EXPANDING THE LINKS BETWEEN BUSINESS AND HIGHER EDUCATION IN MASSACHUSETTS:

A CALL TO ACTION

Massachusetts' universities draw big business into the state.
But how much more could we draw if we really *worked* at it?

Fifth Annual Massachusetts Business Expansion Report – Fall 2000

Mass Insight
CORPORATION

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Expanding the Links Between Business and Higher Education in Massachusetts: A Call to Action

The technology firm executive began with a tribute to Massachusetts' higher education magnet.

"The fact that there are so many schools in this area is why we're here," he said. "It's a huge inducement to locate in Massachusetts. In recruiting engineers and others, we can say that if you come to Boston, you come to the Athens of America. We use that to attract both people and business."

Then came the reality check.

"Massachusetts thinks that it has so much going for it that [its academic cluster] alone will sustain it. It won't. Other places are seeking to eat our lunch. They're pitching themselves to us as high-tech Meccas. They understand that tax breaks and cheap land are short-term things that are necessary, but hardly sufficient to draw businesses like us. The new paradigm lies in university collaborations with industry and with government."

Another executive had a similarly sobering view.

"Massachusetts will always have its top tier institutions like MIT. But the academic capability of regional institutions elsewhere continues to improve. And these regions are much more capably and aggressively packaging [business-university] relationships into a complete, integrated program including the research side, public-private incubators, and workforce development.

"If a place like Massachusetts is not very concerned about maintaining a leadership position, it could find itself in a second tier position very quickly," he said.

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The New Competitive Challenge

In recent years, business groups and elected officials have succeeded in leveling the state's competitive playing field in important areas such as tax burden and regulatory environment. Now, countless reports and studies are raising a new challenge: The need for a workforce with sufficient skills to meet technology-based business demands of today and tomorrow.

Business and higher education have responded with a range of individual programs and initiatives, some of them within the state's public university, state college and community college systems. But could these efforts be more effective? Could we develop a more coherent statewide strategy to link industry and university resources and needs? Keeping our competitive edge means not only coordinating business and higher education institutions, but their component aspects, such as recruiting and research.

After all, in today's global economy, industry-university ties must be about more than just workforce development, critical as that is.

"We recruit at dozens of universities, but if recruiting is all you do, it's not a very good relationship," said one of the more than two dozen industry and academic experts interviewed by Mass Insight (listed on page 2). "You must have meaningful partnerships involving research work, collaborations and other broader ties."

Other regions are effectively promoting such partnerships. Some, such as Silicon Valley and North Carolina's Research Triangle, are already technology powers. Now states such as Colorado, Maryland, Florida and Georgia are also vying for technology sectors, assembling economic development packages that pitch far more than lower costs and taxes. They promote how their academic institutions, public and private, can meet the workforce, research and other needs of businesses and market targeted packages to individual firms.

A Call to Action, the fifth in Mass Insight's series of annual Business Expansion Reports, examines the higher education and business landscape here in Massachusetts: how we are different from other states, where our strengths lie, and what opportunities and conditions are created by university governance structures and by the new economy. More to the point, it also looks closely at the dynamics of the relationship between academia and business in the Commonwealth: how each is perceived by the other, how constructive partnerships develop, and what challenges prevent even deeper levels of engagement. The executives' recommendations, distilled and synthesized from our interviews and presented on pages 20–24, represent a collective strategy to meet those challenges – and capitalize on the enormous opportunities that lie before us.

William H. Guenther
President, Mass Insight Corporation

[COMMENTARY]

The Risks of Complacency

Yolanda K. Kodrzycki
Assistant Vice President and Economist, Federal Reserve Bank of Boston
Director, New England Economic Project

Some have said that reinventing higher education is difficult in a state whose two most famous universities date back to 1636 and 1861. Even our newcomer institutions – places like UMass Boston, Middlesex Community College, and Springfield Technical Community College – were conceived back in the 1960s, well before business leaders or policymakers started talking of a "knowledge economy."

Yolanda K. Kodrzycki

In fact, although our colleges and universities were founded in other eras, they have made numerous adaptations over the years in response to changing needs with respect to education and training as well as research and development. The concentration of higher education institutions in Massachusetts has been central in the development of innovative industries and the attendant rise in living standards over the past several decades.

The Mass Insight Year 2000 *Business Expansion Report* draws attention to further changes that are essential if the Massachusetts economy and its higher education institutions are to retain their leadership positions. Consider the basic statistics with respect to educational requirements. The Massachusetts Division of Employment and Training projects that almost half of all local job openings this decade will call for a bachelor's degree or more. Adding in the positions that require an associate degree or professional certification, close to 60 percent of all job openings will call for candidates to have completed a course of study beyond high school.

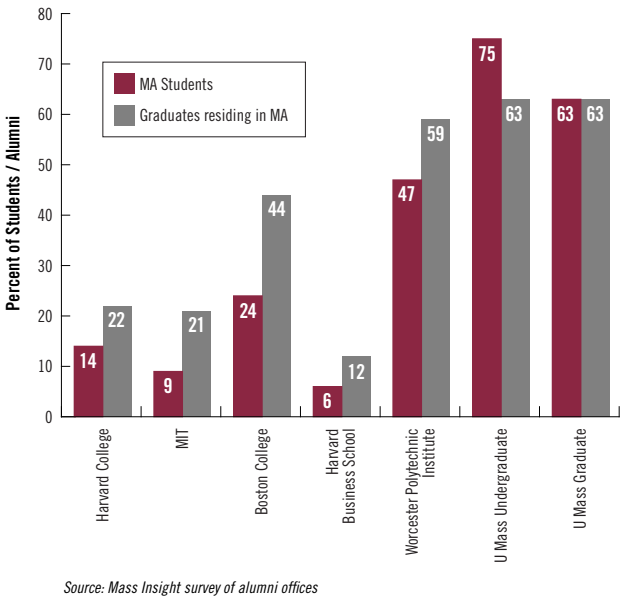
Massachusetts currently ranks third in the nation in educational attainment (behind Colorado and Maryland). Even so, only one-third of adults in Massachusetts have completed a four-year college degree. Including associate degrees, the number remains below 40 percent.

Of course, job projections inevitably are subject to error. However, if anything, recent errors nationally have been in the direction of understating the demand for highly educated workers. Moreover, demographic forces are sure to constrain labor force growth in Massachusetts in coming years, forcing employers to keep investing in new technologies that limit labor requirements. Our workforce will need education and training to make productive use of these innovations.

In most states around the nation, higher education is dominated by public institutions. For example, about two-thirds of U.S. bachelor's degrees in recent years have been granted by public colleges and universities; in states such as California and Texas, the public share is even higher. Massachusetts is unusual in this regard: two-thirds of bachelor's degrees are conferred by private institutions, only one-third public.

The Mass Insight Year 2000 *Expansion Report* draws attention to further changes that are essential if the Massachusetts economy and its higher education institutions are to retain their leadership positions.

Retaining Graduates: An Important Source of Professionals



Source: Mass Insight survey of alumni offices

Higher education institutions in Massachusetts already provide us with a tremendously important pool of "imported" skilled labor – undergraduates and graduates who move here for academics and decide to stay and work here afterwards (see chart). If the number of educated workers is to increase, and if private colleges and universities choose to maintain their selective admissions, then the public higher education system in Massachusetts will face pressures for significant expansion from its relatively small base. Moreover, much of the effort in coming years is likely to focus on developing the skills of the incumbent workforce. This will raise the profile of community colleges, which in Massachusetts – as elsewhere – are mostly publicly funded institutions. However, the *Expansion Report* also notes that unlike the situation in other states, the governance of public community colleges in Massachusetts is separate from that of the public university system.

