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Maine Comprehensive Research and Development Evaluation 2010

Maine Department of Economic and Community Development

Maine Office of Innovation, Department of Economic and Community Development

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Maine Comprehensive Research and Development Evaluation 2010

A Report to the Maine Office of Innovation, Department of Economic and Community Development

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Executive Summary

As global competition intensifies, American businesses are facing pressures to become more innovative, creative, and entrepreneurial. Success in the 21st century economy requires that businesses operate in an environment where innovation is encouraged, where a highly skilled workforce is available, and where there is a business climate that allows companies to grow without unnecessary barriers. Countries across the world are investing at unprecedented rates in research, the education of scientific and technical workers, and the development of new industries and markets. Maine no longer competes with New Hampshire or New Brunswick, but with Brazil, India, Sweden, and others.

Strategic investments in R&D and innovation can help accelerate the development of new companies and jobs, and keep existing companies at the top of their game. This is why so many states develop and support programs that commercialize research and help entrepreneurs and companies develop new markets. Innovation-based industries have the potential for high growth because they sell their products and services throughout the U.S. and the world; furthermore, they pay higher than average wages, which means the ripple effect of spending is greater than most other industries.

Maine, like other states, has been making investments into R&D programs for a number of years in hopes of building a more competitive environment for economic development. This yearly evaluation of Maine's Investment in R&D programs seeks to assess the impact of these state investments, and to identify areas where Maine can become more competitive and build a more robust business climate leading to job and revenue growth for our companies.

Where does Maine make R&D Investments?

Maine's R&D investments have primarily supported research efforts at universities and by academic-industry partnerships, with only approximately 21 percent of total funding focused on entrepreneurship or business development efforts, primarily through the Maine Technology Institute. General fund appropriations account for the majority of state investments, with additional funding provided via bonds. Total General Fund investments have been relatively flat for the past decade, averaging roughly $20-26 million per year.

How competitive is Maine's innovation capacity compared to other states?

Our evaluation assesses Maine's innovation performance in relation to several key benchmarks. We assess this performance in three categories:

- *Innovation Inputs*: How much is being invested to support R&D and innovation-based industries in Maine?
- *Innovation Outputs:* Are these investments leading to productivity increases or better company performance?
- *Innovation Outcomes*: Are these investments helping to create new jobs, new wealth, and better career options for Maine?

Below are highlights of each category, with additional information contained in the full report and Maine's Annual Innovation Index.

Over the past decade, Maine has succeeded in enhancing its innovation capacity in several key areas. University R&D (which receives the majority of state R&D support) has increased from 35% of the U.S. average to over 70% of the U.S. average, with even higher growth rates in the most recent year. However, industry, the largest driver of innovation in the U.S., receives less state funding and is performing well below U.S. averages, with low rates of patents and other indicators of commercial activity. Maine students are performing above average in our eighth grade math and science scores, yet students are failing to enroll in college programs leading to scientific and technical degrees, which are critical for innovation-based industries from forestry and food products to software and biosciences

Innovation Inputs

	Total R&D Expenditures	Industry R&D	Academic R&D	Nonprofit R&D	Science & engineering enrollment in college	8th grade math/science scores
Ranking among states	**40**	**38**	**41**	**3**	**51**	**19 / 9**
5-year trend line	⟷	⟷	↑	↓	↓	↑

Maine's performance for turning ideas into new products and businesses is mixed. While university R&D funding has risen significantly, the number of patents and licenses generated by this research fall far below the average for U.S. research universities. However, data reported for 2010 show that the state's universities are improving their performance in terms of new research investments and spin-off companies. Industry R&D performance remains weak. Maine ranks among the bottom ten U.S. states for the number of patents generated by private industry. Other more positive trends include improved performance in new venture capital investments and in the percentage of scientists and engineers in the workforce.

Innovation Outputs/Productivity Measures

	Patents	Entrepreneurial activity (business formation)	Venture Capital Investments	Scientists & engineers in the workforce	SBIR/STTR Awards
Ranking among states	**42**	**21**	**34**	**43**	**36**
5-year trend line					

Mainers start businesses at a brisk pace, but face challenges when trying to fuel more rapid business growth. Maine ranks 21st in the U.S. for new business formation, but it ranks 40th for fast-growing firms. Companies that are growing appear to take advantage of national and regional industry networks as well as strategic partnerships or federal contracts and grants to jumpstart or expand markets. Maine's export per gross state product is half the U.S. average (ranking 40th among states); and while Maine's international trade programs are well-crafted, they are not funded at a scale to reach many companies that could benefit from export assistance. The lack of business development and market expansion support contributes to the flat to modest growth rates in innovation-based jobs.

Innovation Outcomes

	Fast-Growing Companies	Workforce Employed Producing Goods and Services for Export	Share of Workforce Employed by Foreign-owned Companies	Per Capita Income	5yr Employment Growth in Innovation Sectors
Ranking among states	**40**	**40**	**14**	**25**	**N/A**
5-year trend line	**N/A**	**N/A**	**N/A**		

Across the nation, states continue to make investments in R&D and innovation initiatives to maintain a competitive edge and to create high wage jobs. Maine is no different. However, without these investments, data suggests that the state would fall further behind in its economic competitiveness. Over time, Maine has made modest progress in many aspects of R&D, and in areas where the state has focused its investments (e.g. university R&D), more rapid improvements have been made.

These R&D outcomes are a cause for cautious optimism. If these trends continue, they may indicate important progress in building a strong foundation for Maine's innovation economy. However, industry, the state's largest engine for R&D, is still woefully underperforming. This relatively weak performance is a potential concern as industry

R&D is generally considered to have higher direct economic impact (jobs) and commercialization potential.

