

Staying Power II

A Report Card on Manufacturing in Massachusetts 2012

Prepared by:

The Kitty and Michael Dukakis Center for Urban and Regional Policy at Northeastern University



Northeastern University
*Kitty and Michael Dukakis Center
for Urban and Regional Policy*

For:



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The research and writing for this report was supported by:

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It is the mission of GBMP, as a nonprofit organization, to sustain a strong and vibrant regional economy by improving the operational profitability and competitiveness of existing and emerging manufacturing organizations, large and small, through training in lean and continuous improvement principles. By promoting successful implementation, GBMP will help perpetuate a positive future for the region's industry. Our vision is to be a leading contributor in strengthening the manufacturing sector and increasing employment opportunities in the Northeast. GBMP's values include True North Orientation, Experience, Mutual Respect, Professionalism, Collaboration and Community Service.

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E X E C U T I V E S U M M A R Y

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The Greater Boston Manufacturing Partnership
RBS Citizens
The Boston Foundation

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Dear Friends,

In July of 2008, the Boston Foundation published a detailed and illuminating report on the state of manufacturing in Massachusetts—researched and written by Barry Bluestone and his team at Northeastern University’s Dukakis Center for Urban and Regional Policy. We named the report *Staying Power* because, while some analysts had predicted the decline of the manufacturing sector as a major economic player, the news was surprisingly good. In 2007, the sector had employed almost 300,000 people in thousands of companies across the Commonwealth.

Within several months of the release of that report, of course, Massachusetts—along with every other state in the country—was rocked to its core by the worst global recession in seven decades, leading to layoffs and tough times for workers on almost every rung of the economic ladder.

As this new report reveals, the manufacturing sector in Massachusetts did lose jobs during the recession, but far fewer than anticipated, with more than 250,000 surviving. These are jobs that pay well, with an average annual wage of \$75,000. In addition, the sheer number of manufacturing firms, which had declined every year since 2002, actually increased in 2011.

Within this positive forecast, however, there are some clouds—and one of them relates to an issue that is a major focus of our work at the Boston Foundation: educating and training our workforce. Despite the recession, more than 40 percent of the state’s manufacturing firms reported that they have difficulty finding skilled craftsmen to replace those retiring or leaving the industry. Nearly a quarter find it very difficult to recruit R&D personnel. One of the most disturbing concerns revealed here is that only one in eight of these firms consider the state’s community colleges to be a vital training ground for the workers they need.

An assessment of total job openings across all Massachusetts industries by skill level, from 2006 through 2016, shows that 38 percent of jobs require more than a high school diploma but less than a four-year degree. These “middle skill” jobs are a key component of the new economy and community colleges are crucial to preparing students for these jobs.

A 2011 Boston Foundation report, titled *The Case for Community Colleges: Aligning Higher Education and Workforce Needs in Massachusetts*, drew attention to the central role that community colleges can and should play in preparing our workforce, especially for the kinds of middle-skill jobs that manufacturing firms offer.

Because manufacturing firms have invested in new technology and have remained strong in a fiercely competitive global economy, this sector is even more robust than it was in 2008. For those of us dedicated to creating a strong education pipeline, the ultimate goal is to provide the residents of Massachusetts with rewarding careers and family-sustaining wages. If we do that successfully, this important sector will continue to have true staying power.



Paul S. Grogan
President and CEO
The Boston Foundation

Manufacturing in Massachusetts: Background

In July of 2008, when the Boston Foundation and the Dukakis Center for Urban and Regional Policy at Northeastern University released *Staying Power: The Future of Manufacturing in Massachusetts*, there was little attention being paid to this industrial sector in the Commonwealth, and treatment of the sector by the media and by government could best be described as “benign neglect.” Indeed, the report suggested that relative to biotech, financial services, health care and high tech, manufacturing was suffering from a “Rodney Dangerfield Syndrome.” It received little respect despite its once venerable position in the state and the fact that it still employed, back in 2007, nearly 300,000 workers.

The manufacturing workforce in the state had, in fact, been contracting by nearly 15,000 jobs per year from 2000 through 2006, just before we began our research. At that rate, the last manufacturing job would disappear from Massachusetts by 2025. If you were an investor, a worker, a student or a government agency, putting your eggs in a different basket seemed prudent.

What was surprising then was that our research uncovered a trove of evidence that suggested manufacturing’s long decline since World War II was slowing down remarkably and that the future of the sector in the Bay State was potentially quite encouraging. Many manufacturers had either left the state or ceased production altogether because they could not compete in national and international markets.

But what was left in the state—among its more than 8,000 manufacturing firms—were enterprises that for the most part had remained competitive by investing in advanced technologies that boosted productivity at prodigious rates and in the training of its labor force to take advantage of these new technologies. This was not only true of “new” manufacturing companies in state-of-the-art high technology industries but “old” manufacturing firms in traditional industries such as food processing, fabricated metal operations and plastics extrusion. These companies remained successful by producing existing products of exceptional quality, brand new products for expanding markets, and using new efficient processes to produce them.

Based on a huge amount of secondary data from government sources, a survey involving more than

700 manufacturing firms in the state, and personal interviews with CEOs or owner/managers of more than 100 of these companies, we concluded that over the next 10 years—through 2018—total employment in the sector would continue to decline, but at an annual rate only one-fifth as great as was true in the previous six years. Moreover, because of the rapid aging of the manufacturing workforce and because of normal turnover in this sector, we projected that as many as 100,000 job openings would occur in the state’s manufacturing sector over the coming decade. The problem would not be so much finding jobs for those displaced from the sector, but finding workers to hire for the vacancies company managers were trying to fill.

As it turned out, the timing of our report could not have been worse. We completed most of our secondary research and all of the surveys and interviews by November 2007. Less than one month later, America’s “Great Recession” would begin. More than eight million Americans would lose their jobs. National unemployment would reach 10 percent. Major industrial players would come close to bankruptcy, including, in the auto industry, General Motors and Chrysler.

The result was that many Massachusetts manufacturing companies went out of business and total employment in the sector declined precipitously from 299,000 in 2007 to 252,000 by the middle of 2009. Had our 2008 report been excessively sanguine given the depth and duration of the unfolding economic slowdown?

With support from the Massachusetts Technology Collaborative, the Greater Boston Manufacturing Partnership (GBMP) and RBS Citizens, we had the opportunity to undertake a second major investigation of Massachusetts manufacturing. This was carried out during the first half of 2012 and involved, once again, a major review of government data on the sector, a second survey of nearly 700 manufacturers and another series of interviews with nearly 60 CEOs and managers of manufacturing enterprises in the Commonwealth.

The results, as you will see in this report, published by the Boston Foundation, are startling. Manufacturing in Massachusetts has survived the Great Recession and, if anything, appears to be in a better position today than in 2007 to prosper in the future.