As Mass Insight indicates, how higher education is to be expanded and who will finance it are questions that need to be addressed systematically. In this regard, the *Expansion Report* raises challenges not only for state government and academia, but also for Massachusetts businesses, who have historically given higher education issues less attention than other priorities. Moreover, with a growing share of the state's employment concentrated in smaller enterprises, coordination between the business community and academic institutions becomes more complex – in addition to being more pressing.

Why Massachusetts Is Different

In general, industry pursues university links at three different levels. Massachusetts' higher education picture is different from that of other states at all three levels.

> **National/international institutions** – (MIT, Harvard, Stanford University, etc.). Relationships focus on research and development, technology licensing and transfer, faculty resources and recruiting top-drawer graduate and other students;

> **Regional institutions** – (UMass, San Jose State, North Carolina State, etc.). Some technology transfer and faculty research ties; workforce recruiting and ongoing professional training and retraining;

> **Local institutions** – Junior colleges and community colleges. Targeted mainly to meeting workforce needs, including incumbent worker retraining, certification programs and other technology entry-level skill development.

MIT

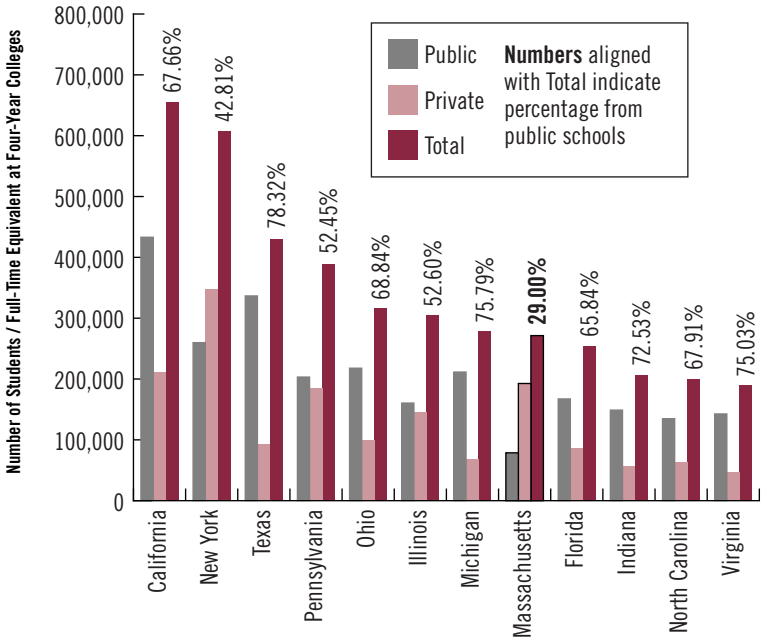
The Top Tier: Massachusetts is exceptional.

"MIT is so far off the chart that it's a special case unto itself, with well-documented contributions to the state economy," said one university official. Other interviewees cited major private institutions such as Harvard University, Boston University and Northeastern University for collaborative efforts with industry in research, workforce and other areas.

Government has at best a limited role in influencing how closely such private institutions will work with industry. But at the same time, several interviewees noted that the same competitive spirit among private colleges here that on the one hand drives innovation can also hinder the coordination and cooperation seen in some other states.

The same competitive spirit among private colleges here that on the one hand drives innovation can also hinder the coordination and cooperation seen in some other states.

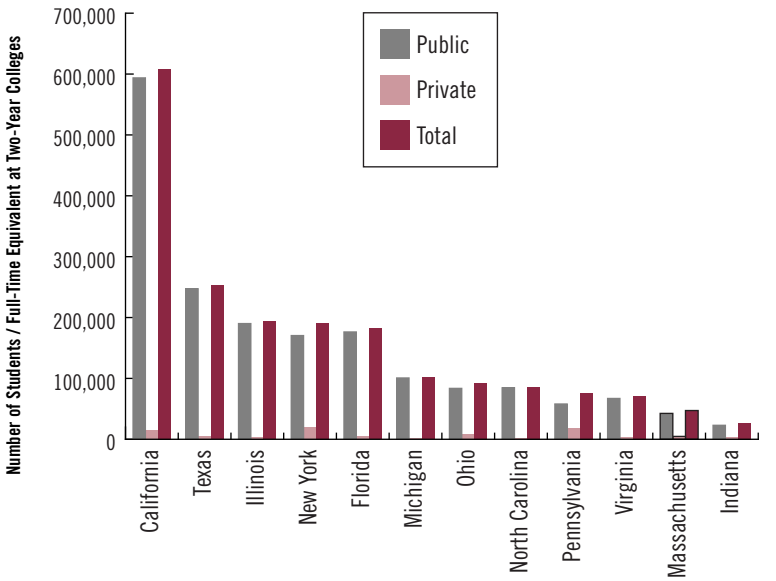
The Top 12 Four-Year College States: Public/Private College Enrollment



Massachusetts is a leader in four-year higher education – but we have competition. Private colleges are a bigger factor in MA than in any other state…

Source: Fall 1997 data, US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) "Fall Enrollment" surveys.

The Top 12 Four-Year College States: Community College Enrollment



…But: Massachusetts lags in two-year community college enrollment.

Source: Fall 1997 data, US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) "Fall Enrollment" surveys.

Public Vs. Private: Compared to other states, Massachusetts has far more college students enrolled in private institutions than in its own public higher education system.

While engineers in other states are produced mainly by public universities, in Massachusetts only two of 13 engineering colleges are public. The community college and public four-year institutions here take a back seat to the "privates" in terms of enrollment, influence, and prominence in ways other states do not experience.

"To some extent, the public system here is overshadowed by these incredible privates," one interviewee said. "The [public system's] flagship campus is located away from the state's political and economic center. Even the absence of a public law school – which in other states produces graduates who fill the legislatures – kills [the Massachusetts university system] on Beacon Hill."

Why Massachusetts Is Different
(continued)

Massachusetts' private higher education powerhouses lead the way in attracting huge federal research investments, and they're joined by the state's equally powerful medical establishment.

Between them, Massachusetts' leading hospitals and private universities generate a level of federal and sponsored investment that would be the envy of any other state – perhaps excepting California. (See charts at right.) But their presence has lulled the Commonwealth into investing comparatively lightly in research and development.

Differences in the Business Landscape: Big changes in the state's economy have also affected business-university ties here.

Disparities between the public and private sides of the Commonwealth's university community aren't the only way Massachusetts is different; we are different on the business side from the way we used to be. How? This thing called "Massachusetts industry," interviewees said, is far harder to define today than it was 10 or 20 years ago – let alone strategically assemble.

