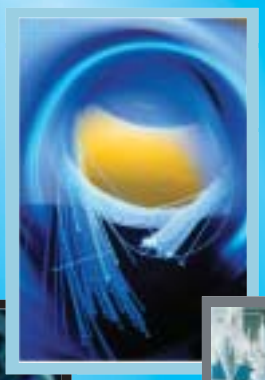

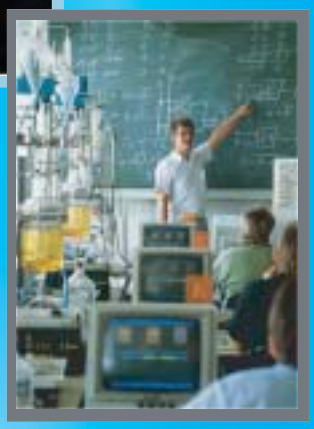

Index of the Massachusetts Innovation Economy 2001

Massachusetts TECHNOLOGY Collaborative

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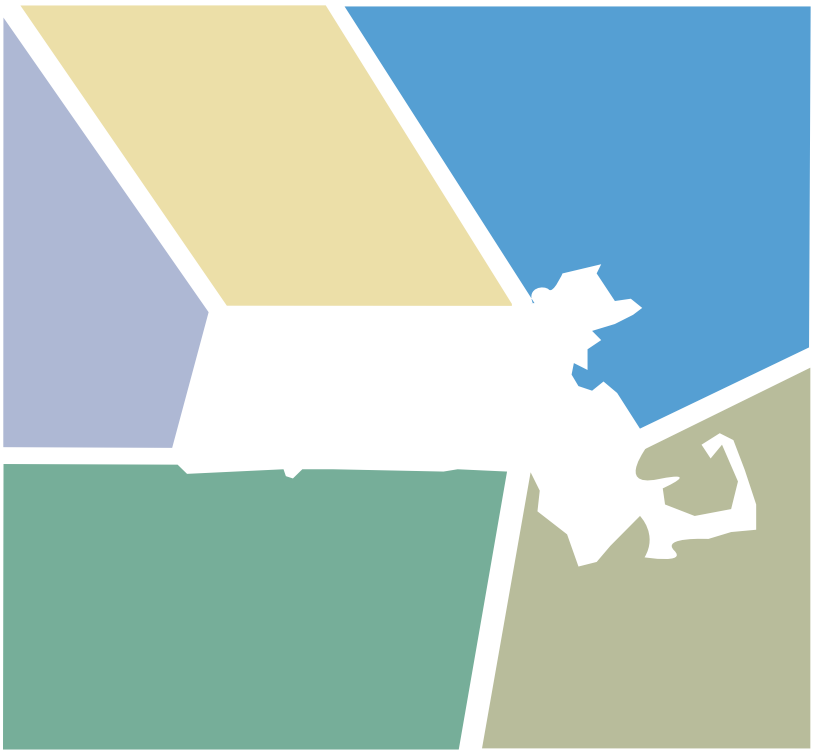

Index of the Massachusetts Innovation Economy 2001

Prepared by:

Massachusetts Technology Collaborative
Westborough, Massachusetts

The Massachusetts Technology Collaborative (MTC) harnesses the state's most abundant resource — KNOWLEDGE — to encourage economic development throughout the Commonwealth.

Created in 1994 at the request of the state legislature, MTC identified the state's knowledge-based innovation economy as a promising venue for economic success. Since then MTC has undertaken projects that enhance the state's reputation as a world-class research and technology development center and foster the long-term growth of technology-based industry.

MTC offers hands-on project guidance to communities interested in nurturing high-tech business and provides expert advice on a wide variety of policy issues facing Massachusetts. In addition, MTC regularly analyzes the state's economic performance and the impact of federal R&D investments on the Commonwealth's economy.

How the Innovation Economy *Works*

What is the Index *and the Massachusetts Innovation Economy?*

This is a report on the Massachusetts economy. Like most such reports, it uses statistics to illustrate how the state economy performs, and compares its performance to that of similar state economies throughout the United States. These states are referred to as the Leading Technology States (LTS) throughout the *Index*, and they include: California, Colorado, Connecticut, Minnesota, New Jersey, and New York.

But unlike most economic studies, the *Index* does not report on the entire economy of Massachusetts. The *Index* does not cover all the industries active in the state, nor all the jobs in the state. Instead, the *Index* focuses on nine broad industry groups—or "clusters"—that are concentrated in Massachusetts, and thirty statistical indicators that tell us something about the state of innovation in Massachusetts.

Why Does the Index *Do This?*

The *Index* is based upon the premise that innovation is a critical factor in the growth of the state's economy.

The nine key industry clusters featured in this report represent industries that are heavily concentrated in Massachusetts. The jobs within these nine clusters represent a high proportion of all the jobs in the Massachusetts economy, compared to jobs within similar clusters in other states, and in the U.S. economy as a whole. Their dominance within the state's economy is a reflection of their competitiveness, either in the past or in today's economy.

The *Index* focuses on the nine key industry clusters to better understand how the state's climate for innovation influences the growth of these heavily-concentrated clusters, and to help gain important insights into the entire Massachusetts economy.

Why is Innovation Important?

Innovation is one of the most important factors behind economic growth in today's global economy. As the nation competes and trades with many countries that often have lower costs, innovation may be the most important factor in generating future economic growth in the U.S.

Economists now estimate that fifty percent or more of all the growth in the U.S. economy since World War II has been the result of new technology. Some economists estimate that as much as two-thirds of U.S. economic growth during the 1990s was due to the introduction of new technologies, particularly information technologies (IT).

Many tend to think that innovation and technology are the same thing, but businesses innovate all the time, with and without new technology. Boston's financial services industry has grown for decades, thanks in part to the creation of the mutual fund—not a technology, but an innovative way of purchasing and holding stocks on behalf of investors.

Economists now speak of innovation as the result of a series of inter-related processes that range from basic scientific research to methods of finance and business strategy. Increasingly, they speak of these processes as part of a national innovation system. According to the RAND Corporation, "the system. . . has emerged as one of our most important national assets, as important a source for growth today and in the future as have been. . . the nation's natural resources in the past."

Why Does Innovation Matter to Massachusetts?

If innovation is extremely important to the U.S. economy, it is critically important to the Massachusetts economy.

For 150 years or more in Massachusetts, new industries with new technologies have supplanted older, shrinking industries with older technologies. Most recently, the state's Internet and data communications hardware and software companies picked up the economic slack left by the decline of minicomputer and defense electronics firms.

Historically, Massachusetts has maintained a competitive advantage in the innovative, high-tech sector, which depends on highly-skilled and well-educated workers, R&D, venture capital, and a culture that supports entrepreneurial thinking. In contrast, the state has not been, nor sought to be, the lowest cost producer of mass-produced, standardized products that required unskilled workers.

Innovation not only creates new products, it also creates new industries, which create new jobs in Massachusetts. Innovation creates a competitive edge for Massachusetts firms, which increasingly compete with firms all over the world, as well as with U.S. firms. Just as important, innovation creates productivity-increased economic output from each person working in Massachusetts. In effect, higher productivity cuts the cost of doing business, since the state's historical costs of doing business are high relative to the rest of the U.S. Sustained productivity increases create the environment for increased wages and other employee compensation.

Harvard Business School Professor Michael Porter recently summarized the process this way in a report for business and government leaders in San Diego:

"The central economic goal. . . should be to attain and sustain a high and rising standard of living for. . . citizens. The ability to earn a high and rising standard of living depends on increasing productivity which in turn depends on innovation. The central challenge, then, in enhancing prosperity is to create the conditions for sustained innovation output."

For a complete description of the data and analysis utilized in the *Index*, see page 60.

How the Index *Works*

The Framework for Innovation

The Massachusetts Innovation Economy has three interrelated and interactive components:

- Results: Outcomes for people and business—job growth, rising average wages, and export value
- Innovation Processes: Dynamic interactions that translate resources into results—idea generation, commercialization, entrepreneurship, and business innovation
- Resources: Critical public and private inputs to the Innovation Economy—human, technology, and investment resources, plus infrastructure.

The *Index* measures progress of three key components of the Massachusetts Innovation Economy. It is based on a dynamic conceptual framework that links them together. The framework measures Massachusetts progress in leveraging its resources through innovation to create higher levels of economic performance. In a vital cycle, high economic performance supports ongoing investment and reinvestment in the key resources required to sustain the Innovation Economy.

The format of this document reflects the relationship among these components. The *Index* begins by presenting the economic **results** of the Massachusetts Innovation Economy and follows with measures of the state's **innovation processes**. It concludes by setting out a number of **resources** that fuel the Massachusetts Innovation Economy.

Selecting Indicators

Indicators are quantitative measures that tell us how well Massachusetts is doing: whether the state is going forward or backward; getting better, worse, or staying the same.

A rigorous set of criteria was applied to all potential indicators. All of the selected indicators:

- Are derived from objective and reliable data sources
- Are statistically measurable on an on-going basis
- Are bellwethers that reflect the fundamentals of economic vitality
- Can be understood and accepted by the community
- Measure conditions in which there is an active public interest.

Benchmark Comparisons: Leading Technology States

MTC believes that Massachusetts should be able to track the Innovation Economy over time. This monitoring capacity is crucial for regularly assessing its strength and resilience.

At the same time, benchmark comparisons can provide an important context for understanding how Massachusetts is doing in a relative sense. Thus, in some cases, Massachusetts is compared with the national average or with a composite measure of six competitor Leading Technology States (LTS). The six LTS chosen for comparison throughout the 2001 *Index* are California, Colorado, Connecticut, Minnesota, New Jersey, and New York. Appendix B describes the methodology for selecting the LTS.

Nine Key Industry Clusters

It is important to monitor the impact of innovation through those key industry clusters critical to the state's economy. MTC has a program devoted to facilitating cluster development in Massachusetts. Nine industry clusters have been identified that have a disproportionately large presence in the state and are linked to the Innovation Economy. These clusters range from the long established, such as Postsecondary Education, Defense, and Textiles & Apparel industries, to Software & Communications Services (which includes telecommunications), and Innovation Services (which includes engineering services and management consulting services). Appendix C provides a detailed definition for each of these clusters.

The *Index* tracks nine key industry clusters; together, they account for 25% of non-government employment in Massachusetts and 38% of total private sector payroll. Several indicators compare total key industry cluster employment to total private sector employment and wages in the state. When referring to total private sector employment and wages in the state, this does not include farm or government employment (which includes Federal, State, and local workers, postal workers, and education workers at the state and local level).

At $67,306, the average wage paid by the nine key industry clusters is 34% higher than that of the rest of the Massachusetts economy ($44,605).

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Massachusetts Facts

Area	8,257 square miles
Population	6,349,097 (Census 2000)
Total employment (All industries)	3,151,000 (2000 average, Massachusetts Department of Employment & Training)
Ethnic composition	White: 84.5%, Black/African American: 5.4%, American Indian/Alaska Native: 0.2%, Asian: 3.8%, Native Hawaiian and Other Pacific Islander: 0.1%, Other Race: 3.7%, Two or More Races: 2.3% (Census 2000)
Age distribution	0-9 years old: 13.1%, 10-19 years old: 13.3%, 20-44 years old: 37.7%, 45-64 years old: 22.4%, 65 and older: 13.5% (Census 2000)
Percentage of residents born in a foreign country	12.5% (Census 2000 Supplementary Survey)
Percent of population 25 years & older w/	Bachelor's degree or higher: 34.9% High school degree or higher: 86.0% (Census 2000 Supplementary Survey)

KEY

The direction of the arrows reflects the performance of the Massachusetts Innovation Economy in 2000 and the key determinants of its future growth: results, innovation process and resources.

- ▲ Denotes a strength
- ▼ Denotes a potential sign of weakness
- ◆ Denotes mixed progress

Measuring Results

Several of the indicators in the 2001 Index *demonstrate that the state's Innovation Economy began to put the brakes on its rapid growth in 2000. Growth in several areas slowed even more rapidly in the first half of 2001. As the* Index *goes to press, the impacts of the September terrorist attacks on the United States may compound an economy that had already begun to slow down.*

It is worth noting that, even as some indicators began to weaken, growth in several of the state's key industry clusters continued, and even accelerated in some cases. The ongoing economic slowdown will test whether the recent, rapid growth in the state's clusters represented sustainable growth in the base of the Innovation Economy, or whether the state's key industry clusters will find themselves regrouping to compete on new terms in a changed national and world economy. The state's long-term prospects will bear heavily on its ability to innovate its way to new growth, as it has so often in the past.

The extent of the current economic weakness can be seen in a summary of several economic indicators comparing the first half of 2001 to the first two quarters of 2000:

	MA Q1 and Q2 2000	MA Q1 and Q2 2001	US Q1 and Q2 2000	US Q1 and Q2 2001
Venture Capital	$5.6 billion	$2.2 billion	$50.3 billion	$18.6 billion
IPOs	24	2	267	30
Consumer Confidence	135.5	101.3	140.7	114.3
Unemployment Rate	2.9%	3.8%	4.0%	4.5%

The weakness comes on the heels of robust growth which had driven job expansion in most of the state's key industry clusters, including some that have been in long-term decline (measured in jobs, not necessarily in revenue), including the Diversified Industrial Support and Computers & Communications Hardware clusters.

▲ Overall net employment in the nine key industry clusters grew 3.1% from 1999 to 2000, compared to an overall state increase of 2.8%. This percentage growth is more than double that in the previous one-year period (1.2%). Seven of the nine key industry clusters added jobs between 1999 and 2000, compared to four key industry clusters in the previous year.

▼ The Computers & Communications Hardware, Diversified Industrial Support, and Financial Services clusters were the only Massachusetts clusters whose employment growth, 3.1%, 2.9%, and 1.5%, respectively, outpaced the LTS average in these clusters.

◆ The Software & Communications Services cluster added 10,991 new jobs in 2000. The cluster's growth was the largest absolute and relative employment increase of the nine key industry clusters between 1999 and 2000 (see page 63 for list of clusters). However, the annual growth rate of 10.4% fell short of the comparable LTS average growth rate (11.0%) during this period. Also, this Massachusetts cluster's average pay of $81,210 in 2000 lagged the LTS average pay of $84,519 in the same cluster.

◆ Financial Services remained the largest cluster, with 141,355 jobs, adding 2,055 positions between 1999 and 2000. During the previous one year period, this cluster added more than 6,200 jobs. The average pay per worker ($80,861) makes Financial Services the third-highest paying key industry cluster in Massachusetts. But Financial Services continues to have its average pay lagging the LTS and it is the state's biggest gap relative to other states' average pay.

▲ With total employment of just over 722,900, eight of the nine key industry clusters (all except Postsecondary Education) each paid an average annual wage greater than the all-industry Massachusetts average ($44,605) and the LTS average for all industries ($42,947).

▲ Since January 2001, the Job Opportunity Index (JOI) has ranked Massachusetts first in the U.S. in best places to find a job.

▼ As of July 2001, both the Massachusetts and U.S. Consumer Confidence Indices had dropped over 20% from the previous year. This decline is in sharp contrast to the period from 1992 to 2000, during which there had been a steady increase in both the state's and the nation's consumer confidence.

Index Highlights

Measuring the Innovation Process

The innovation process in Massachusetts is actually a wide number of inter-related processes that turn the raw talent of Massachusetts and new ideas and discoveries into new products, companies, jobs and wealth. In 2000, Massachusetts remained very strong in the processes that generated new ideas and discoveries, but began to see signs of weakness in the processes that govern new business creation and business growth.

◆ In 2000, Connecticut and Minnesota tied with Massachusetts at 61 patents per capita. Massachusetts has historically led the LTS in patents per capita. Patent activity is diverse in the state, and it is most active in the Healthcare and Transportation/Aerospace sectors.

▲ The number of invention disclosures received by Massachusetts universities, hospitals, and research institutions increased by 9.5% from 1998 to 1999.

▲ The number of new technology licenses issued by Massachusetts universities, hospitals, and research institutions increased by 10.2% between 1998 and 1999. Royalties from technology licenses were $51 million in 1999, an 18.6% increase from 1998.

▲ New business incorporations in Massachusetts increased 7.3% in 2000 to 18,569, from 17,306 in 1999.

▲ Massachusetts received a total of 708 SBIR awards in 1999, a 12.9% increase from 1998. On a per capita basis, Massachusetts had the highest award rate in the U.S. in 1999.

◆ Although the total number of IPOs decreased 5.6% from 1999 to 2000 in Massachusetts, the average dollar value of IPOs jumped to $207 million in 2000, a 179% increase from the previous year ($74 million).

▼ From March 2000 to March 2001, Massachusetts NASDAQ firms market capitalization decreased 62.8%. Over time, from March 1996 to March 2001, the state's annual average growth rate of 9% for NASDAQ firms lagged California (25%), the U.S. (16%), and New York (15%).

▼ Massachusetts had 238 corporate headquarters in 2000, a 1.2% decrease from 1999 (241).

Measuring Resources

Human resources and investment capital are critical to the growth of the Innovation Economy. Massachusetts continues to be strong in capital resources, including R&D funds and venture capital. However, the state faces chronic slow growth in its labor force, which portends a long-term shortage of skilled technical workers, notwithstanding the current economic slow-down and resulting layoffs.

▼ Massachusetts experienced a net out-migration of 10,200 people in 2000, over 70% more than in 1999 (-5,900).

▲ In 2000, 32.7% of Massachusetts residents had a bachelor's degree, compared to 25.6% nationwide.

▲ The total number of graduates awarded degrees in engineering in 2000 was 4,512, a 3.3% increase from the previous year (4,368).

▲ The state experienced a 19.4% increase in total number of graduates awarded degrees in computer and information science in 1998.

▼ In 2000, 77% of Massachusetts schools had access to the Internet from one or more classrooms, which was the fourth-lowest among the LTS. Only 52% of Massachusetts schools accessed the Internet through a high-speed connection (T1 or cable modem), which was the second lowest percentage among the LTS.

◆ Of those Massachusetts students taking the SAT in 2000, only 6% indicated an intention to major in engineering in college, the second lowest percentage among the LTS. Although the intended major of Computer or Information Science of students taking the SAT in 2000 ranked low across the LTS, Massachusetts increased to 6% in 2000 from 5% in 1999.

▲ In 1999, Massachusetts had the highest per capita federally-funded R&D expenditures ($303) of the LTS, with the next closest LTS, California ($146), at 48.2% of the Massachusetts level. At $202 per 1,000 people, Massachusetts is substantially ahead of its nearest competitor in per capita health R&D expenditures. Of the six other LTS, Connecticut ($82) ranks second with 40.6% of the Massachusetts per capita spending amount.

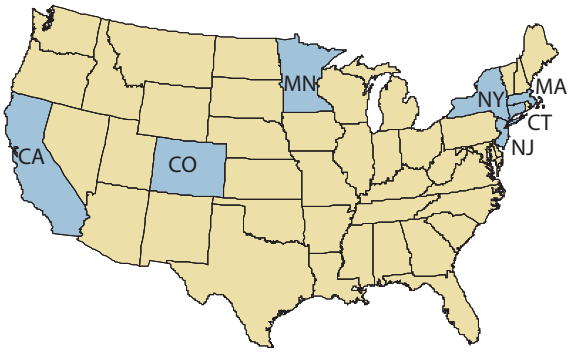
▲ Venture capital investment in Massachusetts soared to $8.8 billion in 2000, doubling the 1999 investments at $4.4 billion. Massachusetts attracted a 10.1% share of the venture capital in the U.S. in 2000, increasing its share from the previous year (9.5%).

▲ Companies in the Consumer/Business Services sector received the highest amount (25%) of venture capital investment in Massachusetts in 2000, followed by Software (23%), then Communications (22%). The state also continued to have strong venture investment in e-commerce relative to that of the other LTS, with over $7.1 billion being invested in 2000, more than doubling the total 1999 investment ($3.4 billion). Over two-thirds of the e-commerce and Internet-related venture capital investments in Massachusetts were in the Business Services and Software/Database Management industry sectors.

▼ In 2000, the median price of a single-family home in Massachusetts was $205,793, the second highest among the LTS and all states in the U.S. Between 1996 and 2000, the median home price in Massachusetts increased by 47.4%, the highest percentage increase among the LTS.

Nine Key Industry Clusters

Computers & Communcations Hardware	Defense	Diversified Industrial Support	Financial Services	Healthcare Technology	Innovation Services	Postsecondary Education	Software & Communcations Services	Textiles & Apparel



Leading Technology States

Massachusetts
and
California
Colorado
Connecticut
Minnesota
New Jersey
New York

Building an Innovation Economy in Every Region of Massachusetts

The American Industrial Revolution started in earnest in Massachusetts and touched every corner of the state. When manufacturing industries were at their peak in the Commonwealth, nearly every major city was a center of industry, and many smaller towns were known for their factories and mills.

The availability of waterpower, critical infrastructure, and natural resources determined where the new mills and factories were built. During this industrial age, these mills and factories served as the backbone of communities throughout Massachusetts, attracting a workforce that ultimately settled in close proximity to the workplace.

Today, workers still move to where business is located, but the profound shift in the state's economy towards technology-based or technology-intensive enterprise has increasingly turned this equation around: many businesses now go, or are created, where the skilled people are to be found.

This is certainly true in Greater Boston. The heavy concentration of colleges and universities, and the deep pool of technically skilled people to be found in Greater Boston have driven the growth of the region's Innovation Economy industry for over fifty years. During this time, much of nearby Merrimack Valley has also been absorbed into the Innovation Economy, notwithstanding the continuing economic need in its older cities.

While this expansion has historically occurred in Greater Boston and the Merrimack Valley, in recent years, the Innovation Economy has found its way west of Route 128. In fact today, close to half (48%) of the Innovation Economy's total employment in the nine key industry clusters lies outside of the Greater Boston and Merrimack Valley regions.

However, it is clear that the resources for regional expansion—measured in educational attainment, skills training, research and development, and access to capital—are unevenly distributed across the Commonwealth. Hence, public and private sector leaders throughout the state continue to promote new strategies to attract high-growth companies to their areas and nurture existing ones, in order to expand the Innovation Economy to every region of the state.

This year's special analysis looks at seven distinct regions of the state and presents several summary statistics that suggest some of the strengths and potential weaknesses of the regions that pertain to growth in the Innovation Economy. An accompanying summary, "Innovation Initiatives," enumerates some of the approaches that the state's regions have adopted to spur the growth of the Innovation Economy.

The existing industrial base: the challenge of new technology in industries young and old

Each region's success in expanding the Innovation Economy rests in some part on its success in maintaining the competitive edge of its existing firms. Today, each region of the state is host to companies within the nine key industry clusters identified in the *Index*.

However, the challenge to expand this existing base differs region by region. For example, the Greater Boston economy is dominated by the services industries (Financial Services, Innovation Services, Software and Communication Services) while Postsecondary Education is the leading cluster in the Berkshire and Pioneer Valley regions.

Variations aside, what the *Index* has defined as the Diversified Industrial Support cluster continues to play an important role in several regions. In fact, in Central and Southeastern Massachusetts, the Diversified Industrial Support cluster is the largest employer of all the key industry clusters.

The Diversified Industrial Support cluster represents a broad range of companies that creates products for industrial customers both within Massachusetts and outside the state. This cluster is a legacy of the state's historic manufacturing tradition. Its products range from metal castings and forgings to fabrication of plastic forms, to industrial machinery and advanced materials: tools or components of end products manufactured by other firms, for the most part. It remains an important cluster for the state because it provides a wide range of industries in the state with a nearby and ready capability to fabricate parts and components, and because it remains a source of relatively well-paying jobs.

Data available to the *Index* does not allow further analysis into the trends of this cluster, yet the trends at work in the state's overall manufacturing sector are almost certainly present within the Diversified Industrial Support cluster. These trends represent a continued shift away from older, mature industries to newer, technology-based industries; a trend towards higher degrees of automation and productivity-enhancing technologies. Productivity-enhancing technology can bolster output with fewer workers. Higher productivity in the manufacturing sector has allowed the state to maintain its industrial output (measured in dollar value) with fewer workers directly employed in manufacturing. * [Forrant, Robert et al, *Knowledge Sector Powerhouse: Reshaping Massachusetts Industries and Employment During the 1980s and 1990s*, University of Massachusetts-Lowell Center for Industrial Competitiveness and University of Massachusetts Donahue Institute, 2001, p.32].

The continuing transformation of the Diversified Industrial Support cluster means two things for the state's regional economies:

First, cluster firms in the region are under pressure to keep up with the demands of their customers for high worker productivity, low-cost production, and the utilization of newer generations of technology. Second, cluster firms in even the most mature industries are under pressure to find and retain employees who can operate new generations of technology.

For example, retaining skilled Information Technology (IT) employees can be as much of a challenge for these firms as it is for the technology-intensive firms in the Greater Boston region. Recently, extension of the H1B visa program to allow a continued influx of foreign IT workers into the U.S. has led to a diversion of H1B fee revenues into new training programs that upgrade the skills of incumbent and older workers. Job training agencies in several regions of the state have these types of programs well underway. Some of the most innovative education and training initiatives in the state, such as those at Springfield Technical Community College, have focused on meeting the needs of workers both in the region's existing, more mature industries, and in growing Innovation Economy industries such as telecommunications.

In short, retaining even the blue collar jobs still present in the Diversified Industrial Support cluster poses a challenge increasingly similar to that faced by Greater Boston, Merrimack Valley, and the state: ensuring the education and training of a workforce that can adapt to the changing demands of innovation in a broad range of industries.

Innovative Initiatives in EXISTING INDUSTRY

Pioneer Valley: The University of Massachusetts-Amherst Center for Manufacturing Productivity, Amherst (1990-present)
This Center undertakes projects with Western Massachusetts manufacturers to improve manufacturing processes and new product development. http://www.ecs.umass.edu/

Central: Manufacturing Assistance Center, Worcester (1998-present)
The Manufacturing Assistance Center (MAC) is a private, not-for-profit corporation founded to increase the competitiveness of local small manufacturers. http://www.massmac.org

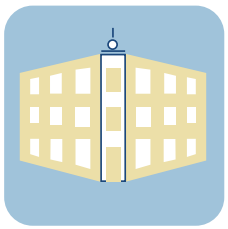
Greater Boston: Greater Boston Manufacturing Partnership, Boston, (1994-present):
The GBMP is a non-profit corporation that was established to help small and medium sized manufacturing companies to become more productive and competitive. http://www.gbmp.org

Infrastructure: Real Estate and Broadband Connectivity

Infrastructure, including roads, water supply, and wastewater disposal services are a prerequisite for industrial growth in the regions. For decades the state's regions have developed and marketed real estate to attract outside firms or nurture existing ones.

The dramatic difference in real estate prices between Greater Boston and other regions has spurred the regions to highlight this difference as much as possible.

During the late 1990s peak, first-class office space in downtown Boston cost approximately $63 per square foot, one of the most expensive rental rates in the U.S. Comparable space along the I-495 Corridor cost approximately $33 per square foot. As the entire Greater Boston area becomes more built-out, and sites become more rare and more expensive to develop, available and affordable land elsewhere in the state becomes more attractive.



The current economic slowdown has sharply eroded the price advantage that regions outside of Greater Boston have enjoyed relative to real estate in Greater Boston. Office rental rates in some Greater Boston locations have declined by as much as 10-20 percent over the prior year. Nevertheless, aggressive marketing of commercial real estate, region by region, will remain a priority of regional economic development organizations.

Innovative Initiatives in INFRASTRUCTURE

Berkshire: BTech, Great Barrington (2000-present)
This association fosters communication and teamwork among professionals and companies for whom utilizing modern technology is one of the key attributes for success. http://www.btechonline.org

Southeast: Advanced Technology and Manufacturing Center, Dartmouth (1999-present)
The UMass ATMC is a regional incubator for advanced technology and manufacturing solutions available to existing industry in the region, and to new ventures. The ATMC partners with industry, government agencies and other academic institutions. http://www.umassd.edu/advtechctr

Statewide: The Massachusetts Alliance for Economic Development (MAED), (1993-present) a public/private initiative funded by the state's utilities and other industries, provides statewide, coordinated marketing for all the regions. http://www.massecon.com/

Merrimack Valley: Merrimack Valley Economic Development Council, Lawrence (1999-present)
The Council's mission is to promote the economic interests of the entire Merrimack Valley; it encourages greater communication and cooperation between the public and private sectors, and fosters collaborative efforts between and among communities, leading to sustainable economic growth and prosperity for every community in the Valley. http://www.mvcouncil.com

Cape Cod and Islands: Cape Cod Business Information Center (BIC), West Barnstable (1998-present)
BIC is a joint venture among several businesses and is located at Cape Cod Community College. It provides a wide variety of resources including one-on-one business counseling, access to capital, and specialty training. http://www.capecodchamber.org/

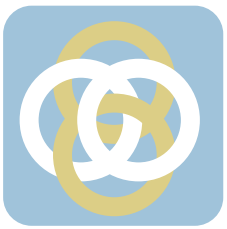
Broadband

In the last several years, it has also become apparent that high-speed Internet access and other data communications services have become a necessity for business growth. A wide variety of businesses, small and large, are increasingly dependent upon rapid Internet and data communications services for basic business functions, such as purchasing and supply chain management and inventory control.

There is virtually no non-proprietary data available to indicate precisely where competing high-speed services are available in the Commonwealth. As a rule, high-speed services of one variety or another can be provided to any location in Massachusetts that can be served by a wire strung from the telephone network, provided the user is willing to pay. The real issue for the state's regions is how quickly competitive, high-quality services of various types will be available to serve them, at prices that are reasonably competitive with better-served areas of the state and the country.

Special Analysis

Unfortunately, while the availability and pricing of commercial real estate becomes more competitive with distance from Greater Boston, the opposite is largely true when it comes to telecommunications services. Direct, high-speed connections to the Internet, such as those used by major corporations, are available in all areas of the state, but priced on a distance-sensitive basis that tends to impose higher prices on outlying areas of Western Massachusetts and some other, less-populated regions. The two primary forms of consumer Internet access—Digital Subscriber Line (DSL) services and cable system Internet access—are less expensive, and when reliably deployed, sufficient for a wide variety of business users. However, both are unevenly deployed in even the most affluent areas of Greater Boston, and cable Internet services are not currently marketed for business users.



For the foreseeable future, new deployment of high-speed Internet and data communications services will be targeted to areas of proven demand. The current economic slowdown and the shrinking availability of investment funds for telecommunications has driven telecommunications providers to give up on plans that blanket (or "overbuild") a given area with new infrastructure in expectation of earning a return over time; providers now expect to build out their systems only in areas that will generate a near-immediate return.

