives will play out
- Connect other training and education providers to regional planning process

Other Shared Strategies. What other shared strategies will the region adopt to ensure progress towards the common agenda?

No other shared strategies.

Mutually Reinforcing Activities

Education. Describe the changes in programming, recruitment, retention and placement strategies, assessment, tracking, or other strategies specific educational partners have committed to in order to meet shared regional goals.

- Propose and develop college programs in IT and health care
- Provide career awareness and exploration activities to high school and early college students to inform them of career paths in priority areas
- Ensure Pre-K through 16 expectations and coursework are aligned
- Provide professional development for high school teachers from higher education
- Explore strategies to improve college math readiness of high school graduates
- Increase access to ESOL for K-12 students

Workforce Development. Describe the changes in programming, employer relations, recruitment, retention and placement strategies tracking, or other strategies specific workforce development partners have committed to in order to meet shared regional goals.

- Focus Youth Works (publicly-funded internships) and connecting activities (employer-paid internships) on jobs in chosen sectors/occupations and career awareness activities
- Embed these goals and strategies into existing health care and technology industry initiatives
- Focus funds under control of WDBs on chosen sector jobs (i.e. ITAs – Training vouchers)
- Increase access to ESOL for adult learners

Economic Development. Describe the changes in economic development strategy that economic development partners have committed to in order to meet shared regional goals.

- Support innovative solutions to last mile services
- Support coordination of transit services across jurisdictions and providers
- Advocate for transportation and land use policies aligned with plan objectives
- Coordinate with State agencies (MOBD, Mass Development, MTCs, Digital Health, etc.) on employer retention, expansion, and attraction initiatives

Conclusion

As we undertook the challenge of devising solutions to critical labor supply gaps in our local economy, we repeatedly came back to a crucial point: we anticipate our region's greatest challenge will be coordinating programmatic objectives that will cover one-third of the state's population and half of its jobs. Furthermore, if we are successful, today's labor supply gaps will not be tomorrow's. As a result, a focus of our group will be to build an infrastructure that will allow Greater Boston to be more proactive and nimble in its approach to labor supply issues. This blueprint forms the foundation of a future approach.

As with all things, intention without means is only half the story. Identifying critical labor supply shortages in a few priority industries and occupations does not absolve us from other demands on our education, workforce development, and economic development system. In fact, ignoring our other obligations will only create greater problems in the future. We will continue to search for the resources necessary to implement the goals identified in this report. We are heartened to see that the results of the regions' planning blueprints are already being put to use in the Governor's FY2019 budget. Previously-announced initiatives like Housing Choice, the MBTA's study of the future needs of the commuter rail, and the *Opportunities for All* strategy address many of the same challenges identified in our stakeholders meetings.

It continues to be the goal of the workforce development boards of Greater Boston and the stakeholders who provided input for this project to create an environment that serves all the region's residents and provides them with the skills and opportunity to earn a living wage. We are looking forward to working with each other, our neighboring regions, and the Commonwealth to better serve the citizen of Greater Boston and Massachusetts.

Appendix A: Credential Asset Mapping Tool

Table 7. Credential Asset Map for Respiratory Technicians (29-1000)

Occupation	*List the occupation the credential is for, including the SOC code.*	**Respiratory Technicians (29-1000)**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	Degree. All degrees granted in the Greater Boston region for Respiratory Care Therapy/Therapist (CIPS code 51.0908) were master's degrees. There were no degrees granted at any level for Respiratory Therapy Technician/Assistant (CIPS 51.0812).
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	Northeastern University Global Network - 15
Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	The program is geared toward adult learners and includes experiential learning.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time.
Pell-eligible?	*Is the program Pell-eligible?*	No, post-graduate

Fee?	*What are the fees?*	Approx. $30,000
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Unknown
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Credential is a master's degree though some of its requirements may be available to be used toward another program.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Yes, the program focuses on leadership and management training for existing respiratory therapists.
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	This program is designed for existing respiratory care therapists so it does not add to supply. That does not mean other institutions are not training respiratory techs, it only means that their degrees/certificates are not classified using the precise code for this award type (51.0908).