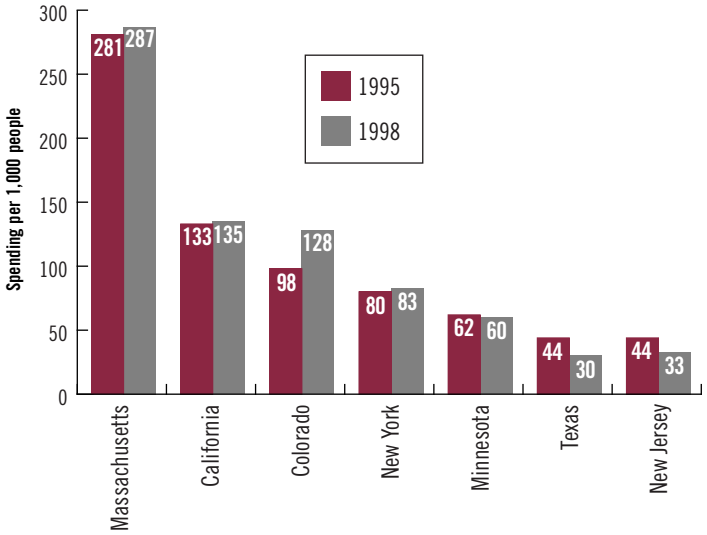
"Not too long ago, the Massachusetts economy was dominated by a half dozen or so top players, such as Raytheon, Wang, Data General and Digital. You could get together a dozen people in an informal way to plan strategies and programs. Then that economy crashed, and the new economy is filled with hundreds of smaller, fast-growing players. Now you have to bring a hundred people to the table."

It's not that best practices of industry-university collaboration don't exist here. They are common. So too are programs to advance such partnerships. They range from Industrial Liaison programs to collaborative efforts to win major federal grants to revamped technology transfer and licensing programs.

The problem is not a lack of opportunity to make links, but a lack of strategic coordination behind many of these activities. This problem is especially pronounced as the industrial landscape shifts away from a small number of major employers toward an industrial field full of smaller organizations who often lack the time or financial resources necessary to find and then utilize existing relationship opportunities – let alone forge their own.

Massachusetts vs. Leading Technology States: Federal R&D

Federal R&D expenditures in academic and non-profit research institutions, per capita, MA and other LTS, 1995 and 1998 ($ 1996 inflation-adjusted)



Massachusetts leads the country in Federal R & D spending per capita (and with $1.8 billion, is second to California in absolute dollars)…

Source: MTC, National Science Foundation. LTS refers to selected leading Technology states used as benchmarks for the MTC "Index" Report

Federal dollars dominate Massachusetts' research landscape. State investments are increasingly focused on leverage.

State and Local Government Research Spending

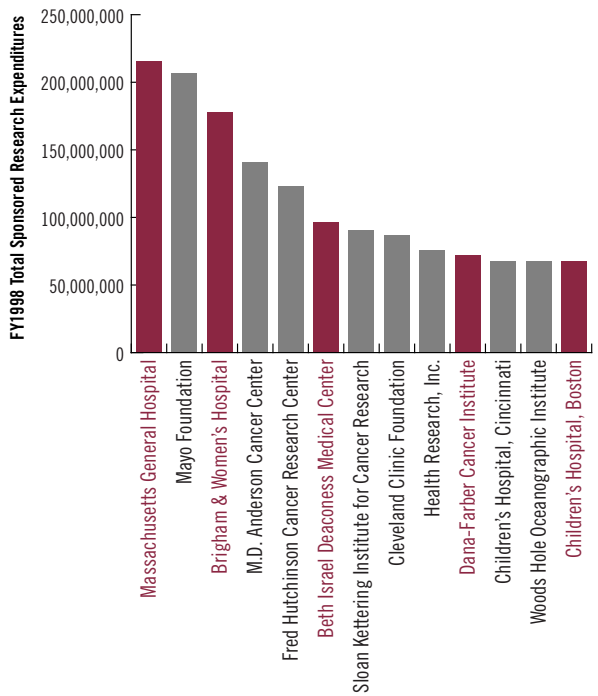
Ranking of 12 Top Four-Year College States by Research Spending at Public Universities

State	Total R&D Spending (000s)	State and Local Gov't Spending – Public Universities (000s)	Percent of Total Spending – Public Universities
Texas	$1,698,363	**$172,513**	10.16%
California	3,344,740	**134,683**	4.03%
North Carolina	898,513	**122,493**	13.63%
Florida	712,704	**77,498**	10.87%
Ohio	808,210	**68,891**	8.52%
Michigan	877,804	**56,142**	6.40%
Illinois	1,045,800	**50,982**	4.87%
Virginia	490,695	**49,292**	10.05%
Indiana	425,293	**25,378**	5.97%
Massachusetts	**1,342,712**	**25,089**	**1.87%**
New York	1,924,667	**17,504**	0.91%
Pennsylvania	1,341,607	**14,970**	1.12%

…But, Massachusetts has been a relatively small player in research funding for its universities.

Source: 1998. National Science Foundation.

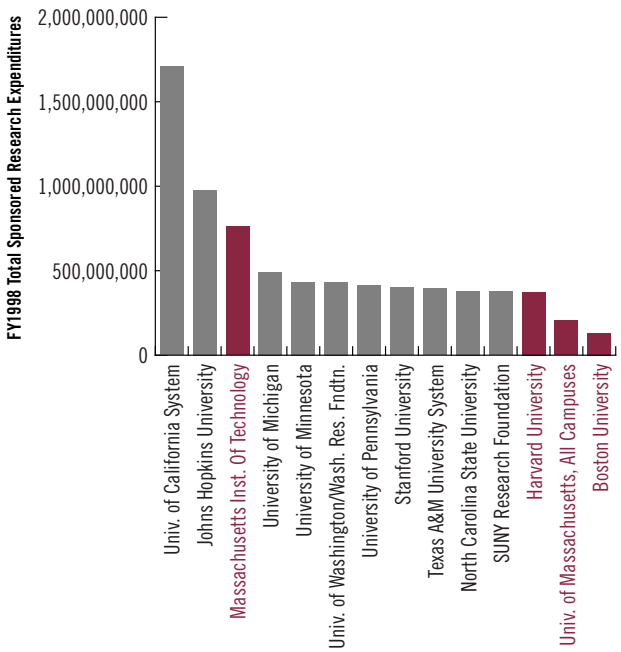
U.S. Hospitals & Research Institutes: Sponsored Research



Massachusetts teaching hospitals dominate the field in sponsored research…

Source: The Association of University Technology Managers, Inc.

U.S. Universities: Sponsored Research



…As do our private universities. UMass has a growing presence – but newer competitors like Texas and North Carolina are in the top 12.

Source: The Association of University Technology Managers, Inc.

What We Could Learn From Other States

If smaller new-economy firms in Massachusetts have links with local colleges at all, it's likely due more to individual connections rather than to any structured matchmaking.

Their industry-academic ties often derive from either the particular stature of the institution or from high-level, personal connections between academic and industry officials.

These individual links – between graduates and their alma maters; trustees and corporations; company and faculty researchers – will always be at the core of many industry-university relationships, public and private.

But interviewees said the state could do more to broker such links and to promote the lessons and best practices they offer. After all, increased competition for federal grants has made higher education institutions at all levels more eager to tap into industry resources.

Many of these relationships are personal, but there must be a structure so that individuals who want to interact have a vehicle to do so," said a university official. "Most of us academics are hopelessly naïve about the potential commercial impact of our work, for instance. That kind of narrow vision often stifles development. Having business people who can open up whole new areas – and having help to facilitate such contacts – is very important."