Some regions of the state have responded to the problem by organizing Internet users to aggregate their demand, and to attract competitive providers by demonstrating that a profitable base of business is ready for them. Among the first such groups is Berkshire Connect, an affinity group of business Internet users organized by the Massachusetts Technology Collaborative and others in 1997. Since early 2000 Berkshire Connect has provided high-speed Internet and data services to its members through a new, regional network constructed by private vendors chosen through a competitive proposal process.

Innovative Initiatives in BROADBAND

Berkshire: Berkshire Connect, Berkshire County (1997-present)
Berkshire Connect is an initiative to improve Berkshire County's telecommunications infrastructure. The Connect initiative will become a principal foundation for renewing cultural and economic vitality without sacrificing quality of life. http://www.bconnect.org/

Pioneer Valley: Franklin-Hampshire Connect, Franklin-Hampshire Counties (2000-present)
This is an initiative of the Franklin Regional Council of Governments—in partnership with the Massachusetts Technology Collaborative and other state, regional, and local entities—to assess the current state of the telecommunications infrastructure in Franklin and Hampshire counties and to develop strategies for improving access to low-cost, high-quality broadband Internet services throughout the region.
http://www.franklinconnect.org/

Greater Boston: Coastal Connect, Gloucester (March 2001-present)
Coastal Connect is a nonprofit corporation that was formed to bring affordable, reliable, high-speed telecommunications to the coastal communities of Northeastern Massachusetts. Coastal Connect intends to make the Northeast region a more attractive market to commercial telecommunications vendors by identifying a group of businesses and nonprofit organizations that will commit to purchasing a certain level of telecommunication services from selected vendor(s). http://www.capeannconnect.org/

Statewide: MassBroadband Initiative (2000-present)
MassBroadband is an initiative of the Massachusetts Technology Collaborative in partnership with the Massachusetts Software and Internet Council. The MassBroadband Advisory Board identifies key policy issues, project goals, and possible outcomes for achieving ubiquitous broadband deployment throughout the Commonwealth. http://www.massbroadband.com/

Housing

Economic development officials rarely think of regional housing as an economic development tool, but housing may well be an even more potent source of competitive advantage for regions outside of Greater Boston than commercial real estate. By year-end 2000, median housing costs in Greater Boston were 32.7% above the state average, and more than two-thirds the national average. Housing costs on Cape Cod and in the Merrimack Valley followed at 26.2% and 19.3% above the national average.

Lower housing costs are one of several reasons why many of the fastest-growing communities in the state are found along the I-495 Corridor. While housing in several I-495 communities is becoming more expensive, the pressure of accelerated costs in Greater Boston and along I-495 has pushed the leading edge of new housing growth west and south of these two regions.

The outward sprawl of new housing and new business facilities has raised growth management concerns in the I-495 Corridor, in the Southeast, and other regions. A positive strategy for regions outside Greater Boston would be one that would parlay the availability of comparatively lower cost housing into new business growth in an environmentally-balanced manner.

This will not be an easy job. With the exception of Cape Cod, average housing prices are lower in the regions outside of Greater Boston and the Merrimack Valley, but they are still high by national standards. High housing costs throughout the state are thought to be one of the reasons for the continuing outflow of Massachusetts residents to other parts of the country. (See Indicator 20). Only the Berkshire and Pioneer Valley regions have housing prices that are close to the national average. The capability of regions outside Greater Boston to capitalize on housing prices that are relatively low by Massachusetts standards is undoubtedly constrained by an unfavorable comparison to other regions outside of Massachusetts that can offer both quality jobs and affordable housing.

Innovative Initiatives in EDUCATION & WORKFORCE DEVELOPMENT

Pioneer Valley: Springfield Technology Community College, Springfield (1967-present)
The college has created a number of innovative programs linking its educational programs to area employers, and has been very active in the telecommunications field. http://www.stcc.mass.edu

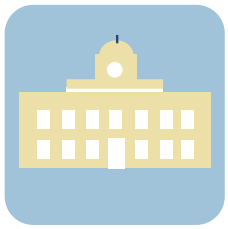
STCC Initiatives include:
The Northeast Center for Telecommunications Technologies, Springfield, (1997-present)
This center provides technical training in telecom-related fields, acting in close coordination with telecom providers, hardware and software companies. http://nctt.org; The Springfield Technical Community College Technology Park, Springfield, (1996-present)
It is only community college-owned industrial park in the country, and home to several telecommunications industry tenants.
http://www.stcc.mass.edu/techpark

Greater Boston, Merrimack Valley, and Pioneer Valley: Youth Tech Entrepreneurs (1997-present)
YTE is a program that helps high school students develop technology and entrepreneurial skills by helping them upgrade their own schools' technology programs. The YTE program currently operates in the Burlington, Everett, Haverhill, Lawrence, Malden, Medford, Springfield, and Waltham school systems. http://www.yte.org

Greater Boston: The MetroWest Center of Excellence for Women and Minorities in Science, Technology, Engineering, and Math, Ashland, Framingham, Holliston, Hopkinton, and Natick (1998-present):
This is a partnership of local school systems and industry to upgrade science and mathematics instruction and spark interest in technical careers among female and minority students. Female and minority students are greatly under-represented in college engineering courses and other technical disciplines nationwide. http://mwschooltocareer.org

Education and Workforce Development

The Postsecondary Education cluster is a cornerstone of the Innovation Economy. With colleges and universities located in every region of the state, Massachusetts has one of highest concentrations of postsecondary institutions in the U.S., which makes the state attractive to many young people looking for a wide range of choices in educational opportunities. While Greater Boston leads the state in number of colleges and universities (84) and in the number of students enrolled, other regions also attract their fair share of undergraduate students.



For example, Pioneer Valley colleges and universities account for over fifteen percent of total postsecondary student enrollment in the state; only Greater Boston has more students. Many students in both Greater Boston and the Pioneer Valley come from outside of Massachusetts. Non-native graduates of Greater Boston colleges and universities are widely acknowledged to be one of the region's greatest assets, as many of the most significant new firms established since World War II were created by entrepreneurs who originally came from out of state to attend college in Massachusetts. In recent years the Pioneer Valley has seen a number of new companies spring up near its colleges and universities, created by faculty members or alumni of the area's schools. While new companies continue to be created around the entrepreneurial atmosphere fostered by colleges and universities of the Pioneer Valley and other regions, they have yet to realize their full potential for Innovation Economy growth as has Greater Boston.

In several regions of Massachusetts the influx of college students into the region has been offset by a decade-long decrease in residents of prime working age (25-45 years old). The decrease in this age demographic in working-age adults is most pronounced in Western Massachusetts, where the number of 25-44 year-olds decreased by over 9 and 14 percent in the Pioneer Valley and the Berkshire regions between 1990 and 2000.

Currently, stagnant workforce growth has not hindered the growth of the Innovation Economy in Greater Boston or the Merrimack Valley; instead, robust growth has created a long-term skills shortage. For regions such as the Pioneer Valley, the long-term decrease in working age residents also exacerbates the long-term skills shortage.

As was noted above, the prevailing cost of housing in Berkshire, Pioneer Valley, Central, and Southeast regions could be a magnet for attracting new residents and retaining existing ones, given the extraordinarily high cost of housing in Greater Boston, Merrimack Valley, and the Cape Cod and Islands regions. Reasonably-priced housing could also be attractive to college students who want to remain in the region where they attended college to work or create businesses.

However, homeowners new and old will want good schools; anecdotal evidence suggests that local housing markets are sensitive to public perceptions of the quality of local school systems. School systems that are perceived to be effective in upgrading student skills attract new residents; school systems that are not perceived to effective, do not. * [FOOTNOTE: * For an example of an ongoing effort to evaluate the effectiveness of local school systems in Massachusetts see Robert Gaudet,

"Effective School Districts in Massachusetts," University of Massachusetts Donahue Institute, March 2000, at http://www.donahue.umassp.edu/publications.] The continuing release of yearly student testing data in Massachusetts will make school performance an even greater issue for regional economic development in the years ahead. Many communities around the state have made education programs at both the K-12 and college level a highly visible part of their effort to build up an Innovation Economy workforce and nurture their firms.

Table: Comparative Regional Overview

	Key industry cluster employment as a % of total regional employment, 1999	Top key industry cluster by employment, 1999	Percent change in total population, 1990-2000	Total population, 2000; % of total state population in region	Unemployment rate, 2000	Weighted median sales price of new home, 2000; % increase in home price, 1996-2000	High school dropout rate, 1998-1999
Massachusetts	25%	Financial Services (141,355 jobs)	5.5%	6,349,097 (100%)	2.7%	$205,793 (49.9%)	3.6%
Berkshire	13%	Postsecondary Education (1,903 jobs)	-3.2%	134,953 (2.1%)	3.7%	$106,859 (22.7%)	3.5%
Pioneer Valley	15%	Postsecondary Education (12,094 jobs)	1.0%	695,368 (11.0%)	3.0%	$106,008 (23.4%)	4.2%
Central	18%	Diversified Industrial Support (11,322 jobs)	6.0%	773,220 (12.2%)	2.8%	$155,637 (39.4%)	3.4%
Merrimack Valley	28%	Computers and Communications Hardware (19,516 jobs)	8.6%	588,639 (9.3%)	3.7%	$194,372 (51.4%)	4.0%
Greater Boston	24%	Financial Services (96,731 jobs)	4.9%	3,015,981 (47.5%)	2.2%	$273,146 (58.6%)	3.3%
Southeast	16%	Diversified Industrial Support (12,152 jobs)	6.6%	894,199 (14.1%)	4.1%	$150,545 (41.8%)	3.5%
Cape Cod and Islands	8%	Innovation Services (2,590 jobs)	20.8%	246,737 (3.9%)	3.5%	$205,605 (68.0%)	3.3%

Conclusion

The economic boom times of the 1980s started to pull the state's technology industries past I-495 and into other regions of the state. The 1990s boom resumed the process, and the Innovation Economy has penetrated more deeply into the state's regions as a result. However, there is still work to be done, as the summary statistics presented in the following pages demonstrate.

When the current economic slowdown ends and growth in the state's Innovation Economy resumes, the regional economies of Massachusetts will once again face the challenge of marketing their assets aggressively, particularly the availability of affordable real estate. Critical infrastructure gaps, such as the gap in broadband services, will have to be addressed through approaches such as customer aggregation. As this analysis suggests, the growth of the Innovation Economy in each region of the state hinges heavily on the ability of each region to upgrade the educational levels and skills of current residents, and the attraction of the region to outsiders who will bring new technical and entrepreneurial skills into a region's industries.

Special Analysis Framework

The 2001 special analysis addresses issues of location, distribution, and benefits of the Massachusetts Innovation Economy throughout the state. Data, resources, and time constraints restrict the annual *Index* to analysis at the state level. Comparisons with other Leading Technology States (LTS) also foster the need for statewide assessments. Discussions of the findings of the Massachusetts annual *Index*, however, raise questions about the impacts and policy implications for sub-state regions. The goals of this special analysis are to document the location of the Massachusetts Innovation Economy throughout the state, and to help map future work that can be done at the public and private levels to ensure that New Economy growth is reaching all regions of the Commonwealth.

These regions include, from west to east: Berkshire, Pioneer Valley, Central, Merrimack Valley, Greater Boston, Southeast, and Cape Cod and Islands.* A brief, customized analysis follows for the seven regions of Massachusetts. Each regional analysis highlights:

- The employment distribution of the state's nine key industry clusters within each region
- The assets in each region that support the Innovation Economy.

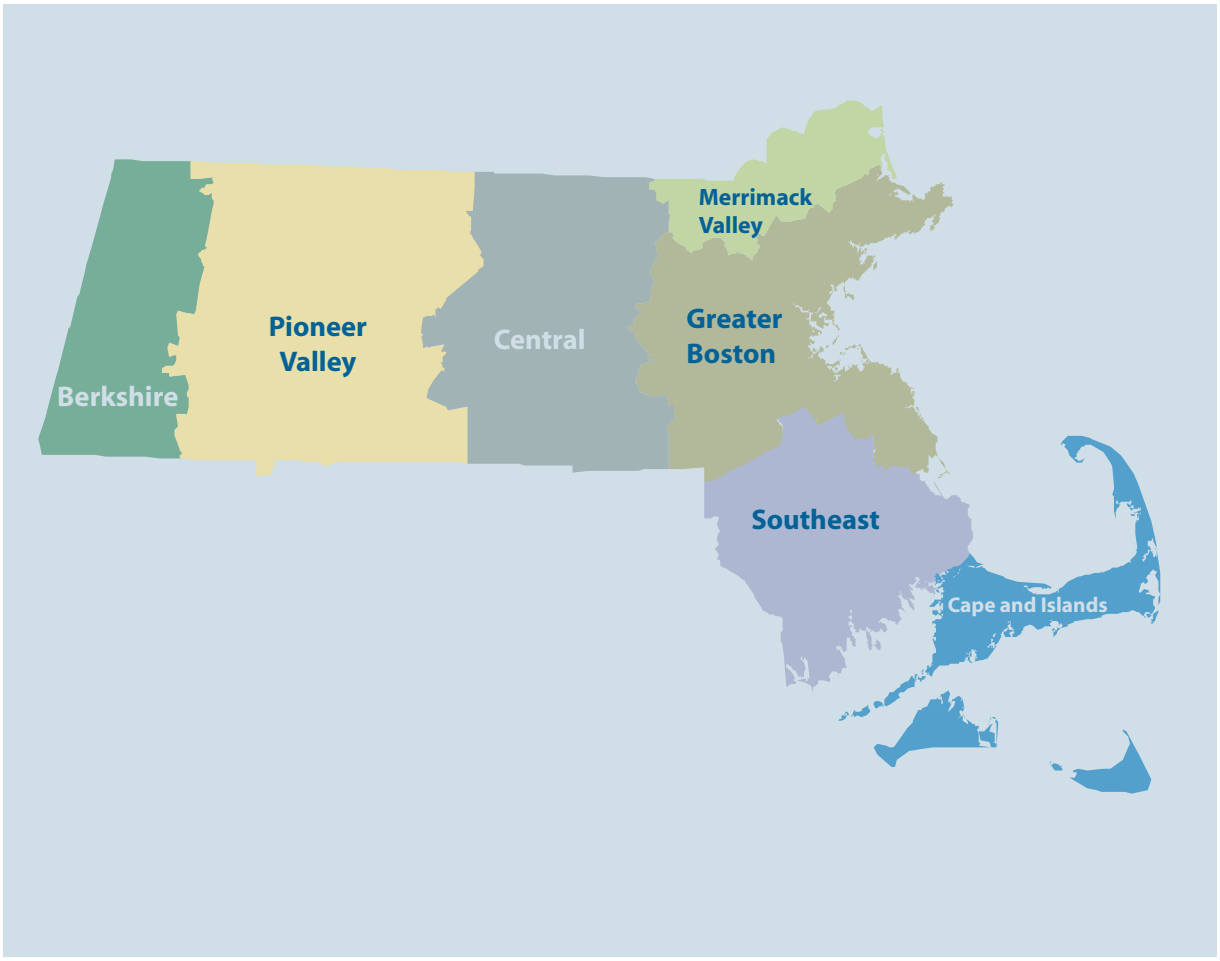
Employment Distribution

For the special analysis, each region's Innovation Economy has been profiled based on the *Index's* nine key industry clusters. The top ribbon bar shows the employment distribution of the largest key industry clusters for that region. This section also includes average pay for all industries and for the nine key industry clusters, as well as the region's share of employment in relation to the state.

Assets

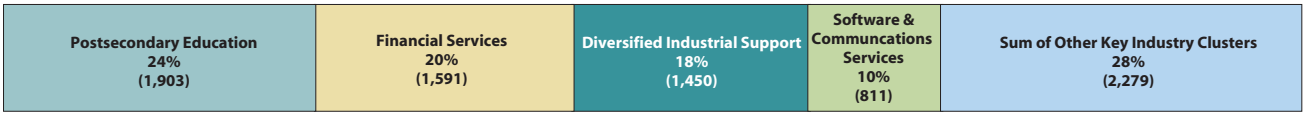
Each region of Massachusetts has assets that are important to the continued growth of the Innovation Economy. For this analysis, assets are measured by the following data: high school dropout rate, percent change in population, unemployment rate, median sales price of new homes, and location of colleges and universities. The analysis strives to show regional economic development based upon data that are derived from objective and reliable data sources, and includes several key elements of the Innovation Economy.

**The regions of Massachusetts were chosen based upon data availability, previous regional analysis work in the state, and through consultation with the Donahue Institute, University of Massachusetts; and the Massachusetts Department of Economic Development.*



Special Analysis
BERKSHIRE

Distribution of select nine key industry clusters, by employment, Berkshire region, 1999



EMPLOYMENT FACTS :

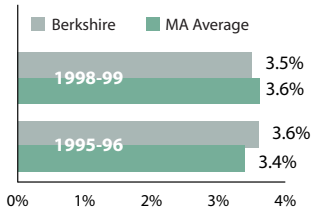
Key industry cluster employment as a percent of total employment: 13%

1.9% of the state's total employment is located in the Berkshire region.

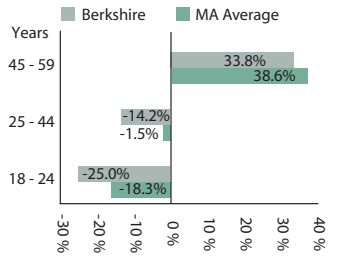
Total cluster employment: 8,034

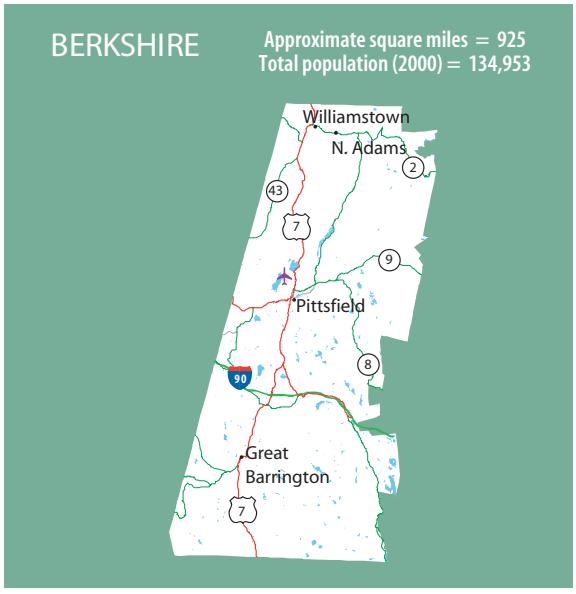
Total regional employment: 61,595

Dropout Rate

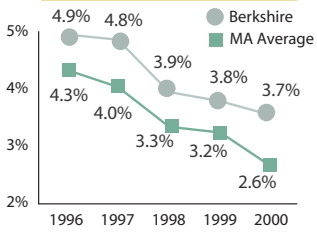


Percent Change in Population, 90-00

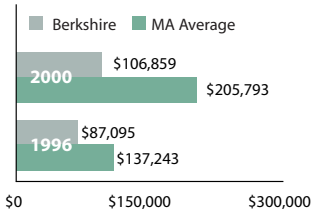




Unemployment Rate



Median Sales Price of Homes



Berkshire Regional Highlights

Industry Clusters
Postsecondary Education (24%), Financial Services (20%), and Diversified Industrial Support (18%) comprise more than half of the Berkshire region's key industry cluster employment; a total of 3,041 jobs are located within these three clusters. Ten percent, or 811 jobs, of the region's key industry cluster employment is in Software & Communications Services.

Dropout Rate
During the 1998-1999 school year, Berkshire's high school dropout rate was 3.5%, lower than the Massachusetts average of 3.6%. Since the 1995-1996 school year, the region's dropout rate has remained constant.

Percent Change in Population, 1990-2000
The Berkshire region has a decline in its 18-24 and 25-44 year old population. From 1990 to 2000, there has been a 25.0% decrease of 18-24 year olds and a 14.2% decrease of 25-44 year olds. These rates are comparatively higher than those for Massachusetts at -18.3% and -1.5%, respectively. The Berkshire region saw its 45-59 year old population increase over 30%, below the trend in Massachusetts of a 38.6% increase from 1990 to 2000.

Unemployment Rate
The Berkshire region's unemployment rate has been decreasing in recent years, dropping to 3.7% in 2000 from 4.9% in 1996. The region's unemployment rate of 3.7% in 2000 remained higher than the Massachusetts rate of 2.6% in the same time period.

Median Sales Price of Homes
In 2000, the median sales price of a home in the Berkshire region was $106,859, which is 48.1% less than the $205,793 median price of a home in Massachusetts. From 1996 to 2000, the median sales price of a home in the Berkshire region increased 22.7%, compared to a 49.9% increase in statewide price during the same time period. When compared to the other regions in Massachusetts, the Berkshire region experienced the lowest increase in median sales price from 1996 to 2000.

Population Density and Colleges and Universities
In 2000, the Berkshire region's total population was 2.1% of the state's total population. The Berkshire region is approximately 925 square miles, which is 11.2% of the state's total area, and the region has a population density of 146 people per square mile. There are 4 colleges and universities located in the Berkshire region, constituting 2.8% of the state's total number of colleges and universities, and comprising 1.2% of total enrollment in Massachusetts.

Special Analysis
PIONEER VALLEY

Distribution of select nine key industry clusters, by employment, Pioneer Valley region, 1999

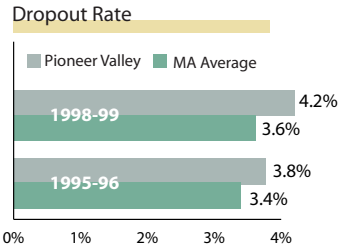
EMPLOYMENT FACTS :

Key industry cluster employment as a percent of total employment: 15%

9.0% of the state's total employment is located in the Pioneer Valley region.

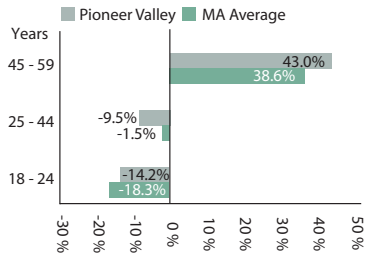
Total cluster employment: 42,529

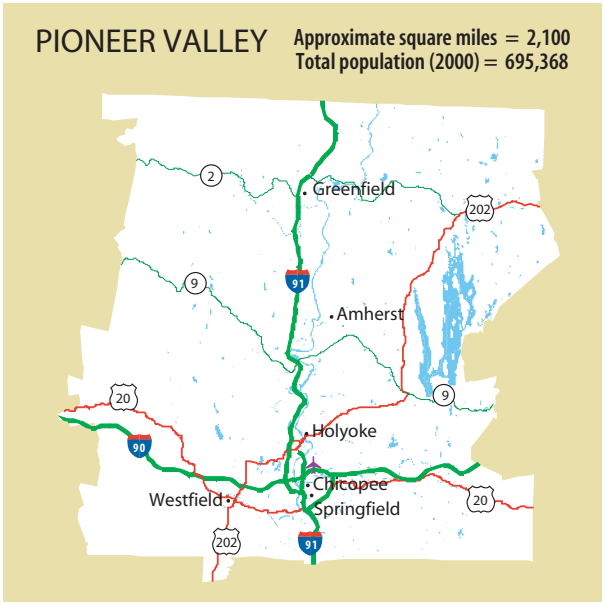
Total regional employment: 286,291



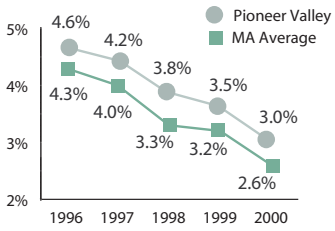
Dropout Rate

Percent Change in Population, 90-00

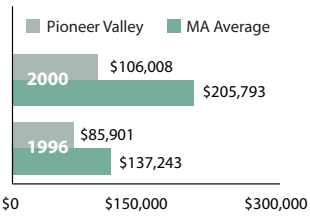




Unemployment Rate



Median Sales Price of Homes



Pioneer Valley Regional Highlights

Industry Clusters
Postsecondary Education (28%), Diversified Industrial Support (26%), and Financial Services (23%) comprise over two-thirds of the Pioneer Valley's key industry cluster employment, or 32,871 jobs. The remaining key industries in the Pioneer Valley comprise 9,658 jobs, or 23% of the key industry cluster employment in the region.

Dropout Rate
During the school year 1998-1999, the region's high school dropout rate was 4.2%, higher than the Massachusetts average of 3.6%. Since the school year 1995-1996, the region's dropout rate has increased slightly.

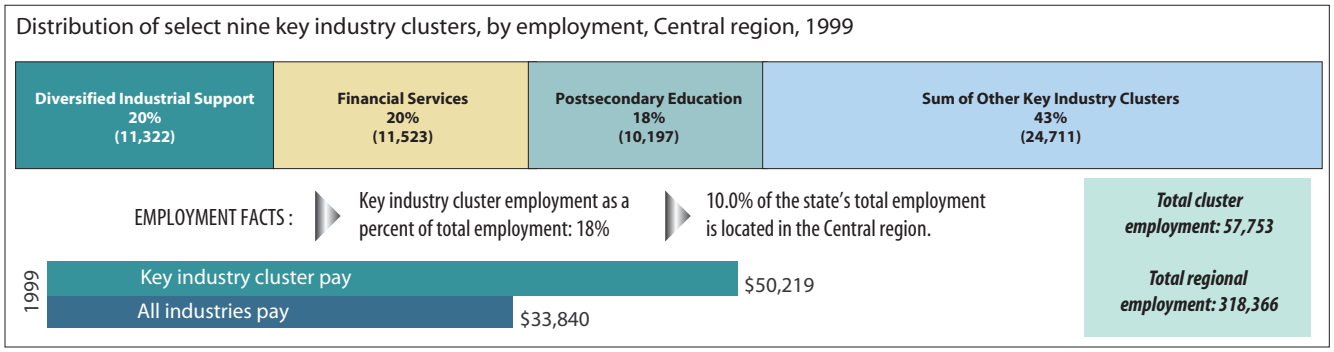
Percent Change in Population, 1990-2000
The Pioneer Valley has seen a decrease in the 18-24 and 25-44 year old population. From 1990 to 2000, there has been a 14.2% decrease of 18-24 year olds and a 9.5% decrease of 25-44 year olds. The rate of decline for 25-44 year olds in this region is over six times higher than that of Massachusetts, which was 1.5%. The Pioneer Valley region saw its 45-59 year old population increase over 40%, consistent with Massachusetts trend of a 38.6% increase from 1990 to 2000.

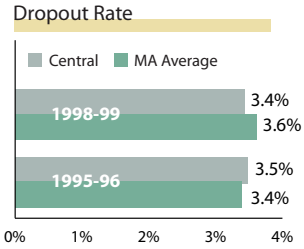
Unemployment Rate
The Pioneer Valley's unemployment rate has been decreasing over time, dropping to 3.0% in 2000 from 4.6% in 1996. The region's unemployment rate of 3.0% in 2000 remained higher than the Massachusetts rate of 2.6% in the same time period.

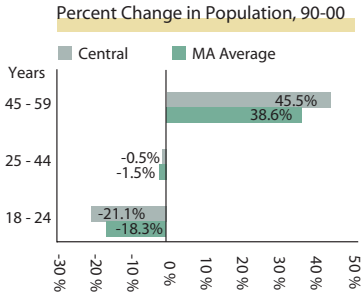
Median Sales Price of Homes
In 2000, the median sales price of a home in the Pioneer Valley region was $106,008, 48.5% less than the state wide median price of $205,793. From 1996 to 2000, the median sales price of a home in the region increased 23.4%, compared to a 49.9% increase in Massachusetts price during that period. The Pioneer Valley region saw the second smallest increase in median sales price in Massachusetts.

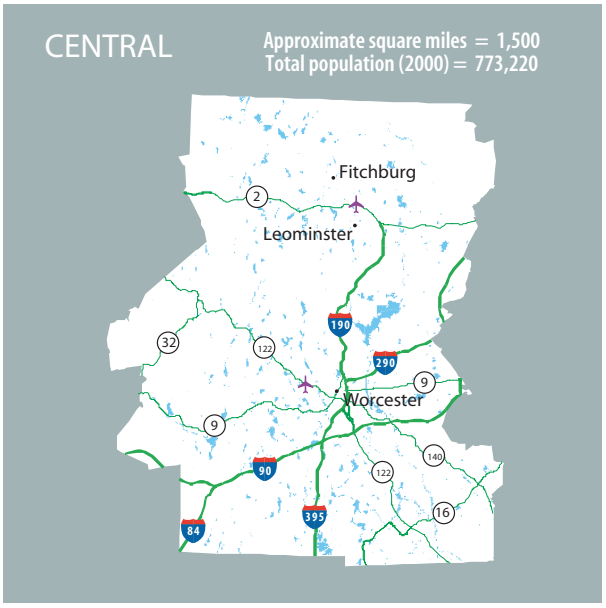
Population Density and Colleges and Universities
In 2000, the Pioneer Valley region's total population was 11.0% of the state's total population. Pioneer Valley is approximately 2,100 square miles, which is 25.4% of the state's total area, and the Pioneer Valley has a population density of 84 people per square mile. There are 18 colleges and universities located in the Pioneer Valley region, constituting 12.4% of the state's total number of colleges and universities, and comprising 15.4% of total enrollment in Massachusetts.

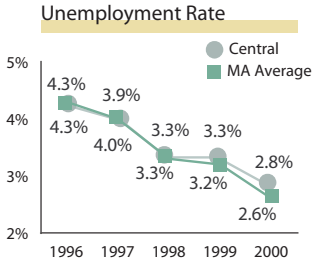
Special Analysis
CENTRAL

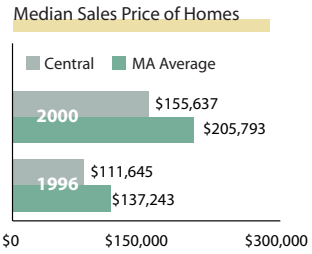












Central Regional Highlights

Industry Clusters
In the Central region, Diversified Industrial Support (20%), Financial Services (20%), and Postsecondary Education (18%) comprise over half of key industry cluster employment; these three clusters constitute 33,042 jobs. The other six key industry clusters comprise 24,711 jobs in the Central region.

Dropout Rate
During the 1998-1999 school year, the region's high school dropout rate was 3.4%, which was lower than the Massachusetts average of 3.6%. Since the school year 1995-1996, the region's dropout rate has remained relatively constant, decreasing only 0.1%.