With limited funding, future state R&D investments should be focused on addressing the most critical innovation gaps in Maine and on accelerating the creation of business and jobs in high growth industries. It is clear from data, surveys and interviews that the growth of existing innovation-based industries and the capacity for industry to conduct R&D is perhaps the most pressing of all R&D issues in Maine. For this reason, recommendations focus on three themes:

Fostering the Growth of Existing Innovation-based Companies

- Help innovation-based companies expand U.S. and international sales through expanded export assistance programs and greater participation in conferences and tradeshows.
- Increase state marketing efforts of Maine's innovation-based industries through web and media and more fully integrate innovation-industries into economic development recruitment efforts.
- Utilize trade and industry associations to engage in international partnerships, help promote export opportunities and provide technical assistance to help members be more prepared to grow out of state revenues.

Building Lasting Entrepreneurial Capacity and Accelerating Early-stage Growth

- Maximize the growth potential for startups and early stage companies by better connecting capital programs with innovation-based mentoring and advisory services that will enhance the business development and survival rate of businesses.
- Establish entrepreneurial networks focused on the needs of high growth industries, and which more readily connects entrepreneurs with market opportunities inside and outside of the state.
- Promote programs that help small companies demonstrate the market potential of new products and services.

Enhancing Overall Industry R&D and Competitiveness

- Help companies find and access federal contracts and awards, focusing on agencies that build expertise in Maine's targeted industries.
- Establish an industry-led collaborative to commercialize university research.
- Reward companies that grow their innovation workforce in Maine.

Some of the key institutional ingredients---a growing base of tech-savvy workers and researchers, and effective research partnerships between industry and academia---appear to be emerging. As we noted in this report and in previous evaluations, these outcomes are a necessary, but not sufficient, condition for success in the 21st century innovation

economy. They must be accompanied by continued efforts to nurture the transition of ideas into commercial products and new businesses, and to grow companies by expanding markets and attracting talent.

Finally, the state government needs to think about its investment in innovation as a way to build economic capacity, rather than a series of independent projects where the economic impact ends soon after the funding. Establishing nationally known research and industry competencies that accelerate economic growth requires systematic and consistent funding that is driven by industry and market needs, and which can effectively leverage the resources of companies, academia and government. When an R&D program is funded, the state should ask the question, "How does this lead to the development of new products, businesses or jobs in high growth industries, or how does it build R&D expertise that differentiates Maine and enhances the state's competitive position?"

1. Introduction

In 2001, the Maine Legislature enacted 5 MRSA §13122-J and 13122-K, which called for an annual evaluation of Maine's public investment in R&D. The Maine Department of Economic and Community Development (DECD) is responsible for developing and overseeing this evaluation process. An advisory board, the Maine Innovation Economy Advisory Board, is charged by the state with providing guidance and input including the evaluation project. To conduct the R&D Evaluation, DECD has contracted with PolicyOne Research, EntreWorks Consulting, and Scruggs & Associates LLC for data gathering, analysis, and reporting.

The evaluation is guided by the Science and Technology Action Plan for Maine, developed in 2010 with the vision to "create an environment where science, technology, innovation and entrepreneurship stimulate Maine's economy." The plan focuses on growing research capacity, businesses, and jobs in seven innovation-based industries where Maine has or is developing a competitive advantage: biotechnology, environmental technology (including energy), advanced technologies for forestry and agriculture, precision manufacturing technology, aquaculture and marine technologies, composites materials technology, and information technology. The plan also recognizes that innovation and entrepreneurs are the drivers of economic growth and that innovation-based sectors tend to require highly skilled workers and have a disproportionate share of high-growth, high-wage occupations.

1.1 Strategies and Goals of 2010 Science & Technology (S&T) Action Plan

Maine's 2010 Science and Technology Action Plan contains three primary strategies and related goals. They are summarized in Table 1.1.

Table 1.1

Strategies and Goals of 2010 Science & Technology (S&T) Action Plan

Strategy	Goal
Grow R&D activity to a sustainable level of research and development activity in our private, academic, and nonprofit laboratories.	Maine's total R&D activity will equal $1.4 billion by 2015 (3% of GSP).
Increase employment in the seven targeted technology sectors, creating well-paying jobs for Mainers.	Maine's innovation sectors will increase their employment by 5,400 jobs, raising total employment in these sectors to 60,000 by 2015.
Increase per capita income through the growth of innovation-based jobs [and the skills of workers].	Maine's per capita income will increase to $42,000 by 2015, from the 2008 level of $35,381.

1.2 Purpose of the Evaluation

As stewards of public funds, the Legislature has asked for an annual comprehensive evaluation of R&D programs that receive funding from the state. The evaluation considers the performance and impact of R&D programs based on three primary objectives:

1. **A strong foundation for innovation**: To build a *competitive level of R&D* capacity in industry, academia and nonprofits that can turn discoveries and technological advances into new commercial products and services, and support the growth of a *highly skilled workforce* that will be required for economic prosperity.
2. **A robust entrepreneurial environment**: To *assist entrepreneurs* in commercializing new technologies and accessing the capital and networks required to *form and build successful companies*.
3. **Competitive and well-connected innovation industries**: To help existing industries *continually innovate* their products and services, and to create opportunities that *expand their national and global markets*.