The state, of course, can play only a limited role in enhancing ties between private businesses and private colleges and universities, though even these could be better promoted and coordinated. Other states such as North Carolina have been more active in leveraging private college initiatives, sometimes through coordination, other times with the boost of financial incentives such as matching R&D grants.

While academic-industry ties in these other regions are shaped by economic, social, political and other local factors, they offer some basic lessons for Massachusetts:

They invest more heavily in higher education.

As a proportion of total state spending, other states invest more heavily in higher education (in large part because they have made their public systems bigger players in the local landscape). In fact, Massachusetts is among the lower-performing states in:

Capital spending to upgrade campuses or to build new facilities with IT and other systems necessary for state-of-the-art R&D research activities;

Operational spending for various needs, including attracting and retaining faculty, scholarship and internship assistance, matching funds and seed grants for industry partnerships and research grant applications.

True university-industry partnerships must be based on long-term strategic needs, not just the "hot" technology of the moment.

They have a strategic focus on collaborative efforts, both within their higher education institutions and between them and industry.

More strategic and programmatic coordination is needed within the Massachusetts four-year and two-year institutions, as well as between them. States with the most effective programs tend to have strong, central public university systems.

They think – and act – in the strategic long term.

True university-industry partnerships must be based on long-term strategic needs, not just the "hot" technology of the moment. Workforce demands ease when an economy cools, but truly effective collaborations will anticipate the next new sector.

They encourage risk-taking.

This applies to both the public and private sectors. Public investments in facilities and educational programs may sometimes appear risky, but they are essential in an increasingly competitive field. And businesses – individually and in organized groups – are more willing to back and help pay for such investments.

The latter three points were highlighted in a recent analysis completed by one of our interviewees of Silicon Valley's relationship with Stanford and Bay Area colleges.

How Massachusetts' higher education system and its business community can – and must – learn from these dimensions of the collaborative partnerships developing in other states is the focus of the next sections of this report.

{LEARNING FROM OTHER STATES}

New York: Consolidating and Investing

New York state has consolidated a $131 million science and technology initiative into a new office of Science, Technology and Academic Research in an effort to enhance university-related R&D efforts. A $7.5 million campaign will be launched to attract "the brightest research minds" to New York university campuses, and $95 million goes to a capital facilities program to finance state-of-the-art laboratory space on the public campuses.

Websites: www.nystar.state.ny.us/home.htm and **www.empire.state.ny.us**

Missing It in Massachusetts

With near unanimity, executives interviewed for this report called for two important players to improve the ways they work toward effective industry-academic links. Massachusetts public higher education system and the business community must both make a larger commitment to this high-stakes, competitive game.

Challenge 1: Making More Strategic Use of Public Higher Education

Even high-ranking state officials sometimes neglect their own public college system when they plot economic strategy.

"I was at one workshop in Wisconsin recently about how community college students could develop a global perspective," said a university official. "That meeting was run right out of the governor's office. But here in Massachusetts, there was recently a high-level meeting on workforce training – and no one from the community colleges was even invited. That would never happen in North Carolina or Wisconsin or Texas, all of which see community colleges as their training arm. There is thinking going on in Massachusetts. There just needs to be implementation."

Public higher education in Massachusetts suffers from a lack of coordination within and among its different pieces.

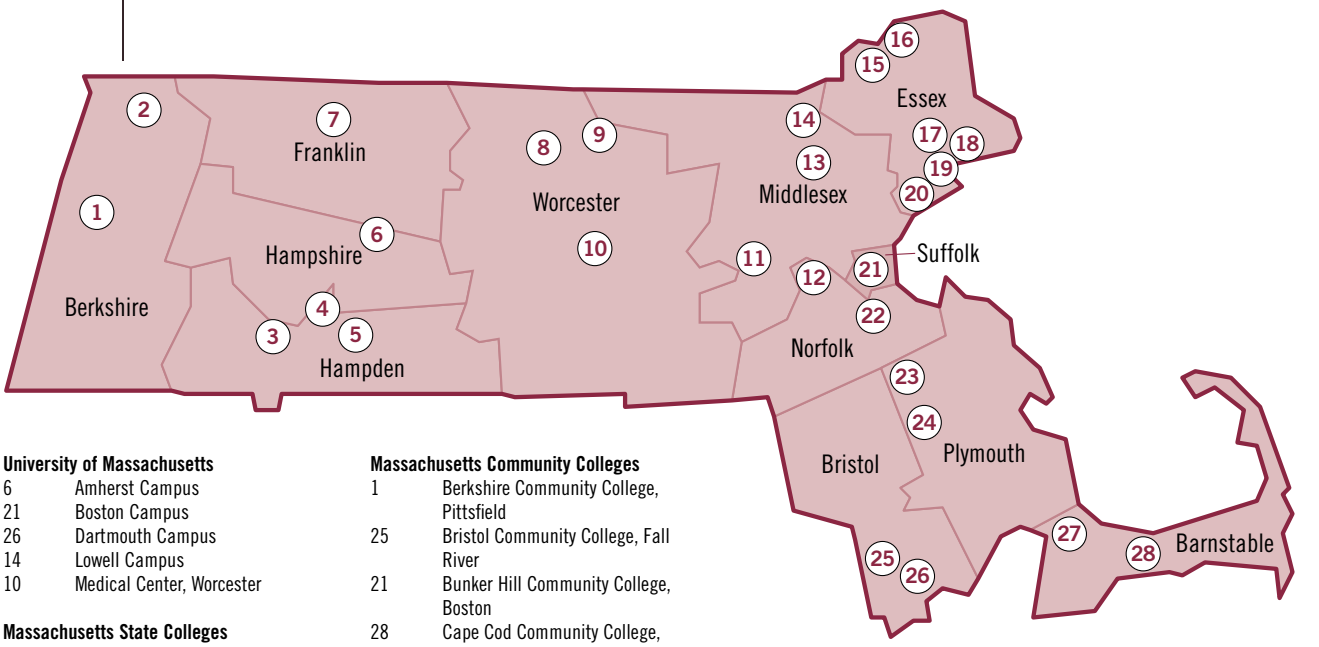
Interviewees consistently criticized the structure of public higher education here. The university system is run by one entity, the state colleges and community colleges by another. This structural discontinuity has been cited often in the past, of course – but it remains unresolved.

"The structure here is such that each of the higher ed institutions is largely independent," said an executive who develops corporate-academic links in several states. "That can make it slow to put together a major program here. In other states, the same board of regents oversees all pieces of the public system. That simply forces more coordination, tying together university campuses and the community colleges. It means you can get top-to-bottom solutions. Increasingly, this is becoming a discriminator of where we locate our operations."

Campuses within the same public university system often fail to coordinate efforts with each other. They can even compete more than collaborate.

"Within the university system, we'd get hit by Lowell and then Amherst," said a top official of a major Bay State firm. "We've decided that we have to push back: We actually end up as the clearinghouse, telling them, 'You decide your priorities and come to us in a collective way'. They are trying to pull it together, but they're not there yet. It's a given that the privates will do this kind of thing, but we didn't expect to see it intra-public."

Interviewees consistently criticized the structure of public higher education here. The university system is run by one entity, the state colleges and community colleges by another.