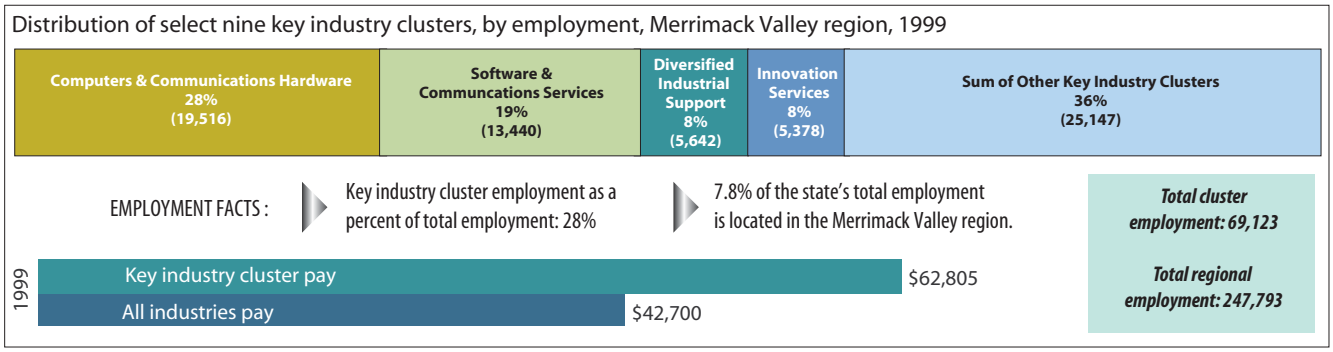
Percent Change in Population, 1990-2000
From 1990 to 2000, there was a 21.2% decrease of 18-24 year olds, which is a higher percentage than for Massachusetts (-18.3%). But the Central region has seen a smaller percentage decrease in 25-44 year olds (-0.5%), compared to a decrease of 1.5% for Massachusetts. The Central region saw its 45-59 year old population increase 45.5%, outpacing the Massachusetts trend of a 38.6% increase for this age group from 1990 to 2000.

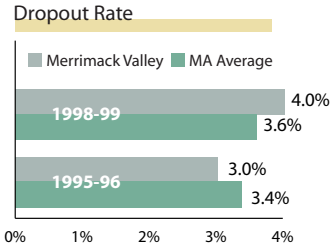
Unemployment Rate
The Central region's unemployment rate has been decreasing over time, dropping to 2.8% in 2000 from 4.3% in 1996. The Central region's unemployment rate in 2000 remained slightly higher than the Massachusetts rate of 2.6% in the same time period. A slight gap has developed, whereas the unemployment rates for the Central region and Massachusetts were equal in 1996 and 1998.

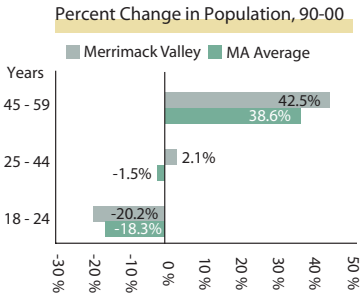
Median Sales Price of Homes
In 2000, the median sales price of a home in the Central region was $155,637, which is 24.4% less than the median home price for Massachusetts at $205,793. From 1996 to 2000, the median sales price of a home in the Central region has increased 39.4%, lower than the 49.9% increase in Massachusetts prices during that time.

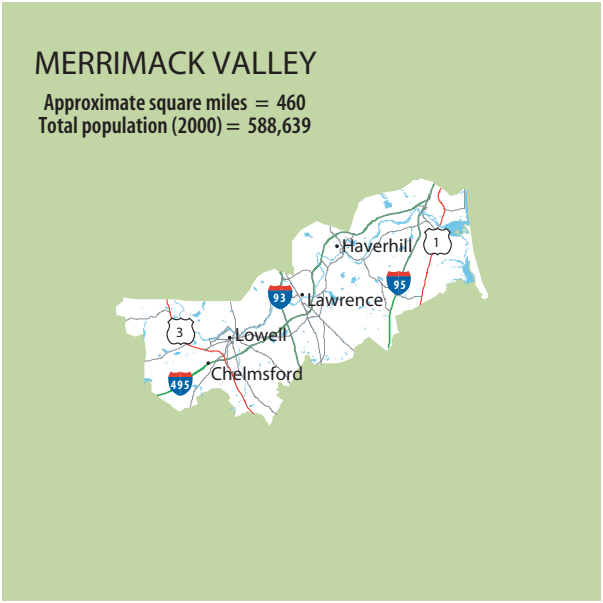
Population Density and Colleges and Universities
The Central region's total population was 12.2% of the state's total population in 2000. The Central region encompasses approximately 1,500 square miles, which is 18.2% of the state's total area, and the region has a population density of 94 people per square mile. There are 18 colleges and universities located in the Central region, constituting 12.4% of the state's total number of colleges and universities, and comprising 9.1% of total enrollment in Massachusetts.

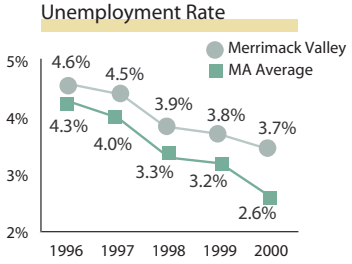
Special Analysis
MERRIMACK VALLEY

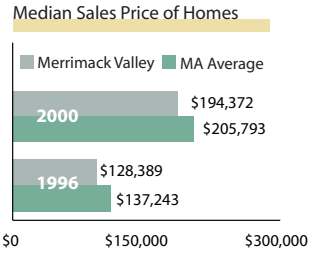












Merrimack Valley Regional Highlights

Industry Clusters
In the Merrimack Valley region, Computers & Communications Hardware (28%) and Software & Communications Services (19%) comprise close to half of total key industry cluster employment. Diversified Industrial Support and Innovation Services clusters each have 8% of the total key industry cluster employment for the Merrimack Valley region. These four industry clusters combined constitute a total of 43,976 jobs in the region.

Dropout Rate
During the 1998-1999 school year, the region's high school dropout rate was 4.0%, higher than the Massachusetts average of 3.6%. The Merrimack Valley region has experienced a 1.0% increase in its dropout rate from the school years 1995-1996 to 1998-1999, compared to a 0.2% increase statewide.

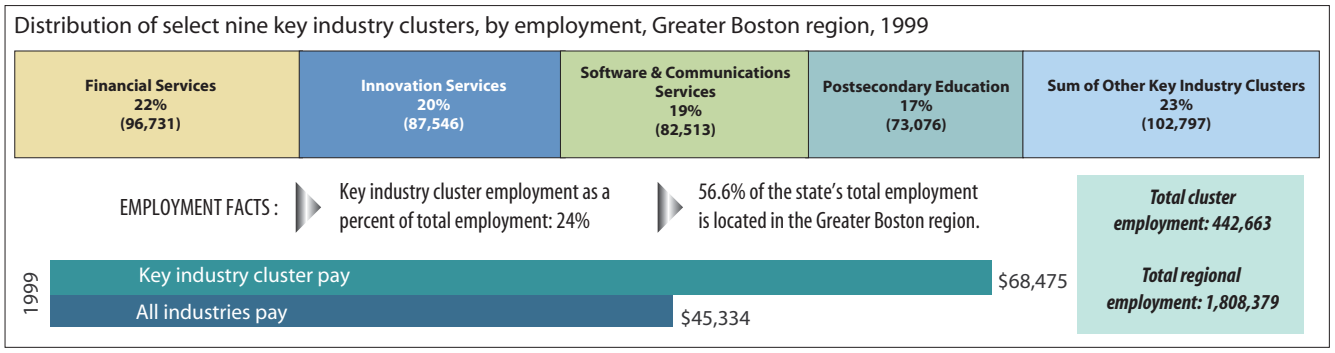
Percent Change in Population, 1990-2000
From 1990 to 2000, there was a 20.2% decrease of 18-24 year olds in the Merrimack Valley region, higher than Massachusetts (-18.3%). But the Merrimack Valley region increased its percentage of 25-44 year olds by 2.1%, compared to a decrease of 1.5% for Massachusetts. The region experienced a 42.5% increase in its 45-59 year old population, outpacing the state increase of 38.6% from 1990 to 2000.

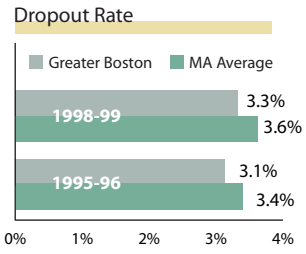
Unemployment Rate
The Merrimack Valley region's unemployment rate has been decreasing over time, dropping to 3.7% in 2000 from 4.6% in 1996. The region's unemployment rate of 3.7% in 2000 remained slightly higher than the Massachusetts rate of 2.6% in the same time period.

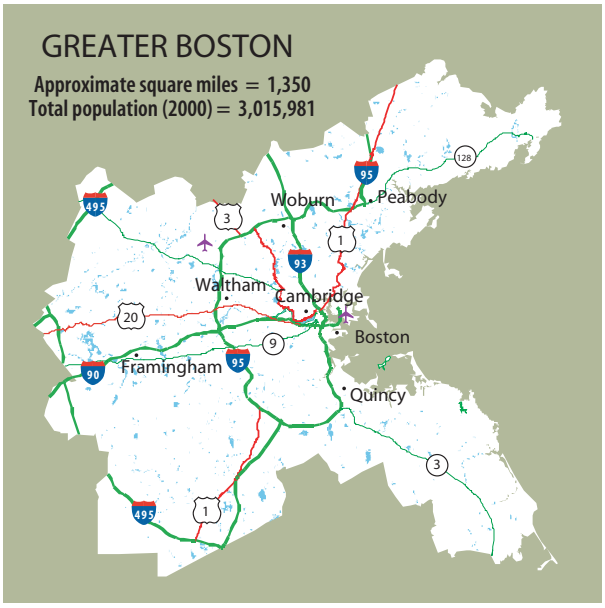
Median Sales Price of Homes
In 2000, the median sales price of a home in the Merrimack Valley region was $194,372, 5.5% lower than the Massachusetts median sales home price ($205,793). From 1996 to 2000, the median sales price of a home in the Merrimack Valley region has increased 51.4%, which was greater than the 49.9% increase in Massachusetts during this period.

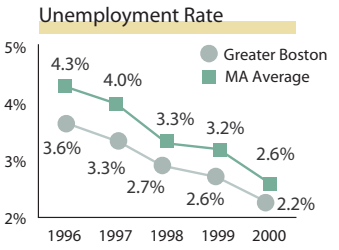
Population Density and Colleges and Universities
In 2000, the Merrimack Valley region's total population was 9.3% of Massachusetts total population. The Merrimack Valley region encompasses approximately 460 square miles, which is 5.6% of the state's total area, and the region has a population density of 1,280 people per square mile. There are 7 colleges and universities located in the Merrimack Valley region, constituting 4.8% of the state's total number of colleges and universities, and comprising 5.1% of total enrollment in Massachusetts.

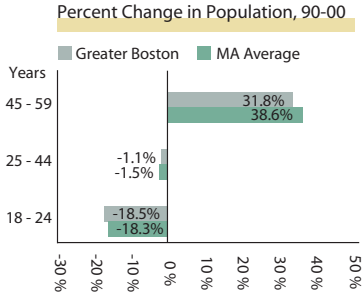
Special Analysis
GREATER BOSTON

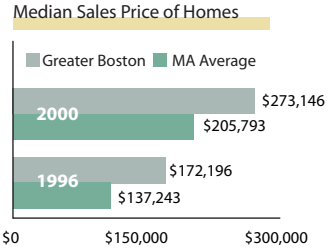












Greater Boston Regional Highlights

Industry Clusters
Within Greater Boston, Financial Services (22%), Innovation Services (20%), Software & Communications Services (19%), and Postsecondary Education (17%) comprise over two-thirds of total key industry cluster employment, or 339,866 total jobs. The remaining key industry clusters constitute 102,797 jobs in the Greater Boston region.

Dropout Rate
During the 1998-1999 school year, the region's high school dropout rate was 3.3%, which was lower than the Massachusetts average of 3.6%. Greater Boston's dropout rate has increased 0.2% from the school year 1995-1996 to 1998-1999, the same increase as Massachusetts.

Percent Change in Population, 1990-2000
From 1990 to 2000, there was an 18.5% decrease of 18-24 year olds in the Greater Boston region, which is slightly higher than Massachusetts (-18.3%). Greater Boston had a 1.1% decrease in its 25-44 year old population, compared to a decrease of 1.5% for Massachusetts. The Greater Boston region experienced a 31.8% increase in its 45-59 year old population, which was lower than the state increase of 38.6% from 1990 to 2000.

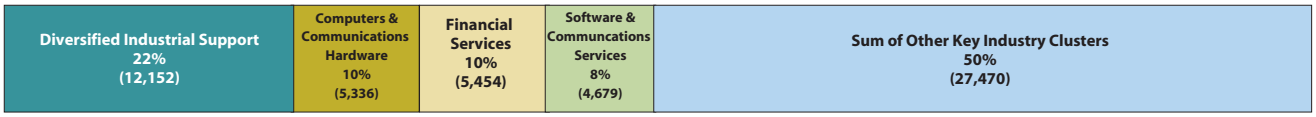
Unemployment Rate
Greater Boston's unemployment rate has been decreasing over time, dropping to 2.2% in 2000 from 3.6% in 1996. The region's unemployment rate of 2.2% in 2000 was lower than the Massachusetts rate of 2.6% in the same time period, and the lowest rate when compared to the other regions. The Greater Boston region has been closing the unemployment rate gap with the state since 1996.

Median Sales Price of Homes
In 2000, the median sales price of a home in Greater Boston was $273,146, which was nearly 25% higher than the Massachusetts median home price ($205,793) and the highest compared to the other regions. From 1996 to 2000, the median sales price of a home in the Greater Boston region has increased 58.6%, which was a higher percent increase than Massachusetts (49.9%), and the second highest increase among all regions in the state.

Population Density and Colleges and Universities
The Greater Boston region's total population was 47.5% of Massachusetts total population in 2000. The Greater Boston region encompasses approximately 1,350 square miles, which is 16.3% of the state's total area, and the region has a population density of 2,234 people per square mile. Over half (57.9%) of the state's colleges and universities (84) are located in the Greater Boston region; this comprises 60.7% of total enrollment in Massachusetts.

Special Analysis
SOUTHEAST

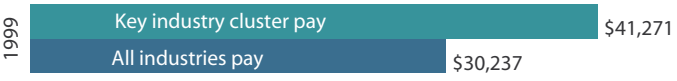
Distribution of select nine key industry clusters, by employment, Southeast region, 1999



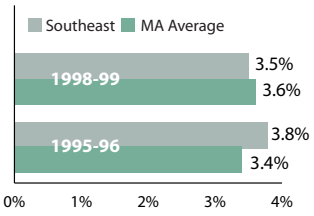
EMPLOYMENT FACTS : Key industry cluster employment as a percent of total employment: 16%

11.0% of the state's total employment is located in the Southeast region.

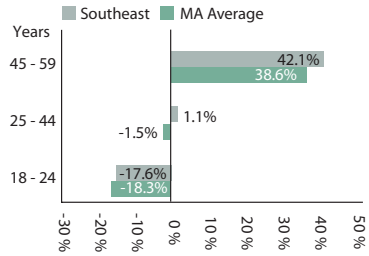
Total cluster employment: 55,091
Total regional employment: 350,144

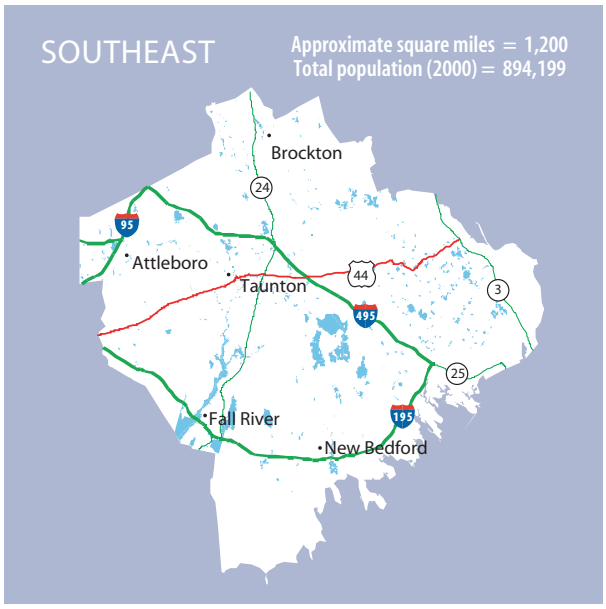


Dropout Rate

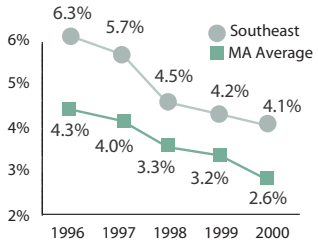


Percent Change in Population, 90-00

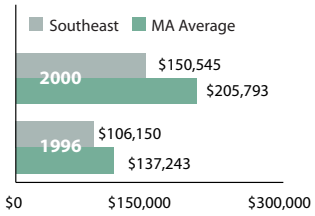




Unemployment Rate



Median Sales Price of Homes



Southeast Regional Highlights

Industry Clusters
In the Southeast region, Diversified Industrial Support (22%), Computers & Communications Hardware (10%), and Financial Services (10%) comprise over 40% of total key industry cluster employment, or 27,621 total jobs. Software & Communications Services comprise 8%, or 4,769 jobs, of key industry cluster employment in the region.

Dropout Rate
During the 1998-1999 school year, the region's high school dropout rate was 3.5%, which was lower than the Massachusetts average of 3.6%. The Southeast region has decreased its dropout rate by 0.3% from the school years 1995-1996 to 1998-1999; in contrast, the state's dropout rate increased 0.2% during the same period.

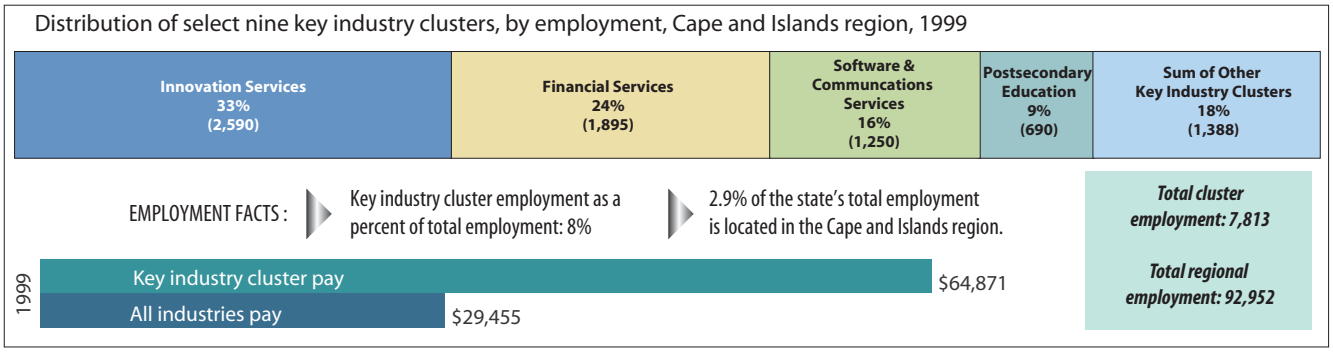
Percent Change in Population, 1990-2000
From 1990 to 2000, there was a 17.6% decrease of 18-24 year olds in the Southeast, which is slightly lower than Massachusetts (-18.3%). The Southeast experienced a 1.1% increase in its 25-44 year old population, compared to a decrease of 1.5% for Massachusetts. The region experienced a 42.1% increase in its 45-59 year old population, which was higher than the state increase of 38.6% from 1990 to 2000.

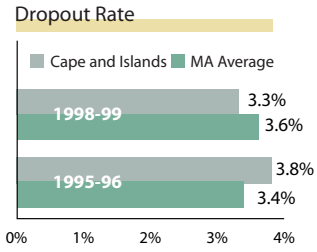
Unemployment Rate
The Southeast's unemployment rate has been decreasing over time, dropping to 4.1% in 2000 from 6.3% in 1996. The region's unemployment rate of 4.1% in 2000 is higher than the Massachusetts rate of 2.6% in the same time period, and is the highest unemployment rate when compared to the other regions.

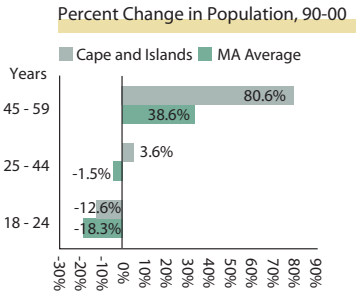
Median Sales Price of Homes
In 2000, the median sales price of a home in the Southeast region was $150,545, 26.8% lower than the Massachusetts median home price of $205,793. The Southeast region had the third lowest median home price when compared to the other regions. From 1996 to 2000, the median sales price of a home in the Southeast region increased 41.8%, which was lower than the Massachusetts increase (49.9%) during the same time period.

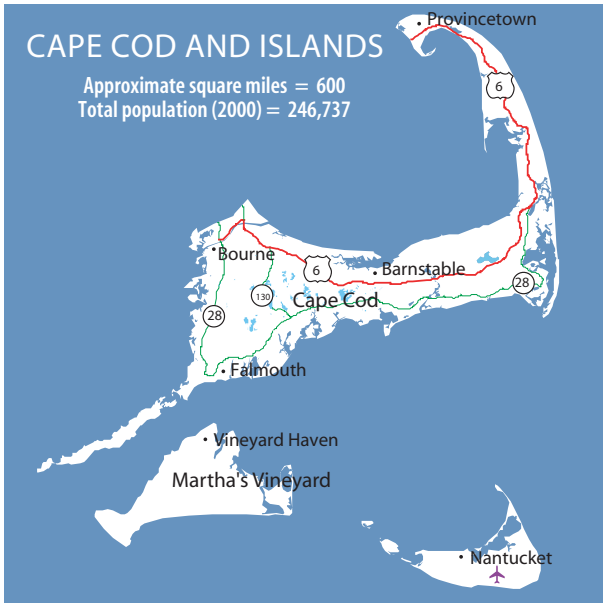
Population Density and Colleges and Universities
In 2000, the Southeast region's total population was 14.1% of Massachusetts total population in 2000. The Southeast region encompasses approximately 1,200 square miles, which is 14.5% of the state's total area, and the region has a population density of 745 people per square mile. The Southeast region is home to 11 colleges and universities, which comprises 7.6% of the state's total number of colleges and universities, and comprising 7.5% of total enrollment in Massachusetts.

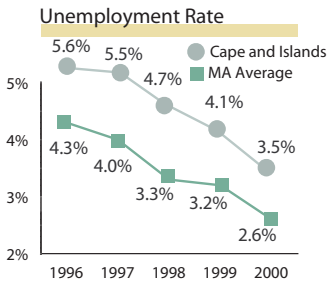
Special Analysis
CAPE COD AND ISLANDS

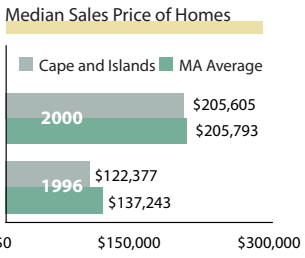












Cape Cod and Islands Regional Highlights

Industry Clusters
Within the Cape and Islands region, 4,485 jobs are located within two key industry clusters: Innovation Services (33%) and Financial Services (24%), which comprises over half of total key industry cluster employment. Software & Communications Services has 16% of key industry cluster employment in the region (1,250 jobs), followed by Postsecondary Education at 9% (690 jobs).

Dropout Rate
During the 1998-1999 school year, the Cape and Islands' high school dropout rate was 3.3%, which was lower than the Massachusetts average of 3.6%. The region has decreased its dropout rate by 0.5% from the school years 1995-1996 to 1998-1999; in contrast, the state's dropout rate has increased 0.2% during the same time period.

Percent Change in Population, 1990-2000
From 1990 to 2000, there was a 12.6% decrease of 18-24 year olds in the Cape and Islands, a smaller decrease than Massachusetts (-18.3%). The region experienced a 3.6% increase in its 25-44 year old population, compared to a decrease of 1.5% for Massachusetts. The region experienced an 80.6% increase in its 45-59 year old population, which is over double the Massachusetts increase of 38.6% from 1990 to 2000.

Unemployment Rate
The Cape and Islands' unemployment rate has been decreasing over time, dropping to 3.5% in 2000 from 5.6% in 1996. The region's unemployment rate of 3.5% in 2000 is higher than the Massachusetts rate of 2.6% during the same time period. However, the Cape region's rate has been falling faster than Massachusetts since 1996.

Median Sales Price of Homes
In 2000, the median sales price of a home in the Cape and Islands was $205,605, almost identical to the Massachusetts median home price of $205,793. From 1996 to 2000, the median sales price of a home in the Cape and Islands increased 68.0%, which was higher than Massachusetts price (49.9%) during the same time period, and the highest percent increase of all regions in the state.

Population Density and Colleges and Universities
In 2000, the Cape and Islands region's population was 3.4% of Massachusetts total population in 2000. The Cape and Islands region encompasses approximately 600 square miles, which is 7.3% of the state's total area, and the region has a population density of 411 people per square mile. The Cape and Islands region is home to 3 colleges and universities, or 2.1%, of Massachusetts total number of colleges and universities; this comprises 1.0% of total enrollment in Massachusetts.

Results Indicators

Results Indicators

The most important outcome of the Massachusetts Innovation Economy is what it does for the people of Massachusetts by creating good jobs, rising wages, and a high standard of living. In this section we look at how jobs and wages changed in the Innovation Economy and the nine key clusters in 2000. We also look at several measures of the Innovation Economy's resilience, to look for weaknesses or signs of trouble that may test the state's competitiveness in the months and years ahead.

Indicator 1

Industry Clusters

Job growth in key industry clusters surpasses state growth rate, although state's job growth lags average growth rate among LTS

Why is it significant?

The nine key industry clusters comprise 25% of all non-government jobs in Massachusetts. Each cluster is more highly concentrated within the Massachusetts economy than similar clusters on average elsewhere in the U.S. Such high concentration is a reflection of current or past competitive advantage that helped the cluster grow in Massachusetts.

How does Massachusetts perform?

Total employment in the nine key industry clusters grew by 3.1% from 1999 to 2000, to just over 722,900 people. This increase compares to a 2.8% increase in total jobs statewide. During the previous year, the nine key clusters grew by 1.2%, and total jobs in the state increased 1.9%. Financial Services is the largest employer among the nine key industry clusters in 2000 with 141,355 people, while Defense remains the smallest at about 28,000.

Overall, the knowledge-intensive services clusters continued to add jobs, but at a slower rate compared to the LTS average from 1999 to 2000. The Massachusetts Software & Communications Services cluster registered the largest increase in jobs over 1999 (10,991 new jobs, a 10.4% increase), second only to California (14.6%) among the LTS in terms of job growth, and outpacing the U.S. (5.4%) in this cluster. For the first time in several years, job growth in the state's Computers & Communications Hardware cluster from 1999 to 2000 not only grew 3.1%, but outpaced LTS growth (2.0%).

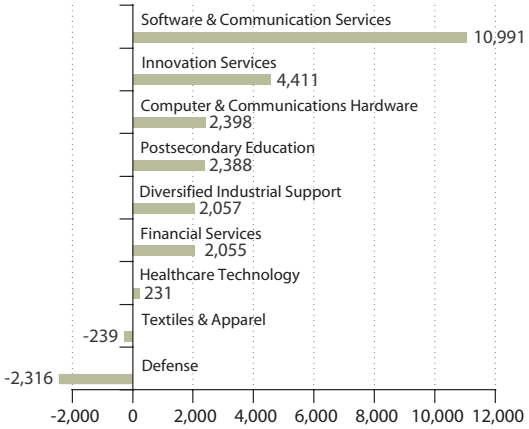
Massachusetts Postsecondary Education and Healthcare Technology grew, but not as rapidly as similar clusters in the LTS from 1999 to 2000. The state's Computers & Communications Hardware (3.1%), Diversified Industrial Support (2.9%), and Financial Services (1.5%) were the only key industry clusters that experienced a higher percent growth rate than the LTS average in these clusters (2.0%, -0.3%, and 1.4%, respectively).

What does this trend mean for Massachusetts?

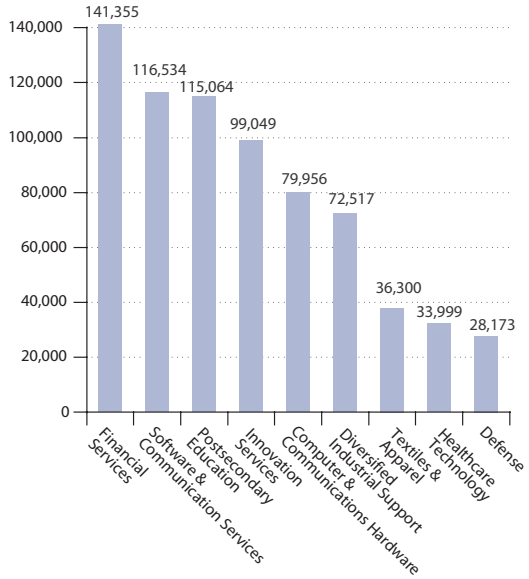
For the first time in several years, clusters strongly associated with manufacturing and the production of durable goods—Computers & Communications Hardware and Diversified Industrial Support—experienced an increase in employment. Within the state, job creation continues to move towards the service-related clusters, such as Software & Communications Services and Financial Services; these two are among Massachusetts top employers and pay significantly higher than average wages in the state. Only two Massachusetts clusters, Defense and Textiles & Apparel, experienced a decrease in employment in 2000. Most of the state's key industry cluster growth rates have closed in on the LTS average growth rates differential from 1999 to 2000.

The issue is whether these gains in the key industry clusters can be maintained, considering the economic slowdown that began in late 2000 and continues throughout 2001. The high technology sectors' growth has slowed, particularly in telecommunications-related products, and this has already led to job losses in related industries. With the continuous changes in the marketplace, it is important to be aware of the needs of these and other emerging clusters to ensure that Massachusetts does not lose its competitive strengths in the Innovation Economy.

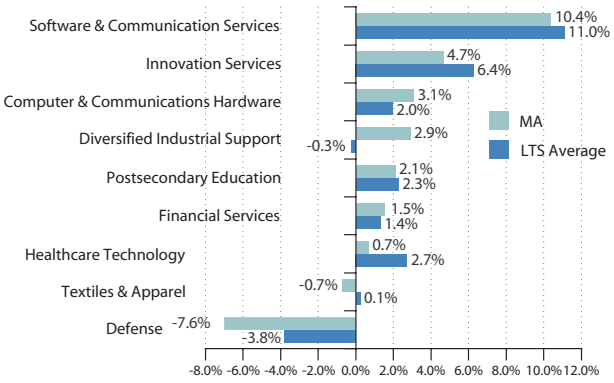
Net employment change, nine key industry clusters, Massachusetts, 1999-2000



Total employment, nine key industry clusters, Massachusetts, 2000



Percent change in cluster employment for Massachusetts and LTS average, 1999-2000



Source of all data for this indicator: Collaborative Economics, Regional Financial Associates

Indicator 2

Employment Diversification

Massachusetts has a diverse cluster portfolio; the largest and growing proportion of jobs are within the services and high technology industries

Why is it significant?

