



Engines of Economic Growth

The Economic Impact of Boston's Eight Research Universities on the Metropolitan Boston Area

REPORT SUMMARY



BOSTON UNIVERSITY



BOSTON COLLEGE



BRANDEIS UNIVERSITY



HARVARD UNIVERSITY



STATE HOUSE



MASSACHUSETTS INSTITUTE OF TECHNOLOGY



TUFTS UNIVERSITY



NORTHEASTERN UNIVERSITY



UNIVERSITY OF MASSACHUSETTS BOSTON

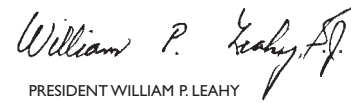
Communities include Boston, Brookline, Cambridge, Grafton, Medford, Newton, Somerville, Waltham, and Watertown

John Adams, writing the Massachusetts Constitution of 1780 (Part 2, Chapter 5, Section II), envisioned the central role that educational institutions would play in the life of the Commonwealth: "...It shall be the duty of legislatures and magistrates in all future periods...to cherish the interests of literature and the sciences...to encourage private societies and public institutions...for the promotion of agriculture, arts, sciences, commerce, trades, manufactures, and a natural history of the country..."

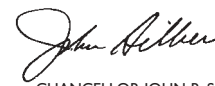
Today, 223 years later, educational institutions have redeemed in full measure his confidence and remain central to the present and future of the Commonwealth's social, cultural and economic life. Greater Boston's eight research universities in particular are the region's special advantage: an enduring and stable economic engine, constantly changing and developing as new knowledge is gained and new technologies and industries are created.

Collectively, our eight institutions are developers and employers of talent, incubators of business and industry, storehouses of cultural resources, research centers, purchasers, economic magnets, and community partners committed to our state and local governments. In the knowledge economy of the 21st Century, our universities can maintain their role as generators of economic growth and jobs only as they go into new fields and continue to grow.

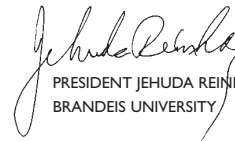
At this time of fiscal crisis in the state, our eight institutions have commissioned a report by Appleseed, Inc., a specialist in such studies, to help us understand our multi-faceted role as integral parts of the Massachusetts economy; a summary of this report follows. We are committed to our essential role in assisting the Commonwealth's economic recovery.



PRESIDENT WILLIAM P. LEAHY
BOSTON COLLEGE



CHANCELLOR JOHN R. SILBER
BOSTON UNIVERSITY



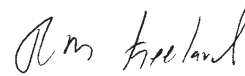
PRESIDENT JEHUDA REINHARZ
BRANDEIS UNIVERSITY



PRESIDENT LAWRENCE H. SUMMERS
HARVARD UNIVERSITY



PRESIDENT CHARLES M. VEST
MASSACHUSETTS INSTITUTE OF TECHNOLOGY



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UNIVERSITY OF MASSACHUSETTS BOSTON

Engines of Economic Growth:

The Impact of Boston's Eight Research Universities on the Metropolitan Boston Area

The metropolitan Boston area has long been recognized as a leader in the fields of education, innovation and knowledge. Research at the region's eight research universities has had a fundamental impact on the growth of industry and society. The result of this research has helped to define industries such as computing, information technology, medical devices, biotechnology and genetics. University research has also played a significant role in the shaping of current economic and social policies, ranging from Nobel Prize-winning theories of economic growth to long-term analyses of the Social Security system.

The Boston area is unique in having the campuses of eight diverse research universities concentrated within a nine-mile radius of its state capitol. (Figure 1)

Figure 1

For purposes of this report, we have defined the Boston area research universities as institutions within the Route 495 loop that grant doctoral degrees, and that spend at least \$10 million annually on research.

- ★ State House
- ① Boston College
- ② Boston University
- ③ Brandeis University
- ④ Harvard University
- ⑤ Massachusetts Institute of Technology
- ⑥ Northeastern University
- ⑦ Tufts University
- ⑧ University of Massachusetts Boston



In the current knowledge-based economy, the impact of these universities on the community at large is more significant than at any other time in modern economic history.