Employment and Output in Manufacturing since 2007

The decline in manufacturing employment in Massachusetts between April 2008 and October 2009—a period that coincided with the trough of the recession—was every bit as steep as the job loss suffered over the previous six years. If this rate of decline had continued, the last manufacturing job in the state would disappear sometime in 2019, just seven years from now. Yet, as **Figure 1** demonstrates, manufacturing employment ended its contraction at the end of 2009 and for all intents and purposes has stabilized over the past two and a half years. This is despite the fact that the national economy and the European economy have slowed to a crawl.

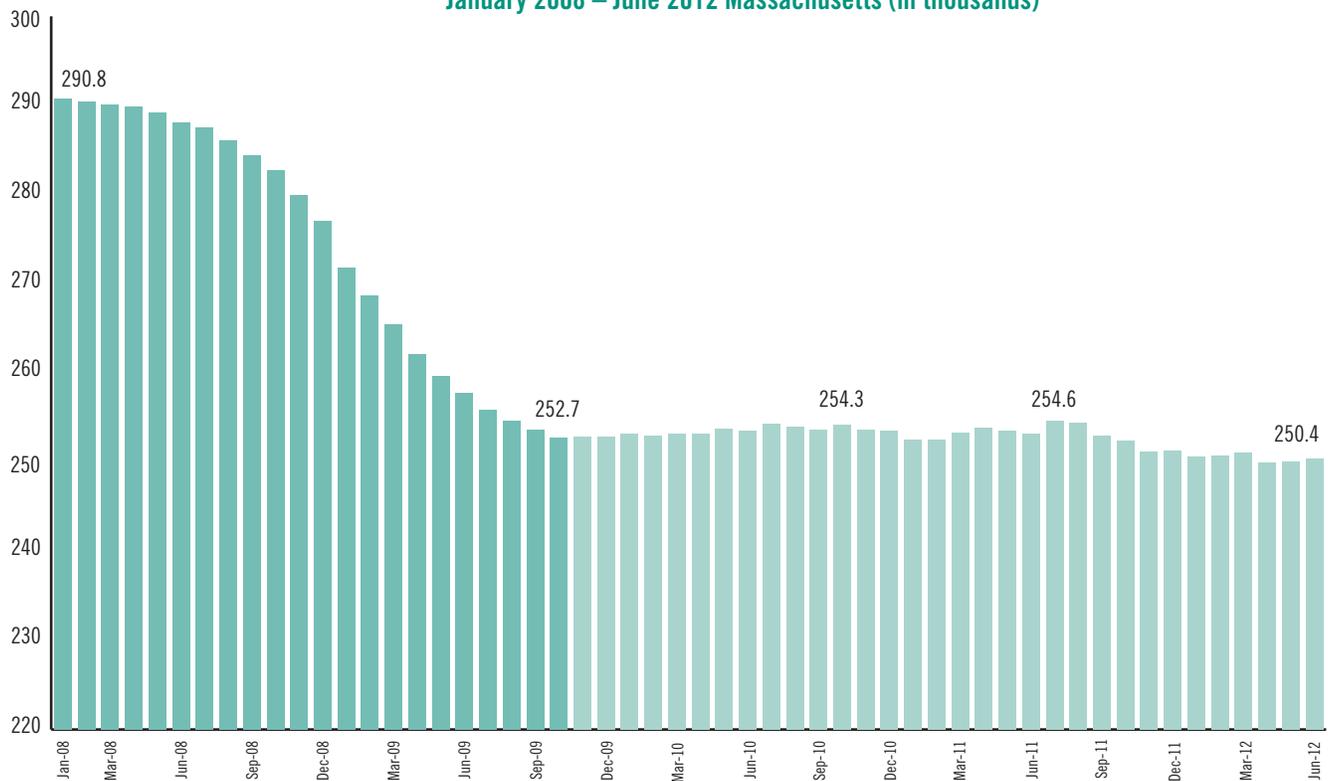
What is more, as **Figure 2** reveals, the number of manufacturing firms in the Commonwealth actually increased in 2011, after declining every year since at

least 2002. Indeed, the last time that the number of these firms increased in Massachusetts was probably in the 1970s.

Additional evidence of the resiliency of the state’s manufacturing sector is that after 2009, manufacturing’s share of total private industry output in the state began to increase after falling almost steadily since at least 1997. As **Figure 3** shows, by 2011, manufacturing’s share of output was back up to 12.2 percent, having fallen to 10.8 percent during the depth of the recession.

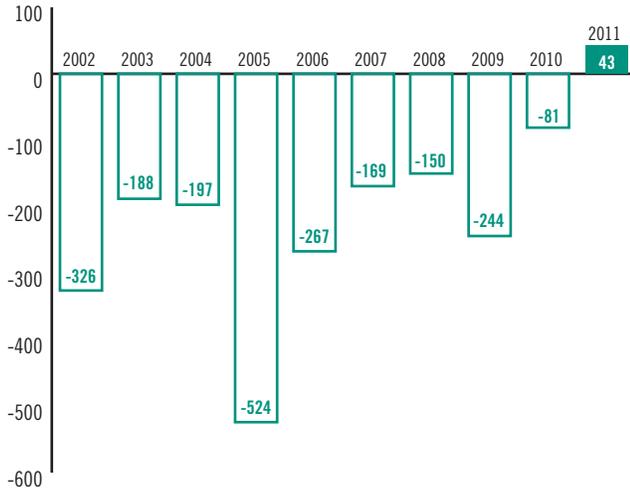
This growth in output reflects, at least in part, a continued high level of productivity improvements in the sector that we first detected in our 2007 research. Productivity advanced at an 8.7 percent annual

FIGURE 1
Manufacturing Employment in Massachusetts (Seasonally Adjusted)
January 2008 – June 2012 Massachusetts (in thousands)



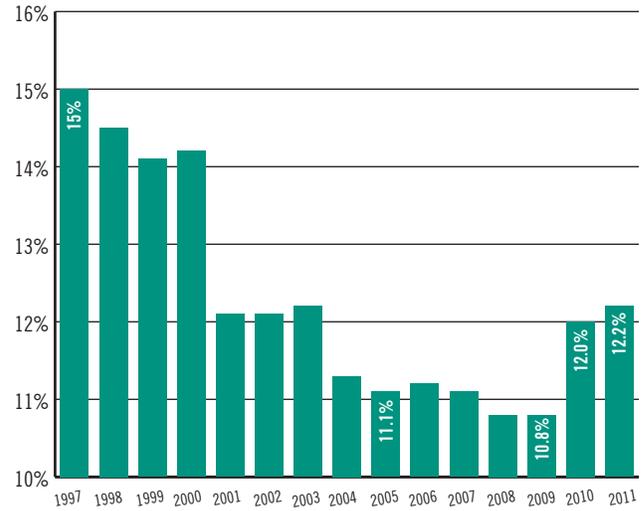
Source: U.S. Bureau of Labor Statistics

FIGURE 2
Change in the Number of Massachusetts Manufacturing Establishments 2002-2011