The "bubble chart" below illustrates employment growth in the nine key industry clusters over time, as well as the degree of concentration of each cluster compared to the U.S. economy as a whole.

Similar or inter-related industries frequently agglomerate, or "cluster." Industries may cluster in order to be near the same source of raw materials, but they also cluster because proximity to a skilled workforce and to each other reduces costs and enhances the absorption of new technology and skills. The clustering of firms creates a unique set of relationships which become a true economic asset for the region and create a competitive advantage for industry.

How does Massachusetts perform?

The nine key industry clusters remain highly concentrated in Massachusetts; that is, they employ a higher proportion of the state's workforce than the proportion of the U.S. workforce employed by similar industries nationwide.

The industry clusters that are most concentrated in Massachusetts relative to the nation are Postsecondary Education (3.0 times as concentrated), Defense (2.6 times), and Computers & Communications Hardware and Textiles & Apparel (each at 2.3 times).

Of the nine key industry clusters, Financial Services is the largest, with 19.6% of total cluster employment in the state. The Software & Communications Services, Postsecondary Education, and Innovation Services clusters have 16.1%, 15.9%, and 13.7% of total cluster employment, respectively. The Defense cluster has the smallest at 3.9%. (The size of each circle on the chart reflects the relative size of employment in Massachusetts.) Between 1995 and 2000, the average annual growth rate of Software & Communications Services (8.6%) was more than three times the state's overall growth rate (2.3%); the other key industry clusters to surpass the state's growth rate were Innovation Services (3.3%), and Financial Services (2.4%). The Defense (-3.7%) and Textiles & Apparel (-1.3%) clusters contracted during the same time period. However, these two clusters continue to remain highly concentrated in Massachusetts due to the fact that these industries are not only declining in the state but in the nation as well.

What does this trend mean for Massachusetts?

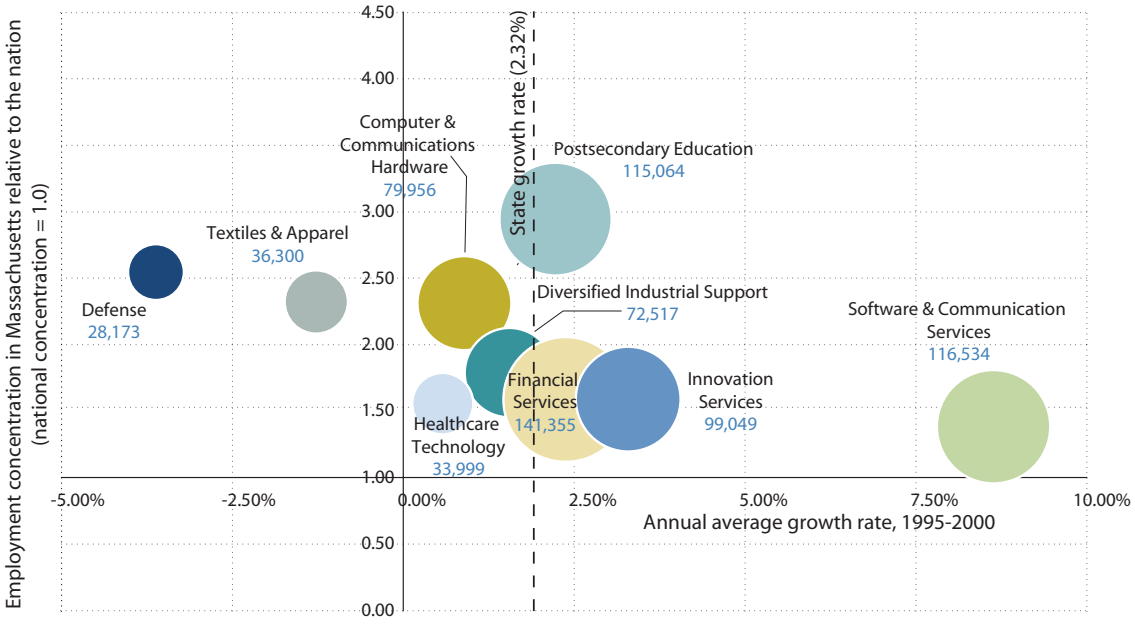
Overall, the diversity of Massachusetts key industry clusters portfolio is a positive sign, providing a varied employment base for the state and avoiding over reliance upon one or two industries. The nine key industry clusters represent a significantly higher share (25.0%) of Massachusetts total employment than they do in the other LTS (17.2%) and in the nation as a whole (13.7%). Over time, two things should be monitored on the "bubble chart:" the growth of each cluster and its relative degree of concentration. The first will show whether the cluster is still creating jobs for Massachusetts residents, and the second gives a measure as to whether firms in the cluster are doing well and maintaining a competitive edge in global economic competition.

In some industries, a decrease in employment does not necessarily mean that they are not performing well. For example, while job growth in the Computers & Communications Hardware cluster has lagged the state average over the last five years, productivity in the computer industry and in related sectors has been extraordinary due to technological advances.

The more rapidly growing clusters, including Software & Communications Services and Financial Services, remain highly concentrated in Massachusetts. The Software & Communications Services cluster has also become the least concentrated of the nine key clusters. Fifteen years ago the U.S. software industry was confined to Silicon Valley (California), Boston, and a few other cities and regions. As the software industry has become a national and global industry, the state's significant proportion of this industry's employment becomes more difficult to maintain due to increased competition from other states and countries.

The employment diversity in Massachusetts is an important strength in sustaining and growing the New Economy. To maintain its clusters and global competitiveness, Massachusetts should continue to nurture a climate for world-class innovation for its clusters.

Portfolio of nine key industry clusters by employment concentration and growth, Massachusetts, 1995-2000



Note: Numeral below name of industry cluster is 2000 total employment

Source: Collaborative Economics, Regional Financial Associates

Indicator 3

Average Pay in Key Industry Clusters

Although average pay in knowledge-intensive services clusters is higher than average pay of all industries in the state, Massachusetts pay continues to lag LTS average in several key industry clusters

Why is it significant?

Growth in average pay per worker, adjusted for inflation, is a measure of job quality and a key factor in standard of living. It can reflect rising levels of education and productivity but can also result from employers increasing wages to attract and retain workers in short supply. Key industry clusters generate wealth through national and international sales of their innovative products, processes, and services. The strong demand for their innovative offerings enables these cluster firms to pay higher wages to their knowledge workers.

How does Massachusetts perform?

Workers in the knowledge-intensive services clusters continue to earn the highest wages. The Software & Communications Services cluster had the highest average pay, at $81,210 per year in 2000, a 7.5% increase from 1999. Innovation Services ranked second in 2000 (it was first in 1999) at $81,079 per year, followed by Financial Services at $80,861 per year. The average annual increase in pay (inflation-adjusted) for the nine key clusters was 6.8% between 1999 and 2000, leading the average wage growth rate in all Massachusetts industries of 5.5%, and the LTS average for all industries at 4.6%.

Compared to the other LTS, Massachusetts has higher average wages in five industry clusters: Innovation Services, Healthcare Technology, Diversified Industrial Support, Textiles & Apparel, and Postsecondary Education. In 2000, the salary gap between Massachusetts and the LTS narrowed in Software & Communications Services, but widened in Financial Services; this Massachusetts cluster's average pay per worker was 16.0% lower than the average for the LTS, which is dominated by New York and Connecticut.

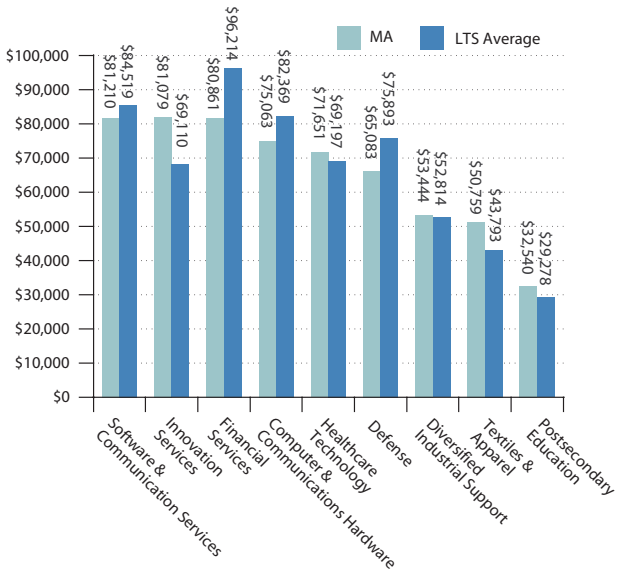
From 1996 to 2000, the average annual wage growth rate in Healthcare Technology increased by 6.9% in inflation-adjusted terms. Wages in Financial Services and Computers & Communications Hardware each grew by 6.6%, closely followed by Software & Communications Services at 6.3%. Innovation Services (4.5% growth rate), Diversified Industrial Support (4.0%), and Postsecondary Education (1.5%) clusters' annual average wage growth rates fell below the Massachusetts average wage growth rate (4.6%) in all industries during the same time period.

The average pay in eight of the state's nine key clusters (all but Postsecondary Education) is higher than the average annual pay per worker in all industries of $44,605 in the state and the LTS average in all industries of $42,947.

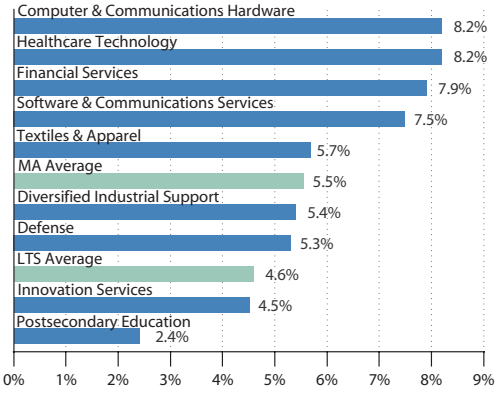
What does this trend mean for Massachusetts?

The annual average wage growth rate within most of the nine key industry clusters in Massachusetts outpaces the LTS average. These clusters in Massachusetts help the state's competitive advantage in the high-tech knowledge-based industries. However, several of the state's key industry clusters' average pay continues to lag the LTS, as seen in the Financial Services and Computers & Communications Hardware clusters. Industry differences by state (e.g., occupational mix, share of new hires vs. experienced workers, total compensation [including benefits]) may account for some of the pay differences. Further study, including competitor analysis, should be conducted of these key Massachusetts industry clusters to better understand what lies behind the statistics. Lower relative pay, in addition to higher housing costs, could also be contributing to the skilled workforce shortage that the state has been experiencing over the past several years. In any case, Massachusetts firms need to be competitive with other states in the knowledge-intensive services industries if it is to remain a leader in the Innovation Economy.

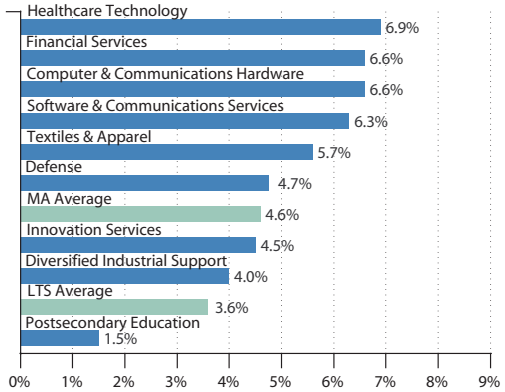
Average pay per worker, nine key industry clusters, Massachusetts and LTS average, 2000



Cluster industry wage growth rate, Massachusetts, LTS average, 1999-2000 (inflation-adjusted)



Cluster industry annual average wage growth rate, Massachusetts, LTS average,1996-2000 (inflation-adjusted)



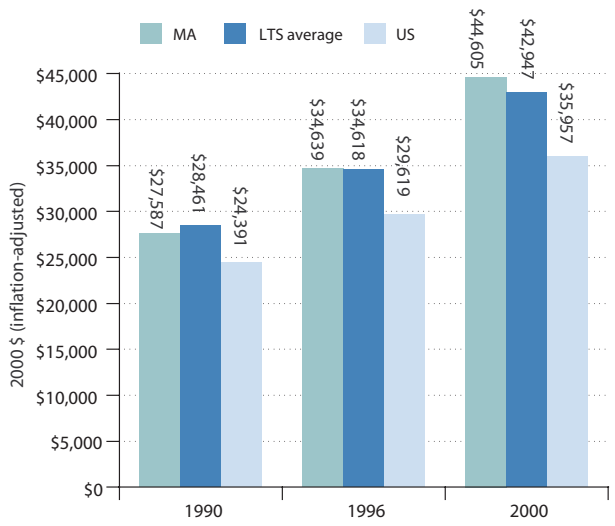
Source of all data for this indicator: Collaborative Economics, Regional Financial Associates

Indicator 4

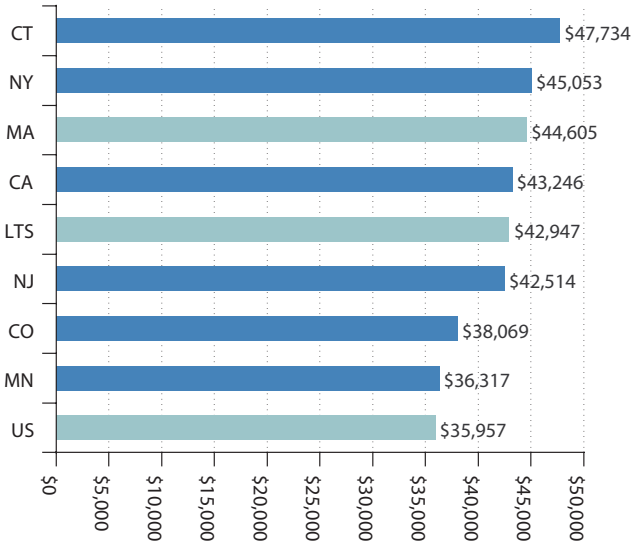
Pay per Worker in All Industries

Average pay in the state remains higher than the LTS and national average

Average annual pay per worker, Massachusetts, LTS average, and US, 1990, 1996 and 2000 (inflation-adjusted)



Average pay per worker, Massachusetts, other LTS, LTS average, and US, 2000 (inflation-adjusted)



Source of all data for this indicator: Collaborative Economics, Economy.com

Why is it significant?

Growth in pay per worker, adjusted for inflation, is a measure of job quality and a key determinant of standard of living. It can also result from employers increasing wages to attract and retain workers in short supply.

How does Massachusetts perform?

In 2000, the average annual pay in Massachusetts was $44,605 compared to an LTS average of $42,947, and the U.S. average of $35,957. From 1996 to 2000, average annual pay per worker increased 5.8% in inflation-adjusted terms in Massachusetts, which was higher than the LTS average of 4.8%.

Between 1990 and 2000, the annual average pay of Massachusetts workers increased 6.2% in inflation-adjusted terms, compared with 5.1% in the LTS average. Of the six other LTS, Massachusetts average pay per worker in 2000 was third to Connecticut ($47,734) and New York ($45,053).

What does this trend mean for Massachusetts?

Rising pay per worker indicates that, on average, Massachusetts workers are benefiting from the economic growth occurring in the state. Higher pay may contribute to rising quality of life costs (such as housing), and increases a company's cost of doing business. However, the comparatively high level of average pay in the state is consistent with the state's high level of workforce educational attainment and resulting returns in worker productivity for companies. Labor shortages and low population growth exert additional pressure on firms to pay higher-than-average wages in order to attract and retain workers. Housing and taxes influence purchasing power, so the state should monitor these two areas, because these costs are rising faster in Massachusetts than in most of the nation.

Indicator 5

Median Household Income

The growth rate in Massachusetts median household income continues to lag LTS and US average over time

Why is it significant?

Successful economies create opportunities for all households to increase their incomes. A rising standard of living throughout the state will not only reduce poverty and improve lives, it also improves the incentives for a broad range of the state's residents to seek the education and skills training essential to maintain a competitive workforce. This indicator compares change in median household income in Massachusetts, in the LTS, and in the U.S as a whole.

How does Massachusetts perform?

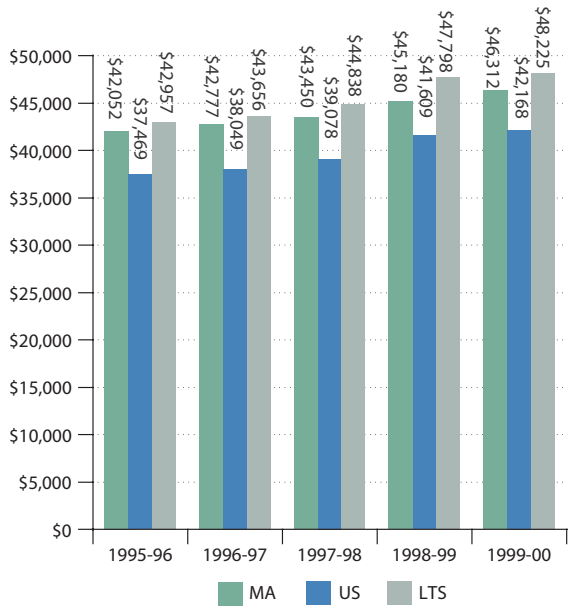
Since the 1995-1996 period, Massachusetts median household income has increased at an annual average rate of 2.0%, which is the second-lowest among the LTS and the U.S. Among the LTS, New Jersey had the lowest rate at 0.9%, while Minnesota had the highest at 3.5%, closely followed by Connecticut (3.2%).

However, from 1998-1999 to 1999-2000, Massachusetts median household income increased 2.5%, from $45,180 to $46,312. The Massachusetts rate was higher than the LTS average (0.9%) and the U.S. (1.3%).

What does this trend mean for Massachusetts?

Median household income began to increase during the late 1990s, after several years in which median household income in Massachusetts declined, in real terms. Despite its reputation as a high-wage, high-cost state, Massachusetts does not lead the LTS in median household income, and the gap between Massachusetts and the LTS has widened somewhat in recent years. The disparity underscores the continued importance of upgrading the educational attainment and skill levels of all residents, and of retaining high-quality jobs in the state, in order to maximize good opportunities for all residents.

Median household income, Massachusetts, LTS average, and US, 1995-2000 (2-year moving average)



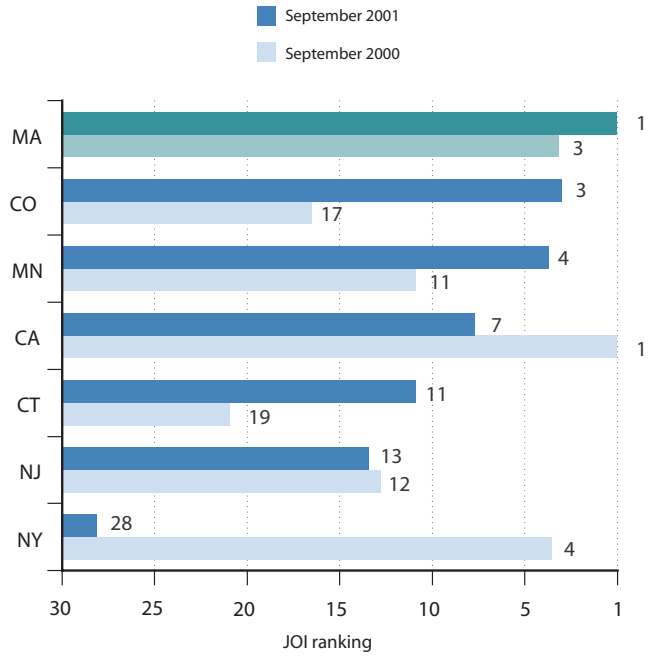
Source: U.S. Census Bureau

Indicator 6

Job Opportunity Index (JOI)

Survey ranks Massachusetts first among the LTS and US in best places to find employment

Job Opportunity Index (JOI) rankings, Massachusetts and other LTS, September 2000 and September 2001



Job Opportunity Index (JOI) rankings, Massachusetts and other LTS, June 2000- September 2001

	Sept. 2001	June 2001	Jan. 2001	Sept. 2000	June 2000
MA	1	1	1	3	4
MN	4	3	4	11	10
CA	7	6	2	1	1
CO	3	5	5	17	16
CT	11	9	7	19	22
NJ	13	14	13	12	13
NY	28	28	17	4	3

Source of all data for this indicator: FlipDog.com

Why is it significant?

The FlipDog Job Opportunity Index (JOI) is a monthly measure of the current supply of jobs relative to workforce size (based on a scale from 1-50). The JOI is a measure of how many jobs in the state's economy are unfilled at a given point in time. If the unemployment rate is a measure of how well the state's economy is performing in providing jobs to all citizens (see Indicator 19), the JOI is another indicator of how the state is providing workers with appropriate skills to firms growing in the state. The JOI is developed at the national, regional, state, and metropolitan levels for the U.S. and covers a broad range of companies.

How does Massachusetts perform?

As of September 2001, Massachusetts ranked first in the JOI for job seekers. This signifies that, despite recent layoffs, the chronically-tight labor market that many Innovation Economy companies have faced in recent years has not loosened up greatly at this time.

Among the LTS, Colorado ranked third, followed by Minnesota with a JOI ranking of 4. New York ranked the lowest among the LTS at 28 during the same period. Massachusetts has remained first among the LTS and the U.S. in JOI rankings since January 2001.

Since the inception of the JOI in June 2000, Massachusetts has ranked in the top 5 in JOI rankings of best places to find a job in the nation. Among the LTS, Colorado, Connecticut, and Minnesota have improved their JOI rankings since June 2000, while California, New Jersey, and New York have either remained the same or experienced a decline.

What does this trend mean for Massachusetts?

Through the first three quarters of 2001, every region of the country had experienced a reduction in total employment, as lay-offs ripple through a broad range of industries. Layoffs accelerated in the wake of the September terrorist attacks on Washington and New York, and have included a variety of layoffs in Massachusetts. However, the persistent high ranking of Massachusetts in the Job Opportunities Index is an indication of the long-term workforce problem that continues to confront the state. Minimal, long-term workforce growth in the state (see Indicators 19 and 20) means that the state needs a relatively high degree of workforce participation from its residents, and a relatively high degree of educational and skill attainment from its workers, lest opportunities in the state's growing firms go begging, or go elsewhere.

Indicator 7

Perception of Business Climate and Consumer Confidence Index

State's favorable business climate rating by high-tech business leaders stays constant; however, consumers in the state and the US are less optimistic about economy

Why is it significant?

Confidence of businesses in a region reflects not only current conditions but can also influence future prospects. Positive or negative perceptions of a state affect investment patterns. The perception by high technology business leaders of how Massachusetts rates as a place in which to create, operate, or expand businesses is a bottom-line indicator of the overall climate for innovation and technology-based industry in the state.

Consumer confidence is a leading indicator for the business cycle and for future spending. The U.S. Consumer Confidence Index measures how optimistic or pessimistic consumers are with respect to the economy in the near future. The quarterly Massachusetts Consumer Confidence Index is modeled on the U.S. Conference Board Index. Consumer confidence correlates with business and job prospects, incomes, and inflation. The growth of help wanted advertisements and stock market performance are two examples of occurrences that contribute to boosting consumer confidence.

How does Massachusetts perform?

Massachusetts CEOs continue to rate the state very favorably as a place to conduct business, although there was a slight decline in their ratings. In 2001, 90% of the executives responding to the Massachusetts High Technology Council annual survey rated the Massachusetts business climate as "good" or "outstanding," down slightly from 91% a year earlier. The state's favorable business climate rating has, however, been decreasing since the survey high of 96% in 1999.

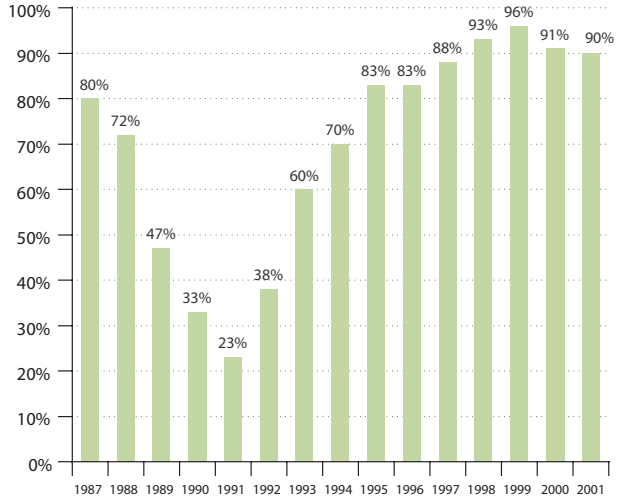
As of July 2001, the Massachusetts Consumer Confidence Index had declined 31 points to 101.3, representing a 23.5% decrease in consumer confidence from 2000 (132.5). The U.S. Consumer Confidence Index dropped 24.4 points to 114.6 (a 17.6% decrease) during the same time period. These declines are in sharp contrast to the trends from 1992 to 2000, during which time there had been a steady increase in both the Massachusetts and U.S. Consumer Confidence Indices.

What does this trend mean for Massachusetts?

Massachusetts CEOs continue to rank Massachusetts as a favorable place to conduct business, although there has been a downward trend since 1999. The Massachusetts High Technology Council reported that its CEO members noted that the "unprecedented period of high-tech business growth had begun to moderate" for 2001.

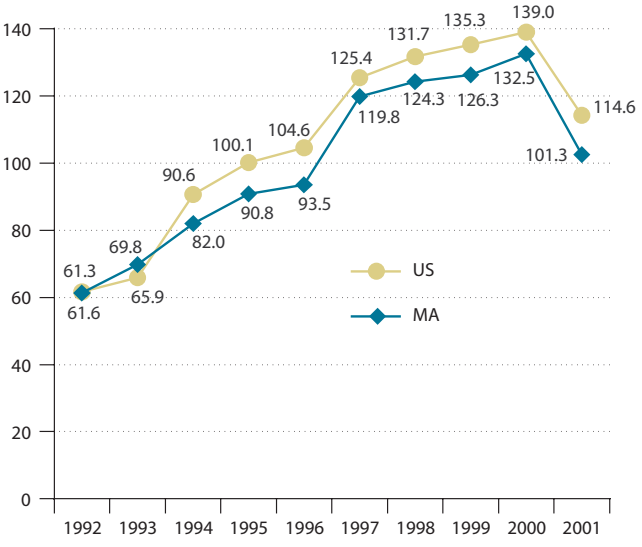
By July 2001, consumer confidence in Massachusetts and the U.S. experienced its first point dip since 1992. The drop in consumer confidence is a cause for concern regarding future economic growth. Consumers' assessment of current economic conditions in both Massachusetts and the U.S. has been falling steadily in line with the slowdown in the economy and the stock market since the latter part of 2000. Consumer spending accounts for two-thirds of economic activity; hence, weaker consumer confidence should be a source of concern for the state and for the U.S.

Percentage of high-tech CEOs rating Massachusetts "good" or "outstanding" as a place to create, operate, expand high-tech businesses, 1987-2001



Source: Mass High Tech Council

Consumer Confidence Index, Massachusetts and US, 1992-July 2001



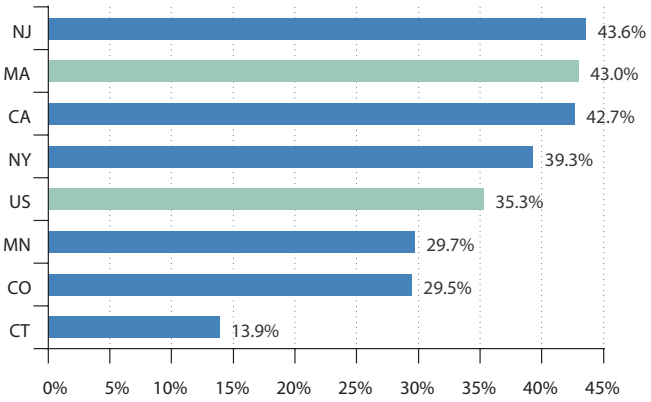
Source: The Conference Board (U.S.); Mass Insight Corporation/New England Economic Project (Massachusetts)

Indicator 8

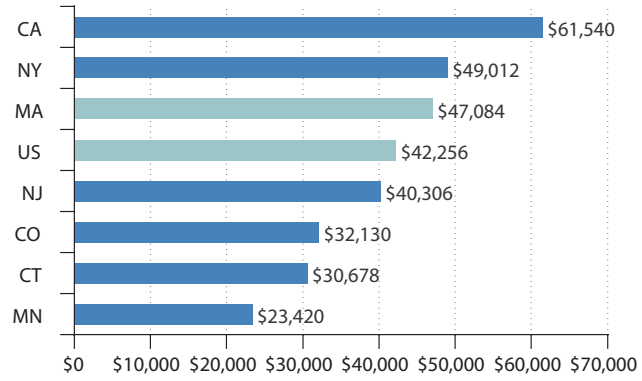
Manufacturing Exports

Value of manufacturing exports rises; Massachusetts exports to Asia and Mexico increase

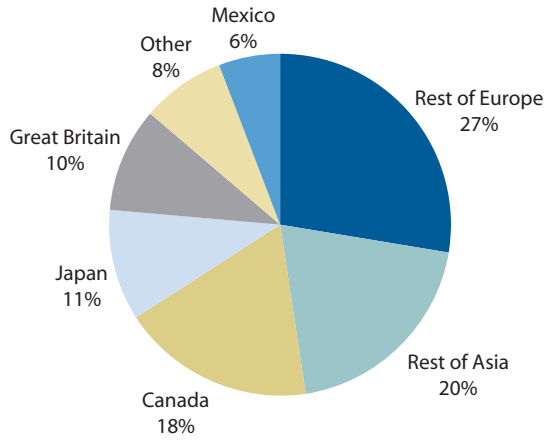
Percent change in value of manufacturing exports per employee, Massachusetts, other LTS, and US, 1999-2000



Value of manufacturing exports per employee, Massachusetts, other LTS, and US, 2000



Destination of Massachusetts exports, 2000



Source of all data for this indicator: MISER; Office of Trade and Economic Analysis; International Trade Administration, U.S. Department of Commerce; Bureau of Labor Statistics

Why is it significant?

Exports are an important indicator of global competitiveness. By participating in the global marketplace, innovation-based companies have greater opportunity to bolster growth in employment, sales, and market share. Market diversification is vital to the success of global companies, as it guards against downward economic fluctuations in any single market.

How does Massachusetts perform?