Using the State's Science & Technology Plan as a guide, the evaluation has been constructed around the following questions to best relate state investments to innovation plan goals:

- To what degree have state investments led to a stronger foundation for an innovation-based economy, including increases in R&D capacity and development of a more highly skilled workforce?
- To what degree have state investments led to a more robust entrepreneurial environment and a supportive business climate, which fosters the formation of new high-growth businesses?
- To what degree have state investments led to growth in innovation-based sectors and increases in worker wages?

1.3 Evaluation Methodology and Use of Data

Information used in this evaluation was collected in multiple ways to both provide an understanding of Maine's performance compared to other benchmark states and to provide in-depth details regarding performance within Maine among state supported companies and research institutions. The comparison data is drawn from a companion

report to this evaluation: Maine Innovation Index: 2010.[1] This data compares Maine's performance to that of the U.S., New England states, and states that are part of the Federal EPSCoR program (Experimental Program to Stimulate Competitive Research).[2] All of these benchmarks are based on the latest available data, but, because of delays in some Federal data collection efforts, several of the measures use data from earlier years. Therefore, readers of this evaluation must not directly correlate the most recent state budget for R&D with the comparison indicators listed in this report. The in-depth state data is collected through annual surveys of companies (see **Appendix A** for detailed findings) and research institutions (see **Appendix C** for detailed findings) conducted specifically for this evaluation. Additionally, this data is combined with federal and university technology transfer data sources. Best practices related to the recommendations are listed in **Appendix F**.

[1] Maine Office of Innovation, *Maine Innovation Index 2010*, (Augusta: Maine Office of Innovation, 2011).

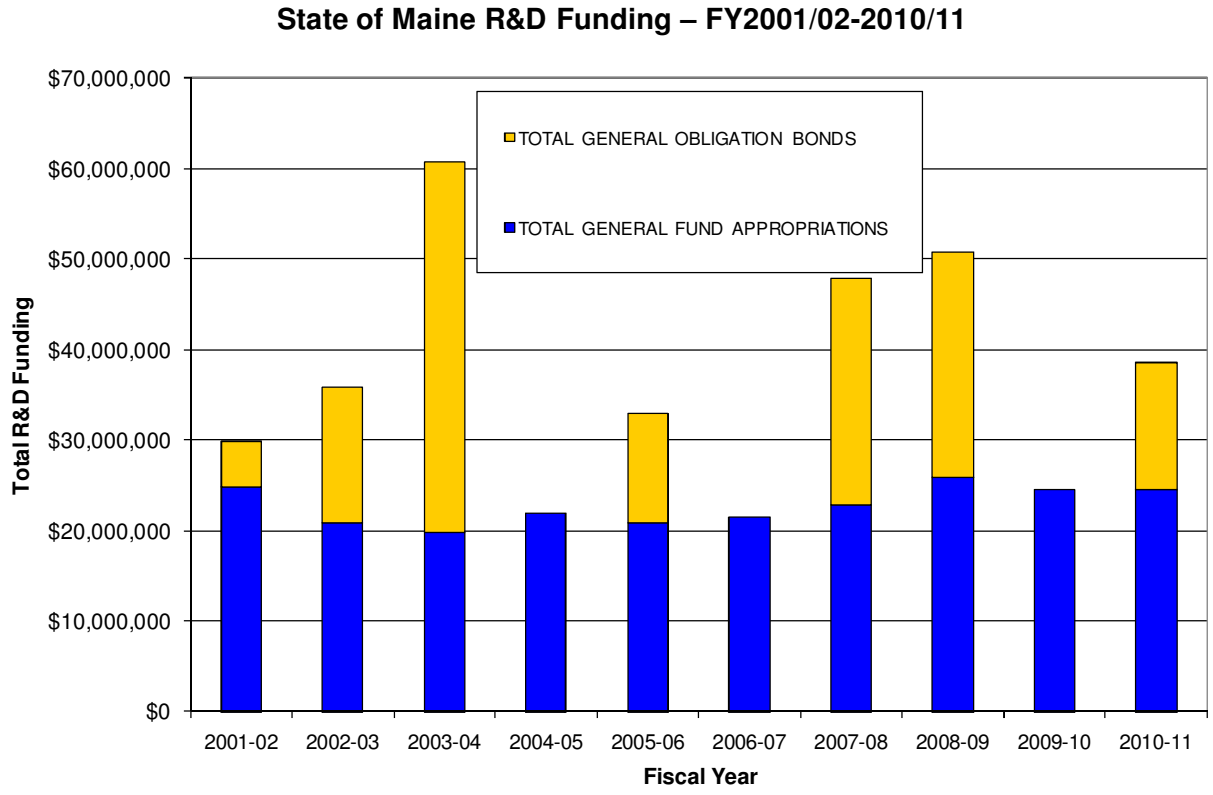
[2] EPSCoR focuses on those states that have historically received lesser amounts of federal R&D funding and have demonstrated a commitment to develop their research bases and to improve the quality of science and engineering research conducted at their universities and colleges. The program currently operates in 23 states: Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Vermont, West Virginia, and Wyoming, as well as the Commonwealth of Puerto Rico and the U.S. Virgin Islands. This description is from the EPSCoR Web site at: www.ehr.nsf.gov/epscor/start.cfm.

2. Overview of Maine R&D Investments

2.1 R&D Funding Levels

Since 1996, the State of Maine has appropriated almost $460 million: roughly $30 million per year (see **Figure 2.1**) to support R&D/innovation programs. During this period, several trends emerged, including a capacity ramp-up in general fund allocation between 1997 and 2001, followed by a relatively consistent general fund appropriations and periodic influx of obligation bonds which are paid out over a five year period. Since 2004-05, Maine has maintained an annual state investment level of general fund appropriations between $20 million and $26 million.