University of Massachusetts

6	Amherst Campus
21	Boston Campus
26	Dartmouth Campus
14	Lowell Campus
10	Medical Center, Worcester

Massachusetts State Colleges

24	Bridgewater State College
9	Fitchburg State College
11	Framingham State College
21	Massachusetts College of Art, Boston
2	Massachusetts College of Liberal Arts, North Adams
27	Massachusetts Maritime Academy, Buzzards Bay
19	Salem State College
3	Westfield State College
10	Worcester State College

Massachusetts Community Colleges

1	Berkshire Community College, Pittsfield
25	Bristol Community College, Fall River
21	Bunker Hill Community College, Boston
28	Cape Cod Community College, West Barnstable
7	Greenfield Community College
4	Holyoke Community College
12/11	Massachusetts Bay Community College, 2 locations (Wellesley and Framingham)
22/23	Massasoit Community College, 2 locations (Canton and Brockton)
14/13	Middlesex Community College, 2 locations (Lowell and Bedford)
8	Mt. Wachusett Community College, Gardner
20/18/17	North Shore Community College, 3 locations (Lynn, Beverly and Danvers)
16/15	Northern Essex Community College, 2 locations (Haverhill and Lawrence)
10	Quinsigamond Community College, Worcester
21	Roxbury Community College, Boston
5	Springfield Technical Community College

Turf wars occur in every region, including between campuses, of course. And compared to other public university systems across the country, Massachusetts' is relatively new. "But," said that official, "it just seems that in states like California and Texas, the (public college) system is a little more glued together."

Indeed, top UMass officials have been recently finding that relationships with firms such as Raytheon and Fidelity are more likely to succeed if pursued system-wide, rather than campus-by-campus.

{LEARNING FROM OTHER STATES}

North Carolina: Building Linkages, Literally

North Carolina State University has built a new campus in the middle of the Research Triangle Park for its engineering school. The campus will literally tie academic and industry environments together. **Website: www.rtp.org**

Missing It in Massachusetts
(continued)

Clearly, good examples of industry-public university/community college collaboration do exist in Massachusetts. Some of these collaborations are profiled on pages 26-27.

And, to be sure, new efforts are under way to encourage greater inter- and intra-system coordination. But the overall pattern that emerges from the interviews is … that there *is* no pattern. Efforts and focus seem to center on individual projects, rather than on building long-term, strategic relationships.

On the promising side of the ledger are efforts like UMass's Commonwealth Information Technology Initiative. This program will bring together not only its own campuses, but the four-year state colleges and community colleges in a concerted effort to upgrade the IT curriculum across the state. Curriculum will initially be tested on the Amherst campus, and then applied to the other campuses and eventually the two-year schools. Students who take the two-year curriculum will receive full credit if they move on to a four-year program.

But this kind of cooperative initiative may be the exception, rather than the rule. Industry officials who report good experiences with a particular campus say the burden was generally on them to figure out where to go and with whom to talk. For their part, university officials eagerly talked about their own good partnerships. But if they are familiar with similar efforts on other campuses, it is likely to be in an anecdotal way or through personal connections – not through a systemic attempt at coordination or information sharing.

"In Massachusetts, we have to contact several universities and colleges to put together a program," said a technology executive. "With each one, we have to learn about their curriculum and their recruitment policies. And we still have to maintain our technology relationship with schools like MIT for development purposes."

"Other places put that all together for you. They will take the two to three months of lead time to coordinate among their colleges or universities and then tell us that collectively, we have enough to meet your needs – and here's how you begin the process, as opposed to us having to do it on our own here and spend more than six months to accomplish the same thing."

Public university officials agree on the need for a more systemic approach. But they are wary of too much central control. It is apparent that there is no one-size-fits-all template for industry-business ties.

"It must be recognized at the top levels of government that the state already has an investment in its public college system. What's needed is to integrate those colleges with a statewide economic development strategy. And that's what's been missing."

"There just isn't any central strategy for public higher education, though real strides have been made in recent years," said one interviewee. "It must be recognized at the top levels of government that the state already has an investment in its public college system. What's needed is to integrate those colleges with a statewide economic development strategy. And that's what's been missing."

Even when higher ed institutions have sought to become more active in economic development, in the past they sometimes found they lacked support from senior education officials within state government to make such a partnership truly work.

Also missing is encouragement of risk-taking by the public institutions, in part because of the financial downside if risks fail.

"If you spend a half million dollars from your budget on one of these partnership efforts and it works, you look great," said one college official. "But what if you took a half million dollar loss? What do you think your president will say the next time you have an idea for a new program? It's harder to make some of these bets pay off here compared to other states, where there is often risk capital offered (to public campuses) so that if a program blows up, you don't take the big hit."

{LEARNING FROM OTHER STATES}

Pennsylvania: The Digital Greenhouse Public/Private Partnership

This alliance includes three Pittsburgh universities, the state, three international corporations and the Pittsburgh Regional Alliance, and seeks to position southwestern Pennsylvania as a worldwide leader in system-on-a-chip (SOC) technology. Funding goes to research, advanced degree programs at the three universities and other programs, including one to send specialized teams into medium to large companies to assess opportunities for improved use of electronics. **Website: www.digitalgreenhouse.com**

Community Colleges: Still an Untapped Resource

Many executives interviewed for this report cited the community college system as an underutilized, major resource that the state can hardly afford to keep neglecting.

Asked to summarize the state of the state's 15 two-year public colleges, one interviewee responded succinctly: "We have a few good community colleges, but we should have a lot more of them."

Added an industry interviewee who works in several technology states: "I find it stunningly surprising that a state so dependent on high-technology would not have a laser-like focus on the role of its higher education systems as vehicles for workforce development."

"We just don't see coordination among the community colleges," he continued, "so you end up responding to the one closest to you. Which means we may be missing something. The community college system in Massachusetts is just not as strong as in other states, where there are these huge institutions connected in many ways to the business community."

Why? Some important studies, including one by MassINC, have analyzed the state's community college system. Interviewees for this report cited several general factors, some of which also apply to the university system:

Lack of consistency and coordination

Interviewees reported uneven experiences with different community colleges in terms of outreach, levels of responsiveness and quality.

"You have some colleges where the presidents are very committed to running programs tied into employer needs and they want to get kids good jobs," said one. "But statewide, the colleges are pretty independent. They all view themselves as having different missions. Many see themselves as two-year transfer institutions, not as places giving people degrees to leverage them into labor markets."

Insufficient flexibility

Even with good top leadership, a serious challenge is to convince faculty to make curricular and other changes necessary to remain current with industry practices.

"With a lot of schools, there's both institutional rigidity and faculty rigidity. When you have a faculty that's largely tenured, it's hard to change the services mix necessary to tie community colleges with today's employers."

{LEARNING FROM OTHER STATES}

Pennsylvania: A Community College Strategy

Two Pennsylvania initiatives focus specifically on high-tech workforce development. The SciTech Scholars program is slated to provide scholarship assistance annually (of up to $3000 each) to 23,000 full-time students earning degrees in selected fields. A partner program (the "GI Bill for the New Economy") supports sci-tech students in the state's community colleges and two-year institutions. **Websites: http://papower.state.pa.us/papower/** and **www.inventpa.com**.

Budget problems

Interviewees cited both overall funding as well as the lack of creative, targeted programs to help community colleges finance industry partnerships, especially in their early stages.