Massachusetts and each of the other six LTS experienced strong increases in the value of their manufacturing merchandise exports between 1999 and 2000. The value of Massachusetts exports increased by 43.0% during that period, the second highest increase among the LTS, and above the U.S. growth (35.3%). Since 1991, the value of Massachusetts manufacturing exports has increased 83.7%. New Jersey ranked first among the LTS in growth in value of manufacturing exports per employee at 43.6%, outpacing the growth rate of California (42.7%) and New York (39.3%) from 1999 to 2000.

Per employee, Massachusetts manufacturing exports ($47,084) places the state third among the six other LTS, well above the national average ($42,256) in 2000. California ranked first among the LTS ar $61,540, followed by New York at $49,012.

There was little change in the destination patterns for Massachusetts exports between 1999 and 2000. Canada (18%), Japan (11%), and Great Britain (10%) remained the state's largest trading partners. Mexico received 6% of the state's exports, an increase from 1999 (4%). Major trading regions were Europe (excluding Great Britain) at 27%, and Asia (excluding Japan) at 20%.

What does this trend mean for Massachusetts?

The manufacturing sector remains valuable to the Massachusetts economy. The increase in manufacturing value per employee is good for the state, denoting a strong exports sector. The value of products that the state is exporting are high and in demand domestically and overseas. The growth of Massachusetts exports shows the state's continued integration into the global economy. Although the manufacturing sector has experienced declines from late 2000 into 2001, over time, manufacturing values continue to increase in the state and in the U.S.

Innovation Process Indicators

Innovation Process Indicators

The innovation process includes idea generation, technology commercialization, entrepreneurship, as well as innovation occurring in established businesses. This dynamic innovation process is an essential component of a competitive economy because it translates ideas into high-value products and services, and creates positive results for both business and people. Although the innovation process has different stages, a strong interrelationship among them is critical for success.

Indicator 9

Number and Type of Patents Issued

Patents per capita remain high, but recent patent activity in the state experiences a slow growth rate when compared to the LTS

Why is it significant?

Patents reflect the initial discovery and registration of innovative ideas. Strong patent activity usually reflects significant commercially relevant research and development. The primary reason to secure patent protection is the potential relevance of an invention or discovery to a marketable product or process.

How does Massachusetts perform?

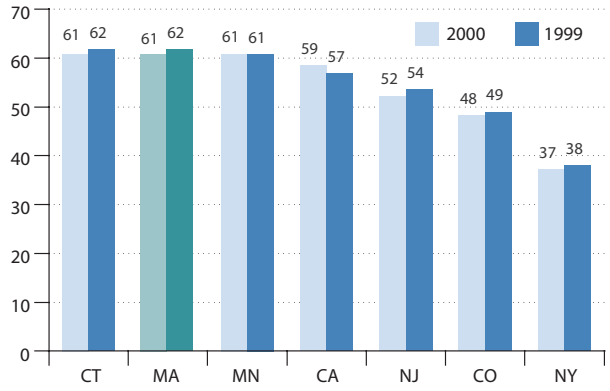
Massachusetts, Connecticut, and Minnesota were in a three-way tie for highest patents per capita among the LTS, with 61 patents per 100,000 people. The absolute number of patents in Massachusetts has increased from 2,713 in 1996 to 3,841 in 2000, a 41.6% increase. California has shown the most growth among the LTS with a 66.0% increase in patent activity from 1996 to 2000, followed by Minnesota at 49.7%. From 1999 to 2000, California (5.2%), Colorado (4.5%), and Minnesota (3.2%) led the LTS in terms of growth in total number of patents. Massachusetts and New Jersey ranked last among the LTS with a total patent growth rate of only 0.6% for the same period.

Patents in Massachusetts cross a wide range of sectors. From 1996 to 2000, Healthcare was the most active area, with 24% of all patents, compared to 16% between 1991 and 1995. Miscellaneous Industry & Transportation/Aerospace was the second most active in the 1996-2000 period, with 19% of all patents, followed by Computers (13%), and Chemicals (9%).

What does this trend mean for Massachusetts?

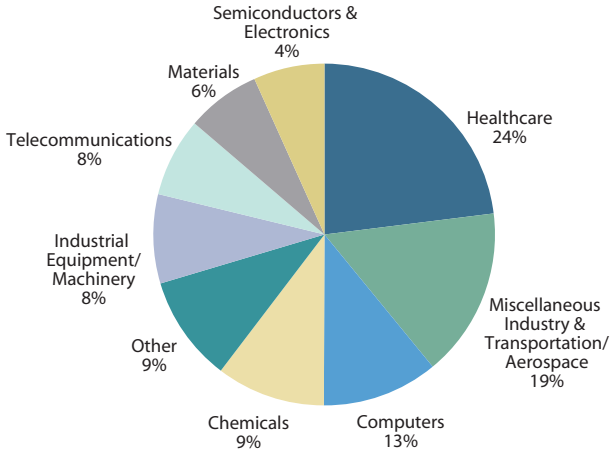
The state continues to remain strong in patents per capita. However, competitor states are closing the gap. During 1999-2000, Massachusetts had one of the smallest increases in total number of patents among the LTS. And most of the LTS, including Massachusetts, exhibited a slowdown in patent activity over the past year on a per capita basis. Patent activity is a key factor in the Innovation Economy and one that the state should watch and support.

Number of patents issued to state residents, per capita, Massachusetts and other LTS, 1999 and 2000

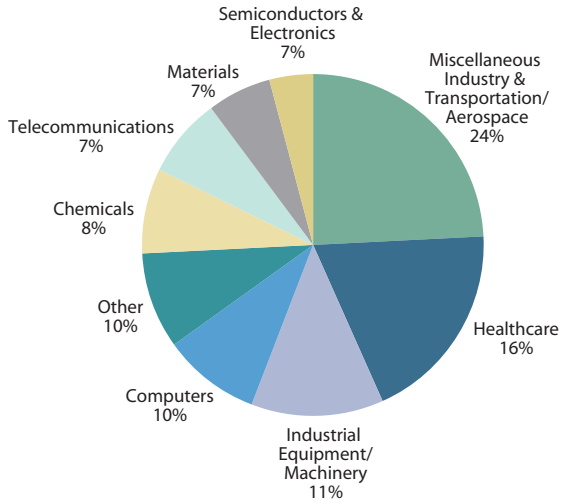


Source: U.S. Patent and Trademark Office, U.S. Census Bureau

Distribution of patents issued, Massachusetts, 1996-2000



Distribution of patents issued, Massachusetts, 1991-1995



Note: Portions may not sum to 100 % due to rounding

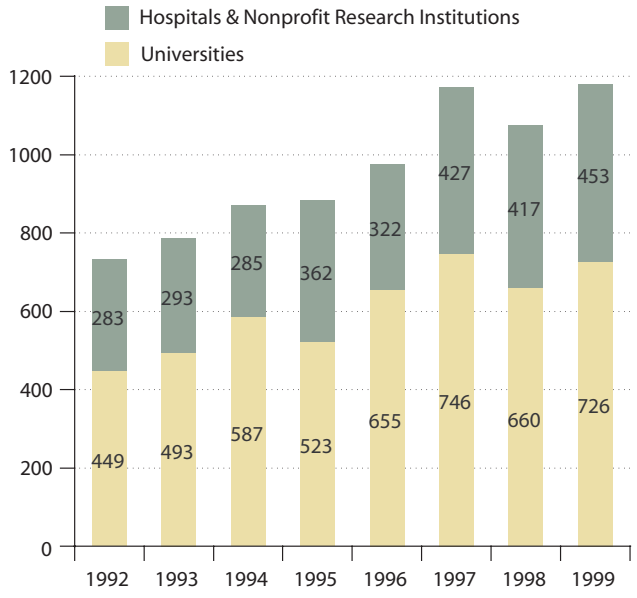
Source of data for pie charts; CHI Research

Indicator 10

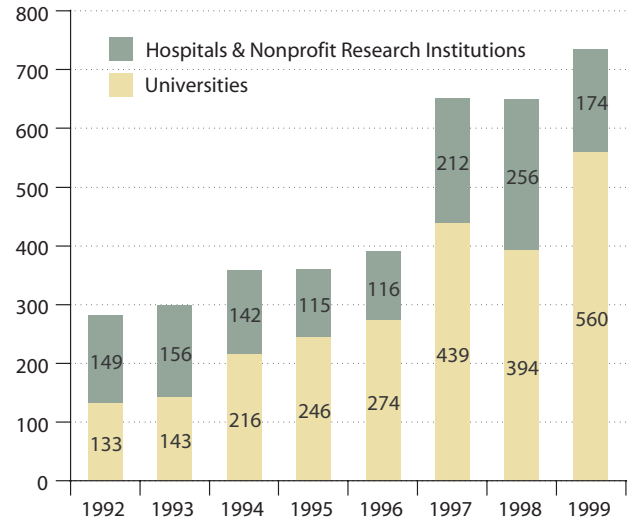
Invention Disclosures and Patent Applications

Patent applications and invention disclosures increase in Massachusetts; patent applications experience a significant increase at universities, while a decline occurs at hospitals and research institutions

Number of invention disclosures received by major universities, hospitals, and nonprofit research institutions, Massachusetts, 1992-1999



Number of new patent applications filed each year by major universities, hospitals, and nonprofit research institutions, Massachusetts, 1992-1999



Source of all data for this indicator: Association of University Technology Managers

Why is it significant?

Massachusetts universities, hospitals, and research institutions are important sources of pioneering ideas. Individual inventors formally disclose inventions to their sponsoring institutions in order to initiate the complex process toward patent protection. The next major step following disclosure is a formal patent application to the U.S. Patent and Trademark Office. The level of invention disclosures and formal patent applications reflects the initial registry of innovative ideas or inventions with commercial potential.

Research conducted by major universities, hospitals, and research institutions has a two-fold "spillover" effect on the state's economy. First, institutional research induces private sector research to capitalize on innovations. The new companies, goods, and services created downstream then spur economic vitality.

How does Massachusetts perform?

The number of invention disclosures reported annually by Massachusetts academic and nonprofit institutions increased 9.5% from 1,077 in 1998 to 1,179 in 1999. Since 1991, two-thirds of all invention disclosures have been reported by universities, with the remainder based in hospitals and other nonprofit research institutions.

Of the hospitals and research institutions, Massachusetts General Hospital (MGH) accounted for the most invention disclosures (38.4%) in 1999. Significant growth occurred at Brigham and Women's Hospital (11.0%) between 1998 and 1999. Among the universities, the Massachusetts Institute of Technology (MIT) was responsible for just over half of all the inventions disclosed during 1998 and 1999. The University of Massachusetts (all campuses) continued to show strong growth in invention disclosures, increasing 19.1% between 1998 and 1999.

Massachusetts universities, hospitals and research institutions filed 734 patent applications in 1999, a 12.9% increase from 1998 (650). Patent applications filed by hospitals and research institutions dropped by 32.0% between 1998 and 1999, while patent applications by universities increased 42.1% during this period. MIT increased its patent applications by over fifty percent from 1998 to 1999, the highest increase among Massachusetts universities.

What does this trend mean for Massachusetts?

Growth in patent applications and invention disclosures is a good sign. The development and protection of intellectual property by Massachusetts leading research institutions continues to keep pace with the increased investments in their research. This activity shows a healthy base for future new products, technologies, and goods. The state's research institutions also continue to file patent applications at a rate significantly above the national average, suggesting that the flow in the intellectual property pipeline will continue to remain strong. An area that needs to be monitored is the slowdown in patent applications by hospitals and research institutions.

Indicator 11

Technology Licenses and Royalties

Massachusetts universities, hospitals, and research institutions increase number of technology licenses and royalties, reversing the decrease experienced in the previous year

Why is it significant?

Technology licenses provide a vehicle for the transfer of intellectual property (e.g., patents, experimental findings) from universities, hospitals, and other research organizations to companies who will commercialize the technology. Royalties from these licenses reflect the perceived value of the intellectual property in the commercial marketplace.

Licensing revenues are affected by the disciplines in which the research is undertaken and by the degree to which university and other institutional research is focused on marketable products. The number of new technology licenses, and gross royalties derived, are indicators of the success of technology-transfer efforts by universities, hospitals, and research institutions.

How does Massachusetts perform?

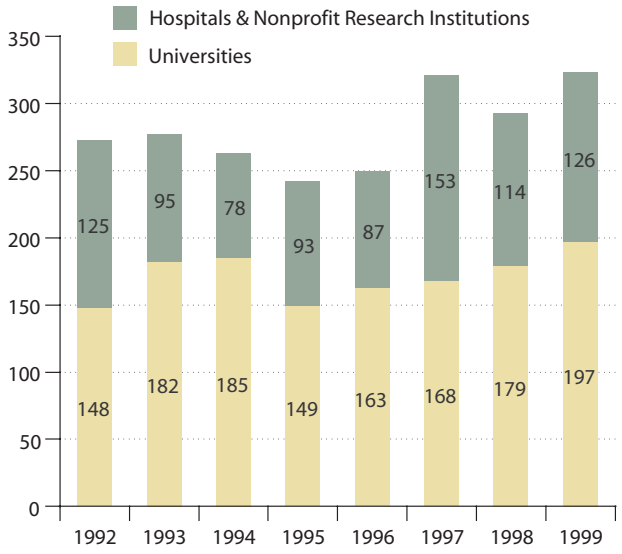
New technology licenses issued by major universities, hospitals and research institutions in Massachusetts increased 10.2% from 293 in 1998 to 323 in 1999. The Massachusetts Institute of Technology (MIT) and Harvard University together generated 44.2% of these licenses in 1999 among major universities.

Gross royalties received from institutional licensing in Massachusetts increased 18.6%, from $43 million in 1998 to $51 million in 1999. In 1999, the four institutions in Massachusetts receiving the highest amount of royalties were, in descending order: MIT, Harvard, Massachusetts General Hospital, and the University of Massachusetts (all campuses). The UMass system doubled its license income from 1998 to 1999.

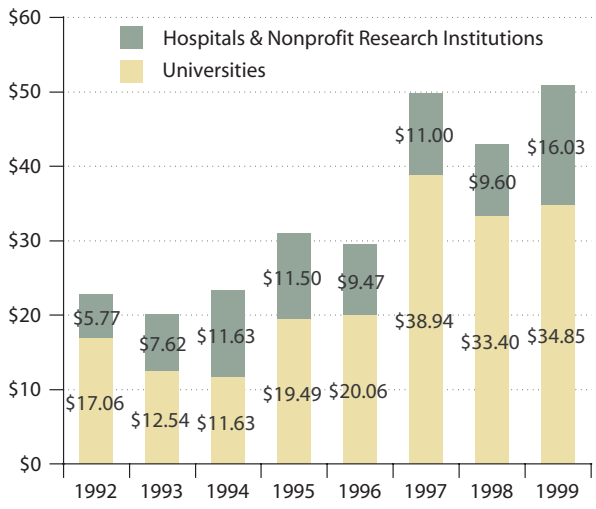
What does this trend mean for Massachusetts?

The across-the-board growth in new licenses issued and royalties received by Massachusetts universities, hospitals, and research institutions is strong evidence of the commercial relevance of the state's basic research enterprise, and the state's continued strength in this area. Two-thirds of these agreements continue to be made with startups and other small businesses, providing a steady stream of proprietary technology to companies to underpin their future growth. This activity highlights the importance of universities in the innovation process—especially the university powerhouses of Harvard University and MIT, and the growing role of the University of Massachusetts system—as significant portions of licensing revenues are recycled back into additional research at the institution.

Number of technology licenses issued by major universities, hospitals, and nonprofit research institutions, Massachusetts, 1992-1999



Value of gross licensing income received, Massachusetts, 1992-1999



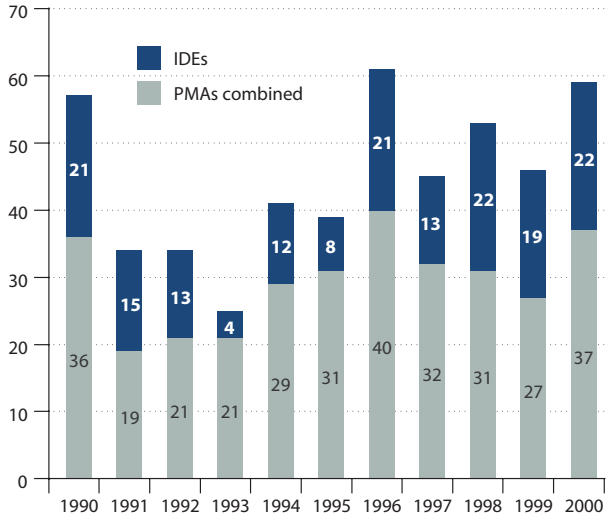
Source of all data for this indicator: Association of University Technology Managers

Indicator 12

FDA Approval of Medical Devices

Medical device applications experience strong FDA approval rate

Number of FDA application approvals for advanced medical devices, Massachusetts, 1990-2000



Source: U.S. Food and Drug Administration

Why is it significant?

The U.S. Food and Drug Administration (FDA) approval process uses three application categories to classify medical devices: investigational device exemptions (IDEs), premarket approvals (PMAs), and 510(k)s for less sophisticated instruments or product improvements. The most complex, the highest-risk, and the newest technologies tend to be classified as IDEs or PMAs. Approval rates reflect innovation in medical device manufacturing and important linkages to the teaching hospitals, where many of these instruments undergo clinical investigation.

How does Massachusetts perform?

Massachusetts consistently ranks among the top states in the nation for approval of IDEs. The total number of IDEs increased by 15.8% from 1999 to 2000, compared to a 13.6% decrease during the previous year. Among the LTS, California, Colorado, and Minnesota also experienced an increase in IDE approvals. In addition, PMAs in Massachusetts increased by 37.0% between 1999 and 2000. With 37 approvals, Massachusetts ranks third among the LTS behind Minnesota and California, with 127 and 103 approvals, respectively.

According to MassMEDIC, the association of medical device manufacturers in the state, there are 264 medical device companies based in Massachusetts. These firms account for approximately 5% of the state's total manufacturing base and employ more than 21,000 people, with an additional 17,000 Massachusetts citizens employed in related industries.

What does this trend mean for Massachusetts?

FDA approval for advanced medical devices is an important step in moving from innovative ideas and health research to commercial products and medicines in the healthcare field. Timely approval of medical devices by the FDA enhances the state's competitiveness in the healthcare industry. Encouraging the collaboration of the state's medical device businesses with local academic and research institutions enhances the level of new device research and commercialization.

Indicator 13

New Business Incorporations

New business incorporations increase in the state

Why is it significant?

The formation of new businesses is a key indicator of a robust economy. High numbers of new business starts typically indicate an economic environment capable of fostering risk-taking and innovative ideas. Successful new companies provide new jobs, ideas, goods, and services.

How does Massachusetts perform?

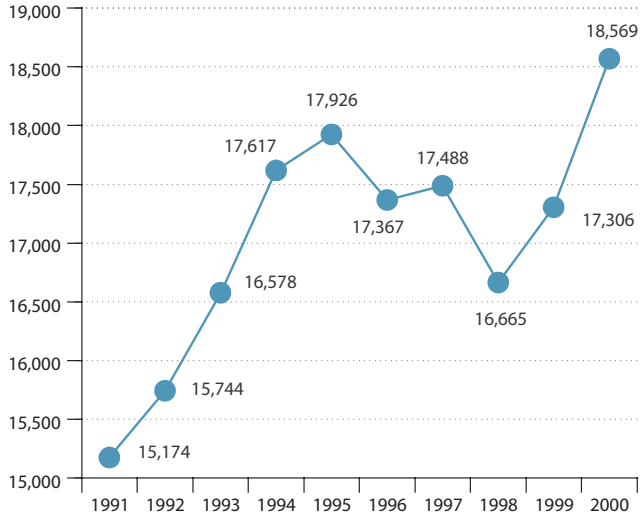
In 2000, 18,569 new business incorporations were registered with the Secretary of State—a 7.3% increase from 1999. Over two-thirds of the new business incorporations in 2000 were for-profit, Massachusetts-based businesses; 23.0% were registered by out-of-state, for-profit businesses conducting business in Massachusetts; and 8.5% were nonprofit businesses. The number of new business registrations by out-of-state entities in Massachusetts increased 15.9% from 1999-2000.

From 1991 to 2000, new business incorporations registered by out-of-state entities have doubled in the state, while nonprofit businesses have increased 19.6%. For-profit businesses in the state increased 8.0% during the same time period.

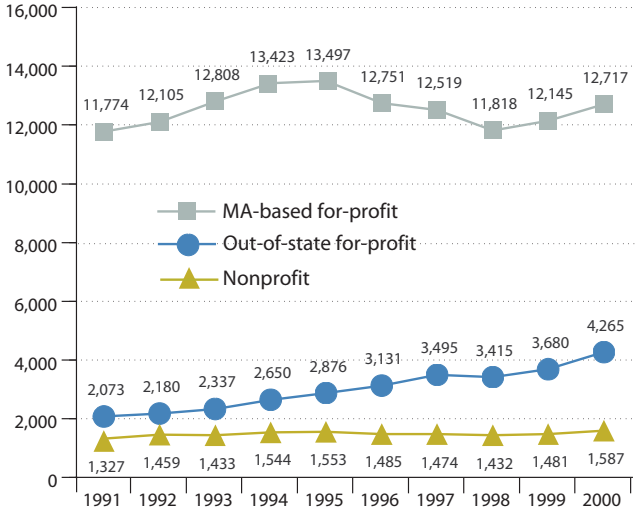
What does this trend mean for Massachusetts?

The diversity in Massachusetts new business incorporations (for-profit and nonprofit new businesses) is encouraging, and shows that the state is an attractive place for all types of businesses. Another positive sign for the state is that the total number of all new business incorporations is increasing over time. The state must ensure that it continues to encourage new business activity by its citizens.

Number of new business incorporations, Massachusetts, 1991-2000



Number of new business incorporations by category, Massachusetts, 1991-2000



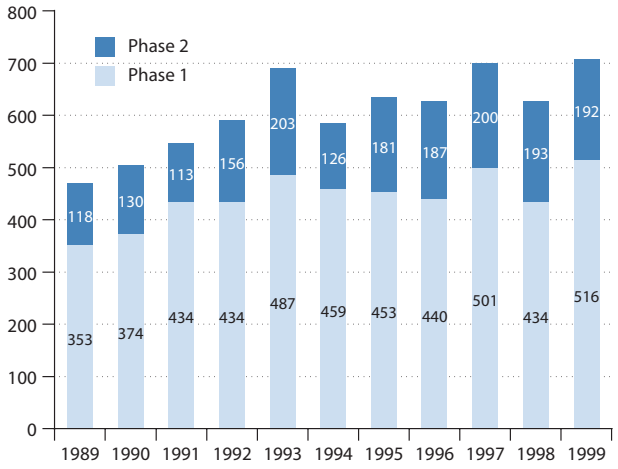
Source of all data for this indicator: Secretary of the Commonwealth

Indicator 14

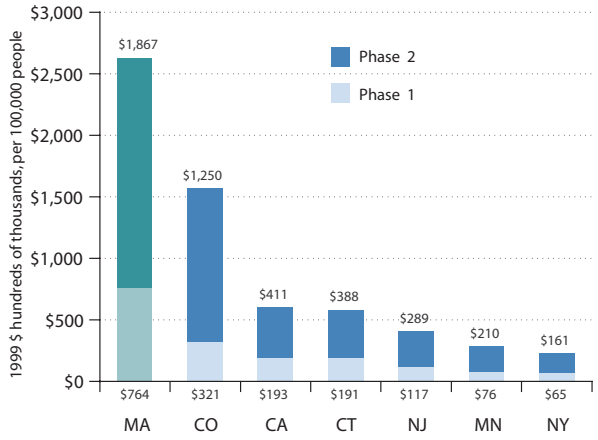
SBIR Awards

Small Business Innovation Research Awards increase in number and value

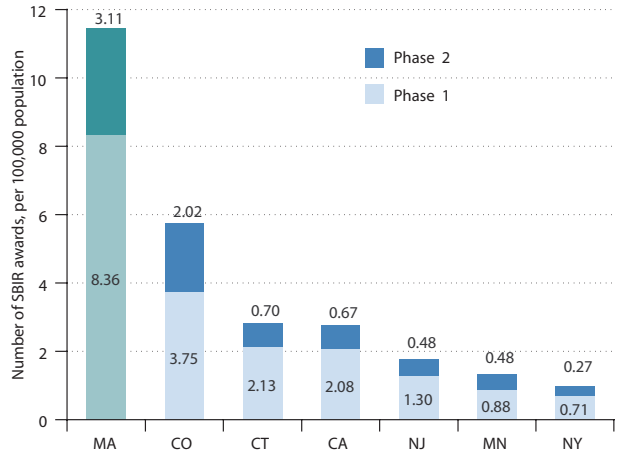
Number of SBIR awards to Massachusetts companies by phase, 1989-1999



Value of SBIR awards to Massachusetts and other LTS companies by phase, per 100,000 people, 1999



Number of SBIR awards to Massachusetts and other LTS companies by phase, per 100,000 people, 1999



Source of all data for this indicator: Small Business Administration

Why is it significant?

The Small Business Innovation Research (SBIR) Program provides competitive grants to entrepreneurs seeking to conduct "Phase I" proof-of-concept research on the technical merit and feasibility of their ideas, and "Phase II" prototype development to build on these findings. The federal SBIR program is reputed to be the world's largest seed capital fund for development of new products and processes, and often provides the initial revenue stream for start-up companies. Nationally, companies that receive funding from Phase II of the SBIR program significantly outperform similar companies that do not receive such support. Participants in the SBIR program are often able to use the credibility and experimental data developed through their research to attract strategic partners and outside capital investment.

How does Massachusetts perform?

Since the inception of the program in 1983, Massachusetts has consistently ranked second behind California in total number of awards and dollar amounts received from the SBIR program. Massachusetts received a total of 708 SBIR awards in 1999, a 12.9% increase from 1998. On a per capita basis, Massachusetts had the highest award rate in the country in 1999. Massachusetts received nearly twice the per capita awards of Colorado, its closest competitor among the LTS, and over four times the per capita awards of California in the same time period.

In 1999, the total dollar value of SBIR awards to Massachusetts companies was $162 million. Phase II awards are significantly larger in dollar value than Phase I awards and comprised about 71% of all SBIR funding in the state in 1999.

What does this trend mean for Massachusetts?

On a per capita basis, Massachusetts is the national leader in this activity. The SBIR program continues to provide Massachusetts technology-focused entrepreneurs with an important source of seed capital to start and grow their companies. The success of Massachusetts in this program is an indicator of innovative thinking and the strong high-tech entrepreneurial activity that exists in the state. By continuing its strong support for the SBIR program, Massachusetts shows its commitment to the continued growth of emerging technology companies.

Indicator 15

Initial Public Offerings (IPOs) and Mergers & Acquisitions (M&As)

Total number of IPOs drops in Massachusetts, but average dollar value increases significantly; total number of M&As increases in the state

Why is it significant?

The number of initial public offerings (IPOs) is one indicator of future high-growth companies. "Going public" raises significant capital to invest and stimulates next-stage growth in a company. Mergers and acquisitions (M&As) are another important avenue to liquidity for entrepreneurs and investors in rapidly growing companies. Innovation-based niche companies may be attractive to other firms seeking to diversify, expand sales or market share.

How does Massachusetts perform?

After a record IPO year in 1999, Massachusetts had 34 IPOs in 2000, a 5.6% decrease from the previous year (36). In 2000, Massachusetts was second among the LTS, with California leading in IPO activity with 131 IPOs. Almost all the LTS and the U.S. as a whole saw a drop (-14.2%) in total number of IPOs from 1999 to 2000. Colorado had the only increase (8.3%) in IPO activity from 1999 to 2000. In 2000, Massachusetts and the LTS had 50% of the total U.S. IPO market.

The average dollar value of IPOs in Massachusetts increased significantly from 1999 to 2000. The average dollar value of IPOs in Massachusetts in 2000 was $207 million, a 179% increase from the previous year ($74 million). During the first two quarters of 2001, Massachusetts had only 2 IPOs, with an average dollar value of $32 million. In the U.S., there have been only 27 IPOs during the same period, compared to 267 during the first two quarters of 2000.

The Software & Communications Services cluster accounted for 32% of the IPOs in Massachusetts in 2000, followed by Business Services (e.g., consulting and website development) at 26%, and Healthcare Technology at 18%. Among the LTS, the key industry clusters and sectors with the highest IPO activity in 2000 included: Software & Communications Services (California), Healthcare Technology (Connecticut and Minnesota), Business Services (Colorado and New York), Computers & Communications Hardware (New Jersey).

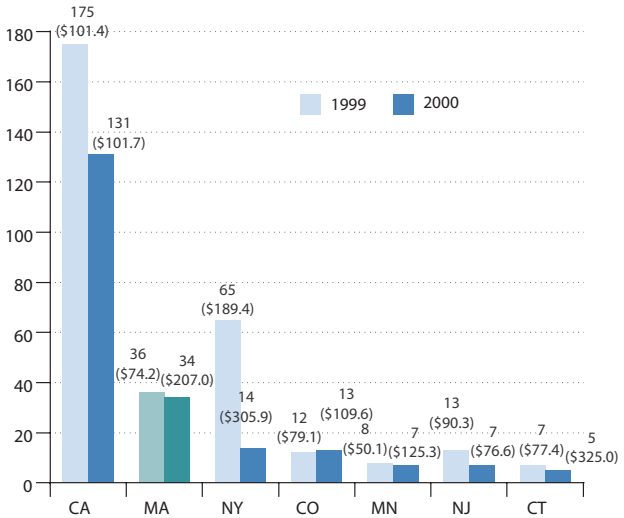
The number of M&As in Massachusetts continued its steady climb to 411 in 2000, a 24.2% increase from 1999, which was the highest percent increase among the LTS and the U.S. California had a 13.8% increase in total number of M&As, followed by New York at 12.9%. Only New Jersey and Connecticut saw a decrease in total number of M&As (-10.0% and -20.0%, respectively). Through the first two quarters of 2001, Massachusetts had 205 M&As, which was the third-highest among the LTS. California was the highest at 676 M&As, followed by New York with 326.

What does this trend mean for Massachusetts?

The industry diversity in Massachusetts IPOs is a good sign. The increase in average valuations of Massachusetts companies going through an initial public offering is also a positive trend. Massachusetts IPOs are now being valued at levels comparable to those in California and the other LTS. However, the trend towards fewer but larger dollar value IPOs may signal the emergence of a new financing gap. The IPO market needs to be monitored in the future to determine how a decrease in total numbers, but an increase in total dollar values, affects the Massachusetts economy.