Figure 2.1

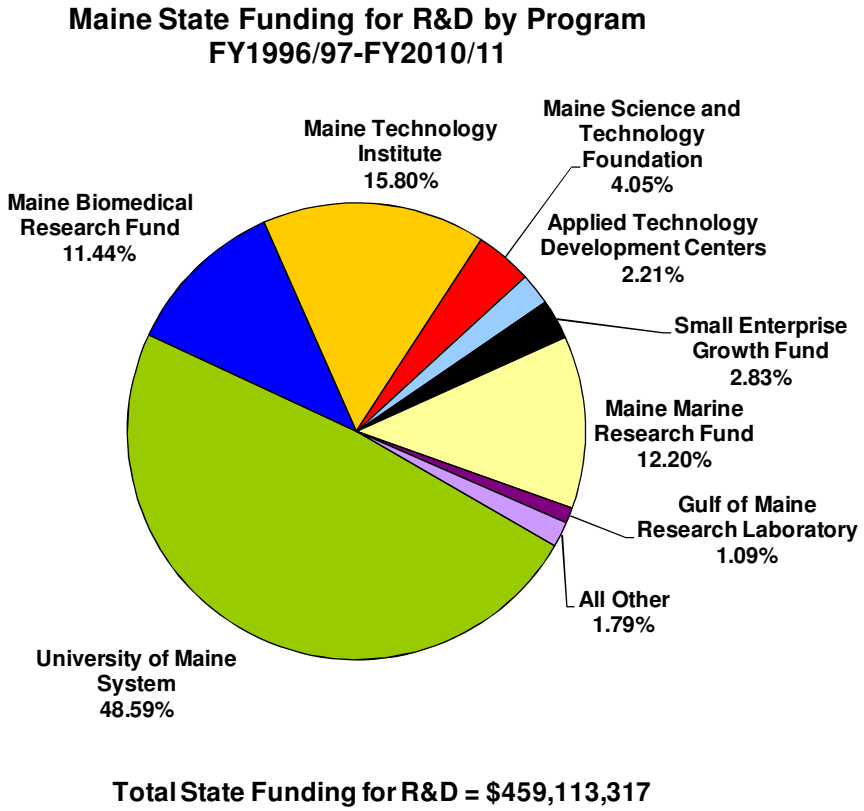


Source: Prepared by PolicyOne Research from data provided by the Maine Legislature, Office of Fiscal & Program Review

Figure 2.2 shows the distribution of R&D investments by major program areas since 1996. Between 1996 and 2010, the University of Maine received the most funding (48.59 percent), followed by the Maine Technology Institute (15.8 percent) and the Marine

Research (12.2 percent) and Biomedical Research Funds (11.44 percent). In all, industry and business development programs received approximately 22 percent of funding while university, nonprofit, and research based programs received 78 percent of funds). In recent years, funding has declined for industry programs including the Maine Patent Program, Applied Technology Development Centers, and Small Enterprise Growth Fund. In the 2009/10 fiscal year, 70 percent of the funding went to the University of Maine system (primarily through the Maine Economic Improvement Fund) and 28 percent went to the Maine Technology Institute.

Figure 2.2



2.2 Types of R&D Programs Funded

Innovation strategies recognize that to create jobs you need new businesses and to create new businesses you need new ideas and products. Therefore, most state strategies for R&D and innovation contain investments that range from programs focused on applied and commercialized research to those targeting business formation and growth. Studies of innovation programs indicate that maximum economic impact is achieved when there is a well-connected continuum of programs for university and industry research, entrepreneurial development, and early stage growth and market expansion. In Maine,

investments have been heavily weighted toward research, especially to universities, with less support for business development and growth.

Table 2.1 compares Maine's previous five-year investment levels[3] by recipient of state funds to the total percent of R&D performance and growth of R&D for each category of recipient. Maine has invested 59 percent of its state R&D funding in universities between 2003 and 2007.[4] In 2007, the universities represented 29 percent of the total R&D activity. The state has invested 17 percent in industry R&D between 2003 and 2007, and industry performed 55 percent of the state's R&D. The nonprofit category received 24 percent of funding and accounted for 16 percent of the total research. In terms of growth in R&D performance between 2003 and 2007 Maine's industry and nonprofit category lagged that of the U.S., whereas Maine's academic sector outpaced the U.S. benchmarks.

Table 2.1 Five-Year Comparison of Public Investment (2003–2007) and Performance of R&D (2003–2007)

	% of Maine Public Investment in R&D 2003–2007	% of Performance of R&D, 2007	Maine % Change in Performance of R&D, 2003–2007	U.S. % Change in Performance of R&D, 2003–2007
Industry	**17%**	**55%**	**33%**	**36%**
Academia	**59%**	**29%**	**64%**	**24%**
Nonprofit	**24%**	**16%**	**3%**	**30%**

[3] Maine's investment by sector was estimated based on actual general fund appropriations and bonds for the State's R&D related programs and an estimated percent of allocation of those funds from the Maine Office of Innovation.

[4] 2007 is the latest year in which data is available for all three sectors of R&D.