Boston College, Boston University, Brandeis University, Harvard University, the Massachusetts Institute of Technology, Northeastern University, Tufts University and the University of Massachusetts Boston are a regional community of more than 500,000 people — 118,300 degree students, 25,000 other continuing education students, 48,750 employees, and a total of 310,000 alumni. (Figure 2)

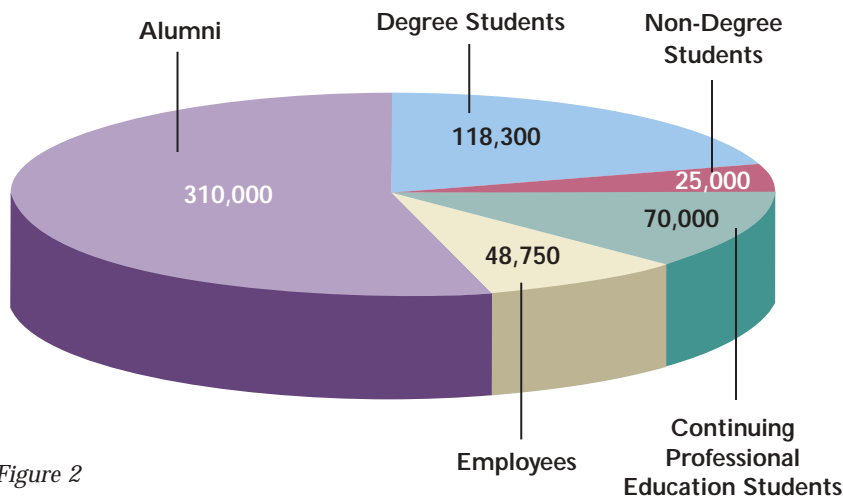


Figure 2
The community of the eight research universities in 2000 totaled more than 500,000 people in the region, nearly the population of Boston (589,141).

The discoveries at these universities have created industries, companies and thousands of jobs in the greater Boston economy.

Today, these universities continue to make discoveries that will be the engines for future growth and economic development. International companies are locating major facilities in the area to gain access to the intellectual strength that is associated with the research universities. The research universities continue to be an anchor for the Boston economy, providing economic stability during downturns.

FAST FACTS

- RESEARCH FUNDING**
 Massachusetts annually receives more federal funding per state resident than any other leading technology state — \$4 billion. The eight universities receive \$1.5 billion in research funds and their affiliated hospitals and research centers attract another \$1 billion. More than 80% of the funds are from federal sources.
- SCIENTISTS AND ENGINEERS**
 Massachusetts has the highest percentage of scientists and engineers within its workforce as compared to other leading technology states.
- COMMUNITY LEADERS**
 310,000 alumni — 31% of the total graduates of the eight research universities — live in the Boston area as taxpayers, voters and significant contributors to the community. They also represent about 30% of the region's residents who have college degrees.
- EDUCATION FOR THE COMMUNITY**
 The eight research universities support ongoing educational programs for K-12 schools in their communities. They delivered non-degree continuing education programs to 25,000 adults in the fall 2000 semester.
- TECHNOLOGY ATTRACTS INVESTMENT**
 Licensing of technology from the major universities generated approximately \$44.5 million in additional revenue from the private sector in 2000.
- STABLE WORKFORCE**
 Among some of the top employers in the region with approximately 50,750 employees in 2002, the universities through their employees are a stable source of ongoing income tax revenue for the state, representing more than \$115 million for that year in income tax revenue alone.

With the subsequent creation of federal agencies such as the National Institutes of Health and the National Science Foundation, research universities have become the primary source of scientific talent and basic research on which both government and private industry depend.

It was not always so. Until World War II, when the research universities were drawn into the war effort and their scientists' research contributed to the allied victory, there had been no recognition by the United States government of the potential power of the university research enterprise. It was the war experience that led to the conclusion that these institutions, if properly financed, could contribute to both the defense of the country and to a civilian industrial effort. With the subsequent creation of federal agencies such as the National Institutes of Health and the National Science Foundation, research universities have become the primary source of scientific talent and basic research on which both government and private industry depend. Since that time — some sixty years ago — the research universities have evolved from somewhat sleepy institutions to critical components for local and national economies.

The eight research universities — seven private and one public — have commissioned this report to assess their combined economic impact on greater Boston. The report shows that the eight universities not only have a large direct financial impact, but more importantly, they form much of the intellectual underpinning of the regional economy, producing human capital and new technologies that fuel economic growth.