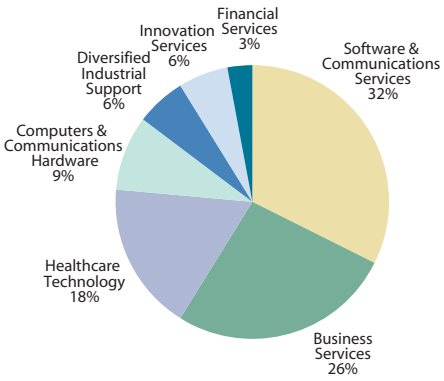
The increases in total M&A activity in Massachusetts reflects dynamism and change in the economy. As M&A activity continues to create larger entities, it will be important to monitor all stages of business formation (new business incorporations, fast growth companies) in the state so that competitive advantage and high-tech growth is not weakened or hindered through this market activity.

Total number and average dollar value of initial public offerings (IPOs), Massachusetts and other LTS, 1999 and 2000



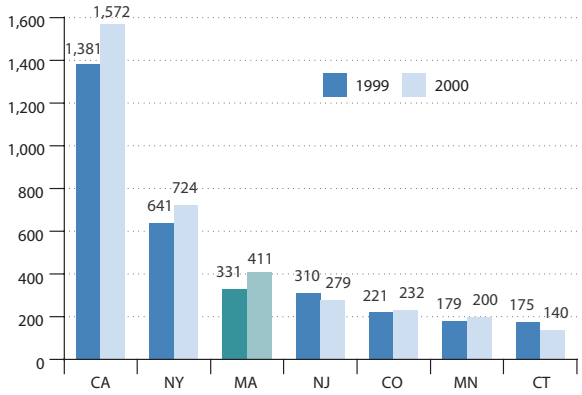
Note: Number in parentheses is average dollar value

Distribution of IPOs, Massachusetts, 2000



Note: Portions may not sum to 100 % due to rounding

Total number of mergers and acquisitions (M&As) Massachusetts and other LTS, 1999 and 2000



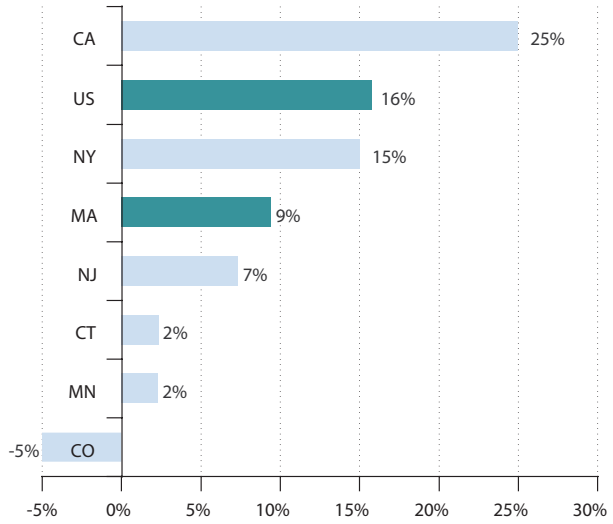
Source of all data for this indicator: Andersen

Indicator 16

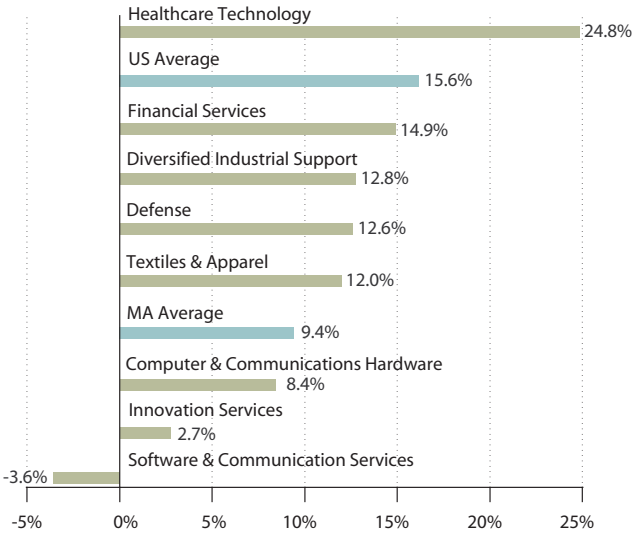
NASDAQ Firms' Market Value

Market slowdown affects overall performance of NASDAQ firms in Massachusetts and in LTS

Annual average growth rate of total market capitalization for Massachusetts, other LTS, and US, March 1996-March 2001 (inflation-adjusted)



Annual average growth rate of NASDAQ companies' market value by clusters, US and Massachusetts, March 1996-March 2001 (inflation-adjusted)



Source of all data for this indicator: NASDAQ and Collaborative Economics

Why is it significant?

The National Association of Securities Dealers' stock exchange, NASDAQ, is known for its innovative, emerging growth companies. Fifty-eight percent of its listed companies are small with market capitalization of less than $100 million. NASDAQ is home to more than half of all public companies listed on the three primary U.S. markets (New York Stock Exchange (NYSE) and American Stock Exchange (Amex) are the other two U.S. markets).

How does Massachusetts perform?

The market value of Massachusetts-based NASDAQ companies grew from $55 billion in March 1996 to $94 billion in March 2001, inflation-adjusted. This annualized growth rate of 9% lagged the 16% annualized growth rate of all NASDAQ firms in the U.S., and placed the state well behind California (25%), the top ranked LTS. From March 2000 to March 2001, Massachusetts firms listed on the NASDAQ experienced a 62.8% decrease in value, compared to 56.5% decrease in the U.S. California's firms experienced a 64.9% decrease during the same time period, while Colorado had the largest decrease (70.6%) among the LTS and all NASDAQ firms in the U.S.

The average annual growth in market value of Massachusetts NASDAQ companies between March 1996 and March 2001 was strongest in Healthcare Technology (24.8%)—due in part to the number of the state's biotechnology firms listed on this exchange—followed by Financial Services (14.9%), and Diversified Industrial Support (12.8%). The average annual growth rate in the Massachusetts Software & Communications Services cluster declined (-3.6%) during the same time period; this cluster had an 84.1% drop in market value from March 2000 to March 2001. These statistics reflect a pattern seen across the LTS: California's Software & Communications Services firms experienced a 68.5% decrease in market value, while the LTS as a whole saw a 71.0% decline in this cluster.

What does this trend mean for Massachusetts?

From March 1999 to March 2001, the market has seen some of its highest and lowest activities in recent history. Over the five-year period, Massachusetts NASDAQ firms underperformed the U.S. average and California. However, from March 2000 to March 2001, Massachusetts firms have faired slightly better than California and several other LTS. One positive sign is that the Commonwealth's NASDAQ portfolio continues to be dominated by strong performers in the Innovation Economy clusters. Over 85% of its value comes from companies in the nine key industry clusters.

Indicator 17

Fast Growth Companies

The total number of fast growth companies in Massachusetts declines—but declines in the LTS as well

Why is it significant?

As the U.S. has made the transition to a knowledge-based economy, a new generation of growth-oriented companies is emerging. One benchmark of such growth is the number and distribution of fast growth companies ("gazelles"), defined as publicly-traded companies whose revenues have grown at an average annual compound rate of 20% or more during the last four years. By generating increases in output and jobs, gazelles stimulate growth in other businesses and personal spending.

How does Massachusetts perform?

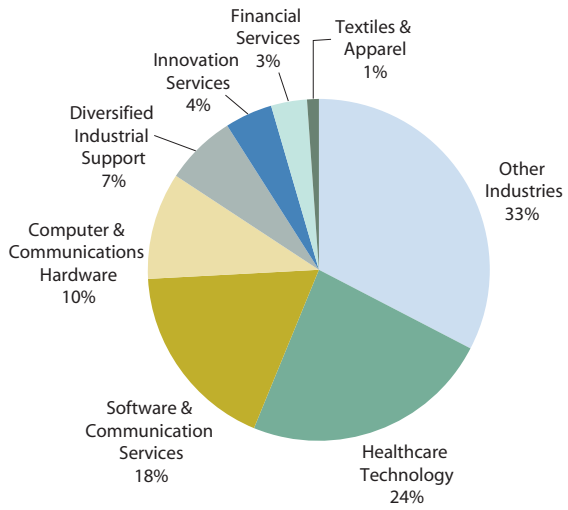
The economic slowdown during the second half of 2000 is reflected in corporate growth patterns. The total number of fast-growth companies in Massachusetts has declined to 89 in 2000 from 111 in 1999, a 19.8% decrease. However, each LTS experienced a similar decrease, suggesting that the decline reflects the overall slowing of the U.S. economy. California, which had the highest number of gazelles (382) in 1999, experienced a decrease of 11.0% to 340. Connecticut experienced the largest decrease (-34.3%) in total number of fast growth companies. Gazelle growth in Massachusetts remains strong over time; from 1992 to 2000, the number of Massachusetts gazelle companies has increased by 122.5%, the highest percentage increase among the LTS.

The Healthcare Technology (24%), Software & Communications Services (18%), and Computers & Communications Hardware (10%) clusters comprise over half of all gazelles in Massachusetts. Thirty-three percent of the gazelles fall into the "other" category, which spans retail, restaurants, and other diverse services and products.

What does this trend mean for Massachusetts?

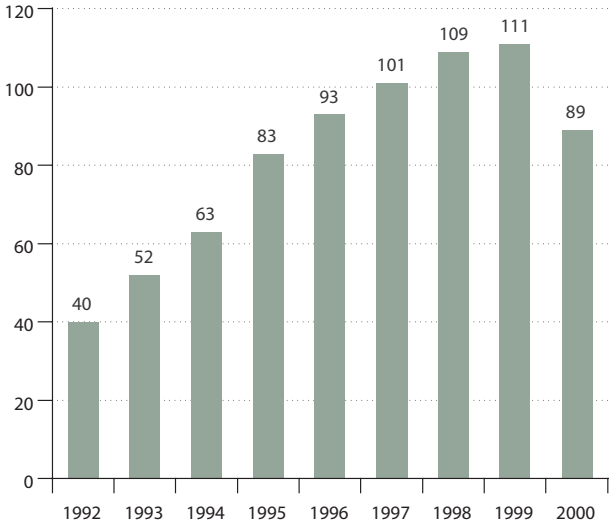
Although the total number of fast-growth companies in Massachusetts decreased in 2000, long-term "gazelle" growth in the state continues to be strong. Fast growth companies are a vital part of the Innovation Economy and Massachusetts should support a business climate that encourages these companies to thrive in the state. The diversity of industries of gazelles in Massachusetts is a good sign and indicative of a climate that is supportive of this type of accelerated business activity throughout the economy.

Distribution of publicly-traded fast growth companies, Massachusetts, 2000



Note: Portions may not sum to 100 % due to rounding

Number of publicly-traded fast growth companies, Massachusetts, 1992-2000



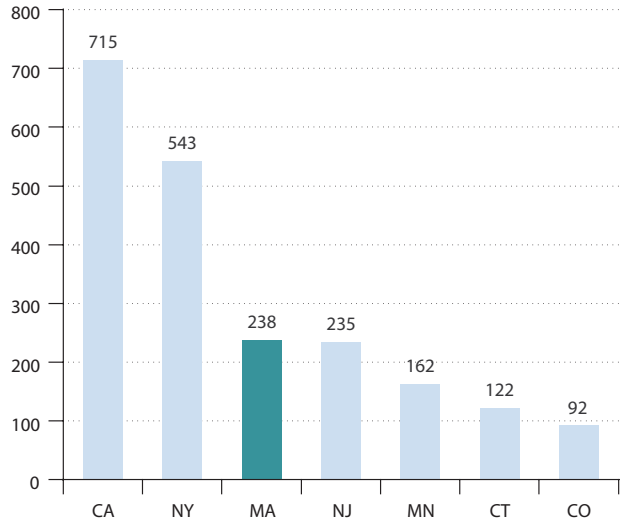
Source of all data for this indicator: Standard & Poor's Compustat

Indicator 18

Corporate Headquarters

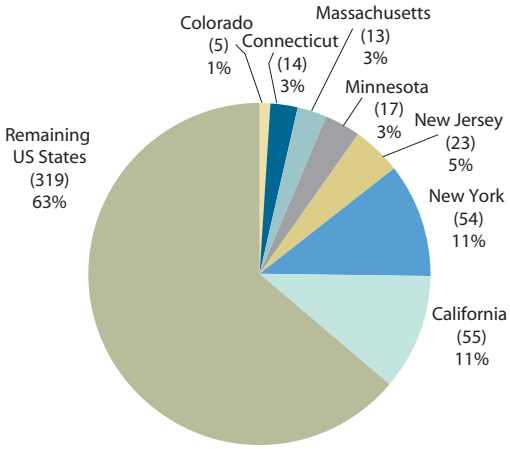
Massachusetts has third-highest number of corporate headquarters compared to the LTS, but state has relatively small number of Fortune 500 firms

Number of corporate headquarters located in Massachusetts and other LTS, corporations with more than 500 employees, 2000



Source: InfoUSA.com

Distribution and total number of Fortune 500 companies located in Massachusetts, other LTS, and remaining US states, April 2001



Note: Portions may not sum to 100 % due to rounding

Source: Fortune Magazine

Why is it significant?

Corporate headquarters are important "anchors" of industry clusters. They spawn new businesses, and corporations typically keep their key strategists and development-related activities near headquarters. Corporate headquarters also tend to have greater community ties, including philanthropic support, than do branch plants.

How Does Massachusetts Perform?

In 2000, Massachusetts was home to the corporate headquarters of 238 firms with 500 or more employees, a slight decrease (-1.2%) from the previous year. Among the LTS, California led with 715, followed by New York with 543; Colorado had the smallest number of corporate headquarters with 92. California was the only LTS to experience an increase in total number of corporate headquarters from 1999 to 2000 at 1.3%.

As of April 2001, Massachusetts was home to 13 of the Fortune 500 firms, ahead of only Colorado (5)of the LTS. California is home to 55 Fortune 500 companies, ranking first among the LTS, followed by New York (54), then New Jersey (23). Massachusetts Fortune 500 firms are distributed primarily among the banking, insurance, and retail sectors. These include: Allmerica Financial, BJs Wholesale Club, EMC, FleetBoston Financial, Gillette, John Hancock Financial Services, Liberty Mutual Insurance Group, Massachusetts Mutual Life Insurance, Raytheon, Staples, State Street Corporation,Thermo Electron, and TJX.

What does this trend mean for Massachusetts?

Although experiencing a slight decline in 2000, the trend in recent years has shown an increase in the number of companies headquartered in Massachusetts and most of the LTS. From 1998 to 2000, Massachusetts grew its total number of corporate headquarters by 11.2%, the second largest increase among the LTS. With its highly-skilled, highly-educated workforce and strong professional services base, Massachusetts is an attractive site for corporate headquarters, which are often the primary location for the firm's research, entrepreneurial, and philanthropic activities. Massachusetts should actively recruit and retain corporate headquarters and be responsive to their needs.

Resource Indicators

Resource Indicators

Critical resources include human resources, technology, investment and infrastructure. These resources provide the fuel for productivity growth and are the foundation of the Innovation Economy. Private investment decisions and public policies affect the level and nature of available resources.

Indicator 19

Population Growth Rate and Unemployment Rate

Massachusetts has second lowest population growth rate of the LTS; state continues to experience low unemployment rate, as do several other LTS

Why is it significant?

State population growth rates represent changes in demographics through the process of births, deaths, aging, and movement from state-to-state or to other countries.

The unemployment rate is indicative of the state's ability to employ its residents in the economy and of its untapped pool of potential workers.

How does Massachusetts perform?

From 1990 to 2000, Massachusetts experienced an average annual population growth rate of 0.5%, which was the second lowest among the LTS (Connecticut was at 0.4%) while the nation grew at 1.2%. Among the LTS, Colorado had the highest average annual population growth rate of the LTS at 2.7%, followed by California at 1.3%.

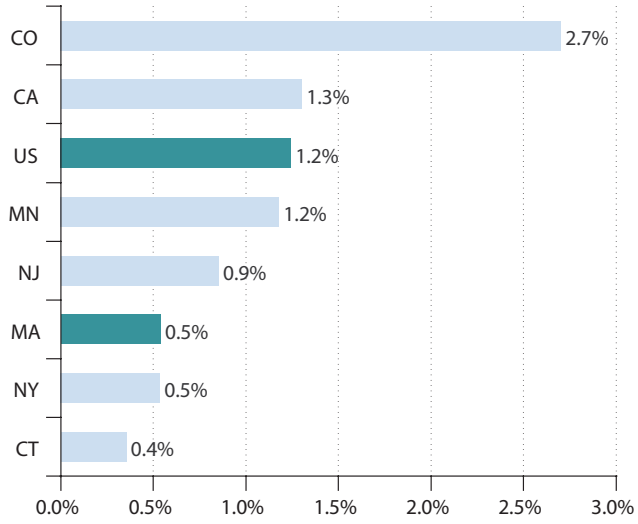
In 2000, Massachusetts had an unemployment rate of 2.6%—the second-lowest unemployment rate among the LTS. The U.S. unemployment rate in 2000 was 4.0%. Connecticut had the lowest unemployment rate of 2.3%, while California had the highest rate among the LTS with 4.9% during the same time period. Most of the LTS and the nation as a whole have experienced a decrease in the unemployment rate over the past several years.

However, recent data for 2001 shows the unemployment rate rising for Massachusetts and the U.S. As of August 2001, Massachusetts unemployment rate had jumped to 3.9%, and the U.S. rate increased to 4.9%.

What does this trend mean for Massachusetts?

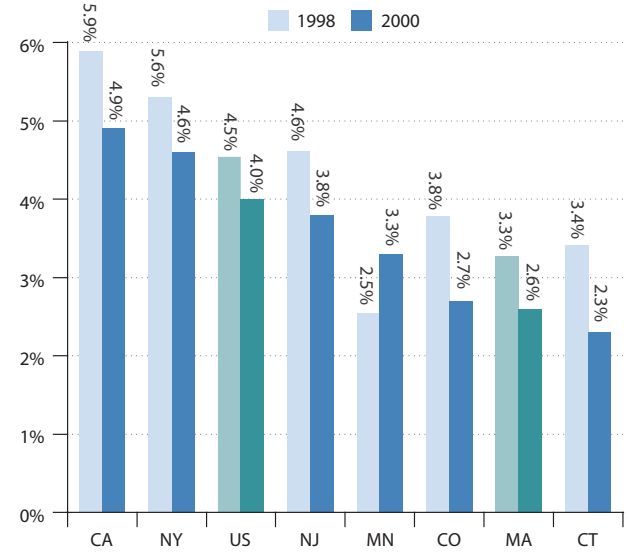
Low population growth and low unemployment continue to create a very tight labor market in Massachusetts. The low unemployment rate means workers are able to find jobs—however, relatively slow population growth results in fewer people in the potential labor pool. This could hurt economic growth in the state—especially if other LTS are not so constrained. A relatively low unemployment rate also puts pressure on wages, as firms compete for a scarce labor pool, and may make the state less competitive. The recent increases in the unemployment rate for Massachusetts will have to be watched over time, and the state should continue to work to ensure that all citizens have access to job opportunities.

Annual average population growth rates, Massachusetts, other LTS, and US, 1990-2000



Source: U.S. Census Bureau

Unemployment rate, not seasonally-adjusted, Massachusetts, other LTS, and US, 1998 and 2000



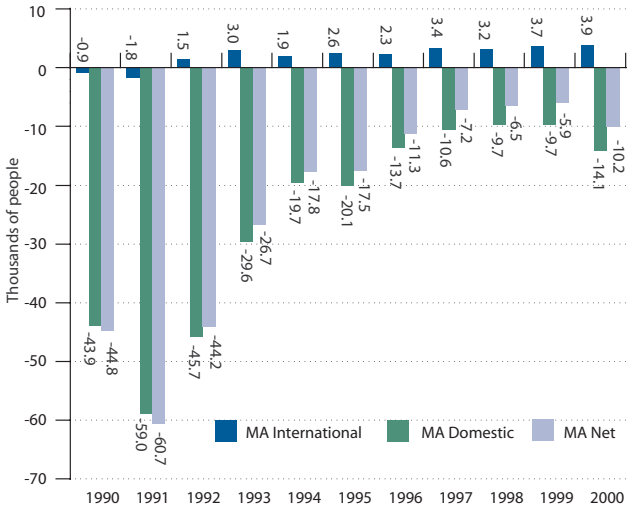
Source: Bureau of Labor Statistics

Indicator 20

Migration

Massachusetts experiences an increase in domestic out-migration; international in-migration continues to increase over time

International in-migration and domestic out-migration, Massachusetts, 1990-2000



Source: Statistics of Income Division, Internal Revenue Service

Why is it significant?

Laborforce expansion can help to sustain the economic growth of a region as employers have a larger pool of workers from which to hire. Alternatively, labor shortfalls, particularly in areas of high demand, can constrain economic growth as employers experience staffing shortages, higher wages, or both.

How does Massachusetts perform?

Each year from 1990 to 2000, when looking at migration patterns based on addresses on income tax returns, Massachusetts has experienced domestic out-migration. In 2000, approximately 14,100 people moved from Massachusetts to other states, a sharp increase from 9,700 people in 1999. However, Massachusetts international in-migration has offset some of the domestic out-migration from Massachusetts to other states. In 2000, approximately 3,900 people moved into Massachusetts, an increase of 5.5% from the previous year (3,700 people).

What does this trend mean for Massachusetts?

Slow population growth, compounded by out-migration, restricts the pool of workers available. International in-migration has helped the state, especially in filling some key jobs in the Innovation Economy. Further study of the out-migration trends needs to be conducted, and more work should be done on ways to attract and retain college-educated and skilled workers.

Workforce Education

Massachusetts has a well-educated population, but should strive for all workers to have access to educational opportunities and reach their full potential

Why is it significant?

The educational attainment level of the workforce is a fundamental indicator of how well a region can generate and support knowledge-based, innovation-driven economic growth. Education and skill levels influence laborforce quality and are of primary concern to employers. Strong mathematical, scientific, and communications skills are a prerequisite for many occupations, usually requiring a high school diploma at minimum, but more likely a college degree or higher.

How does Massachusetts perform?

In 2000, 14.9% of the Massachusetts population did not have a high school diploma, the same as in 1999. The percentage of Massachusetts residents without high school diplomas has declined over 60% between 1970 (41.5%) and 2000 (14.9%). The national percent of the adult population without a high school diploma has declined from 44.8% in 1970 to 15.9% in 2000.

However, the percentage of Massachusetts residents without a high school diploma has increased 0.5% since 1997 in contrast to the U.S, which declined 0.7% during that period.

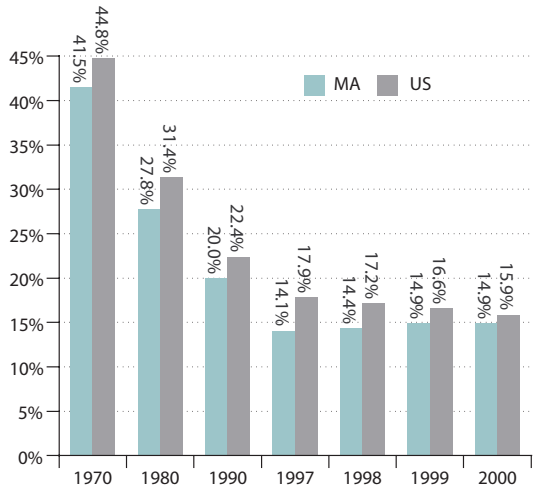
Nearly one-third of the Massachusetts population had a bachelor's degree, compared to 25.6% nationwide. The percentage of the adult population with a college degree in Massachusetts has nearly tripled between 1970 and 2000, consistent with national trends. Among the LTS, Massachusetts ranked second to Colorado (34.6%) in 2000.

The percentage of Massachusetts high school graduates planning to attend college varies by racial/ethnic group. In 1999, 82% of Asian students planned to attend college, followed by 75% of White students. Only 65% of African-American, 56% of Hispanic, and 51% of Native American students planned to attend college. From 1998 to 1999, African-American graduates planning to attend college increased 16.1%, the largest increase among the racial/ethnic groups in Massachusetts.

What does this trend mean for Massachusetts?

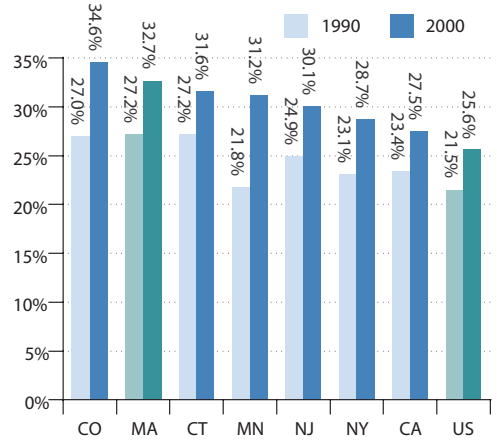
Massachusetts continues to have a relatively well-educated workforce compared to the other LTS and the U.S. This has provided the state a competitive advantage in fostering the growth of the Innovation Economy. Given the state's critical need for skilled and educated workers, Massachusetts needs to ensure access to education and training for all citizens. The increase in the percentage of residents without a high school diploma in recent years (while national statistics continue to drop), likely reflects the influx of immigrants, some of whom have relatively low educational attainment. The state's population is diverse, and the relatively smaller percentages of Hispanic, Native American, and African-American populations planning to attend college need to be addressed if these citizens are to actively participate in the high-tech economy. Mentoring, scholarships, affordable tuition, access to student loans, and supplemental skills training are several ways to help introduce a higher number of skilled workers to the Massachusetts Innovation Economy.

Percentage of the adult population without a high school diploma, Massachusetts, and US, 1970-2000



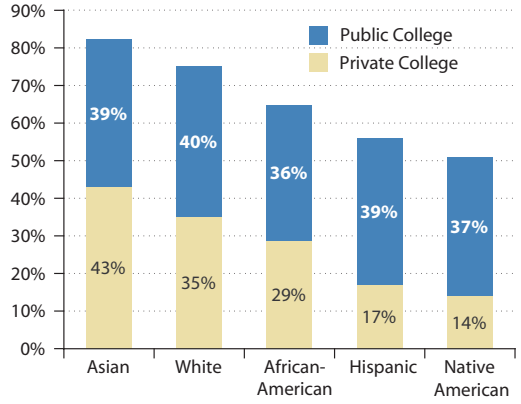
Source: U.S. Census Bureau

Percentage of the adult population with a college degree, Massachusetts, LTS, and US, 1990 and 2000



Source: U.S. Census Bureau

Massachusetts graduates planning to attend college by racial/ethnic group, 1999



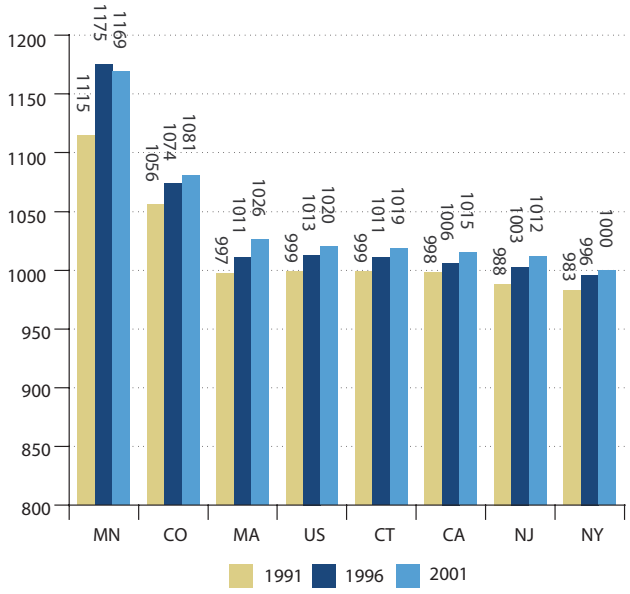
Source: Massachusetts Department of Education

Indicator 22

Scholastic Aptitude Test (SAT) Scores Massachusetts

SAT scores continue to increase; state also has one of the highest participation rates among LTS and US

Mean SAT scores in Massachusetts, other LTS and US, 1991, 1996 and 2001



Source: College Board

Why is it significant?

Taken by high-school students, the Scholastic Aptitude Test (SAT) is designed to assess many skills that are important to students' success in college. More than eighty percent of four-year colleges and universities use SAT scores in the admission process. SAT scores and the participation rate of students taking this test reflect the interest of the future workforce in a postsecondary education.

How does Massachusetts perform?

In 2001, the combined math and verbal SAT scores for Massachusetts was 1026, the third-highest among the LTS and the U.S. Minnesota students had the highest combined SAT scores among the LTS with 1169, followed by Colorado with 1081. Massachusetts SAT scores have increased 2.9% since 1991, which was the second highest percent increase in performance when compared to the LTS average (2.5%) and the U.S. (2.1%) during the same period.

Massachusetts students scored 515 on average on the math SAT in 2001, a 4.0% increase from 1991 (500). For the verbal SAT, Massachusetts scored 511 on average, a 1.8% increase from 1991 (507).

The participation rate of students taking the SAT can affect overall scores, since scores tend to decline with a rise in the percentage of test takers. In 2001, the Massachusetts participation rate was 79%, significantly higher than the national average (45%), and above that of several LTS, including New York (77%), California (51%), Colorado (31%), and Minnesota (9%). Connecticut had the highest participation rate at 82%, followed by New Jersey at 81%. In 2001, 66% of Minnesota students, and 61% of Colorado students, took the American College Testing exam (ACT), a test also used in the college admission process.

What does this trend mean for Massachusetts?

Many Massachusetts students are either choosing or being advised by parents to take the SAT, which is a sign that students are interested in attending college. The increase in test scores is encouraging for the state. As one of the indicators of educational quality, Massachusetts is doing a good job of preparing young people for future learning opportunities.

Indicator 23

Engineering and Computer Science Degrees

Number of engineering degrees awarded in Massachusetts increases, and at a higher rate than the US; total number of computer and information science degrees experiences double digit percent increase

Why is it significant?

Regions that are well-served by postsecondary engineering programs have a strong advantage in the creation of new products and ideas. The resulting pool of new engineers and computer scientists for technology-related industries is an important indicator of future workforce resources.

How does Massachusetts perform?

Massachusetts experienced a 3.3% increase in total number of engineering degrees awarded in 2000, from 4,368 in 1999 to 4,512 in 2000, beating the U.S. increase of 1.5%. At the undergraduate level, the number of degrees awarded by Massachusetts schools increased 2.2% from 1999 to 2000 (2,384 versus 2,437). Nationally, undergraduate engineering degrees increased (1.8%) during the same period.

At the graduate level, the number of master's engineering degrees awarded by Massachusetts institutions increased from 1999 to 2000, and at over five times the national rate, 4.0% versus 0.7%, respectively. The total number of engineering PhD degrees awarded in Massachusetts increased by 8.0%, outpacing the 1.6% increase nationwide, during the same period.