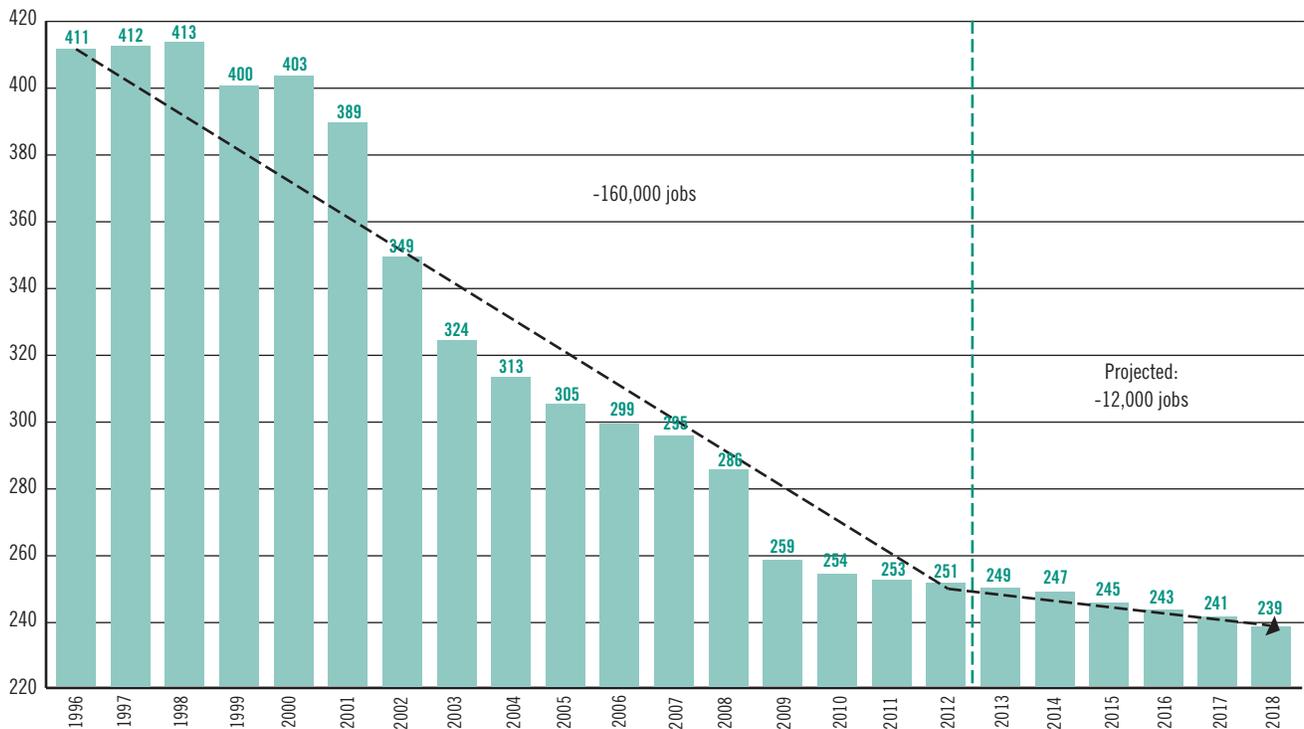
Source: Massachusetts Department of Labor and Workforce Development, ES-202 Employment and Wage Statistics

FIGURE 3
Massachusetts Manufacturing Share of Private Industry Output 1997 – 2011



Source: U.S. Bureau of Economic Analysis

FIGURE 4
Massachusetts Manufacturing Employment 1996 – 2012 plus Projection to 2018 (in thousands)



Source: Dukakis Center Analysis

growth rate in the Massachusetts manufacturing sector between 2007 and 2011. This was more than five times the 1.7 percent annual productivity growth rate for the state’s private sector as a whole. This extraordinary performance has kept many of the state’s manufactured goods at competitive prices so that demand for these goods has remained reasonably strong. Despite these Herculean increases in output per worker over the past two and a half years, demand for Massachusetts manufactured products has grown fast enough to keep more than 250,000 manufacturing workers on the job.

Based on this recent experience and on the results we will preview below, we developed a new forecast for employment in this sector through 2018. Our projection suggests that employment will continue to shrink because of productivity increases, but over the next six years, we project employment will decline by no more than 2,000 jobs a year (see **Figure 4**). As such, we should still have close to 239,000 manufacturing jobs in the state in 2018. If the national and international economy proves stronger and/or Massachusetts manufacturers become even more adept at competing nationally and internationally, total employment may even be higher by the end of this decade than we have projected.

The Changing Technological Intensity of the Massachusetts Manufacturing Sector

In our 2007 report, we analyzed the “technological intensity” of Massachusetts manufacturing firms. Our basis for this analysis was a taxonomy provided by the Organization for Economic Cooperation and Development (OECD).

The OECD uses the concept of “technology intensity” to classify industrial sectors as:

- Low-technology
- Medium-low-technology
- Medium-high-technology
- High-technology

The level of technology specific to an industrial sector is measured by the ratio of research and development (R&D) expenditure to value-added in an industry and the technology embodied in purchases of intermediate and capital goods.

Examples of low-technology industries are textiles and clothing, paper printing and food, beverages and tobacco. Medium-low technology firms are found in such industries as rubber and plastic products and fabricated metal products. Medium-high technology industries include scientific instruments, electrical machinery and chemicals. The high technology sectors include aerospace, computers and pharmaceuticals.

Based on the array of manufacturing firms in Massachusetts, we have tracked the technological intensity of the entire manufacturing sector in the state since 1970. As **Table 1** indicates, in 1970, nearly 40 percent of the Massachusetts manufacturing workforce was found in “low-tech” industries with less than 20 percent in the “high-tech” sector. By 2006, just before we began studying the sector for our original *Staying Power* report, the low-tech sector had shrunk to 31 percent and the high-tech sector had expanded to equal the low-tech sector at 31 percent of the total workforce. Medium-low-tech and medium-high-tech held their own over this 36-year period. But just between 2006 and 2010, the low-tech sector shrunk another six

TABLE 1
Shares of Massachusetts Manufacturing Employment by Technological Intensity (1970 – 2010)

	1970	1980	1990	2000	2006	2010
Low-Tech	39.8%	29.7%	28.4%	29.4%	30.6%	24.5%
Medium-Low-Tech	21.5%	21.1%	20.1%	22.9%	20.4%	23.8%
Medium-High-Tech	18.9%	24.1%	24.8%	21.9%	18.3%	20.5%
High Tech	19.8%	25.0%	26.7%	25.7%	30.6%	31.2%

Source: Author’s calculations based on U.S. Bureau of Labor Statistics data, using OECD categories reported in Hatzchronoglu (1997)

percentage points so that less than a quarter of the state's manufacturing workforce is now employed in low-tech industries. The high-tech sector has increased by just 0.6 percent. The two medium-tech sectors have grown the most since 2006, increasing their combined share of employment by 5.6 percentage points.

This important finding suggests that the strength of the Massachusetts manufacturing sector is not only found in the most R&D intensive sectors, but throughout a broad range of industries. The firms in these industries maintain their competitiveness by using advanced technologies and well-trained workers, but still turn out products that historically have been the mainstay of manufacturing, from metal products, plastic extrusion and printing to food and beverage products. Some firms in Massachusetts continue to successfully produce textiles and apparel.