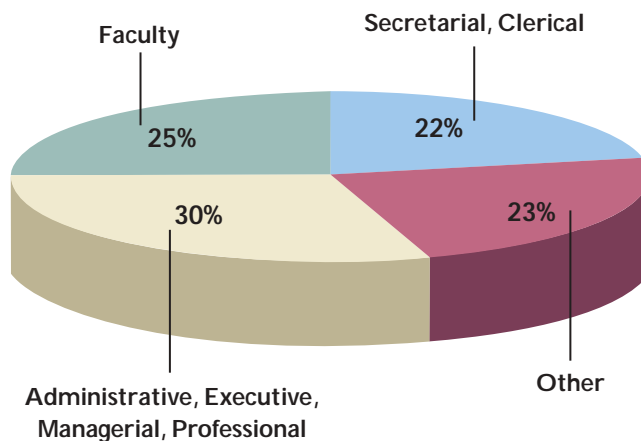


Figure 3
In 2000, the eight universities not only employed more than 12,000 faculty members but also thousands of research technicians, administrative and clerical staff, and maintenance, security and food service workers.

A Stable Foundation

While companies in the private sector come and go, the universities remain a stable base in their communities. The eight universities employed 50,750 people in 2002, slightly more than Greater Boston's financial services industry. While many industries have downsized, the universities have added 2,000 more employees to their payrolls in the last two years. (Figure 3)

The universities and their affiliated hospitals make up the two sectors of the economy that have added jobs in the current downturn. Four of the universities, plus five affiliated medical centers employing 51,800 people, are among the top 25 employers in Massachusetts. In addition, four companies founded by graduates of the universities are also among the top 25 employers¹. The combined 2002 payroll of the eight universities totaled more than \$2.5 billion. Approximately \$2.2 billion was paid to residents of the Boston metropolitan area. That personal income, an average of more than \$51,000 per employee, in turn, became revenue for state and local tax collectors of income tax, property tax, excise tax and other taxes, and revenue for local businesses. Massachusetts' annual income tax revenue from university employees is estimated at more than \$115 million. (Figure 4)

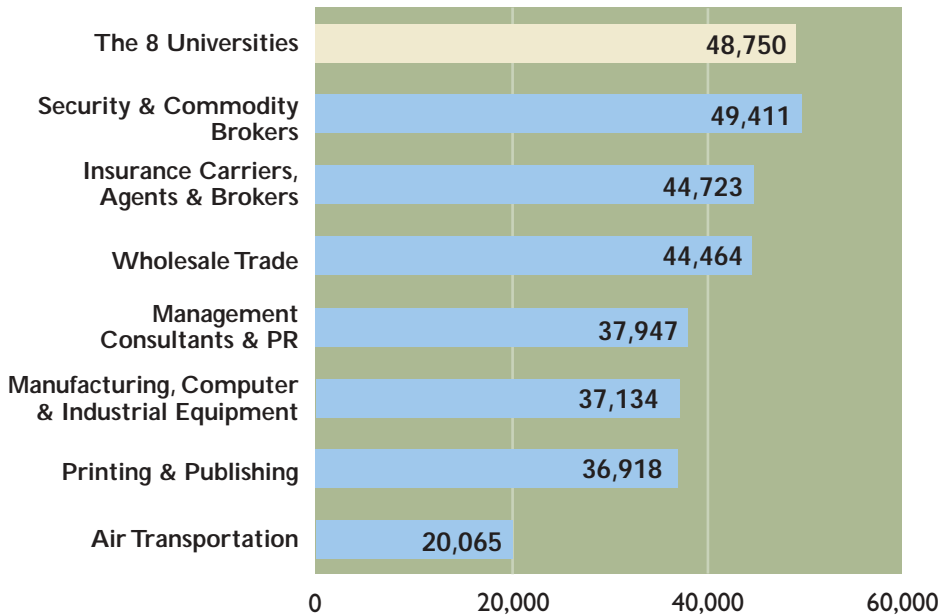


Figure 4

In 2000, the research universities collectively employed more people than a number of other leading industries in the Boston area, including banking, insurance, management consulting and computer manufacturing.