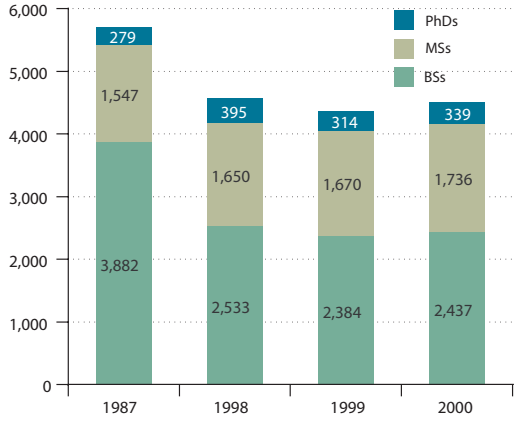
The total number of computer science degrees in Massachusetts increased 19.4% in 1998, from 1,184 in 1997 to 1,414 in 1998 (latest data available). The number of undergraduate degrees awarded by Massachusetts institutions increased by 22.1% between 1997 and 1998. At the graduate level, there was a significant increase in the total number of master's degrees (15.6%) in 1998, reversing the previous year's decrease of 6.5%. There was also an increase in the total number of doctorate degrees awarded in Massachusetts (4.8%) in 1998.

A survey of engineering colleges and universities by the Massachusetts Technology Collaborative found that on average over half (56%) of the engineering graduates stayed in the state after graduation in 2000, the same as in 1999. Since 1997, there had been a gradual increase in Massachusetts engineering graduates that remain in the state.

What does this trend mean for Massachusetts?

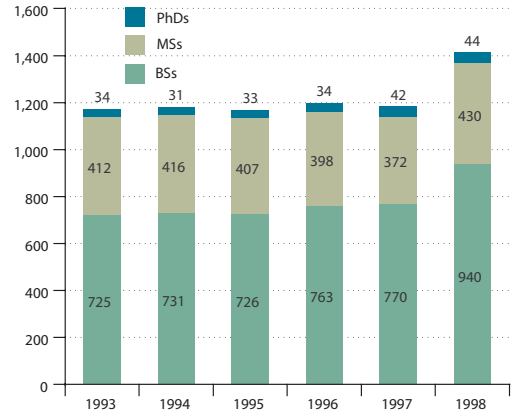
The fields of engineering and computer & information science play important roles in the growth of the Innovation Economy. Massachusetts experienced an increase in degrees awarded in engineering in 2000. The annual number of engineering graduates, however, is still well below those in the late 1980s and mid-1990s. Individuals with engineering and computer & information science skills contribute to entrepreneurship, innovation, and new business starts; they are also valuable resources in attracting SBIR and federal R&D funds. Universities, state government, and the private sector need to continue to support programs that encourage more young people to enter and complete these programs.

Number of engineering degrees awarded by Massachusetts schools, by degree level, 1987, 1998, 1999 and 2000



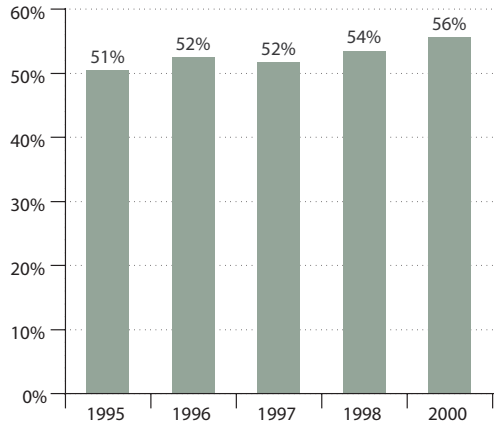
Source: American Association of Engineering Societies

Number of computer and information sciences degrees awarded by Massachusetts schools, by degree level, 1993-1998



Source: National Science Foundation

Percentage of Massachusetts engineering graduates still living in Massachusetts, by year of graduation, 1995-2000



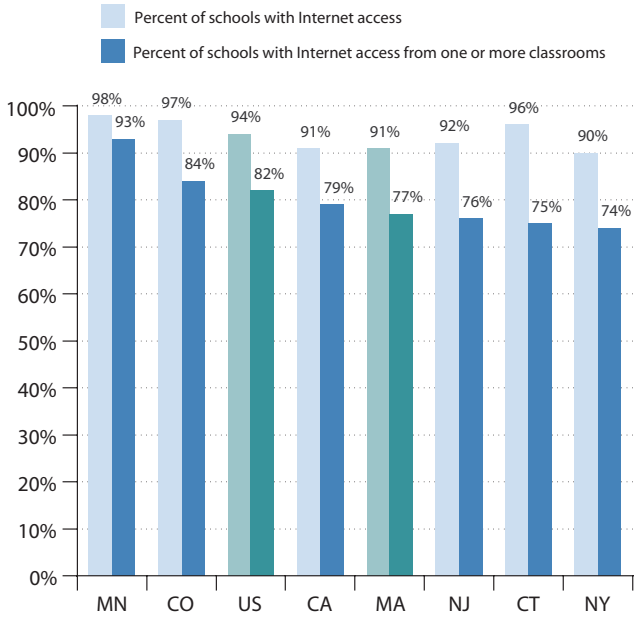
Source: MTC Engineering Survey

Indicator 24

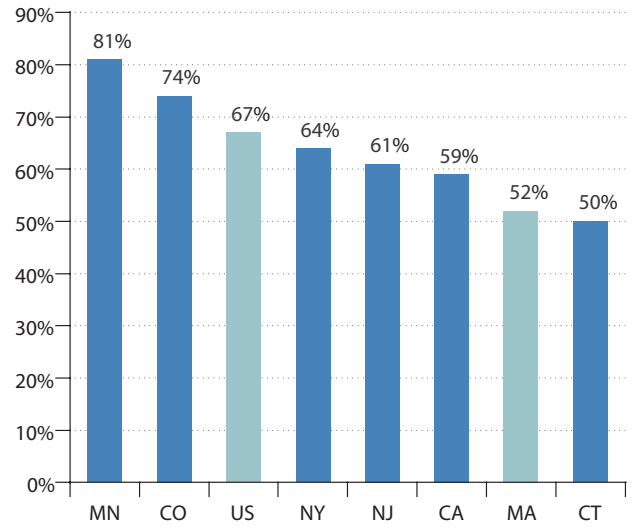
Computers in Education

Most Massachusetts schools have access to the Internet; however, high-speed access and classroom availability of the Internet lags behind most LTS and the US average

Access to technology, Massachusetts, other LTS, and US, 2000



Percentage of schools that access the Internet through a high-speed connection (T1 or cable modem), Massachusetts, other LTS, and US, 2000



Source of all data for this indicator: Education Week

Why is it significant?

Access to computers and access to the Internet in the classroom allows children to develop computer skills at an early age. Thus, students will acquire technical expertise and understanding of the Innovation Economy and be better prepared for higher education and jobs in the New Economy.

The level of Internet connectivity is also critical for schools. Schools that have 'broadband' access to the Internet (high-speed connections that allows large amounts of video and data to be transmitted in two directions) benefit from faster transmissions of information, thus allowing the Internet to become a more accessible tool for learning.

How does Massachusetts perform?

Ninety-one percent of Massachusetts schools had access to the Internet in 2000, which was the fourth highest among the LTS and below the U.S. average. Minnesota led the LTS with 98% of its schools being connected to the Internet, followed closely by Colorado at 97%. Although Massachusetts has a high percentage of schools with Internet access, only 77% of the schools have access to the Internet from one or more classrooms in 2000. Minnesota (93%) and Colorado (84%) lead the other LTS and the U.S. in schools having Internet access from one or more classrooms in the same period. However, many of the LTS lagged behind national averages for Internet access.

In 2000, 52% of Massachusetts schools accessed the Internet through a high-speed connection (T1 or cable modem), which was the second lowest percentage among the LTS and the U.S. Minnesota ranked first among the LTS with 81% of its schools accessing the Internet through a high-speed connection, followed by Colorado at 74%. Connecticut ranked the lowest among the LTS, with only 50% of its schools with Internet connectivity through a high-speed connection.

What does this trend mean for Massachusetts?

This is a significant indicator in terms of the future of the Innovation Economy in Massachusetts. The relatively poor access to the Internet among the LTS compared to the U.S. stands in sharp contrast to other indicators. The data indicates that Massachusetts and the LTS appear to be lagging in the application of technology in the classroom. There is a strong correlation between broadband access and having the Internet available in the classroom for routine use in instruction. Computer usage in the schools impacts the highly-educated and skilled workforce, the interest and understanding of students for new technologies, and the distribution of benefits of the Innovation Economy, as discussed in the special analysis. If Massachusetts is serious about maintaining its competitive edge in innovation and high-tech, the state should be a leader in this and related indicators. Being below the U.S. average is inconsistent with this goal.

Indicator 25

Student Interest in Technical Careers

Massachusetts experiences an increase in the percentage of high school students interested in computer science; however, demand continues to exceed supply of computer science and engineering graduates

Why is it significant?

Postsecondary education is a basic requirement for many jobs in innovative companies. In particular, the fields of science, engineering, and Information Technology (IT) are especially important to the growth of the Innovation Economy. Most colleges and universities require the Scholastic Aptitude Test (SAT) as part of the admission requirement. The profile of intended majors of college-bound seniors who take the SAT is an important indicator of the interests that secondary school students have in those fields that are important to the growth of the Innovation Economy.

How does Massachusetts perform?

In 2000, of those Massachusetts students taking the SAT, only 6% indicated an intention to major in engineering in college, the second lowest percentage among the LTS. This pattern has remained relatively constant over the past several years. Colorado and Minnesota students ranked first among the LTS, with 11% of students intending to major in engineering, followed by California at 9%. Minnesota, New Jersey, and New York all experienced a small decrease in percentage of students intending to major in Engineering from 1999 to 2000.

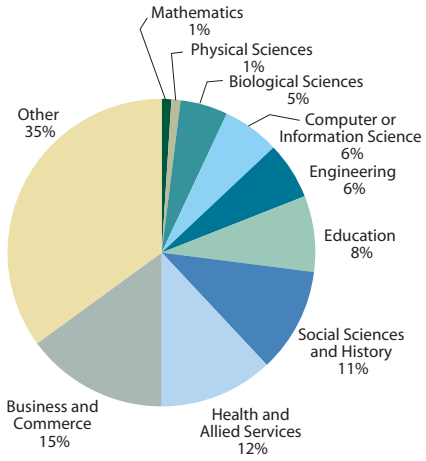
The other most popular intended majors of Massachusetts students taking the SAT in 2000 included Business & Commerce (15%), Health and Allied Services (12%), Social Sciences and History (11%), Education (8%), and Biological Sciences (5%). Only 1% of Massachusetts students surveyed expressed the intention to major in Mathematics.

The intended major of Computer or Information Science of students taking the SAT in 2000 ranked low across the board, with the highest percentage at 7% and lowest at 4%. Massachusetts increased to 6% in 2000 from 5% in 1999. California and Colorado also experienced a 1% point increase in the same time period.

What does this trend mean for Massachusetts?

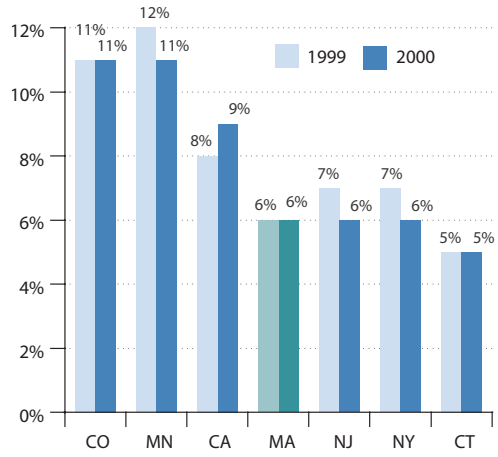
From 1999 to 2000, Massachusetts experienced an increase in students interested in pursuing a Computer or Information Science major in college, and did not lose any ground in students intending to major in Engineering. These are both good signs for the state. The tight labor market, particularly for scientific and technical workers in the state is expected to continue. Moreover, these key areas of expertise are projected to be in high demand nationwide. For example, according to an Information Technology Association of America (ITAA) study, employers in the U.S. will attempt to fill 900,000 Information Technology (IT) jobs this year, but anticipate a shortfall of 425,000 workers because of a talent gap. Partnerships between business and academia, such as summer internships and scholarship offerings, can help build awareness of the high-tech industries and their workforce needs.

Distribution of intended college majors, Massachusetts students taking the SAT, 2000

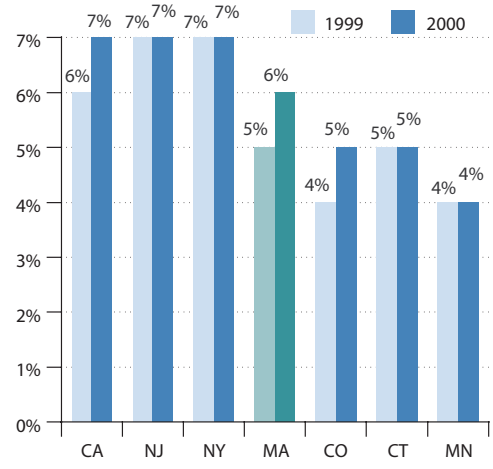


Note: Portions may not sum to 100 % due to rounding

Percentage of students taking the SAT I intending to major in Engineering, Massachusetts, and other LTS, 1999-2000



Percentage of students taking the SAT I intending to major in Computer or Information Science, Massachusetts, and other LTS, 1999-2000



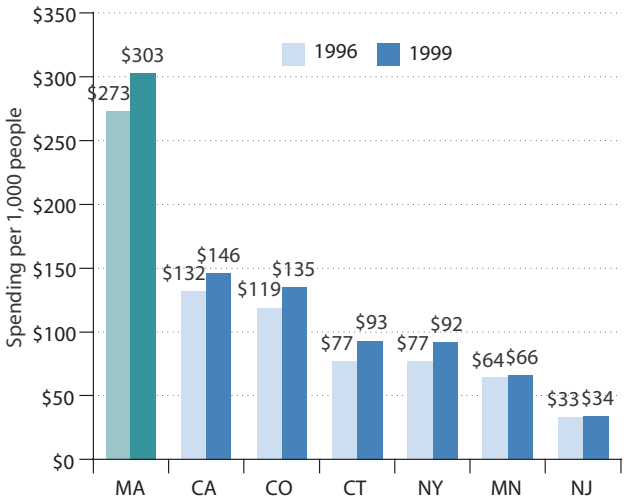
Source of all data for this indicator: College Board Online

Indicator 26

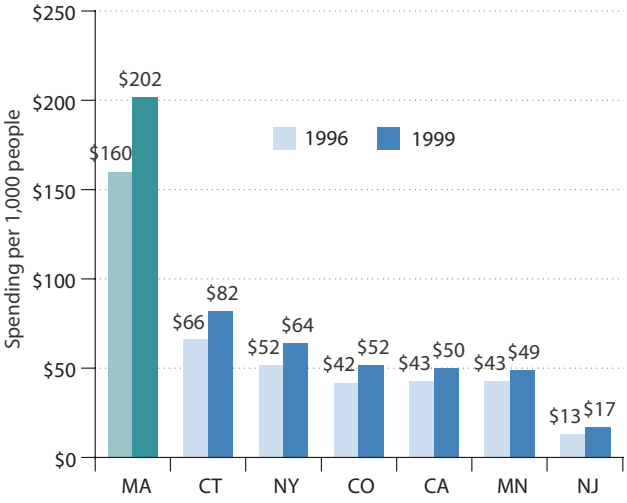
Federal R&D Spending and Health R&D Spending

Per capita federal R&D expenditures in Massachusetts continues to be the highest among the LTS

Federal R&D expenditures in academic and nonprofit research institutions, per 1,000 people, Massachusetts and other LTS, 1996 and 1999 (1999 $ inflation-adjusted)



US Department of Health and Human Services R&D expenditures, per 1,000 people, Massachusetts and other LTS, 1996 and 1999 (1999 $ inflation-adjusted)



Source of all the data for this indicator: National Science Foundation

Why is it significant?

Research universities and other academic centers are pivotal institutions in the Massachusetts economy, and federal research and development (R&D) spending is the primary source of their funding. R&D conducted by academic institutions also has a pronounced inducement effect in stimulating private sector R&D investments.

The National Institutes of Health (NIH) is the major funder of health-related research in the U.S.. It is the largest source of federal funding for non-defense research and is a critical driver for Massachusetts biotechnology, medical device, and health services industries. More than 95% of the U.S. Department of Health and Human Services (HHS) R&D expenditures occur through the NIH.

How does Massachusetts perform?

In 1999, Massachusetts universities, hospitals, and nonprofit research institutions had the highest per capita federally-funded R&D expenditures ($303) of the LTS, with the next closest LTS, California, at a little less than half that amount ($146). Total federal R&D spending in these Massachusetts institutions was $2.0 billion in 1999, ranking the state second among the LTS in absolute R&D spending (California ranks first in total R&D spending with $5.1 billion).

From 1996 to 1999 per capita federally-funded R&D expenditures at Massachusetts academic institutions increased 11.0%, when adjusted for inflation. Among the LTS, Connecticut experienced the largest increase at 20.8%, followed by New York with 19.5%. California rose by 10.6% during this time period, while Minnesota and New Jersey each experienced a 3.1% and 3.0% increase, respectively, in comparable funding.

Massachusetts has the highest per capita federally-funded R&D expenditures in health ($202) of the LTS. The state's health-related funding is more than double the closest LTS, Connecticut ($82). Since 1993, health R&D funding for Massachusetts has consistently increased in inflation-adjusted terms and relative to the other LTS. From 1996 to 1999, HHS funding per capita for Massachusetts increased 26.1%, second only to New Jersey at 37.1%. Total federal healthcare R&D expenditures in Massachusetts were $1.3 billion in 1999, ranking second among the LTS in total federal healthcare R&D (California ranks first with $1.7 billion).

What does this trend mean for Massachusetts?

Massachusetts continues to be a leader in R&D spending-overall and in health. This is a good sign for the Innovation Economy, and it highlights the key role of universities in Massachusetts for innovation and research. Strong R&D spending reflects the strong collaborative efforts taking place between federal government and the research universities and other academic centers within Massachusetts.

Indicator 27

Corporate R&D per Employee

Massachusetts continues to have steady increase of corporate R&D spending

Why is it significant?

Corporate R&D spending is an important indicator of how Massachusetts companies are investing in the future. Nationally, the private sector provides about $2 out of every $3 invested in R&D. R&D is essential for developing new products and services that help companies stay on the cutting edge, grow, and produce more jobs.

How does Massachusetts perform?

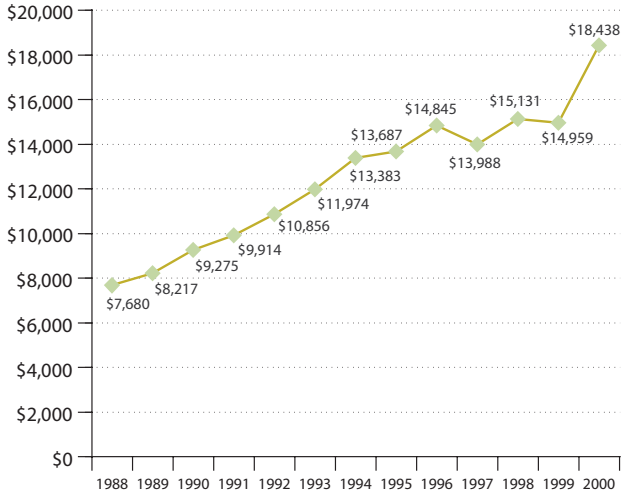
From 1999 to 2000, corporate R&D spending per employee rose 23.3%, in inflation-adjusted terms, among Massachusetts publicly-traded firms. Between 1988 and 2000, the annual average increase in Massachusetts corporate R&D spending per employee has been 10.8%.

Massachusetts key industry clusters posted significant levels of R&D per employee in 2000. The Innovation Services cluster had the highest R&D per employee at $46,500 per employee. Software & Communications Services ($36,556), Healthcare Technology ($33,577), and Computers & Communications Hardware ($31,734) also had relatively high levels of R&D investment per employee during this period.

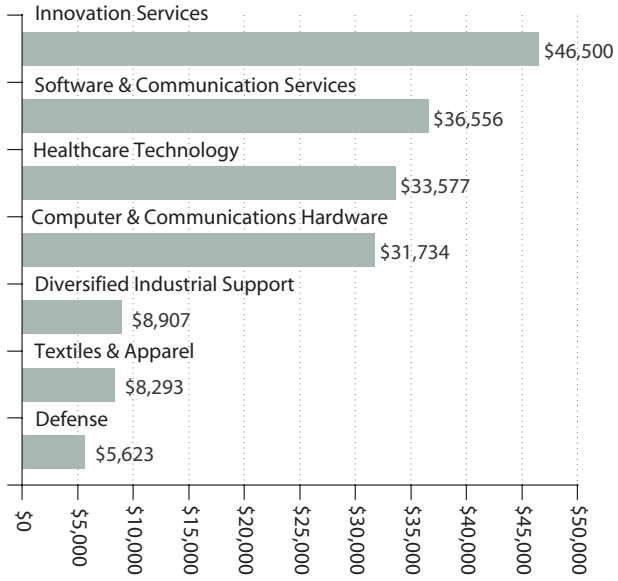
What does this trend mean for Massachusetts?

R&D fuels the development of new technologies and goods and services that drive company growth in the Innovation Economy. Strong levels of corporate R&D spending show commitment to innovation and the development of new technologies and products in the private sector, which is a positive sign for the Massachusetts economy. Some industry sectors in Massachusetts tend to be more R&D intensive, as reflected in both the level of corporate investment and patent statistics. Corporate and federal R&D keeps Massachusetts at the forefront of the Innovation Economy and the state remains a preferred location for firms with high R&D expenditures. These firms, in turn, attract a relatively highly-skilled, well-educated workforce.

R&D expenses per employee for Massachusetts publicly-traded companies, 1988-2000 (unadjusted)



Corporate R&D per employee by industry cluster, publicly-traded companies with R&D expenditures, Massachusetts, 2000



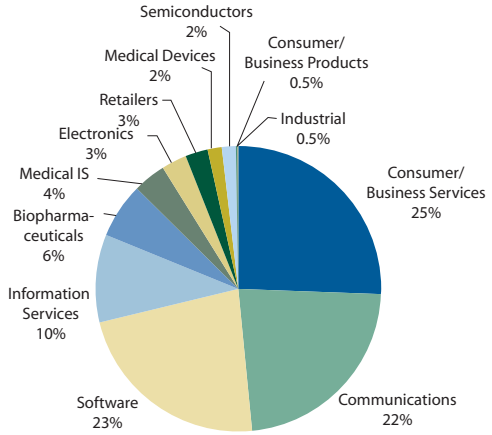
Source of all data for this indicator: Standard & Poor's COMPUSTAT, Collaborative Economics

Indicator 28

Venture Capital

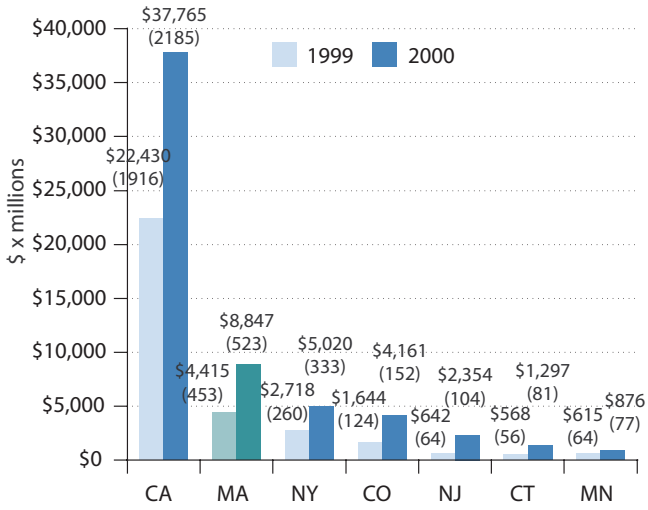
State attracts a record amount of venture capital, doubling its investments from 1999 to 2000

Distribution of venture capital investments, Massachusetts, 2000

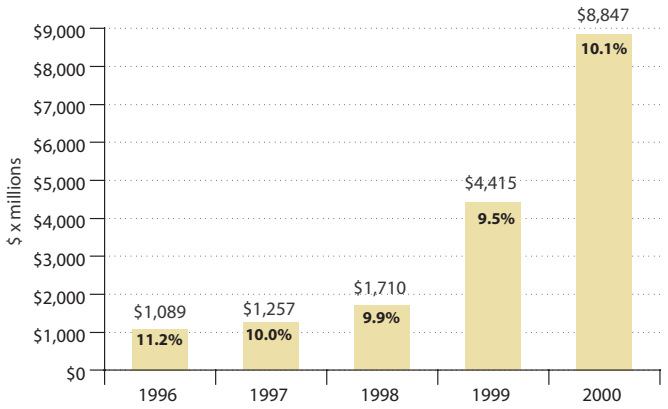


Note: Portions may not sum to 100 % due to rounding

Value and total number of venture capital investments, Massachusetts and other LTS, 1999-2000



Venture capital investments received by companies and as a percent of total US venture capital investments, Massachusetts, 1996-2000



Source of all data for this indicator: PricewaterhouseCoopers LLP and Venture One Money Tree Survey

Why is it significant?

Venture capital is one of the three main sources of funding used to grow new companies. (Other sources include personal savings, investment by family, friends, and individual investors, and short-term debt, including credit cards and home equity loans.) The amount of venture capital invested and the types of industries supported are predictors of future job and revenue growth in a region.

How does Massachusetts perform?

Massachusetts continues to attract significant venture capital investments. In 2000, Massachusetts companies received $8.8 billion in venture capital funding, double that of 1999 ($4.4 billion). California was first among the LTS and the U.S., receiving over $37 billion in venture capital investments in 2000. Massachusetts has consistently ranked second to California in total venture capital investments since 1996. Massachusetts share of the total venture capital dollars invested in the U.S. increased in 2000 to 10.1%, from 9.5% in 1999. In contrast, California's share of the U.S. total decreased in 2000 to 43.0%, from 48.4% in 1999.

Through the first two quarters of 2001, Massachusetts received $2.2 billion in venture capital funding, which was 11.9% of the U.S. total ($18.6 billion). In Massachusetts, the Software & Communications industry sectors attracted over 40% of the venture capital funding during this period.

In Massachusetts, the sector that received the most venture capital funding in 2000 was the Consumer/Business Services sector (which encompasses financial services, sports and entertainment, transportation, education, and training services) with a 26% share ($2.27 billion). This was followed by Communications and Software, each with a 23% share ($2.02 billion and $2.01 billion, respectively).

Massachusetts and the LTS attracted more than 70% of all venture capital investments in the U.S. in 2000.

What does this trend mean for Massachusetts?

Venture financing is an important source of funding for new firms in the Innovation Economy. The Massachusetts share of the U.S. venture capital increased from 1999 to 2000, and the state continues to rank second only to California in total venture capital investments. A diverse investment portfolio—from new and emerging computer technologies (Software, Communications) to healthcare technology (Biopharmaceuticals and Medical Information Systems)—in addition to a large number of venture capital firms and strong professional services infrastructure, reflect Massachusetts strengths in fostering innovative growth and encouraging local entrepreneurs to bring their ideas and concepts to the marketplace.

Indicator 29

Massachusetts E-Commerce Companies and Academic Offerings

Number of e-commerce companies nearly doubles in Massachusetts from previous year; state continues to attract strong e-commerce and Internet-related venture capital investments

Why is it significant?

E-commerce plays an important role in the Innovation Economy. E-commerce companies are important for maximizing supplier-producer relationships and a shared infrastructure. This cluster also develops a competitive position for the state in the e-commerce marketplace. The growth of e-commerce companies requires a highly-skilled workforce that can develop and manage electronic commerce business and strategies.

How does Massachusetts perform?

According to the 2000 Massachusetts Directory of High Technology Companies, published by the *Mass High Tech Journal*, 1,208 companies identified themselves as e-commerce companies, a 91.7% increase over 1999. These companies employed a total of 56,604 people in 2000. Over 41% of these people were employed by e-tech companies (which includes commerce-enabling tools for the Internet, search engines, and security). In 2000, e-commerce services companies comprised the largest number (587) of identified e-commerce companies in Massachusetts.

E-commerce has become an important element of the Massachusetts Innovation Economy, and has attracted significant venture capital investment. In 2000, Massachusetts received over $7.1 billion in venture capital investments for e-commerce and Internet-related firms, more than double the 1999 figure ($3.5 billion). California was first among the LTS in investment dollars, receiving over $31 billion in e-commerce venture capital in 2000, a 74.8% increase from 1999's total investment ($18.0 billion). Among the LTS, Massachusetts continues to rank second to California in the total number of Internet-related venture capital investments.

All the LTS experienced an increase in e-commerce and Internet-related venture capital investments from 1999 to 2000. New Jersey had the highest percent increase, more than tripling its e-commerce and Internet related venture capital investments.

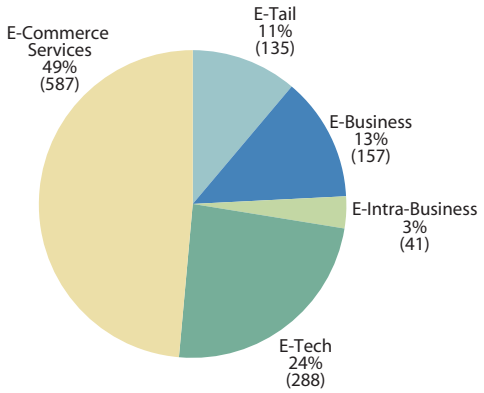
During the first two quarters of 2001, Massachusetts received $1.6 billion in e-commerce and Internet-related venture capital investments. This suggests that these technologies are still important to the Innovation Economy, despite the obvious downturn in the e-commerce marketplace.

E-commerce companies require a highly-skilled workforce that can address the challenges and strategies involved in developing and maintaining electronic commerce. According to the 2001 Massachusetts Technology Collaborative (MTC) survey of major academic institutions in Massachusetts, e-commerce-related courses and programs have expanded significantly over the past three years. Of the 31 academic institutions surveyed by MTC, 26% offered undergraduate course work (an 8% increase from 2000), 38% offered graduate course work (a 19% increase from 2000), and 15% offered degrees or certificate programs in e-commerce (a 25% percent increase from the previous year).

What does this trend mean for Massachusetts?

As with the overall venture capital (Indicator 28), this indicator shows that Massachusetts continues to attract venture capital supporting the Innovation Economy. This is key not only for e-commerce companies, but also for e-commerce capabilities of all sectors. Massachusetts academic institutions are responding to the evolving needs created by e-commerce, and this adaptability of the state's institutions plays a critical role in the future of e-commerce.