Size and Ownership of Massachusetts Manufacturing Firms

Currently, there are more than 7,500 manufacturing firms operating in Massachusetts. The typical enterprise is small. More than 70 percent of all firms in the state have fewer than 20 employees each and, combined, they only account for 13 percent of the sector's workforce (see **Table 2**). The largest firms in the state, with 100 or more employees in their workforce, account for just 7 percent of all firms, but six out of 10 manufacturing workers (61%) work for these firms. Still that leaves nearly 100,000 working in manufacturing enterprises with fewer than 100 employees.

TABLE 2

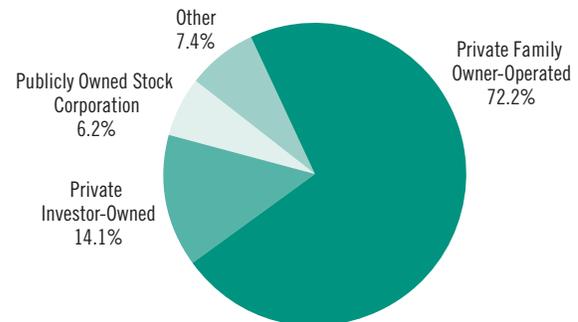
Manufacturing Firms by Size of Employment, 2012

Size of Firm (Employees)	Share of Manufacturing Firms	Share of Total Manufacturing Workforce
1-4	36.1%	2.7%
5-19	35.7%	10.3%
20-99	21.4%	25.6%
100-499	6.1%	34.3%
500+	0.9%	27.1%

Source: Info USA Database 2011; Dukakis Center Manufacturing Survey 2012

Consistent with the large number of small manufacturing firms in the state, more than 70 percent are private or family-owned (see **Figure 5**). About one in seven (14.1%) are private investor-owned, with public stock corporations comprising just 6 percent. The remaining 7 percent are owned cooperatively or are employee-owned.

FIGURE 5
Ownership Structure of Massachusetts Manufacturers 2012



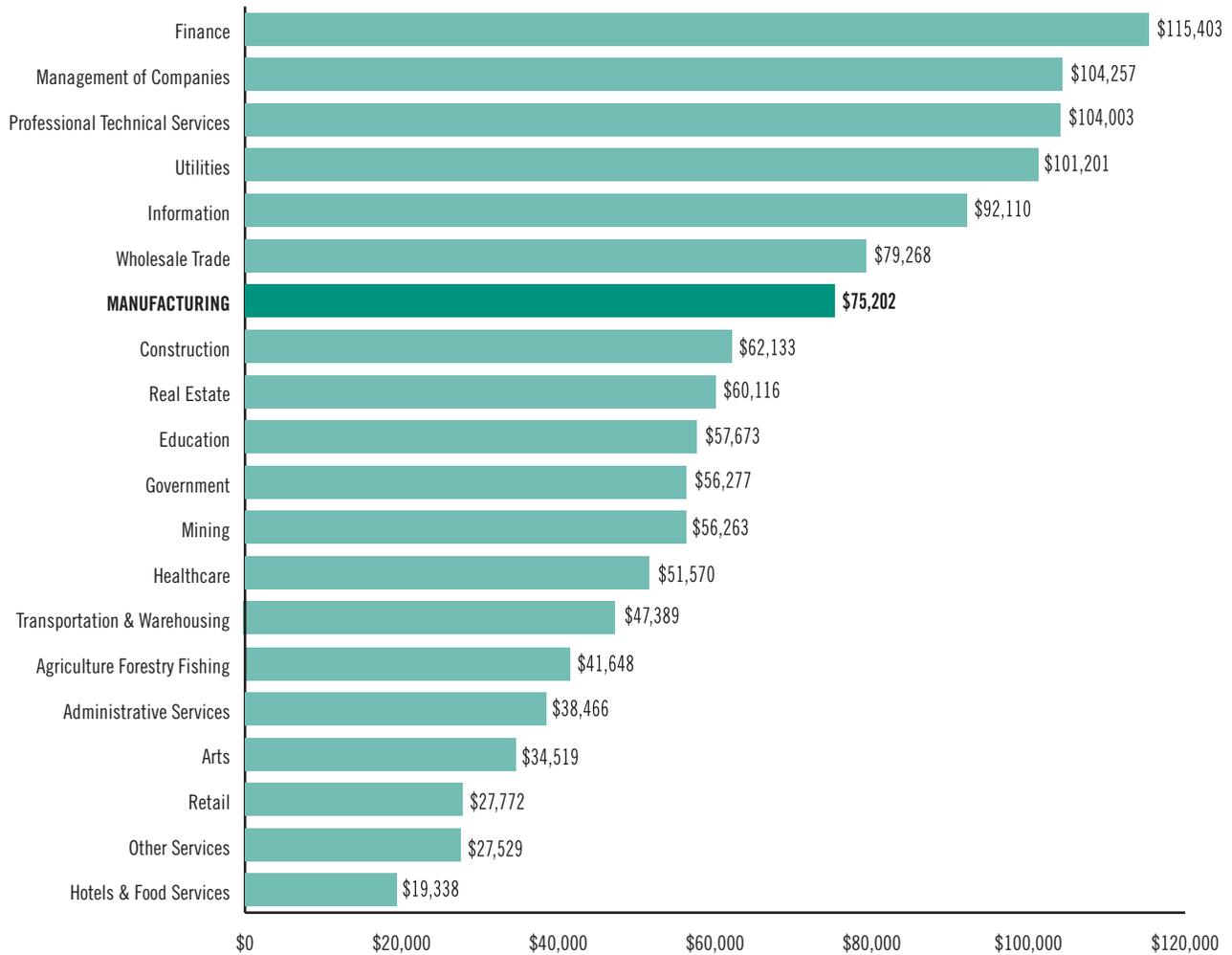
Source: Dukakis Center Manufacturing Survey, 2012

The size and ownership pattern reflects a high degree of entrepreneurship in the state, but it means that many firms have small management teams that must cope not only with all of the exigencies of dealing with the marketplace, but compliance with state and local regulations. For smaller firms, this can be a substantial burden.

Despite the relatively small size of many firms, manufacturing continues to be a high wage sector in Massachusetts. As **Figure 6** reveals, the average annual wage in this sector in 2010 was in excess of \$75,000. This is a higher wage than in such sectors as construction, real estate, education, healthcare and government.

Given that the amount of formal education needed to work in this sector is relatively low, it provides many "middle-skilled jobs" for workers who have not completed college and, in many cases, never attended college at all (see **Table 3**). More than seven out of 10 (71%) jobs in the sector, according to our survey respondents, require no more than a high school degree. Only one in five (21%) requires a bachelor's degree or more. Larger firms tend to provide more job opportunities for those with a college degree, but otherwise there are no major differences in educational requirements by firm size.