"People think the campuses get a lot of money, but net budgets this year were flat with inflation," said one academic official. "We want to do more with industry partnerships, but you can't do that without the technology infrastructure. It's a monumental effort just to keep pace with that challenge."

Innovative financing approaches

Others said that rather than more dollars, more creative financing approaches are needed. Many individual companies have entered into training partnerships with the colleges, offering paid scholarships and internships. Financial assistance can be especially critical for adults who want to return to school. But smaller firms are either unaware of or are largely shut out of this effective approach. Even with larger companies, the track record in such cost-sharing programs is uneven, driven more by the aggressiveness of individual colleges than any coordinated state strategy.

Several interviewees called for the state to directly support programs in which corporations provide paid internships and scholarships to students by offering to match such loans. The scholarships are for studies in areas in demand, and are often linked to paid internships. Others called for a state revolving fund that could be tapped to help launch industry-college partnership efforts.

Faculty recruitment and retention

Several interviewees warned that the state must create greater financial incentives to attract and retain faculty in key technology areas. This is a problem on all campuses, but low pay at community colleges was frequently cited as threatening the ability of the two-year schools to match industry training requirements.

> "Statewide, the colleges are pretty independent. They all view themselves as having different missions. Many see themselves as two-year transfer institutions, not as places giving people degrees to leverage them into labor markets."

The Need for Leadership from Business and Industry

The state's higher education system may have shortfalls. But industry associations need to play a larger role in pursuing an effective, long-term agenda for improved industry-academic ties.

Compared to other regions, business organizations here are not active in lobbying for and promoting higher education as a competitive strength, and they need to improve their function as effective brokers for university-industry relations, interviewees said.

"When you have highly visible, high-level partnerships between business and higher education, it makes it far more likely that governors and legislators will be willing to fund public higher education overall," said one interviewee familiar with what happens in other states. "Leadership must come not just from the public sector, but from the private." In Maryland, for example, private technology organizations advocated for major capital spending on a new high-tech campus at the University of Maryland. "Here in Massachusetts," continued this contact, "business groups tend to be against such public spending."

Another executive was harsher in his analysis: "It won't be through (the President of UMass) that the legislature begins to really understand and act upon the importance of higher ed (ties to industry). The politics on Beacon Hill regarding higher education would change if business groups put as much lobbying time into budget increases and other programs for higher ed as they did with tax breaks."

There are promising signs that business is beginning to take the lead. Business associations in Massachusetts individually and collectively are forging ties and developing programs. "Our primary mission has always been to improve Massachusetts as a place that can compete with other states and regions for technology-intensive jobs," said one business group official.

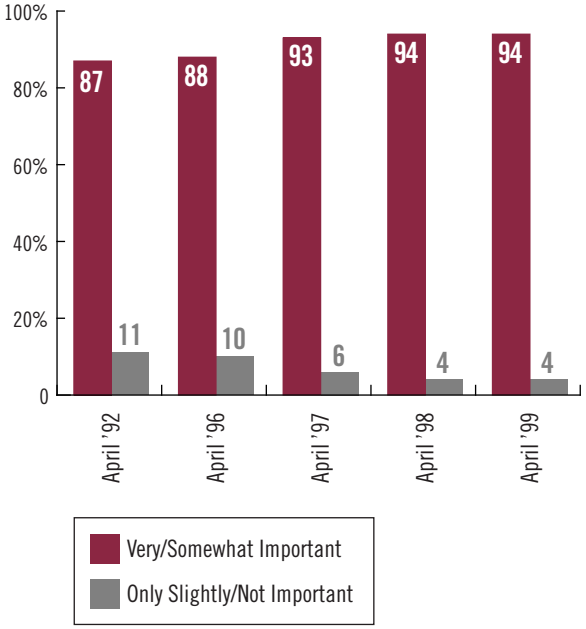
And one executive agreed that business-university efforts are now becoming "more and more of a two-way street in Massachusetts. Ten years ago, we needed to do all the reaching out. Now there is more of a collaborative perspective, though it's still usually directly between firm and campus."

But as is true with the public higher education system, organizational and strategic coordination is lacking.

"An organization like MassMEDIC (the Massachusetts Medical Device Industry Council) was formed because there was no organizing body specifically for medical device manufacturers in the state," observed one executive. "And it's been a helpful and effective group. But it's just one organization added to hundreds. It would be nice if these (groups) were structured in some way that they knew what each other was doing so they could be mutually supportive."

Changed economic factors partly account for this relative lack of business initiatives, said another interviewee. "In Massachusetts, the rhetoric level is high about the labor shortage problem, but there is much less activity [than elsewhere] by employers actually working with

Public Attitudes on Importance of Colleges & Universities to Massachusetts' Economic Health



The public understands the importance of higher education to the Massachusetts economy.

Source: Mass Insight Corporation Public Opinion Data, May 1999.

> "In Massachusetts, the rhetoric level is high about the labor shortage problem, but there is much less activity [than elsewhere] by employers actually working with public or private universities to respond to it."

public or private universities to respond to it. That's partly because you never had a tradition of it here, and partly because, until recently, there's generally been excess labor supply."

Academic and industry interviewees alike stressed that businesses and universities must think in symbiotic terms. When a relationship is established based on one need – workforce, for example – it can snowball into far more.

"In one state, the state university brought together about six of us major firms (in a certain sector)," recalled an executive. "They weren't coming at us to get money, they really wanted to know how to shape their curriculum so their students could work for us.

"We ended up with good face time with engineering deans and professors, some of whom we ended up hiring as consultants. We started to give internships to their students. We donated equipment, which they ended up helping test. We got a free test run in the real world, and the students got invaluable training. Now, partnering is ingrained in the culture."

{LEARNING FROM OTHER STATES}

Georgia: The Yamacraw Mission

This five-year, $100 million initiative combines research, education and economic development into a unified strategy to develop the key sector of microchip design and high bandwidth communications. Five higher education institutions participate in research efforts, and the state has launched the Georgia Tech Regional Engineering Program, which allows students at three smaller state schools to enroll at Georgia Tech without leaving their home campuses.

In addition to the usual tax and other incentives, semiconductor firms locating in Georgia will receive special access to the research facilities and personnel of participating colleges and universities. **Website: www.yamacraw.org**

A Call to Action for the State, Public Higher Education, and Business

Industry-university-government ties are no longer a luxury, but a prerequisite to technology-based industry competitiveness. Interviewees strongly urged greater efforts at coordination, collaboration and marketing. And they called for greater investments in targeted spending and other resources from all of the key players.

These investments of time, energy, and money are spelled out over the following pages. While some of the specifics points are new, the general call for better links between industry and higher education in Massachusetts is not. In the mid-1980s, the Massachusetts High Technology Council and the American Electronics Association issued a guide for firms seeking to establish or improve "productive partnerships" with institutions of higher education in the state.

Nor is Massachusetts alone in advocating for such links. A report issued earlier this year by the National Governors' Association, Using Research and Development to Grow State Economies, echoes many of the recommendations presented here. The most important High Technology Council and NGA proposals are provided below.

High Tech Council/AEA: A Mid-'80s Call to Action

The Council's report called for companies to make annual contributions to education support equivalent to at least two percent of their internal research and development expenses. Complete with cost estimates and performance measures, the report's "characteristics of an ideal package of industry support" for education included:

- Faculty support, such as endowed professorships and sponsored research support;
- Direct support to campus facilities, including direct donations of equipment;
- Student support structured to encourage students to pursue particular skills;
- Greater involvement in helping to improve K-12 education, such as "adopt-a-school" programs.