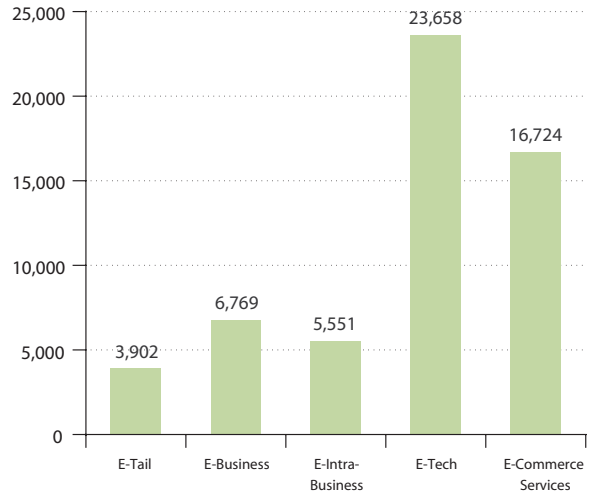
Distribution and total number of e-commerce companies, Massachusetts 2000



Note: Portions may not sum to 100 % due to rounding

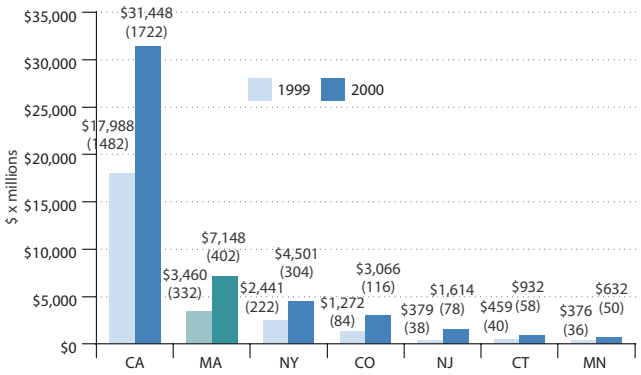
Source: Mass High Tech

Total number of employees, select e-commerce companies, Massachusetts 2000



Source: Mass High Tech

Value and total number of e-commerce and Internet-related venture capital investments, Massachusetts and LTS, 1999 and 2000



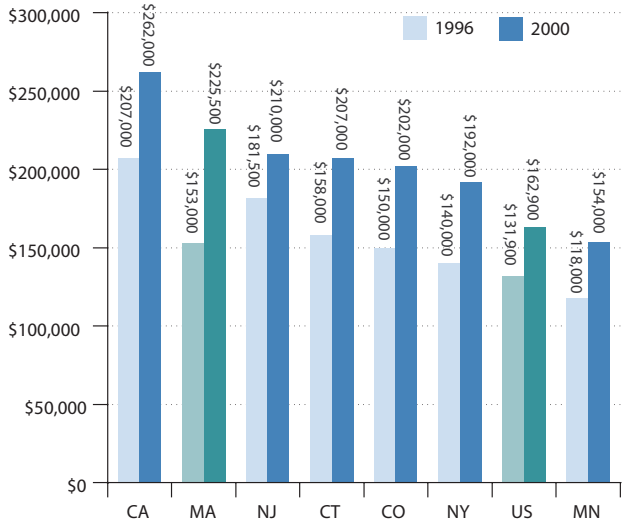
Source: PricewaterhouseCoopers LLP and Venture One Money Tree Survey

Indicator 30

Median Price of Single-Family Homes and Home Ownership Rates

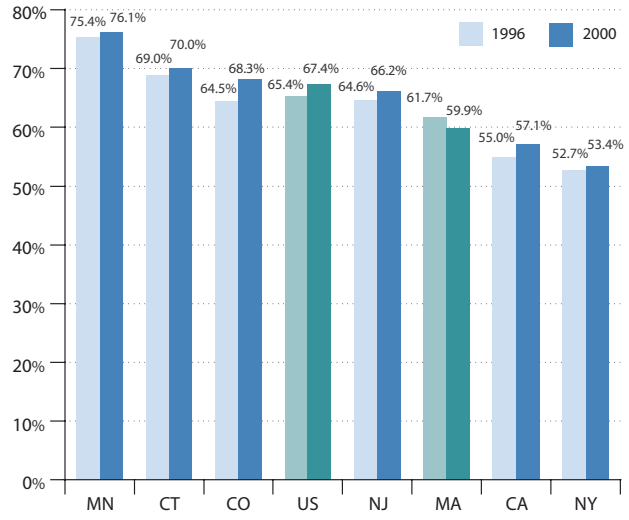
Massachusetts housing costs high and increasing fastest among the LTS; home ownership rates are among the lowest in the LTS and the US

Median price of single-family homes, Massachusetts, other LTS, and US, 1996 and 2000



Source: Federal Housing Finance Board

Home ownership percentage rates, Massachusetts, other LTS, and US, 1996 and 2000



Source: U.S. Census Bureau

Why is it significant?

The affordability of housing is not only a key indicator of a region's quality of life, it is a critical factor in overall cost of living, and thus in its ability to retain residents and attract new workers. In the highly-mobile world of today's Innovation Economy workforce, housing affordability ranks with job opportunities and rising wages as a determinant of the state's future success in the Innovation Economy.

How does Massachusetts perform?

In 2000, the median price of a single-family home in Massachusetts was $225,500, the second highest among the LTS and all states in the U.S. California topped the LTS and the nation with a median home price of $262,000. Of the LTS, Minnesota had the lowest median single-family home price at $154,000.

Between 1996 and 2000, the median price of a single-family home in Massachusetts increased by 47.4%, the highest percentage increase among the LTS, which averaged 29.3%. The Massachusetts increase was double that of the U.S. average (23.5%) during that period. Among the LTS, New York was second at 37.1%, followed by Colorado at 34.7%.

In 2000, Massachusetts had a home ownership rate of 59.9%—the third lowest among the LTS and below the U.S. average of 67.4%. Minnesota had the highest home ownership rate at 76.1%. New York had the lowest home ownership rate at 53.4% in 2000. Between 1996 and 2000, Massachusetts was the only state to experience a decrease in home ownership rates (-2.9%) among the LTS.

What does this trend mean for Massachusetts?

The high median sales price of a home is a challenge for Massachusetts and a constraint for its Innovation Economy. In a time of workforce mobility and labor shortages, the cost of housing is becoming an increasingly important factor in determining where people want to live and work. Those who live in regions with relatively high housing costs and who cannot afford to buy a home are often forced into a high rental market, or settle for less housing (e.g., smaller home). Massachusetts high housing costs are a negative factor in attracting and retaining well-educated and highly-skilled workers who are relatively mobile, as such workers may look outside of Massachusetts for affordable housing. The state must remain vigilant in helping to ensure that affordable housing is available to all its citizens.

Appendices

Appendix A

DATA SOURCES for Special Analysis

The special analysis focuses on seven regions within Massachusetts:

- Berkshire
- Pioneer Valley
- Central
- Greater Boston
- Merrimack Valley
- Southeast
- Cape Cod and Islands

Each region consists of a portion of the 351 towns and cities located in Massachusetts. Statistics for each region depend on aggregating the appropriate city and town data. Following is a detailed explanation of the sources and methods used for all data in the special analysis:

Key Industry Clusters (Employment and Wages)

Data for key industry clusters are from the Massachusetts Department of Employment and Training (DET). DET computed the data based upon MTC's definitions of the nine key industry clusters, by 4 digit Standard Industry Classification (SIC) codes, which are defined in Appendix C. Data that refers to all industries cover farm and government employment, and the self-employed.

Unemployment Rate

Data for unemployment rates are also from the Massachusetts DET. The unemployment rate is computed by aggregating the number of individuals unemployed for each town and city in a region, and then dividing by the size of the region's labor force.

Population

The U.S. Census Bureau provides population data for each town and city in Massachusetts. Regional populations are calculated by combining the population of each town and city in the region.

Dropout Rate

Data to compute dropout rates for each region are provided by the Massachusetts Department of Education. Regional statistics are calculated by aggregating the number of dropouts for every public school district in a region and dividing by the total number of students in a region. Dropouts are defined as those individuals who dropped out of high school (grades nine through twelve) during a given school year and did not return by October 1st of the following school year.

Median Sales Price of New and Existing Homes

Data for this indicator are from The Warren Group. Since the median sales price of new and existing homes is only available by town and city, a weighted statistic is computed for each region. Specifically, the median sales price of new and existing homes for a town or city is multiplied by the number of sales in that town or city and aggregated with the similar number for each town and city in a region. This number is then divided by total number of sales in that region to arrive at a weighted median sales price of new and existing homes.

Square Miles of Region (approximation)

The approximate square miles of each region was calculated using Maptitude software.

Total Number of Colleges and Universities

The total number of colleges and universities is derived from Mass Home. This number denotes the total number of colleges and universities in operation as of August 2001.

Appendix B

DATA AVAILABILITY

For the 2001 *Index*, most indicators are developed from existing secondary sources. The exceptions are primary data gathered by MTC on the retention of engineering graduates within the state (Indicator 23), and a survey of academic institutions on e-commerce course work and degree programs (Indicator 29). In most cases, indicators from secondary sources required the reconfiguration of existing datasets. These groupings of data were derived from a wide range of sources; consequently, there are some unavoidable variations in the time frames used and in the specific variables that define the indicators being measured. This appendix provides notes on data sources for each indicator.

We intend to continue updating and refining the *Index* in future years, so that it can serve as an effective monitoring system. In some key areas, however, the team found that data are simply not available or are cost-prohibitive. The team searched for measures that could serve as effective proxies for unavailable data.

I. Selection of Leading Technology States (LTS) for Benchmarking Massachusetts Performance

To provide context, a goal of the *Index* is to measure Massachusetts performance on various indicators in comparison with appropriate benchmarks. The *Index* focuses on the Massachusetts Innovation Economy and states with similar economic strengths were selected for comparison. The LTS are selected based on the total number of innovative clusters having an employment concentration above the national level. The set of Leading Technology States (LTS) for the 2001 *Index* includes California, Colorado, Connecticut, Minnesota, New Jersey, and New York. A change in the LTS was made for the 2001 *Index* reflecting changing state economies. In the case of a tie, the state with the highest sum in the five key industry clusters concentrations in the table below was selected.

On several indicators in the document Massachusetts is compared to an LTS average. This average is always the mean of each states' reported data, not including Massachusetts. It is not the mean of all LTS data aggregated together.

II. Inflation-Adjusted Values

Throughout the document, dollar values are presented in current dollars unless noted as real, inflation-adjusted values.

Employment Concentration

State	Computer/ Comm. Hardware	Financial Services	Healthcare Technology	Innovation Services	Software Comm. Services	2000 LTS	2001 LTS	No. of 9 key clusters above 1.0
MA	2.45	1.73	1.66	1.64	1.28	x	x	9
CT	1.44	2.25	2.05	0.81	1.10		x	7
CA	2.21	0.88	1.38	1.23	1.25	x	x	6
NJ	0.45	1.57	3.07	1.47	1.49	x	x	5
MN	2.05	1.24	1.54	0.66	0.95	x	x	5
NY	0.79	1.75	1.01	1.00	0.92	x	x	5
CO	1.77	0.94	0.95	1.23	2.06	x	x	4
AZ	2.22	0.81	0.49	1.16	1.18	-	-	4
MD	0.56	0.95	0.71	1.78	1.30	-	-	4
TX	1.62	0.84	0.63	1.01	1.17	x	-	3

Indicators related to wages and income are adjusted using the Consumer Price Index (CPI) for all urban consumers (all items, U.S. city average). All other inflation-adjusted indicators use the calendar-year-based Gross Domestic Product (GDP) implicit price deflator (1996 base equal to 100.00) published by the Office of Management and Budget. The GDP price deflator is considered the most appropriate adjustment for various kinds of R&D activity.

III. Notes on Data Sources for Individual Indicators

Results Indicators

1. Industry Clusters

Regional Financial Associates (RFA) and Collaborative Economics tracks industry employment at the state level using a methodology based upon individual corporations filings with State Employment Securities Agencies (SESA) and the Bureau of Labor Statistics (BLS). Data from RFA was analyzed by Collaborative Economics in comparison to information from the Massachusetts Department of Employment and Training (DET) to arrive at the number of jobs in Massachusetts cluster industries. Both sets of data do not cover self-employment, employment of military personnel, or government employment. Definitions for each industry cluster are included in Appendix C.

2. Employment Diversification

This indicator was developed from RFA state-level data of unemployment insurance filings between 1995 and 2000. Employment concentration is measured as the relative amount of employment in a cluster as a portion of total state employment compared with the same clusters' employment nationally as a portion of total U.S. employment. For each cluster, the level of national employment is indexed at 1.0. Therefore, Postsecondary Education employment at 3.0 is three times more concentrated in Massachusetts than at the national level. The annual average growth rate is the rate of change in industry cluster employment over the five periods from 1995 to 2000. The size of each circle on the chart reflects the relative size of employment in Massachusetts. The largest cluster, Financial Services, employed 141,355 people in 2000.

3. Average Pay in Key Industry Clusters

Data are from RFA and Collaborative Economics and are derived from payroll data reported as part of unemployment insurance (UI) filings. The average pay estimate for each cluster is the mean payroll per employee in 2000 current dollars. The average pay estimate for each cluster is the mean payroll per employee in 2000 current dollars.

4. Pay Per Worker in All Industries

Data for Massachusetts, LTS and the U.S. are from RFA and Collaborative Economics.

5. Median Household Income

Data on median household income for Massachusetts, LTS, and the U.S. are from the U.S. Census Bureau, Current Population Survey.

6. Job Opportunity Index (JOI)

The FlipDog.com Job Opportunities Index (JOI) measures the current supply of U.S. jobs relative to workforce size. JOI reports are based on statistical methodology that utilizes FlipDog.com's sample of jobs listed on employers' web sites and non-adjusted workforce data from the Bureau of Labor Statistics. While the JOI covers a broad number of hiring organizations, it is not intended to be an exhaustive survey of U.S. employers.

7. Perception of Business Climate and Consumer Confidence Index

Data are from the Massachusetts High Technology Council's annual business climate survey, 1987-2001.

Appendix B

U.S. consumer confidence data are from a monthly survey conducted by the Conference Board. A yearly statistic is computed by averaging the monthly surveys for that year. U.S. consumer confidence data includes through the month of July, 2001.

Massachusetts consumer confidence data are from a quarterly survey conducted by Mass Insight in cooperation with the New England Economic Project (NEEP), University of Massachusetts (UMASS), and Associated Industries of Massachusetts (AIM). A yearly statistic is computed by averaging the quarterly surveys for that year. Massachusetts consumer confidence includes through the third quarter of 2001. It is scaled to allow for comparison to U.S. consumer confidence; a score of 100 or better denotes high consumer confidence.

8. Manufacturing Exports
The Office of Trade and Economic Analysis in the U.S. Department of Commerce tracks the dollar value of exported manufactured goods from all U.S. states through the Exporter Location Series. Percentages reported in this indicator are for the change in dollar value.

Destination of Massachusetts exports for 2000 was derived from the Massachusetts Institute for Social and Economic Research (MISER).

Innovation Process Indicators

9. Patents per Capita
Patents per capita data for Massachusetts and other LTS are provided by the U.S. Patent and Trademark Office (USPTO). Patent distribution by industry sectors and patent citation of scientific literature data are from CHI Research, Inc.

10. Invention and Patent Applications
Indicator data are from the Association of University Technology Managers' (AUTM) annual licensing survey of universities, hospitals, and research institutions. For this analysis the Massachusetts universities which provided information for the AUTM report include: Massachusetts Institute of Technology (MIT), Harvard University, Boston University, Brandeis University, University of Massachusetts (all campuses), and Tufts University. Massachusetts hospitals/research institutions included are Massachusetts General Hospital, Children's Hospital Boston, Brigham and Women's Hospital, Woods Hole Oceanographic Institute, Dana-Farber Cancer Institute, New England Deaconess Hospital, St. Elizabeth's Medical Center of Boston, and Schepens Eye Research Institute.

11. Technology Licenses and Royalties
Data on licensing agreements involving Massachusetts institutions are also from AUTM. These data are from the same institutions providing patent and invention disclosure information in indicator number 10.

12. FDA Approval of Medical Devices and Pharmaceutical Drugs
Information is provided by the U.S. Food and Drug Administration (FDA) via the Freedom of Information Act.

FDA approval of investigational device exemptions (IDEs) allow for clinical trials to begin on particularly high-risk medical devices. Medical device companies are also required to secure premarket approvals (PMAs) before intricate medical devices are allowed market entry. 510(k)s approvals are required of less sophisticated instruments or small product modifications and improvements.

13. New Business Incorporations
Data are provided by the Massachusetts Secretary of the Commonwealth's Office. Of the 18,569 new business incorporations in 2000, 12,717 were Massachusetts-based for-profit businesses, 4,265 were out-of-state businesses, and 1,587 were nonprofit businesses.

14. SBIR Awards
Data are provided by the Small Business Administration (SBA) and U.S. Department of Commerce. Data are for the number and dollar value of awards distributed in each fiscal year. Phase I awards are for companies to research the technical merit and feasibility of their idea; Phase II awards build on these findings and further develop the proposal idea.

15. Initial Public Offerings (IPOs) and Mergers & Acquisitions (M&As)
The total number and distribution by industry sector of initial public offerings (IPOs) by state and for the U.S. are provided by Andersen. Andersen's industry classifications for IPOs is based upon the four-digit Standard Industrial Classification (SIC) code level.

The total number of mergers and acquisitions (M&As) by state and for the U.S. are provided by Andersen. M&A data represents all entities that have been acquired by another for all years presented in the indicator.

16. NASDAQ Firms' Market Value
The dataset contains the market capitalization/value of all publicly-traded firms listed on the NASDAQ Exchange on the March 31 of each year from 1996-2001. Market capitalization for an individual company is defined as the product of the number of shares outstanding times the share price on a given day.

17. Fast Growth Companies
The number of fast growth "gazelle" companies is derived from a special data run conducted by Standard & Poor's Compustat of publicly-traded companies headquartered in Massachusetts. This dataset tracks all publicly-traded companies filing 10K and 10Q reports with the Securities and Exchange Commission (SEC) from between 1986 and 2000. This dataset has been updated for 2000 using information from corporate 10K filings as reported by COMPUSTAT, Global Researcher, and the SEC.

David Birch of Cognetics, Inc., in Cambridge, coined the term "gazelle."

18. Corporate Headquarters
Data on total number of corporate headquarters by state are provided by infoUSA.com. Due to a change of LTS and because infoUSA.com frequently revises their database, 1999 data was unavailable for Connecticut and therefore a time series could not be created.

Data on location of Fortune 500 Companies in Massachusetts and the LTS are derived from the annual Fortune 500 List, as of April 2001. Fortune magazine determines the annual Fortune 500 List by a criterion that includes: revenues, profits, assets, stockholders' equity, market value, earnings per share, and total return to investors.

Resource Indicators

19. Population Growth Rate and Unemployment Rate
Data on population growth rate by state are derived from the U.S. Census Bureau.

Data on unemployment rate by state are derived from the Bureau of Labor Statistics.

20. Migration
Total foreign and domestic immigration data are provided by the Statistics of Income Division, Internal Revenue Service (IRS). State-to-State migration flow data show migration patterns, between U.S. states, based on year-to-year changes in addresses entered on income tax returns filed by individual taxpayers. The data are the result of a joint effort between the Internal Revenue Service (IRS) and the Census Bureau. The migration flow data were developed by matching records of individual income tax returns filed in a base year with tax returns filed in the following year. Only returns for which the SSN (of the primary taxpayer) reported on the return filed in 1999 matched the SSN (of the primary taxpayer) reported on the return filed in 2000 were included in the statistics. These data do

Appendix B

not include individuals who move to the U.S. from a foreign country, since these people would not have filed a U.S. tax return prior to the move.

21. Workforce Education
Data on percentage change in the number of adults without a high school diploma from 1970-2000, and with a college degree from 1990 to 2000, are provided by the U.S. Census Bureau.

Data on Massachusetts students planning to attend college by race/ethnicity are provided by the Massachusetts Department of Education.

22. SAT Scores
SAT combined and disaggregated mathematics and verbal scores data by state are from the College Board, SAT Program Summary Reporting Service, Annual Profiles of SAT Test Takers, 1991, 1996, and 2001.

23. Engineering and Computer Science Degrees
Data on total number of engineering degrees and degrees by ethnicity are provided by the American Association of Engineering Societies (AAES). The AAES tracks the number of engineering degrees awarded from accredited institutions throughout the U.S. each year. Data on the total number of computer science degrees are provided by the National Science Foundation.

Information on the number of engineering degrees retained in Massachusetts is compiled by MTC in partnership with the major engineering degree granting institutions in Massachusetts. Data for this indicator are based upon information provided by Boston University, Harvard University, Massachusetts Institute of Technology, Merrimack College, University of Massachusetts-Amherst, University of Massachusetts-Dartmouth, University of Massachusetts-Lowell, Tufts University, Wentworth Institute of Technology, and Western New England College.

24. Computers in Education
Data for percent of schools that access the Internet through a high-speed connection, percent of schools with Internet access, and percent of schools with Internet access from one or more classrooms, and for Massachusetts and LTS, are provided by *Education Week's Technology Counts 2001* report.

25. Student Interest in Technical Careers
Data for intended majors of students taking the SAT in Massachusetts and the LTS are provided by The College Board Online, Profile of College Bound Seniors, 2000. The Profile of College-Bound Seniors presents data for 2000 high school graduates who participated in the SAT Program during their high school years. Students are counted once no matter how often they are tested, and only their latest scores and most recent Student Descriptive Questionnaire (SDQ) responses are summarized. The college-bound senior population is relatively stable from year to year; moreover, since studies have documented the accuracy of self-reported information, SDQ information for these students can be considered a highly accurate description of the group.

26. Federal R&D Spending & Federal Health R&D Spending
Data are provided by the National Science Foundation for all academic institutions. This includes its university-associated federally-funded research and development centers.

Data are provided by the National Science Foundation. Data are for all R&D expenditures by the U.S. Department of Health and Human Services. More than 95% of these expenditures occur through the National Institutes of Health.

27. Corporate R&D per Employee
Data are derived from publicly-traded corporations annual 10K report filings with the SEC using Standard & Poor's COMPUSTAT database. Industry R&D per employee was calculated for all companies that reported any R&D expenditures. Only those companies that filed both employment and R&D expense data were included in the data.

28. Venture Capital
Data for total venture capital investments in Massachusetts and venture capital investments by industry activity are provided by PricewaterhouseCoopers, LLP, and Venture One. Industry category designations are determined by PricewaterhouseCoopers, LLP, and Venture One.

29. Massachusetts E-Commerce Companies' Investments and E-Commerce Academic Offerings
Data on total number, type, and revenues of e-commerce companies located in Massachusetts are derived from Mass High Tech, The Massachusetts Directory of High Technology Companies, 2000. Data for total venture capital investments in Massachusetts by e-commerce and Internet-related activity are provided by PricewaterhouseCoopers, LLP, and Venture One.

Data on the e-commerce offerings of Massachusetts institutions are derived from a special MTC survey conducted in July 2001. Universities were chosen based on the Carnegie Foundation Classification of Institutions. Universities were asked to provide information on their current academic course offerings in e-commerce, as well as academic degree/certificate offerings in e-commerce.

30. Median Sales Price of Single-Family Homes and Home Ownership Rates
The Federal Housing Finance Board provides data for median sales price of single-family homes. Data is collected from the Finance Board's Monthly Survey of Rates and Terms on Conventional Single-Family Nonfarm Mortgage Loans. Single-family homes are defined in two ways. They can be unit structures detached from any other house, such as one-family homes and mobile homes or trailers to which one or more permanent rooms have been added; and, they can be unit structures attached to another structure, but with one or more walls extending from the ground to roof separating it from the adjoining structure, such as duplex houses or townhouses. The median statistic represents the value in the middle of a data set.

Home ownership rates data come from the U.S. Census Bureau.

Appendix C

INDUSTRY CLUSTER DEFINITIONS

I. Defining Key Industry Clusters in Massachusetts

The analysis of key industry clusters within Massachusetts begins with a disaggregation of all Massachusetts state industry activity to the four-digit Standard Industrial Classification (SIC) code level. (SIC codes are set by the Executive Office of the President, Office of Management and Budget. These codes were last revised in 1987.) Employment, payroll, and the number of establishments for all four-digit industries are examined. Industry data are analyzed through the following measures:

- Employment concentration relative to that of the nation
- Payroll per employee relative to the state average
- Employment as a share of total state employment
- Average annual growth rate, and absolute change, of employment
- Absolute number of establishments

Clusters are crafted from those interrelated SIC code industries that showed themselves to be individually significant according to the above measures.

Computers & Communications Hardware

3571 Electronic computers
3572 Computer storage devices
3575 Computer Terminals
3661 Telephone and telegraph apparatus
3663 Radio & TV communications equipment
3669 Communications equipment, nec
3577 Computer peripheral equipment, nec
3672 Printed circuit boards
3674 Semiconductors and related devices
3675 Electronic capacitors
3679 Electronic components, nec
3695 Magnetic and optical recording media
3699 Electrical equipment & supplies, nec
3823 Process control instruments
3825 Instruments to measure electricity

Defense

3483 Ammunition, except for small arms, nec
3484 Small arms
3671 Electron tubes
3724 Aircraft engines and engine parts
3761 Guided missiles and space vehicles
3769 Space vehicle equipment, nec
3812 Search and navigation equipment
3827 Optical instruments and lenses
3829 Measuring & controlling devices, nec

Diversified Industrial Support

2992 Lubricating oils and greases
3061 Mechanical rubber goods
3069 Fabricated rubber products, nec
3081 Unsupported plastics film & sheet
3082 Unsupported plastics profile shapes
3087 Custom compound purchased resins
3291 Abrasive products
3357 Nonferrous wiredrawing & insulating
3398 Metal heat treating
3399 Primary metal products, nec
3462 Iron and steel forgings
3469 Metal stampings, nec
3471 Plating and polishing
3479 Metal coating and allied services
3491 Industrial valves
3511 Turbines and turbine generator sets
3545 Machine tool accessories
3547 Metalworking machinery, nec
3554 Paper industries machinery
3555 Printing trades machinery
3559 Special industry machinery, nec
3561 Pumps and pumping equipment
3562 Air and gas compressors
3567 Industrial furnaces and ovens
3568 Power transmission equipment, nec
3569 General industrial machinery, nec
3599 Industrial machinery, nec
3625 Relays and industrial controls
3629 Electrical industrial apparatus, nec
3643 Current-carrying wiring devices
3999 Manufacturing industries, nec

Financial Services

6036 Savings institutions, not Federally chartered
6111 Federal and Federally-sponsored credit
6159 Misc. business credit institutions
6211 Security brokers, dealers, and flotation companies
6282 Investment advice
6289 Services allied with the exchange of securities
6311 Life insurance
6324 Hospital and medical service plans
6331 Fire, marine, and casualty insurance
6411 Insurance agents, brokers, and services
7322 Adjustment and collection services
7323 Credit reporting services

Appendix C

Healthcare Technology

2833 Medicinals and botanicals
2834 Pharmaceutical preparations
2835 Diagnostic substances
2836 Biological products exc. diagnostic
3821 Laboratory apparatus and furniture
3826 Analytical instruments
3841 Surgical and medical instruments
3842 Surgical appliances and supplies
3844 X-ray apparatus and tubes
3845 Electromedical equipment
3851 Ophthalmic goods
8071 Medical laboratories

Innovation Services

8711 Engineering services
8712 Architectural services
8731 Commercial physical research
8732 Commercial nonphysical research
8734 Testing laboratories
8741 Management services
8742 Management consulting services
8743 Public relations services
8733 Noncommercial research organizations

Postsecondary Education

8221 Colleges, universities and professional schools
8222 Junior colleges and technical institutes
8299 Schools and educational services, nec

Software & Communications Services

7371 Computer programming services
7376 Computer facilities management
4812 Radiotelephone communications
4813 Telephone communications, exc. radio
4841 Cable and other pay television services
7372 Prepackaged software
7373 Computer integrated systems design
7374 Data processing and preparation
7375 Information retrieval services
7377 Computer rental & leasing
7378 Computer maintenance & repair
7379 Computer related services, nec

Textiles & Apparel

2221 Broadwoven fabric mills, manmade
2231 Broadwoven fabric mills, wool
2253 Knit outerwear mills
2257 Weft knit fabric mills
2261 Finishing plants, cotton
2262 Finishing plants, manmade
2269 Finishing plants, nec
2295 Coated fabrics, not rubberized
2297 Nonwoven fabrics
2298 Cordage and twine
2299 Textile goods, nec
2337 Women's and misses' suits and coats
2386 Leather and sheep-lined clothing
2389 Apparel and accessories, nec
2391 Curtains and draperies
3021 Rubber and plastics footwear
3111 Leather tanning and finishing
3131 Boot and shoe cut stock and findings
3149 Footwear, except rubber, nec
3171 Women's handbags and purses
3172 Personal leather goods, nec
3911 Jewelry, precious metal
3915 Jewelers' materials & lapidary work
3961 Costume jewelry
5131 Piece goods and notions
5136 Men's and boys' clothing
5137 Women's and children's clothing
5139 Footwear

nec - not elsewhere classified

Data Contributors

Special thanks to the following organizations that contributed data and expertise:

Andersen
American Association of Engineering Societies
Association of University Technology Managers
Boston University, Analytical Services
Bureau of the Census, U.S. Department of Commerce
Bureau of Labor Statistics, U.S. Department of Labor
CHI Research, Inc.
Collaborative Economics
College Board Online
Donahue Institute
Education Week
Federal Housing Finance Board
Fortune Magazine
Harvard University
InfoUSA.com
Internal Revenue Service
International Trade Administration, U.S. Department of Commerce
Massachusetts Benchmarks
Massachusetts Biotechnology Council
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Massachusetts Institute of Technology
Massachusetts Institute for Social and Economic Research
MassMEDIC
Merrimack College
National Center for Education Statistics, U.S. Department of Education
NASDAQ
National Science Foundation
Northeastern University
PricewaterhouseCoopers LLP
Regional Financial Associates, Inc.
Secretary of the Commonwealth
Small Business Administration
Standard & Poor's Compustat
The College Board
Tufts University, Institutional Research
University of Massachusetts, Amherst
University of Massachusetts, Dartmouth
University of Massachusetts, Lowell
U.S. Department of Commerce
U.S. Food and Drug Administration
U.S. Patent and Trademark Office
Venture One
Wentworth Institute of Technology
Western New England College

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Special thanks to the following organizations for their financial and in-kind contributions to this effort:.

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