Table 8. Credential Asset Map for Health Technologists and Technicians (29-2000)

Occupation	*List the occupation the credential is for, including the SOC code.*	**Health Technologists and Technicians (29-2000)**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	Roughly half of all credentials awarded are degrees (386/801). Nearly all the remaining are certificates below the baccalaureate level (414/801). The degrees used for this category are as follows:

CIPS Code	Degree Name
51.10	Clinical/Medical Laboratory Science/Research and Allied Professions
51.0602	Dental Hygiene/Hygienist
51.0901	Cardiovascular Technology/Technologist
51.0910	Diagnostic Medical Sonography/Sonographer and Ultrasound Technician
51.0905	Nuclear Medical Technology/Technologist
51.0911	Radiologic Technology/Science - Radiographer
51.0920	Magnetic Resonance Imaging (MRI) Technology/Technician
51.0808	Veterinary/Animal Health Technology/Technician and Veterinary Assistant
51.3901	Licensed Practical/Vocational Nurse Training
51.0707	Health Information/Medical Records Technology/Technician

Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number*	

Institution	Awards
Assabet Valley Regional Technical School	40
Benjamin Franklin Institute of Technology	10
Blue Hills Regional Technical School	33
Boston University	42
Bunker Hill Community College	41
Fisher College	25

	of individuals receiving the credential per year.	

Lawrence Memorial Hospital School of Nursing	10
Massachusetts Bay Community College	121
MCPHS University	113
Medical Professional Institute	169
Middlesex Community College	83
Mount Ida College	89
Regis College	13
Roxbury Community College	11
University of Massachusetts-Boston	1

Degree Name	**Awards**
Cardiovascular Technology/Technologist	9
Clinical/Medical Laboratory Science/Research and Allied Professions	169
Dental Hygiene/Hygienist	148
Diagnostic Medical Sonography/Sonographer and Ultrasound Technician	42
Health Information/Medical Records Technology/Technician	53
Licensed Practical/Vocational Nurse Training	258
Magnetic Resonance Imaging (MRI) Technology/Technician	15
Nuclear Medical Technology/Technologist	6
Radiologic Technology/Science - Radiographer	63
Veterinary/Animal Health Technology/Technician and Veterinary Assistant	38

Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If*	Many of these programs can be done part-time, online, or with non-traditional classroom hours though they do require onsite clinical training. Because of industry regulation, certified technicians must pass board exams thus whatever the pedagogical methods or special accommodations for non-traditional students, all student must still pass a standard exam to be able to practice in their field.

	no, how to basic learners matriculate?	
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time. Require onsite clinical rotation.
Pell-eligible?	*Is the program Pell-eligible?*	The vast majority of these programs are not post-graduate (all but 22 of 801) and are offered by institutions that participate in Title IV (federal financial aid) therefore it is likely that many are eligible for Pell grants and other federal aid. Some of these programs are for less than one academic year's effort, which may limit their eligibility for financial aid.
Fee?	*What are the fees?*	Varies by degree/certificate type
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because sub-baccalaureate degree/certificate programs are meant to offer practical training to create the opportunity for gainful employment for students, many associate's degree programs and sub-baccalaureate certificates are created with input from employers.
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Yes. Many of these credentials form the first step in a worker's career path. For example, many MRI/CT/Mammography techs start as radiology techs before adding more training and credentials.
Portable?	*Are the credentials portable to other states/*	Though the credential may be accepted, workers would likely have to retest for another state's boards.

	industries? If so, describe.	
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	Our interviews suggested adding CT and mammography techs to this list. However, we could not find any degrees awarded in these fields. It is likely that our data from the Integrated Postsecondary Education Data System (IPEDS) is missing these graduates. A search of local institutions confirms that programs are available in these fields though they seem limited to experienced imaging professions and thus may be offered as add-ons to a radiological technician certificate rather than as separate certificates, making our data blind to them. Our interviews also suggested that the education expectations of clinical and lab techs is moving upward from associate's level to bachelor's level. These increases may cause some disruption in the training pipeline.