3. Findings

3.1 A Strong Foundation for Innovation

In a global economy spurred by scientific and technological advances, the ability to develop and commercialize new ideas and discoveries is essential. Multiple factors contribute to a region's ability to innovate. Among them is the R&D capacity of industry academia and nonprofit institutions, as well as the growth of scientific and technical workers. Nationally, industry R&D accounts for over 80 percent of all innovation, making it a backbone for economic growth. Universities and nonprofits fill a critical role of generating new ideas and helping to turn basic research into new discoveries for commercial technologies. Innovation-based talent (scientists and engineers) has become one of the greatest differentiating factors in our economy, as illustrated by the large investments in math and science education in countries like China and India that is driving economic growth. Together, this synergy of R&D capacity and talent create the foundation for an innovation economy.

Innovation capacity directly relates to several goals within the newly created Science & Technology Plan for Maine. The plan specifically calls for strategies that will: 1) increase Maine's total research and development by increasing R&D in the academic, non-profit and private sector to $1.4 billion in total R&D by 2015, and 2) increase per capita income by increasing the skills of Maine workers, through an increase in the number of science, technology, engineering, and mathematics (STEM) graduates and an alignment of K-20 education with skills required by innovation-based sectors.

In this section, R&D capacity and related education performance is measured to understand how well Maine is performing compared to other regions. The evaluation specifically examines:

- The degree to which entities in Maine generate new ideas and discoveries, measured by R&D spending (expenditures) for industry, academia, and nonprofits.
- The degree to which Maine is educating its youth for jobs of the future as measured by math and science scores of 8th graders and the number of students enrolled in college level science & engineering degree programs.

Is Maine growing the capacity to generate new ideas and discoveries?

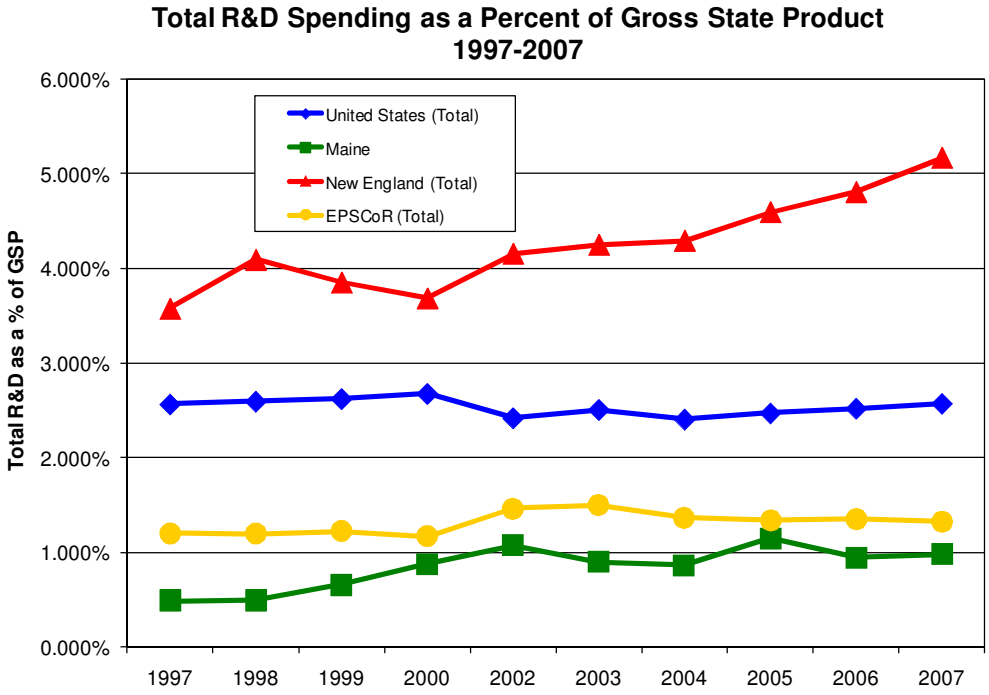
The 2005 and 2010 Science and Technology Plans called for extremely aggressive increases in R&D investment in order for the State of Maine to be competitive; growing

from less than $500 million invested per year to over $1.4 billion by 2015. To reach the state's S&T goal of 3 percent of GSP (or $1.4 billion in total R&D), R&D expenditures will need to significantly increase at a rate more than three times the current rate of growth. This will require significantly more R&D investment at all levels, especially in the private sector.

Total R&D Spending: According to the National Science Foundation, Maine's total R&D capacity (expenditures by industry, academia and nonprofit research institutions) was $485 million in 2007. This total represents a 30 percent increase in total value since 2003, but falls below the most recent high of $524 million invested in 2005. While R&D expenditures have increased in Maine, they did so at approximately the same rate as the U.S. average (29.6 percent) and below that of New England (over 47 percent). Therefore, the relative position of Maine's R&D capacity remained unchanged.

R&D as a percent of the Gross State Product (GSP): The economic impact of R&D can be best illustrated by comparing R&D spending as a percent of the gross state product (GSP), indicating the degree to which R&D contributes to economic output. In Maine, R&D spending represents just less than one percent (1 percent) of the GSP, while R&D accounts for 2.57 percent of the U.S. economy and over 5 percent of New England's economic output. (See **Figure 3.1**)