FIGURE 6
Average Annual Salaries for Massachusetts Industry Sectors, 2010



Source: US Bureau of Labor Statistics, *Quarterly Census of Employment and Wages, Employment and Wages, Annual Wages, 2010*, Table 8 & 10

TABLE 3
Percentage of Massachusetts Manufacturing Jobs by Level of Education Required

	Employees in Firm			
	All Firms	1-19	20-100	101+
Less than a high school degree	17.9%	17.7%	17.9%	16.8%
High school diploma/GED	52.9%	54.5%	53.6%	45.5%
Some college	14.7%	15.5%	14.2%	12.3%
Bachelor's degree or more	20.8%	18.3%	22.5%	30.0%

Source: Dukakis Center Manufacturing Survey 2012

Why Manufacturing Firms Stay in Massachusetts and Why They Might Leave

In an age of hypermobility and global competition, firms can and often do relocate or expand their operations in places other than where they were first established. They do this to reduce their costs, to be closer to new markets for their products, to take advantage of a particularly well-trained labor force, to join in a cluster of similar firms in order to share knowledge and technical support—or for a myriad of other reasons.

We asked our survey respondents to tell us about the most important reasons for their decision to stay put in the Commonwealth. The reasons varied, but a number of them garnered more response than all the others. The top 10 reasons for keeping their operations in Massachusetts are found in **Table 4**. The #1 response

in our 2012 survey, as it was in 2007, is the work ethic of their current workforce. More than half (55 percent) of all firms said that the work ethic of their employees was a very important or even extremely important reason to keep their manufacturing facility in Massachusetts.

The #2 response was inertia. Firms with deep roots in the state find it prohibitively difficult to pick up stakes and move to another location elsewhere in the country. They fear it would be difficult to replace their current workforce. They worry that they would lose their current customer base and disrupt their supply chain.

The #3 and #4 reasons have to do with the availability of appropriately skilled labor, both current and in the

TABLE 4

Top 10 Reasons Why Manufacturers Stay in Massachusetts

	Percent of Firms Who Report Very Important or Extremely Important Reason
Work ethic of workforce	55.0%
Inertia (too hard to relocate)	44.0%
Future availability of appropriately skilled labor	43.2%
Current availability of appropriately skilled labor	42.4%
Current proximity to customers	42.0%
Future proximity to customers	37.4%
Quality of life (e.g. public schools, recreation, and cultural institutions)	33.3%
Access to transportation for shipping/commuting	31.7%
Monetary or in-kind incentives from state or local governments	30.9%
Opportunity for physical expansion	28.1%

Source: Dukakis Center Manufacturing Survey, 2012

TABLE 5

Top 10 Reasons Why Manufacturers Might Leave Massachusetts

	Percent of Firms Who Report Very Important or Extremely Important Reason
Health care costs	84.2%
Cost of worker's compensation	75.5%
Taxes and fees	74.6%
Cost of unemployment insurance	73.1%
Environmental regulations	68.9%
Energy costs	68.8%
Labor costs	68.1%
Trade Unions	67.7%
Time to obtain permits and licenses	60.9%
Future availability of appropriately skilled labor	57.8%

Source: Dukakis Center Manufacturing Survey, 2012

future. Along with the highly regarded work ethic of their employees, most firms are pleased with the skill sets their employees bring to the job and expect future employees to possess equally valuable expertise.

Rounding out the top 10 reasons are current and future expected proximity to their customers, the quality of life in the Commonwealth, access to good transportation for shipping and commuting, the set of monetary and in-kind incentives available from state and local government and, finally, the opportunity for physical expansion if they need additional manufacturing space.

The reasons that companies might think about leaving the Commonwealth are quite different, as **Table 5** suggests. Nearly 85 percent of all the firms in our survey responded that the high cost of health insurance coverage for their employees was a “very important” or “extremely important” reason they might contemplate leaving the state. Other costs are also discouraging, according to the survey. These include the cost of workers’ compensation, taxes and fees and the cost of unemployment insurance.

Just behind these in terms of reasons to consider departing Massachusetts are the state’s environmental regulations, high energy costs, high labor costs, potential conflict with trade unions, the time it takes to obtain permits and licenses from state or local authorities and, finally, a concern that in the future they might not be able to obtain a sufficient supply of appropriately skilled labor.

The Recruitment Challenge

In 2007, before the recession took its toll on the labor force, manufacturing firms expressed a deep concern about whether they would be able to replace current employees with new recruits who were well-trained in the skills they require. Back then, two-thirds (67%) of all firms were finding it “difficult” or “extremely difficult” to recruit skilled craftsmen. More than half (53%) complained of difficulty in finding appropriately trained R&D personnel. More than a quarter (27%) of firms even had difficulty recruiting entry level employees.

Today, after a number of years of layoffs, the immediate concern about recruitment is somewhat muted, but even now it remains pervasive, as **Table 6** demon-

TABLE 6
Proportion of Massachusetts Manufacturers Reporting Difficulty in Worker Recruitment

Skilled craftsmen	43.1%
R & D staff	24.1%
Executive management	15.6%
Middle management	11.0%
Entry level employees	8.0%
Clerical support staff	6.4%

Source: Source: Dukakis Center Manufacturing Survey, 2012

TABLE 7
Proportion of the Massachusetts Manufacturing Workforce Age 45+

	2000	2006	2010
Manufacturing Industries	40.5%	49.6%	53.9%
All Other Industries	36.1%	41.4%	44.6%

Source: American Community Survey (ACS)

strates. In 2012, 43 percent of firms expressed substantial difficulty in recruiting skilled craftsmen and nearly a quarter worry about their ability to hire R&D manufacturing specialists. Only the earlier concern about hiring entry level workers has sharply diminished. Today, only 8 percent of all firms reported that they have trouble hiring these new recruits. But as the economy recovers, this percentage is almost surely going to increase.

The problem is that recruiting a replacement workforce will become more difficult fairly soon as many in the current workforce age and consider retiring. **Table 7** provides stunning data on how quickly the manufacturing workforce is aging compared to the workforce in all other Massachusetts industries. In 2000, less than 41 percent of the manufacturing workforce was age 45 or older. This was only about four percentage points higher than all other industries. By 2006, virtually half (50%) of manufacturing employees were at least 45 years old. Just four years later, in 2010, the proportion was approaching 54 percent and was now more than nine percentage points higher than the aging workforce in all other industries.

TABLE 8
Proportion of Massachusetts Manufacturers Ranking Institution as Very Important or Extremely Important for Training Future Workers

Vocational/Technical High Schools	38.1%
Comprehensive High Schools	21.7%
Four Year Colleges/Universities	17.5%
Community Colleges	13.4%
Private Training Companies	5.7%
The Military	5.6%
Workforce Investment Board	3.1%

Source: Dukakis Center Manufacturing Survey, 2012

What this means is that a large share of the current manufacturing workforce will be disappearing in the near future. Because of retirements and normal turnover, we estimate once again that as many as 95,000 to 100,000 job vacancies could appear over the next 10 years in the state's manufacturing sector. Filling these jobs may not be easy.