Table 9. Credential Asset Map for Nursing Aides (31-1000)

Occupation	*List the occupation the credential is for, including the SOC code.*	**Nursing Aides (31-1000)**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	All credentials awarded in Nursing Assistant/Aide and Patient Care Assistant/Aide (CIPS 51.3902) were for certificates requiring less than one academic year.
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	**Institution** / **Awards** Bunker Hill Community College: 19 Middlesex Community College: 32 **Grand Total: 51**
Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	Many of these programs can be done part-time, online, or with non-traditional classroom hours though they do require onsite clinical training. Because of industry regulation, nursing aides must pass board exams thus whatever the pedagogical methods or special accommodations for non-traditional students, all student must still pass a standard exam to be able to practice in their field.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time. Must do an onsite clinical rotation.
Pell-eligible?	*Is the program Pell-eligible?*	Programs of less than one academic year require extra approvals from the Department of Education before being declared eligible for federal financial aid. It is possible that some nursing aide programs may not offer aid.

Fee?	*What are the fees?*	Varies by degree/certificate type
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because sub-baccalaureate degree/certificate programs are meant to offer practical training to create the opportunity for gainful employment for students, many associate's degree programs and sub-baccalaureate certificates are created with input from employers. In this case, hospitals are going a step farther and taking on much of the training themselves (see note on Gaps below).
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Yes. Can be used to begin a career in nursing.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Though the credential may be accepted, workers would likely have to retest for another state's boards.
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	Low unemployment may be pushing some hospitals to move away from seeking certified nursing aides, which requires the student spend time at a skilled nursing facility where training slots are capacity-constrained and often teach skills different from those needed in an acute care setting. Hospitals can train workers for the skills they will need in their specific role but the training would not yield a marketable and portable certification.

Table 10. Credential Asset Map for Other Health Care Support (31-9000): Medical and Clinical Assistants

Occupation	*List the occupation the credential is for, including the SOC code.*	**Other Health Care Support (31-9000): Medical and Clinical Assistants**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	The region awarded 370 credentials for Medical/Clinical Assistants (CIPS 51.0801). Most (228) are certificates below the baccalaureate level of at least one but less than two academic years' effort. However, 43 associate's degrees were awarded along with 99 awards for programs of less than one academic year.
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	

Institution	Awards
Bay State College	21
Bunker Hill Community College	36
Fisher College	8
Lincoln Technical Institute-Somerville	104
Medical Professional Institute	33
Middlesex Community College	33
Millennium Training Institute	12
The Salter School-Malden Campus	123
Grand Total	**370**

Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	Many of these programs can be done part-time, online, or with non-traditional classroom hours though they do require onsite practical training.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time. Must do an onsite practical training.

Pell-eligible?	*Is the program Pell-eligible?*	These programs are offered by institutions that participate in Title IV (federal financial aid) therefore it is likely that many are eligible for Pell grants and other federal aid. Some of these programs are for less than one academic year's effort, which may limit their eligibility for financial aid.
Fee?	*What are the fees?*	Varies by degree/certificate type
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because sub-baccalaureate degree/certificate programs are meant to offer practical training to create the opportunity for gainful employment for students, many associate's degree programs and sub-baccalaureate certificates are created with input from employers.
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Yes. Many of these credentials form the first step in a worker's career path. For example, medical assistants may do more training to become phlebotomists.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Absent state licensing requirements, it is likely that the credential is portable.
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	As is apparent from the information on the type of credential above, there is considerable variability among medical/clinical assistant programs. Our interviews identified the lack of homogeneity in the curriculum as a challenge because employers cannot be sure what they will get with applicants who have completed a medical assistant program.

Table 11. Credential Asset Map for Computer and Information Analysts (15-1120)

Occupation	*List the occupation the credential is for, including the SOC code.*	**Computer and Information Analysts (15-1120)**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	The region awarded 44 credentials for Computer and Information Systems Security/Information Assurance (CIPS 11.1003) and 0 for Computer Systems Analysts (11.0501). The awards included 30 bachelor's degrees, 12 master's degrees, and 2 certificates of less than one academic year.
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	**Institutions** / **Awards** Boston University: 2 Brandeis University: 10 ITT Technical Institute-Norwood: 16 ITT Technical Institute-Wilmington: 14 Massachusetts Bay Community College: 2 **Grand Total: 44**
Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	Some of these programs can be done part-time, online, or with non-traditional classroom hours. However, given that they are mainly college degrees, it may not be possible to finish the entire program without some in-person instruction.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time.
Pell-eligible?	*Is the program Pell-eligible?*	These programs are offered by institutions that participate in Title IV (federal financial aid) therefore it is likely that many are eligible for Pell grants and other federal aid. The 12 post-graduate degrees are not Pell-eligible while the programs of under one year also may not be.