The economic impact on the regional economy alone is estimated at more than \$7 billion.

Based on current budgets and building programs, it is estimated that construction spending by the eight universities will average about \$850 million per year for the next four years. These new construction projects will support approximately 5,100 full-time construction jobs during each of those years. In 2000 alone, new construction projects generated approximately 3,300 full-time jobs.

The students from the eight universities — 74,000 undergraduates and 44,300 graduate students — spend about \$850 million annually for food, entertainment, transportation and other needs. It is also estimated that visitors to the universities, whether a visiting researcher or family and friends of a university student, generated \$250 million in additional local spending in 2000.

The eight universities themselves in 2000 spent \$3.9 billion in the region on payroll, purchasing and construction. It is estimated that the multiplier effect of that spending, as well as research spending by affiliated institutions and spending by students and visitors, had a collective regional economic impact of more than \$7 billion in 2000. In addition to the 48,750 people they employed directly, the universities' spending on purchases of goods and services and on construction, along with household spending by the universities' employees, supported 37,000 additional full-time jobs in 2000. (Figure 5)

Figure 5

In addition to the 48,750 employees of the eight major universities in 2000, it is estimated that spending by the universities in their local communities support another 37,000 full-time equivalent jobs. This total does not include the people employed by the universities' affiliated hospitals and research centers.



WHAT MASSACHUSETTS NEEDS TO SUSTAIN ITS ADVANTAGE

A Significant Source of Revenue Coming Into the Region

The universities are a significant “export industry” — a major provider of research and education services to companies and students beyond Massachusetts that brings in outside funds that are spent within the Boston area. Collectively, the eight universities spent about \$3.9 billion in the Boston area in 2000 — about two-thirds of total university spending. In contrast, about 70 percent of university revenue — more than \$4 billion — is derived from sources outside of the Boston metropolitan area. The universities spend more than two dollars within the region for every dollar in revenue they receive from local sources. (Figure 6)

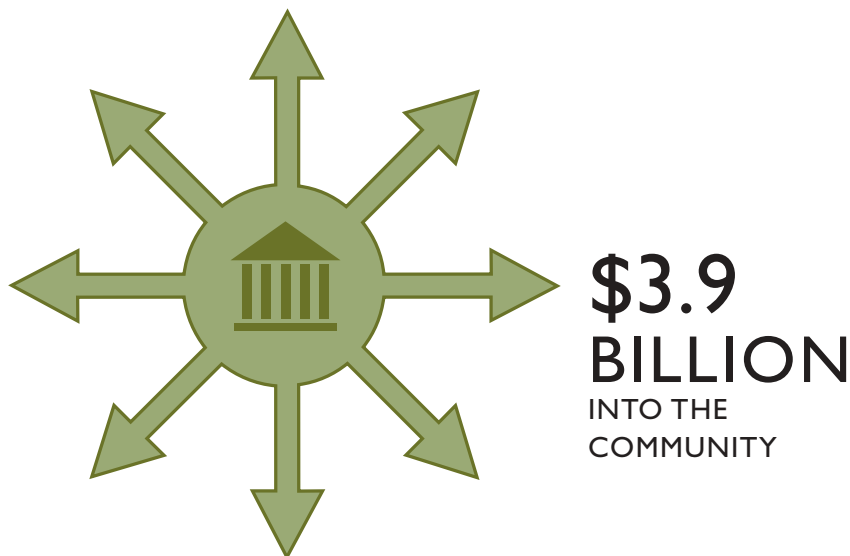


Figure 6

In 2000, the universities spent about \$3.9 billion in the Boston-area economy on salaries, wages and other payments to employees who live in the metropolitan area, on purchases of goods and services from other metropolitan area vendors, and on local construction projects.

- Research universities deliver the basic research that spawns **future industries**; as scientific understanding evolves, state and local policies must support university renovation and renewal.
- The development of a **stronger workforce** is dependent on the universities' ability to compete successfully for the most talented students and retain them locally once they graduate.
- **Lifetime learning** is key to developing an educated workforce that can adapt to industry evolution; university involvement in K-12 outreach and university continuing education programs are critical components of this objective.
- **Encourage entrepreneurial activity** to help sustain entrepreneurial opportunities in Massachusetts.