Figure 3.1



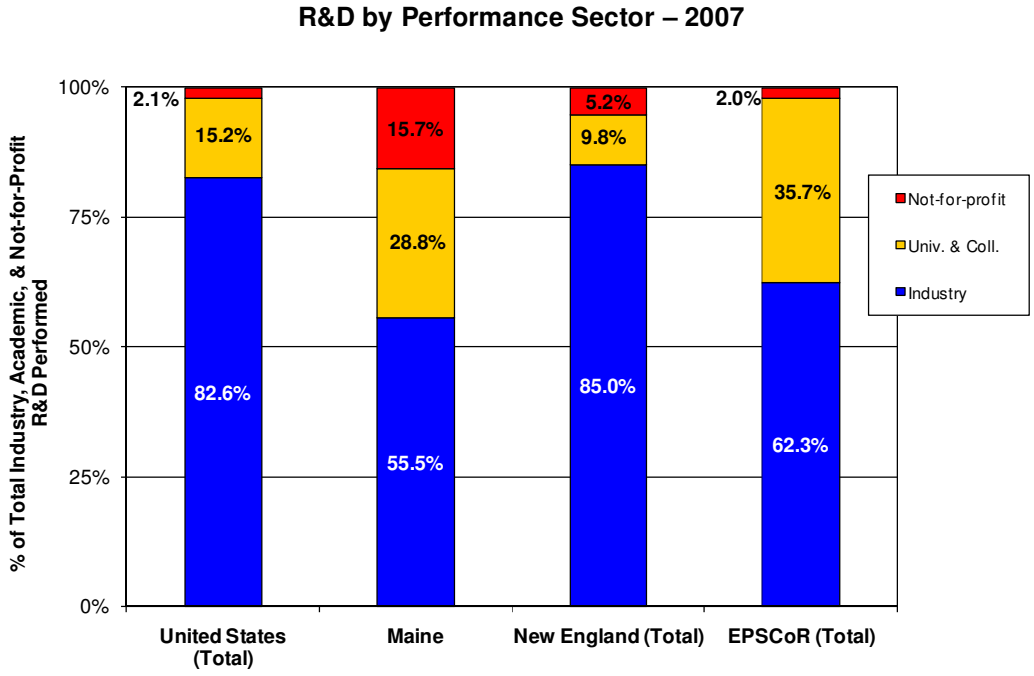
Note: From 1997-2000 & 2002-2007 chart portrays one-year increments; all other years are in two-year increments.

"Total R&D Performed - National Science Foundation/Division of Science Resources Statistics; National Patterns of R&D Resources 2002, 2004, and 2007; Data Updates, derived from four NSF surveys: Survey of Industrial R&D; Survey of R&D Expenditures at Universities and Colleges, Survey of Federal Funds for R&D, and Survey of R&D Funding and Performance by Nonprofit Organizations; http://www.nsf.gov/statistics. Gross State Product - Bureau of Economic Analysis, U.S. Department of Commerce, 1980-1997 data; and Revised Estimates for 2005-2008; http://www.bea.gov/regional/gsp/; 1997-2007 is based on NAICS.

Is Maine's private sector increasing its R&D capacity?

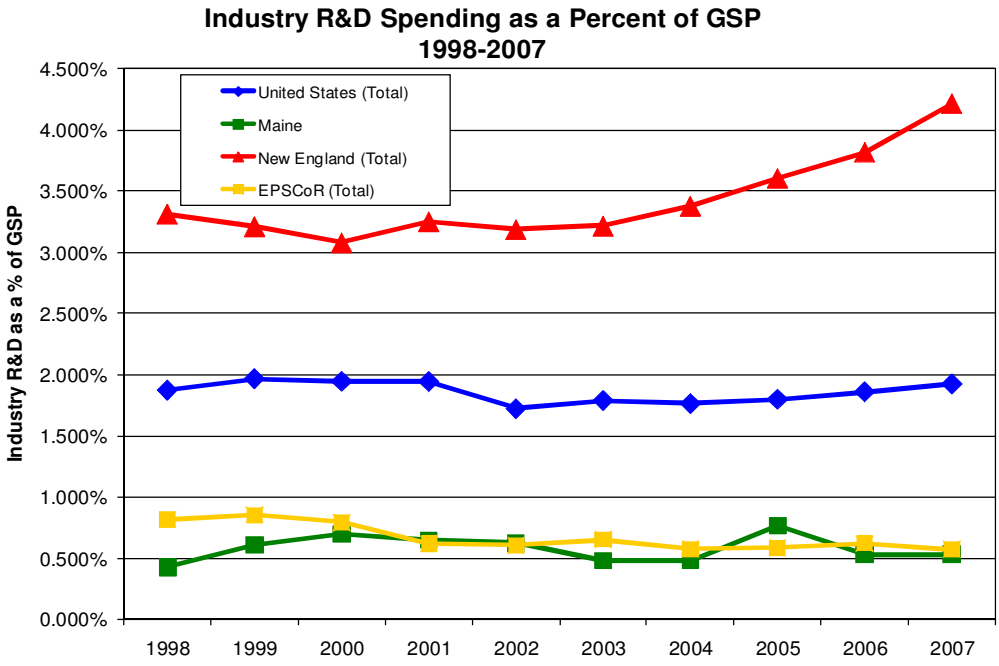
Industry R&D: Maine's low overall R&D capacity can be attributed, to a large extent, to lower levels of industry R&D. In 2007, industry R&D accounted for $265 million. While industry R&D comprises over 82 percent of total U.S. research spending, it only represents 55.5 percent of Maine's R&D expenditures. (See **Figure 3.2**) The low percent of industry R&D reflects the fact that Maine is not home to an extensive base of large R&D intensive corporations. As a percent of GSP, Maine's industry R&D activity is one-fourth that of the U.S. average and one-eighth that of the New England average. (See **Figure 3.3**) If Maine's industry R&D performed at the U.S. average, its 2007 total would be over $900 million, rather than the current level of $265 million. In other words, to build competitiveness in total R&D, the state needs to significantly improve and increase the level of R&D conducted by industry. This shift will not only create high wage private sector jobs, but will also help to better connect university and nonprofit research to commercial markets.