Given this recruitment challenge, which institutions do firms turn to for training their workers? **Table 8** provides an answer to this question. Nearly four out of 10 (38%) of the firms we surveyed told us that they viewed the state's vocational and technical schools as being very important or extremely important to training future workers for their industry. No other institution came close to this ranking. About one in five (22%) firms reported the same regarding traditional comprehensive high schools. Nearly one in four (18%) responded that the Commonwealth's four-year colleges and universities were important sources of trained labor for their industry. We presume that many of these firms rely on these institutions of higher education to provide training for their R&D personnel.

Perhaps surprising, and of some concern, is the finding that only about one in eight firms considered the state's community colleges to be vital as a training ground for their industry. Moreover, while much has been made of the state's Workforce Investment Boards (WIBs), almost no one in the firms we surveyed (3%) considers them to be very important when it comes to training workers to fill future vacancies in their sector. Finding ways to make the state's community colleges

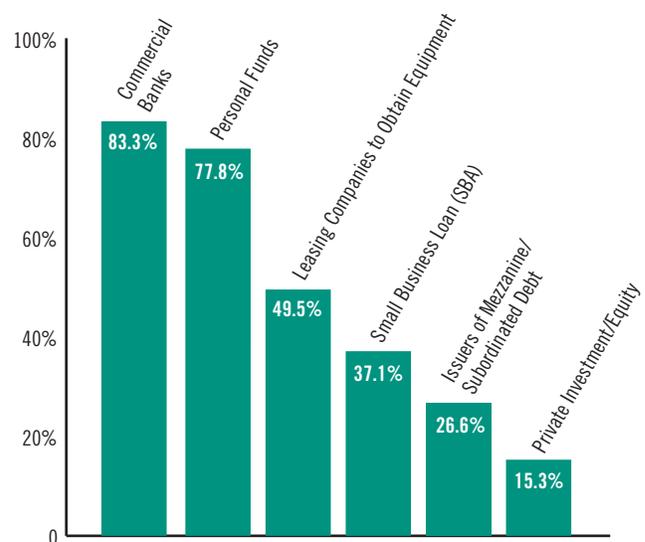
and its WIBs more effective may better serve manufacturing's needs in the future.

The Capital Challenge

We expected that accessing capital for their day-to-day operations and for expansion would pose another problem for Massachusetts manufacturers. What we found, however, is that for most firms, capital availability has not been, so far, a major hurdle to their success.

Across all firms, five out of six (83%) have used commercial banks to provide at least a portion of the funds they have acquired for their operations (see **Figure 7**). Given the small size of the vast majority of manufacturing establishments in the state, more than three out of four (78%) have used personal funds to underwrite operating expenses and capital investments. And half (50%) have used leasing agents to equip their companies with the machinery they need to operate. Nearly four out of 10 (37%) firms have turned to Small Business Administration (SBA) loans while smaller numbers, mostly the larger companies, have used private equity capital and mezzanine and subordinated debt.

FIGURE 7
Sources of Capital Used by Massachusetts Manufacturers



Source: Dukakis Center Manufacturing Survey, 2012

When we asked what were *the most important sources* of capital used by firms in the state, 60 percent responded that commercial banks were very important or extremely important for the loans they needed (see **Table 9**). Nearly half (47%) of all firms and more than half (55%) of those with less than 20 employees reported that personal funds—personal savings and credit cards—were relied upon as a critical source for capitalizing their companies.

Medium-sized firms with 20 to 100 employees were most likely to rely on commercial banks as the chief source of funds for their operations, while more than 25 percent of the largest firms with more than 100 employees reported they found private equity funds and issuers of mezzanine or subordinated debt as important underwriters of their activities. One in eight firms (12%) have found their SBA loans to be absolutely critical to their success.

There are some concerns, however, expressed by manufacturers about their ability to finance their *future* growth. While a third (33%) of all firms were not concerned at all and another 30 percent expressed only mild apprehension about their future financing, a little more than one in five (22%) of all firms told us they were very concerned or extremely concerned that financing would be a major barrier to their firm’s survival or growth. This was true of over 30 percent of small firms, 14 percent of medium-sized firms, but less than 6 percent of the largest ones. Again, given the large proportion of small and medium-sized manufacturers in the state, this represents a challenge that very likely needs attention.

Use of State Incentive and Grant Programs

While commercial banks, private funds, and in some cases private equity may play the most important role in helping manufacturers succeed in Massachusetts, a significant number of firms rely on various forms of assistance from the state. These range from workforce training grants and investment tax credits to low-interest loans and loan guarantees. **Figure 8** provides information on the percentage of all manufacturers in the state that used incentive and grant programs offered by the Commonwealth. In this case, we have compared their use over time relying on both our 2007 and 2012 survey results.

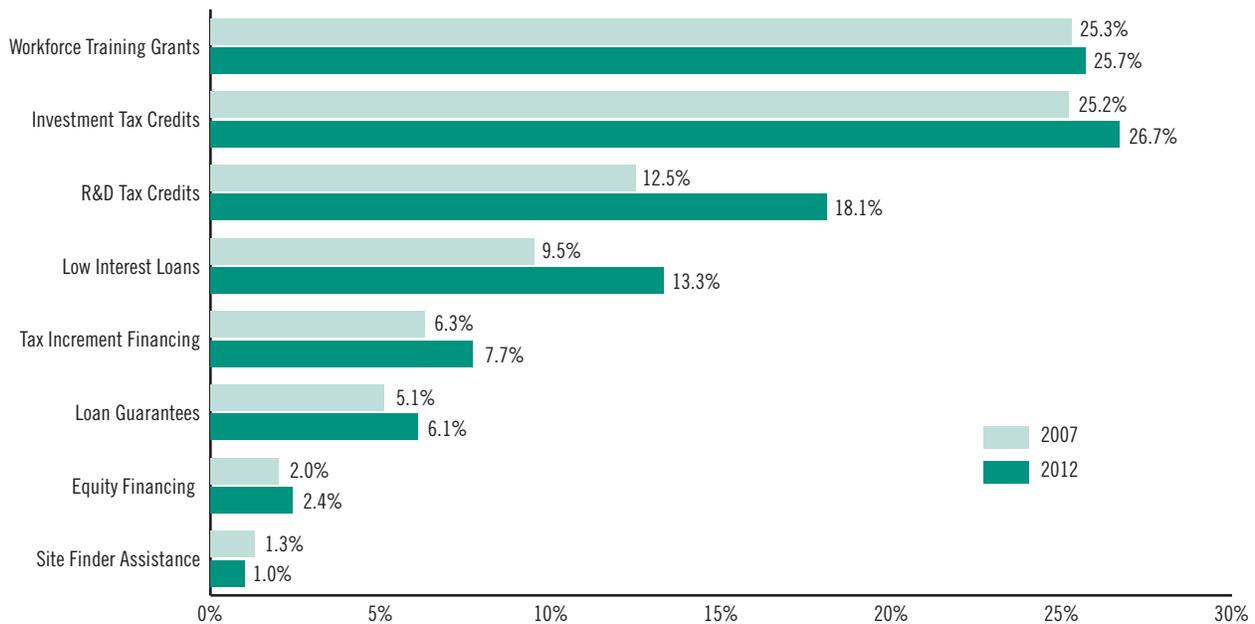
More than one in four (27%) manufacturers have taken advantage of state-supplied workforce training grants, a proportion that has not changed appreciably since 2007. About the same number have used investment tax credits, similar to the proportion five years ago. What has increased is the utilization of R&D tax credits. Back in 2007, one in eight (12.5%) firms reported using such credits to reduce their state tax burden. Today, close to one in five (18%) are using them, suggesting that this credit is helping to underwrite investments in new technology that can help these companies remain competitive. A larger proportion of manufacturers are also turning to low-interest loans offered by a number of the state’s quasi-public agencies. More than 13 percent of firms reported in 2012 that they had used these loans to help fund operations. A small number of firms have benefited from tax increment financing, state loan guarantees and even some equity financing.