RESEARCH FUNDING AND RESEARCH SPENDING

Funding for research at universities comes from many sources: the federal government, corporations, non-profit groups, other organizations and universities' own internal funds. Universities then spend those funds for the costs of research, such as personnel costs for researchers and graduate students, special equipment and materials, administration and the costs of building and operating laboratories.

A Primary Recipient of Research Funding

The universities carried out more than \$1.5 billion of research in 2000. Together, these eight institutions accounted for more than 95 percent of all college and university research spending in the Boston metropolitan area. More than 80 percent of all research spending at the eight universities was financed by federal government agencies, including the National Institutes of Health, the National Science Foundation, and the Department of Defense. Nearly 20 percent came from corporations, foundations and other resources. State or local governments finance less than one-half of one percent of all research spending at the universities. (Figure 7)

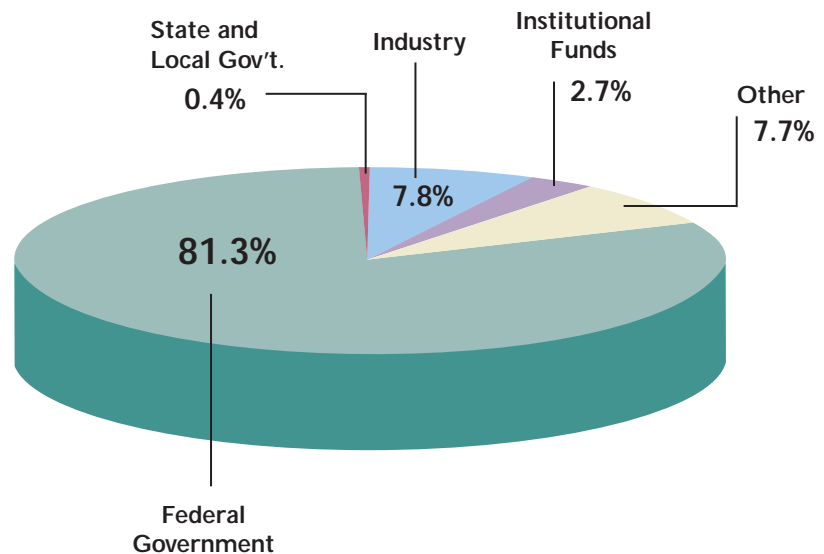


Figure 7

Less than one-half of one percent of all research spending at the eight universities is financed by state or local governments. Federal government agencies funded more than 80 percent; corporations and other organizations funded 18 percent.

University researchers are constantly exploring the latest knowledge and technologies that will be useful in developing future industries, companies and jobs near their campuses, as well as in the Greater Boston area, Massachusetts, the nation and the world. According to the 2002 Index of the Massachusetts Innovation Economy published by the Massachusetts Technology Collaborative,

Massachusetts universities and their affiliated research organizations were the recipients of over \$4 billion in federal research and development funding, second only to California among the leading technology states².

With the growth of other national research universities, Massachusetts is losing ground slightly in federal funding while other technology states are gaining. The amount of research and development funding Massachusetts received from federal resources increased by 20 percent from 1997 to 2000. Other leading technology states, including New Jersey, Connecticut and Minnesota were the recipients of a higher percentage increase in federal funding. It is critical for the universities to be able to maintain and develop the infrastructure needed to support ongoing research efforts and attract the most talented faculty and students into the region. The competing states are investing in their universities and seek to attract top scientists and engineers from all over the nation including Boston.

As jobs become more knowledge-driven, the universities produce not only the research that can lead to the creation of new companies and industries in the Greater Boston area, but the ability to deliver a workforce educated in emerging technologies.

A Commitment to Regional Productivity

Massachusetts as a whole had the highest percentage of scientists and engineers of the leading technology states with .91% of the total workforce in 1999 (1 out of 110 workers), far ahead of California with .52% or one out of 192 workers³.

The universities have also served as a magnet to a number of national and international companies that have located or are developing major research operations in the Boston area. Among them are Amgen, Cisco, Merck, Novartis, Pfizer and Sun Microsystems.