Figure 3.2



Note: not for profit includes only that which is federally funded and therefore the contribution by this sector is understated

Figure 3.3



This flat industry R&D trend line is also reflected in 2010 survey results of Maine companies that received assistance from state-supported R&D programs. Based on these responses:

- Firm R&D investments dropped slightly in 2010. Surveyed companies spent $34,123,504 in R&D in the reporting period ($104,995 per firm average), compared to $31,470,969 in R&D in the previous year ($106,321 per firm average).

- More firms were engaged in R&D in 2010. Since more companies reported R&D spending than in the previous year's survey, total spending increased by $2,652,535; however, the amount per firm remained statistically the same.

Federal R&D Obligations: Funding from federal sources is the single largest source of R&D investment behind industry. Therefore, the extent to which Maine can tap into federal funding becomes a critical pipeline for innovation, especially in the private sector. In 2006, Maine received over $377 million from federal funding sources. In comparative terms, Maine's industry ranked 14th out of all states in terms of federal R&D funding as a percent of gross state product.

Are Maine's universities and nonprofits entities increasing their R&D capacity?

When compared to other states, Maine's R&D environment is unusual. Because industry R&D investments are limited and because of the presence of large research centers like the Jackson Laboratory, Maine's overall R&D portfolio contains a larger than average portion of investments from academic and not-for-profit research institutions. **University and Nonprofit Survey Highlights**: Each year, university and nonprofits research institutions receiving state funding are surveyed about their R&D expenditures, student enrollment in science and engineering programs, intellectual property (patents, licenses, etc.) and other innovation factors.

The 2010 survey results from research institutions highlight positive trends, many of which do not yet appear in the national benchmarking data used in this year's Innovation Index. For example, state science and engineering programs are seeing an increase in both student enrollments and graduation numbers at both the graduate and undergraduate levels. At the same time, current research efforts seem to be gaining traction within academic circles. Total R&D spending by Maine's research institutions climbed by more than 23 percent overall, with investments increasing by more than $60 million last year, due to significant increases in federal and industry funding, as well as the influx of Maine Technology Asset Funds(MTAF) by the state. Measures such as the publication of peer-reviewed journal articles and other scientific papers also jumped.

These activities helped generate better outcomes in areas such as licensing and new firm spin-offs, but they also served to attract increased federal research investments. In fact, the overall value of federal research investments in Maine grew by nearly 13 percent last year. At the same time, the number and value of research grants and contracts from industry also grew. The dollar value of industry research contracts grew by 47 percent last year. In addition, industry sponsored research is up in terms of number of projects and the total value of research, after years of being relatively flat or in decline. This is even more encouraging, since more than 57 percent of industry-sponsored research was with Maine companies.

This all indicates a healthy upward trend in the R&D capacity of the state's universities and nonprofit research institutions. In addition to the total R&D spending, other survey data indicated:

- Universities have experienced an increase in R&D activity of over 40 percent from $102 million in 2009 to over $145 million in 2010. The survey of nonprofits show similar increases in R&D in 2010, reporting $112 million in total R&D compared to $96 million in 2009.

- Universities received 569 new federal grants and contracts for research, compared to 421 grants and contracts in 2009, and 521 in 2008. The dollar value of these grants was $131 million, compared to $122 million in 2009.

- Nonprofits had similar increases in federal awards with a total of 130 grants and contracts in 2010 (compared to 88 in 2009); the dollar value increased from $68 million in 2009 to $88 million in 2010.

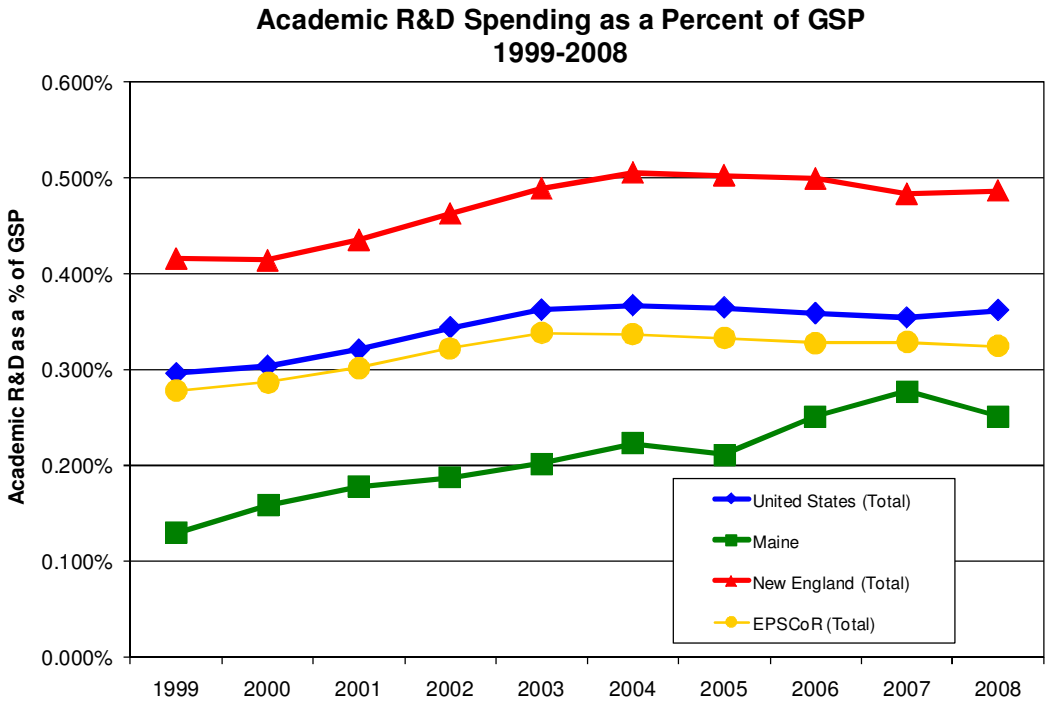
- Universities had 341 industrial research grants, and contracts were awarded for a total of almost $6 million. This is up significantly from the $3.3 million in industry research reported the previous year. The majority of these contracts were with Maine companies.