NGA: Building an Intellectual Infrastructure

The NGA report (www.nga.org/NewEconomy/Links.asp) divides its recommendations into five parts, each associated with one of the five elements it proposes as part of a technology-based economy:

- Intellectual infrastructure: Strengthening the R&D capacity of a state's higher education system and encouraging greater university-industry interaction;
- Spillovers of knowledge: Identifying and removing barriers to the commercialization of university-developed technology and funding industry associations that promote communication among high-tech firms;
- Physical infrastructure: Improving not just roads and telephone systems, but air travel efficiency, fiber optic networks, and high-speed Internet access;
- Technically skilled workforce: Encouraging more students to enter science and engineering fields and providing training for workers in technology-based companies;
- Capital: Using state funds to leverage private funds to invest in technology companies and offering R&D tax incentives.

An Agenda for State Government

The state should bring together high level representatives from government, industry, and public and private universities to devise an overall strategy, or at least a set of recommendations, that would allow the state to make better use of its university resources.

> **Needs assessment:** Through a series of high-level strategy sessions, this group should conduct an up-to-date needs assessment of the technology sector and the R&D and workforce opportunities presented by public and private initiatives. Interviewees emphasized that such efforts will succeed only if they attract high-level participants from both industry and universities, public and private.

> **Brokering long-term relationships:** The focus should be on the role of the state to broker long-term relationships between industry and the campuses, public and private, and to coordinate marketing and packaging of these resources to support business expansions.

> **Additional funds:** New, targeted spending – seed money for partnerships, matching funds for public and private universities to participate in federally-sponsored collaborative R&D initiatives, capital spending on needed infrastructure – will be needed.

> **Asking for guidance:** Legislative, executive and other public players should establish an ongoing technical advisory panel to draw upon technical and other academic expertise within the state for policy guidance – and to vet pending proposals.

> **Scaling up best practices:** The state and its partners should fund an ongoing evaluation of best practices – locally and elsewhere – to assess programs that may merit targeted new funding, such as matching scholarships or seed money for efforts between smaller firms and campuses, or expanded fundraising for successful but small-scale efforts.

> **Improving K-12 education:** High-tech-linked improvements in higher education are meaningless unless these skills are better developed within K-12 education. Special attention is needed by both state and industry sectors to interest young students – especially females and minorities, who remain badly underrepresented – in engineering and other technical careers..

> **Information technology:** Elements of the Board of Higher Education's recent recommendations on information technology – particularly those related to faculty recruitment and curriculum reform – should be aggressively supported by state government.

An Agenda for Public Higher Education

The state's public higher education system should be reexamined in terms of both structure and mission. If Massachusetts chooses to maintain its separate boards for the different higher education systems, greater coordination is needed between the university, state college and two-year operations.

As one interviewee put it, "It may be okay to maintain separate governing structures, but if the educational structures in Massachusetts could think more systemically, that would bring about the appearance of seamlessness."

UMass should be challenged – and given the authority and resources – to provide leadership for all tiers of public higher education when it comes to industry relations. Whatever the governing structure, the different systems must more effectively share information and resources, both between each other and with the private sector. Specific recommendations include:

> **One-stop shopping:** Industry needs a single, effective, easily identifiable contact as a starting point for public campus contacts for recruitment, research or other partnership interests (see the Maryland web portal at right).

> **Community colleges:** While campus independence matters, greater efforts are needed to make sure all two-year schools share similar mission statements and policies to enhance ties to industry. To better respond to industry needs, consideration should be given to converting more community colleges to technical community colleges similar to Springfield Technical Community College.

> **Best practices:** Again, industry-campus ties that have proved effective should be better shared and promoted.

> **Central research data base:** Ongoing research by faculty and other technology efforts should be catalogued into an "R&D Update" data base available to potential corporate clients.

> **Workforce efforts:** Education and training programs – degree, certificate or incumbent worker – should also be linked to an accessible data base so that employers seeking particular skills have access not only to local campuses, but to a statewide pool of skilled labor.

Higher Ed Resources for Business on the Web

An informal scan of higher education-related websites aimed at current and potential business partners turned up some models worth exploring. All appeared to offer, at minimum, a kind of online "brochure" providing general information; some provided much more in the way of project profiles, useful contacts and resources, and downloadable documents and tools.

A Model to Watch

> The University of Maryland's "One Stop Shop" for business assistance provides a wide range of resources in a clear, well-organized site. With a series of clicks, visitors to the site can apply directly for research funding, find zoning requirements at Maryland's major new-technology industrial parks, or use the Maryland Technology Extension Service to seek university-based technological assistance – among other tasks. www.onestopshop.umd.edu/

> The University of Texas at Austin provides a "research" site that guides visitors to all UT programs of interest to researchers and to industry. (left) www.utexas.edu/research/ and (right) www.utexas.edu/industry/

> Several UMass sites provide profiles of the university's economic development efforts and impact, and licensing and research collaboration opportunities. www.umass.edu/oed/; (left) www.massachusetts.edu/building/ (center) and www.umassp.edu/cvip/ (right)

> An example of a technology-oriented community college site, this one provided by Springfield Technical Community College. http://cbt.stcc.mass.edu/

An Agenda for Massachusetts Business

Business associations must refocus their priorities to include higher education-related issues and investments. They should become leading advocates on Beacon Hill for higher education in general and university-industry linkages in particular. They should also develop collaborative efforts to speak more effectively for the workforce needs of their members, helping to mobilize the market for higher ed programs, especially in emerging technology areas.

Specifically, the private sector should:

> **Advocate for and help produce the strategic needs assessment:** Establish a high-level coordinating council of associations to engage with the state and with high-level educators. The goal of the effort would be to determine priorities, establish what resources are needed to achieve them, and recommend practical next steps towards implementation.

> **Support targeted spending increases for higher education when needs assessments justify capital or other forms of state spending.** Business groups should lend their weight to such efforts on Beacon Hill, much as the Greater Boston Chamber of Commerce and MassINC did last year in supporting enactment of new state funds for community college/job training programs.

> **Take the lead in information sharing:** Organizations should more broadly share best practices and other information not only with individual firms and academic institutions, but with each other. The Massachusetts High Technology Council's decision to support the new Engineering in Mass. Collaborative is an encouraging development in this regard.

> **Support collaborative new efforts, particularly to serve smaller firms:** Business organizations should make special efforts to reach newer firms, especially smaller startups, that often are not part of any sector-based private networks. They should also link up with academic resources such as the Council of Engineering Deans.

State and Business-Backed Resources on the Web

Most, if not all, states now appear to offer some form of online information stream regarding high-tech business investment opportunities within their borders; the sites range in quality and in the degree to which they provide meaningful links to, or information about, partnerships with higher education institutions. For more information about state-sponsored initiatives, visit www.ssti.org, the State Science and Technology Institute's website, which offers information on a state-by-state basis. The Massachusetts Office of Business Development's current site can be viewed at www.state.ma.us/mobd/tech_res.html.