Yet, the education and training of the region's workforce base is not limited to the traditional undergraduates or graduates of these universities. Continuing education programs offered by the eight schools fed the ongoing education of approximately 25,000 adults in the fall 2000 semester alone. Another 70,000 people from Boston and around the nation participate or take part in special short courses for professional education on an annual basis. And, as the local economy shifts into highly specialized fields such as biotech manufacturing, continuing education programs form the linchpin of ongoing opportunities for the region's workforce. Corporations also take advantage of access to teaching resources, establishing private programs that are specifically developed for their workforce needs.

According to Mass Biotech 2010, a recent report of the Massachusetts Biotechnology Council and the Boston Consulting Group, a focused effort by the state's political, business and academic communities could create tens of thousands of new jobs directly and indirectly related to the biotechnology field by 2010⁴. The research universities not only provide the raw talent of recent graduates to fill some of these positions but can also develop programs that can certify and retrain professionals from other fields limited by the increasing obsolescence of their current industries.

An Incubator of Innovation and Entrepreneurship

Massachusetts has been recognized historically as a center for entrepreneurship and innovation. Major companies that have been founded by university alumni include Analog Devices, Biogen, EMC, Lycos and Staples. Hundreds of companies started up by university alumni are the basis of future growth in the Boston economy.

The intellectual resources required to start a company are embedded in the fabric of the universities through their world-class faculty. In 2000 alone, the universities assisted in the start-up of 41 new ventures dedicated to commercializing technology developed within the universities. These ventures, in turn, attract private equity financing, further stimulating the growth of the economy in the region. The universities granted 280 licenses to private ventures in 2000. Licensing of university technologies by private enterprises in 2000 generated \$44.5 million in income, further fueling the economic activity of the region.

The universities have also served as a magnet to a number of national and international companies that have located or are developing major research operations in the Boston area. Among them are Amgen, Cisco, Merck, Novartis, Pfizer and Sun Microsystems.

Entrepreneurship is not confined to the faculty and students of the universities. For those not directly affiliated with the university community, some of the universities already provide the basic resources, such as low-cost access to office and laboratory space, to stimulate the growth of new business ventures. Leveraging the expertise of business faculty within the universities, these start-ups receive a unique benefit based on their proximity to the research universities. As the start-ups mature, they further fuel economic growth in the region.

Major companies that have been founded by university alumni include Analog Devices, Biogen, EMC, Lycos and Staples. Hundreds of companies started up by university alumni are the basis of future growth in the Boston economy.

An Active Community Participant

As the economy has changed, the research universities have diversified and helped create the new industries of the region. Massachusetts has evolved from a primarily manufacturing-based economy to one that counts financial services, technology and tourism among its leading industries.

The universities and their staff and students also have provided affordable community housing, improved the urban environment, strengthened local businesses and helped to deliver health services in their communities. In addition, all of the universities provide important cultural resources for the Boston area, myriad concerts, exhibits and lectures open to the public.

The universities play a vital role in their local communities. For example, all eight universities are involved intensely in an array of programs to improve the quality of the K-12 education system in their local communities. Six of the eight universities offer formal degrees in education at either the graduate or undergraduate level.

The universities and their staff and students also have provided affordable community housing, improved the urban environment, strengthened local businesses and helped to deliver health services in their communities. In addition, all of the universities provide important cultural resources for the Boston area, myriad concerts, exhibits and lectures open to the public.

The eight research universities of Greater Boston are one of Massachusetts' greatest sustaining resources. Not only a significant and stable contributor to the economic well-being of the Commonwealth, these universities represent a fundamental source for economic innovation and a major contributor to the region's quality of life. The universities deliver lifetime opportunities for learning that can create a workforce able to adapt to the economic evolution of business and industry.

Combined, Boston College, Boston University, Brandeis University, Harvard University, the Massachusetts Institute of Technology, Northeastern University, Tufts University and the University of Massachusetts Boston will continue to be engines of knowledge and economic growth for the future of the Commonwealth.

¹ Boston Business Journal, January 2, 2003

² 2002 Index of the Massachusetts Innovation Economy, Massachusetts Technology Collaborative, page 50

³ 2002 Index of the Massachusetts Innovation Economy, page 47

⁴ MassBiotech 2010, The Boston Consulting Group and Massachusetts Biotechnology Council, page 18

For information about the universities in this study, please contact the individual offices of government, community, and public affairs as listed below:

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