Fee?	*What are the fees?*	Varies by degree/certificate type
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because these are predominantly bachelor's and master's degree programs, the level of employer validation is likely less than can assumed in sub-baccalaureate degree/certificate programs.
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Somewhat. A bachelor's degree in this field can be a useful, though not necessary, step toward further advanced study in a related field.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Yes
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	All the information presented for the IT credentials was found using the closest available degree name. In many cases, institutions do not award degrees with this level of specificity, especially for bachelor's degrees and higher so they are not captured in this analysis. That being said, it is likely that many of the graduates with general degrees do possess the necessary skills to fill various priority occupations. Our interviews confirm this possibility by suggesting that many employers look for general skills in entry-level candidates, who specialize as their career progresses. See the final asset map for a description of all computer-related bachelor's degrees.

Table 12. Credential Asset Map for Software Developers and Programmers (15-1130)

Occupation	*List the occupation the credential is for, including the SOC code.*	**Software Developers and Programmers (15-1130)**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	The region awarded 26 degrees and certificates for Computer Programming (CIPS 11.02) and Web/Multimedia Management (CIPS 11.1004). Eight were associate's degrees and 18 were for programs of less than one academic year.
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	**Institution** / **Award** Bunker Hill Community College: 24 Massachusetts Bay Community College: 2 **Grand Total: 26**
Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	Some of these programs can be done part-time, online, or with non-traditional classroom hours.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time.
Pell-eligible?	*Is the program Pell-eligible?*	These programs are offered by institutions that participate in Title IV (federal financial aid) therefore it is likely that many are eligible for Pell grants and other federal aid. Programs of under one year may not be.
Fee?	*What are the fees?*	Varies by degree/certificate type
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because sub-baccalaureate degree/certificate programs are meant to offer practical training to create the opportunity for gainful employment for

		students, many associate's degree programs and sub-baccalaureate certificates are created with input from employers.
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Somewhat. The associate's degrees awarded in this field can be a useful, though not necessary, step toward further advanced study in related field.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Yes
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	All the information presented for the IT credentials was found using the closest available degree name. In many cases, institutions do not award degrees with this level of specificity, especially for bachelor's degrees and higher so they are not captured in this analysis. That being said, it is likely that many of the graduates with general degrees do possess the necessary skills to fill various priority occupations. Our interviews confirm this possibility by suggesting that many employers look for general skills in entry-level candidates, who specialize as their career progresses. See the final asset map for a description of all computer-related bachelor's degrees.

Table 13. Credential Asset Map for Database Administrators and Network Architects (15-1140) and Computer Support Specialists (15-1150)

Occupation	*List the occupation the credential is for, including the SOC code.*	**Database Administrators and Network Architects (15-1140) and Computer Support Specialists (15-1150)**
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	The region awarded 115 degrees and certificates in Computer/Information Technology Administration and Management (CIPS 11.10) and for Computer Support Specialists (CIPS 11.1006). Almost 70% were degrees (14 associate's, 30 bachelor's, and 33 master's). The remaining 38 were mainly for brief programs of less than one year, of which 1 was for Computer Support Specialists.
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	**Institution** / **Awards** Boston University: 8 Brandeis University: 31 Bunker Hill Community College: 20 ITT Technical Institute-Norwood: 16 ITT Technical Institute-Wilmington: 14 Massachusetts Bay Community College: 9 Millennium Training Institute: 17 **Grand Total: 115**
Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	Some of these programs can be done part-time, online, or with non-traditional classroom hours. However, given that they are mainly college degrees, it may not be possible to finish the entire program without some in-person instruction.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time.