A Model to Watch

> New York State's Office of Science, Technology and Academic Research provides a resource site for its $131-million effort to coordinate science and technology R&D across the state. www.nystar.state.ny.us/home.htm

> MdBusiness, a service of the Maryland Department of Business & Economic Development (DBED), offers a menu of options to local, state, federal, and global information services for businesses in the state or those interested in doing business in the state of Maryland. www.mdbusiness.state.md.us/

> Pennsylvania touts its "friction-free government" initiative at its "Invent PA" website. www.inventpa.com

> Minnesota Technology, Inc., a nonprofit technology investment support organization, helps industry apply, develop and commercialize technology. www.minnesotatechnology.org

> The Massachusetts Technology Collaborative's New England Directory of Industry integrates the public and private university community in New England. www.mtpc.org/fedfund/partnering.htm

Best Practice Examples in Massachusetts

These are many examples of the kind of effective industry-university partnerships discussed in this report now in place in Massachusetts. Some are briefly profiled below. Their impact offers the promise of geometrically greater benefit to the people of Massachusetts if they can be scaled up and replicated on a systematic basis throughout the state.

Engineering in Mass. Collaborative

> Collaborative effort supported by more than 300 individuals representing business, industry, associations and public and private higher education institutions, including the University of Massachusetts, Tufts University, Worcester Polytechnic Institute and Northeastern University.

> Mission is to "increase the number of engineers, scientists, and technologists produced in Massachusetts by planting the seeds of the future workforce."

> Uses K-16 approach in attracting more students to study engineering in Massachusetts.

> Operated science and engineering summer camp that last summer attracted 60 students from sixth to ninth grade. Camp Telecomm, a similar summer program conducted by the MassTelecommunications Council, enrolled 24 students in Springfield and Boston.

> Teacher in Industry program pays teachers to work for six weeks in a sponsoring business to see application of math, science and engineering concepts in the workplace.

UMass/Fidelity Partnerships

> Goal is a mutually beneficial partnership to increase UMass officials' understanding of Fidelity as a technology-driven company and to help students develop skills needed to fill technology-related jobs at Fidelity and other firms.

> Now in its second year, initiative covers multiple relationships with four of the university's campuses, including Fidelity-financed scholarships to students studying computer science and engineering and Fidelity assistance to help UMass redefine its IT curriculum.

> Every year, UMass students shadow Fidelity staff for a week in different technology areas of the company. Senior Fidelity staff volunteer as relationship managers on each of the four campuses.

> Senior executives at Fidelity are working with the computer science department at Amherst and are exploring potential research affiliations.

Metal Processing Institute/Worcester

> Based at Worcester Polytechnic Institute, the Institute includes participation by more than 120 manufacturers – including many Massachusetts firms – making it among the biggest industry-university alliances in the nation.

> Advances state-of-the-art research and development in metal processing.

> Experiential educational programs offered to both graduate and undergraduate students.

The UMass/Lowell Scholars/Interns Program

> School-to-career scholarship program offered by UMass/Lowell and supported by various companies, including Norwood-based Analog Devices.

> Uses scholarships and paid internships to make a bachelor and associate degree program virtually free for students from eight area high schools.

> Companies like Analog, which support scholarships and paid internships, eventually hire interns as full-time employees.

Cisco Corporation/Community College "Regional Academy" Partnerships

> Three Massachusetts community colleges – Middlesex, North Shore and Wachusett – have been designated "regional academies" by Cisco Corp, as part of an effort to create a supply of employees with hard and soft skills in networking and other areas.

> Cisco develops and donates curriculum to the schools and trains faculty to offer a four-semester program (one hour per week) in area high schools.

> The regional academies/community colleges act as middle managers between Cisco and the high schools, responsible for administrative, mentoring and other relationship issues.

> Curriculum is on-line and available in multiple languages. In-class laboratory experiences overseen by high school and community college faculty develop critical hands-on skills to go with on-line learning

> The Middlesex Community College program is up and running, with five area high schools and about 70 students now enrolled. Another 54 people from dozens of separate companies are studying for Cisco-approved certification at the college.

Needed: Best Practice Models in Licensing and Intellectual Property

The issues of intellectual property and technology transfer – who owns and has the licensing rights to profit from breakthroughs developed in industry-academic consortia – are increasingly complex and high stakes, especially between major firms and major research universities. Developing best practice models among regional players is an important part of the university-business agenda.

As universities struggle with this issue, some corporations are beginning to look elsewhere to form partnerships. Two industry interviewees said that dealings with university technology transfer offices have become so contentious – "the lawyers have taken over," said one – that they are looking more at European research institutions.

"The reality is that most of these (university-generated) patents never turn into a profit," said one interviewee. "But a lot of these American universities assume every one is the next pot of gold." In fact, only a relative handful of entrepreneurial universities have created a major revenue stream from their intellectual property assets.

Universities recognize the need to develop a more consistent approach. "If you gathered a bunch of university presidents today, one of first things they'd talk about is intellectual property, the conflict between faculty and graduate students spending their time in a corporate setting instead of putting things into the marketplace free and unfettered," said a leading academic expert.

"Universities, public and private, are absolutely inconsistent on this. Unless policies get standardized, universities run the risk of becoming office space for faculty entrepreneurs. We need an updated rationale on what it means to be part of an intellectual facility, not just in terms of rights, but obligations."

An executive who sits on several academic boards agreed. "I've not yet found a university that has solved this problem," he said. "What happens is that companies that find the intellectual property created within an institution useful often don't know much about the field. The companies who do want to connect with the universities do know about the field – but they worry that the information flow will be from company to university, rather than the other way around.

"For the university, the mission and ultimate value will be to develop the reputation of building new technologies in extremely ethical and stewardship ways," he said. "You may lose some money short-term by losing licensing agreements, but if you do research well, you get the reputation [that attracts lasting corporate ties]."

Phil Primack

Since 1989, Mass Insight Corporation has organized leadership groups and facilitated public-private initiatives to improve state performance on issues that have a significant economic impact on Massachusetts.

Mass Insight provides public policy services to businesses, institutions, associations and government focused on strategic Massachusetts issues. We identify ways to improve government performance and work with groups of public and private sector leaders to put ideas into action. We provide organization and communications support to synthesize complex policy information into a range of accessible, plain-English issue reports; sponsor the longest-running public opinion surveys in the state; and have earned a unique reputation as a public-private facilitator.

Mass Insight organizes its own public-private leadership initiatives when four criteria are met:

> A major competitive priority exists;
> There is no current effort underway;
> Our initiative will have the support and participation of major business groups, public and private sector leaders;
> We can add value.

This Year 2000 *Massachusetts Business Expansion Report* is the fifth in a series of such annual reports.

Methodology for This Report

For this report, Mass Insight conducted more than 30 formal interviews with senior business executives, higher education officials, and state policymakers, primarily in Massachusetts and California. Interviewees were asked about a range of issues relating to the links between business development and higher education within the state and in other states. Our selection of executives and officials was designed to include a cross-section of companies and higher education institutions (public, private, four-year and two-year) and individuals who have had experience in Massachusetts and other states.

We also held separate discussions with a number of other experts on higher education's relationship with business and collected data from a broad range of federal and state sources, as well as from Massachusetts organizations such as the Massachusetts Technology Collaborative and the Association of Independent Colleges and Universities of Massachusetts.

We are deeply grateful to the executives and professionals who provided their perspectives over the course of our research, and to the co-sponsors of the report and the members of its advisory board. Their time and generosity made this report possible.

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