TABLE 9
Proportion of Firms Reporting their Most Important Sources of Capital Finance by Firm Size

	By Employment Size			
	All Firms	1-19	20-100	101+
Commercial Banks	59.7%	50.7%	73.1%	63.3%
Personal Funds	46.6%	55.2%	42.0%	15.9%
Leasing Companies to obtain equipment	17.7%	19.2%	18.6%	10.5%
Small Business Loan (SBA)	12.3%	14.7%	13.0%	0.0%
Private Investment/Equity	10.1%	7.7%	9.6%	18.2%
Issuers of Mezzanine/Subordinated Debt	3.6%	2.7%	3.0%	7.5%

Source: Dukakis Center Manufacturing Survey, 2012

FIGURE 8
Use of State Incentive and Grant Programs



Source: Dukakis Center Manufacturing Surveys, 2007 and 2012

Initiatives to Grow Companies and Meet the Competition

Given growing national and global competition, Massachusetts manufacturers have not been sitting on their hands. As **Table 10** demonstrates, more than five out of six (83%) firms have invested in new manufacturing equipment and/or manufacturing process software over the past five years. Half have invested in the education and training of their current employees, and half have expanded their workforces to accommodate increased production. Nearly the same number have increased their attention to sales and marketing and invested in more product research and development.

Firms have also implemented performance improvement programs to increase the effectiveness and efficiency of their workforce (42%), hired consultants to help grow their businesses (25%) and nearly one in eleven (9%) report they have opened a sales office abroad.

In addition, we found that one in 10 (11%) firms are considering acquiring additional Massachusetts-based companies in order to expand their businesses while an even larger number (17%) will consider acquiring companies that are currently located outside of Massachusetts.

TABLE 10
Top 5 Initiatives Taken by Massachusetts Manufacturers to Grow their Operations

Top 5 Initiatives	Percent of Firms
Invested in new manufacturing equipment and/or manufacturing process software	82.6%
Invested in education and training for manufacturing workforce	49.5%
Expanded total manufacturing workforce	47.2%
Expanded manufacturing sales and marketing workforce	47.2%
Invested more in product research and development than in the previous five years	45.1%

Source: Dukakis Manufacturing Survey, 2012

Manufacturers are taking these actions because they fully recognize that over the next five years, they will be facing greater competition. As **Table 11** reveals, despite the specialized products that many of the state’s firms produce and the customer loyalty they have acquired based on price, service delivery and quality, a large proportion know they will face new competition especially from national and global enterprises. One fifth (21%) of all firms believe that it is very likely or extremely likely that they will have to contend with more U.S. competitors in the near future. Almost twice as many (37%) feel similarly about international competition.

TABLE 11
Proportion of Massachusetts Manufacturers Reporting Very Likely or Extremely Likely Probability of Facing Greater Competition over next 5 Years by Firm Size

	By Employment Size			
	All Firms	1-19	20-100	101+
More MA Competitors	9.2%	10.6%	5.7%	8.9%
More US Competitors	20.7%	19.8%	19.5%	24.4%
More Global Competitors	37.2%	29.3%	39.5%	61.1%

Source: Dukakis Manufacturing Survey, 2012

Small firms are slightly more concerned about local competition while the largest firms believe the future of competition will be with companies operating throughout the world. More than 60 percent of the largest firms we surveyed suggested it was very likely or even extremely likely they would be operating in an environment of increased global competition.

Because of this, Massachusetts manufacturers are engaging in all kinds of innovation activities. These range from securing new patents, investing in new manufacturing equipment and R&D activities to expanding their sales forces, investing in the education and training of their workers and implementing performance improvement programs. Based on these initiatives, we developed an “Innovation Index” with scores that range from zero to 75. Firms were then assigned an innovation category running from “very low” to “very high” based on their score. According to this index, a third (34%) of our surveyed firms scored

high or very high, a little more than a quarter were “average” and 40 percent were in the low or very low category.

Not unexpectedly, smaller firms with fewer resources were much less likely to score high on this Innovation Index. As **Table 12** reveals, more than half (56%) of firms with less than 20 employees were rated as low or very low innovators. In contrast, only 7 percent of the largest firms and 23 percent of medium-sized firms fell into these two innovation categories. Close to three out of four (73%) large firms ended up being judged, according to this criterion, as high or very high level innovators, along with 44 percent of medium-sized firms.

This should bode well for the future of many of the state’s manufacturers, although it would be helpful to find ways of providing assistance to the state’s smaller manufacturers so they too could more frequently implement innovation strategies that could help them remain competitive and grow their businesses.

TABLE 12
Level of Innovation by Firm Size

	By Employment Size			
	All Firms	1-19	20-100	101+
Very Low	22.2%	34.9%	8.8%	2.9%
Low	17.5%	21.1%	14.6%	4.3%
Average	26.8%	25.5%	32.2%	20.0%
High	20.9%	12.8%	29.3%	32.9%
Very High	12.6%	5.7%	15.1%	40.0%

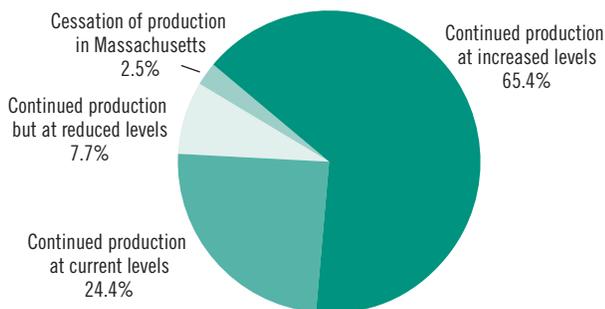
Source: Dukakis Manufacturing Survey, 2012

The Future of Massachusetts Manufacturing in a Post-Recession World

What does all of this mean for the future of the state's manufacturing sector? We asked firms about their expected production levels over the next five years. The results were extraordinarily encouraging. As **Figure 9** discloses, nearly two-thirds (65%) of all the firms we surveyed in 2012 expect to increase their production over the next five years, while another quarter (24%) have lower expectations but still believe they will be able to continue production at current levels. This comes despite their concerns about growing national and international competition, and bests their expectations of five years ago. In our 2007 survey, only 55 percent expected to increase production. Today, only 8 percent expect to be operating at reduced output levels and fewer than 3 percent of the firms we surveyed expected they would cease production in Massachusetts, either going out of business altogether or moving all of their operations to an out-of-state location. This compares with 11 percent and 5 percent, respectively, in our 2007 study.