Pell-eligible?	*Is the program Pell-eligible?*	These programs are offered by institutions that participate in Title IV (federal financial aid) therefore it is likely that many are eligible for Pell grants and other federal aid. Post-graduate degrees are not Pell-eligible. Programs of under one year also may not be.
Fee?	*What are the fees?*	Varies by degree/certificate type
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because these are predominantly bachelor's and master's degree programs, the level of employer validation is likely less than can be assumed in sub-baccalaureate degree/certificate programs.
Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Somewhat. A college degree in this field can be a useful, though not necessary, step toward further advanced study in a relevant field.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Yes
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	All the information presented for the IT credentials was found using the closest available degree name. In many cases, institutions do not award degrees with this level of specificity, especially for bachelor's degrees and higher so they are not captured in this analysis. That being said, it is likely that many of the graduates with general degrees do possess the necessary skills to fill various priority occupations. Our interviews confirm this possibility by suggesting that many employers look for general skills in entry-level candidates, who specialize as their career progresses. See the final asset map for a description of all computer-related bachelor's degrees.

Table 14. Credential Asset Map for Computer and Information Sciences and Support Services (CIPS 11) and Computer Engineering (CIPS 14.09)

Occupation	*List the occupation the credential is for, including the SOC code.*	Supplemental credential data for all computer and IT occupations. This asset map focuses on the bachelor's degrees awarded in the broadest categorization of computer-related fields, which will help to address the true supply of trained workers for the widest variety of in-demand computer and IT fields. These numbers do include some overlap with the preceding computer/IT asset maps. Any bachelor's degrees with CIPS code beginning with 11 are also counted here.
Type of Credential & Title of Credential	*List the type of credential (e.g. Certificate, Degree, Certification, License, or Apprenticeship Certification)*	The region awarded 1,301 bachelor's degrees in Computer and Information Sciences and Support Services (CIPS 11) from 27 institutions and 87 bachelor's degrees from 5 institutions in Computer Engineering (CIPS 14.09).
Credential Provider	*List all training/ education providers that provide this credential in your region. For each provider, list the average number of individuals receiving the credential per year.*	

Institutions	Bachelor's Degrees
Bentley University	47
Boston College	118
Boston University	139
Brandeis University	43
Fisher College	6
Framingham State University	31
Harvard University	98
ITT Technical Institute-Norwood	16
ITT Technical Institute-Wilmington	14
Massachusetts Institute of Technology	290
Newbury College	4
Northeastern University	145
Northeastern University Global Network	26

		Regis College: 1 Simmons College: 8 Suffolk University: 37 The New England Institute of Art: 7 Tufts University: 109 University of Massachusetts-Boston: 113 Wellesley College: 44 Wentworth Institute of Technology: 92 **Grand Total: 1,388**
Integrated/ Accelerated	*Is the training integrated with work experience and/or accelerated for adult learners? If no, how to basic learners matriculate?*	Some of these programs can be done part-time, online, or with non-traditional classroom hours. However, given that they are all bachelor's degrees, it may not be possible to finish the entire program without some in-person instruction.
Online/ Classroom/ Work-based	*Describe education environment and instructional methods.*	Can be done online or in-person, full-time or part-time.
Pell-eligible?	*Is the program Pell-eligible?*	These programs are offered by institutions that participate in Title IV (federal financial aid) and are all bachelor's degree programs therefore it is likely that many are eligible for Pell grants and other federal aid.
Fee?	*What are the fees?*	Varies by program
Employer-validated?	*Do local employers validate the credential? If so, describe.*	Because these are all bachelor's degree programs, the level of employer validation is likely less than can be assumed in sub-baccalaureate degree/certificate programs.

Stackable?	*Is the credential stackable with other certificates? If so, describe.*	Somewhat. A degree in this field can be a useful, though not necessary, step toward further advanced study in a relevant field.
Portable?	*Are the credentials portable to other states/ industries? If so, describe.*	Yes
Credit/ Non-Credit?	*Are they credit or non-credit?*	Credit
Gaps?	*Are there gaps in the pipeline for this occupation that require new strategies in the blueprint?*	These degrees are presented to close a gap in our approach with the IPEDS data that misses degree programs that are not classified under the precise fields that correspond to our priority occupations. This group of computer-related bachelor's degree holders will form the core of the workforce needed to fill high-demand software developer and information analyst roles.