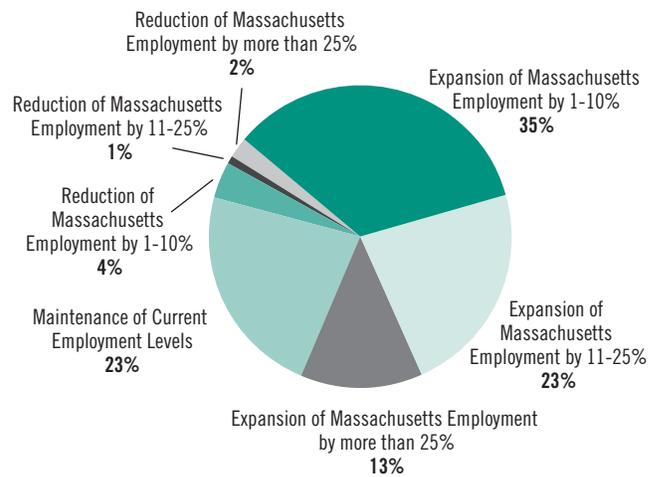
Increased production is going to require a larger workforce, according to these firms, despite increased productivity that reduces the need for added workers *unless* there is a more than an offsetting increase in demand for their products. **Figure 10** suggests that a large proportion of firms are apparently counting

FIGURE 9
Expected Production Levels of Massachusetts Manufacturers (2012 – 2017)



Source: Dukakis Center Manufacturing Survey, 2012

FIGURE 10
Expected Employment Levels of Massachusetts Manufacturers (2012 – 2017)



Source: Dukakis Center Manufacturing Survey, 2012

increased demand. A full 70 percent of firms expect to increase the size of their workforce by 2017, with 13 percent suggesting they could expand the number of employees by twenty-five percent or more and another one in four (22%) firms suggesting increases of 11 to 24 percent. Only 5 percent of all surveyed firms expect to be employing fewer employees five years from now. Back in 2007, only 60 percent of firms expected to hire more workers while 12 percent expected to cut the size of their workforce.

Given these survey results, the projection for employment we presented earlier in this summary may indeed prove to be too conservative. It is possible, if these firms' expectations bear out, that by 2017 we may have a larger manufacturing workforce in Massachusetts than we do today. Of course, expectations and reality have a way of diverging in a world so complex and susceptible to unexpected shocks like the Great Recession, which we, and most manufacturers, could not have foreseen when we surveyed them back in 2007. The sluggish growth of the U.S. national economy and what could be another recession in Europe

would lead to weaker sales at home and abroad for many Massachusetts manufacturers. That 40 percent of Massachusetts exports go to Europe, as opposed to just 18 percent of the nation's exports, puts the Commonwealth's manufacturers at greater risk of a European downturn than U.S. manufacturers elsewhere.

Promoting Massachusetts Manufacturing

To help ensure that the state's manufacturing firms will be able to fulfill their expectations for growth and employment, and to meet their future hiring needs, there are a number of measures that manufacturers themselves have suggested as very important for promoting the sector. As **Table 13** demonstrates, at the top of this list were the following:

- More than 30 percent of firms suggested that finding a way for vocational schools and community colleges to incorporate industry standards into their curricula would be very important to the entire manufacturing sector.
- Nearly the same number of firms called for the creation of a certificate in manufacturing technology that would help them identify well-trained workers to fill current and future job vacancies.
- More than a quarter (28%) of survey respondents said they thought that industry managers and workers could serve as mentors and advisors in selected vocational schools and community colleges.
- A quarter (25%) strongly supported the idea of having industry leaders address parent-teacher organizations and student groups.
- A fifth (21%) favored the idea of firms contributing some machinery and tools to schools so that students could learn to use them before they apply for jobs.
- Other ideas receiving some support included exhibiting at education, career and technology fairs; the institution of company-sponsored educational scholarships; and the hiring of community college and vocational school faculty to train existing company employees.

The newly created Advanced Manufacturing Collaborative in Massachusetts would do well to consider what steps might be taken to implement some, if not all, of these suggestions.

In addition to these efforts involving firms and schools working together, there was strong sentiment among manufacturers for the Commonwealth to develop a statewide marketing campaign to promote manufacturing with an emphasis on encouraging more young people to consider a career in this sector in order to meet future labor demand.

And, not surprisingly, there is a strong desire by manufacturers to have the state work seriously to reduce the cost of health insurance, taxes, fees and energy.

TABLE 13
Most Highly Recommended Methods for Promoting Massachusetts Manufacturing

	Firms Reporting Very Important Initiative
Working with school or community college Instructors to incorporate industry standards into curriculum	30.3%
Creating a certificate in manufacturing technology	27.5%
Serving as mentors/advisors at selected vocational schools or community colleges	27.4%
Speaking to parent organizations/student groups about careers in manufacturing	24.7%
Contributing machinery, tools, or other materials to schools	21.0%
Exhibiting at education, career, and technology fairs	19.7%
Instituting company-sponsored educational scholarships	14.2%
Hiring vocational/community college teachers to train your employees	11.6%

Source: Dukakis Manufacturing Survey, 2012

Conclusion

When we completed the original *Staying Power* report on manufacturing in 2008, we noted it was “very much at odds with the conventional wisdom.” Instead of being a sector that was fast disappearing in a “post-industrial” environment, we found that manufacturing was finally stabilizing in the state and indeed had a reasonably bright future of growth with substantial employment opportunity on the horizon.

When the Great Recession set in just as the report was being released, we worried that our prognosis was too optimistic. In the first year and a half of the recession, output in the sector declined as a share of Gross State Product (GSP), and jobs disappeared at a rate as steep as in the previous six years.

But as we saw output rising as a share of GSP, and employment holding its own after late 2009, we began to gain confidence in our original assessment. An analysis of the results from the survey we carried out

in the spring of this year with nearly 700 manufacturers added to our confidence that manufacturing in the state was truly having a renaissance. Manufacturers themselves, having invested in new technology and fully cognizant of the new competition they will face nationally and globally, seem up to the challenge to maintain, if not expand, this sector’s role in the state economy.

With state government paying much more attention to the manufacturing sector here at home, and the White House calling attention to manufacturing’s future nationwide, the sector no longer is suffering from a “Rodney Dangerfield Syndrome.” It’s getting the respect it deserves. Now we are in a position to take up many of the recommendations made by firms in the state in order to make sure the Commonwealth is putting in place programs and policies that will permit manufacturing to flourish throughout Massachusetts once again.

For More Information

A pdf of the full report **Staying Power II: A Report Card of Manufacturing in Massachusetts** is available on the Boston Foundation's website at www.tbf.org.

For a printed version of the full report or additional printed copies of the Executive Summary, please call 617-338-1700.