Appendix B: Fields of Study in Greater Boston

CIPS Degree Field	Certificates Below BA	Associate's	Bachelor's
Agriculture, Agriculture Operations and Related Sciences	0	0	11
Natural Resources and Conservation	0	0	220
Architecture and Related Services	39	0	283
Area, Ethnic, Cultural, Gender, and Group Studies	22	0	345
Communication, Journalism, and Related Programs	1	45	1,919
Communications Technologies/Technicians and Support Services	15	33	145
Computer and Information Sciences and Support Services	167	273	1,301
Personal and Culinary Services	1,063	232	32
Education	126	298	533
Engineering	2	25	1,755
Engineering Technologies and Engineering-related Fields	119	198	194
Foreign Languages, Literatures, and Linguistics	0	10	420
Family and Consumer Sciences/Human Sciences	10	1	218
Legal Professions and Studies	54	35	50
English Language and Literature/Letters	28	14	886
Liberal Arts and Sciences, General Studies and Humanities	3	1,094	437
Biological and Biomedical Sciences	75	89	2,079
Mathematics and Statistics	0	7	656
Multi/Interdisciplinary Studies	12	1	605
Parks, Recreation, Leisure and Fitness Studies	88	28	226
Philosophy and Religious Studies	0	0	302
Theology and Religious Vocations	1	0	54

CIPS Degree Field	Certificates Below BA	Associate's	Bachelor's
Physical Sciences	0	7	554
Science Technologies/Technicians	35	38	0
Psychology	0	76	2,064
Homeland Security, Law Enforcement, Firefighting, and Related Protective Service	71	297	292
Public Administration and Social Service Professions	85	27	359
Social Sciences	5	26	4,119
Construction Trades	28	15	0
Mechanic and Repair Technologies/Technicians	721	96	8
Precision Production	27	0	0
Visual and Performing Arts	195	108	3,059
Health Professions and Related Programs	1,445	883	3,373
Business, Management, Marketing, and Related Support Services	231	856	6,566
History	0	14	591
Total	**4,668**	**4,826**	**33,656**

Source: IPEDS

Appendix C: Stakeholders' Group

Name	Organization	Name	Organization
Paul Matthews	495/MetroWest Partnership	Geoff Vercauteren	Mass. Dept. of Higher Education
Aixa Beauchamp	Beauchamp and Associates	Jennifer Gaudet	Maynard Public Schools
Joanne Pokaski	Beth Israel Deaconess Medical Center	*Chris Albrizio-Lee*	*Metro North REB*
Alysia Ordway	*Boston PIC*	*Sunny Schwartz*	*Metro North REB*
Angela McCabe	*Boston PIC*	Josh Eichen	Metropolitan Area Planning Council
Anika Van Eaton	*Boston PIC*	Marc Draisen	Metropolitan Area Planning Council
Joe McLaughlin	*Boston PIC*	Paul Joseph	MetroWest Chamber of Commerce
Neil Sullivan	*Boston PIC*	Judy Burke	Middlesex Community College
Michelle Sylvaria	Boston Public Schools	Elizabeth Skidmore	New England Regional Council of Carpenters
Alice Murillo	Bunker Hill Community College	*Sylvia Beville*	*Partnerships for a Skilled Workforce*
George Hallsmith	Bunker Hill Community College	Salvador A. Pina	Roxbury Community College
Michelle Elias Bloomer	Bunker Hill Community College	Christopher Jurek	UMDI
Pam Eddinger	Bunker Hill Community College	Dana Henry	UMDI
Christine Tibor	Framingham Public Schools	Elizabeth Williams	UMDI
F. Javier Cevallos	Framingham State University	Mark Melnik	UMDI
Katie Hebert	Framingham State University	Rod Motamedi	UMDI
David Podell	Mass Bay Community College	Steven Aalto	Work Inc.
William Noonon	Mass Rehabilitation Commission		

Names in *italics* are members of the three workforce development boards of Greater Boston. Names in underline are the members of the UMass Donahue Institute who facilitated this process.