- Nonprofits, however, saw a decrease in industry-sponsored research, with only 24 projects compared to 37 projects in 2009, and a dollar value of only $1.9 million. Furthermore, only 4 research projects were with Maine companies.

- University peer reviewed publications and journal articles were up significantly in 2010 compared to 2009 levels, while nonprofit publications declined slightly.

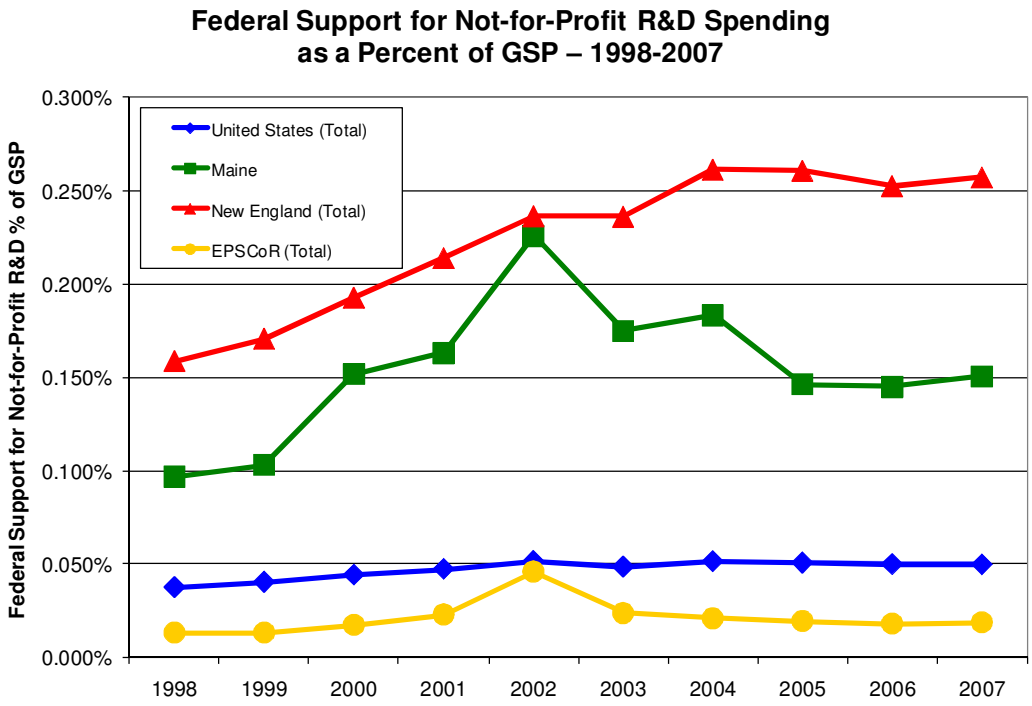
Academic and Nonprofit R&D Compared to Other States: The increase in university research is also reflected in comparisons with the U.S. and other regions. In 2008, academic institutions spent $128 million on R&D, down slightly from 2007, yet up by over 39 percent since 2004. The longer-term trend line is even more impressive. In 1999, Maine's academic R&D performance was approximately 35 percent of the U.S. average, and in 2008, it was approximately 70 percent of the U.S. average, doubling its relative performance. During this same time period, a majority of Maine's state investment for R&D went to academic institutions helping to drive this increase in performance. While Maine ranks 41st overall among all states for academic R&D, the trend line is moving in a positive direction. (See **Figure 3.4)**

Figure 3.4



Nonprofit R&D is the smallest segment of R&D across the nation, yet it is very important in Maine. In 2007, nonprofit institutions spent almost $75 million on R&D, ranking Maine third (3rd) among all states for nonprofit R&D as a percent of GSP. As a percent of GSP, Maine nonprofit R&D accounts for three times as much economic activity as the U.S. average (0.15% of GSP compared to 0.05% of GSP). The performance of Maine's not-for-profits research institutions is driven primarily by one major institution. According to the recent annual R&D survey conducted for this evaluation, the Jackson Labs accounted for 63 percent of R&D expenditures and 74 percent of all research related employment among all Maine not-for-profit institutions. There is concern, however, that the trend line for nonprofits may be declining in terms of being a competitive advantage for Maine. In 2004, nonprofit R&D was 0.184 percent of the gross state product, and has since fallen to 0.151 percent of GSP while New England as a whole has increased to 0.257 percent of GSP. (See **Figure 3.5**) Yet, the sharp uptick in nonprofit R&D over the past year may suggest the trend line has turned positive.

Figure 3.5



Source: 1987-2006 not-for-profit R&D performed is from National Science Foundation/Division of Science Resources Statistics; National Patterns of R&D Resources 2002 Data Update, derived from Survey of R&D Funding and Performance by Nonprofit Organizations; 2004-2006 is from National Science Foundation/Division of Science Resources Statistics, Survey of Federal Funds for Research and Development: Fiscal Years 2002, 2003, 2004, 2005 and 2006; http://www.nsf.gov/statistics..

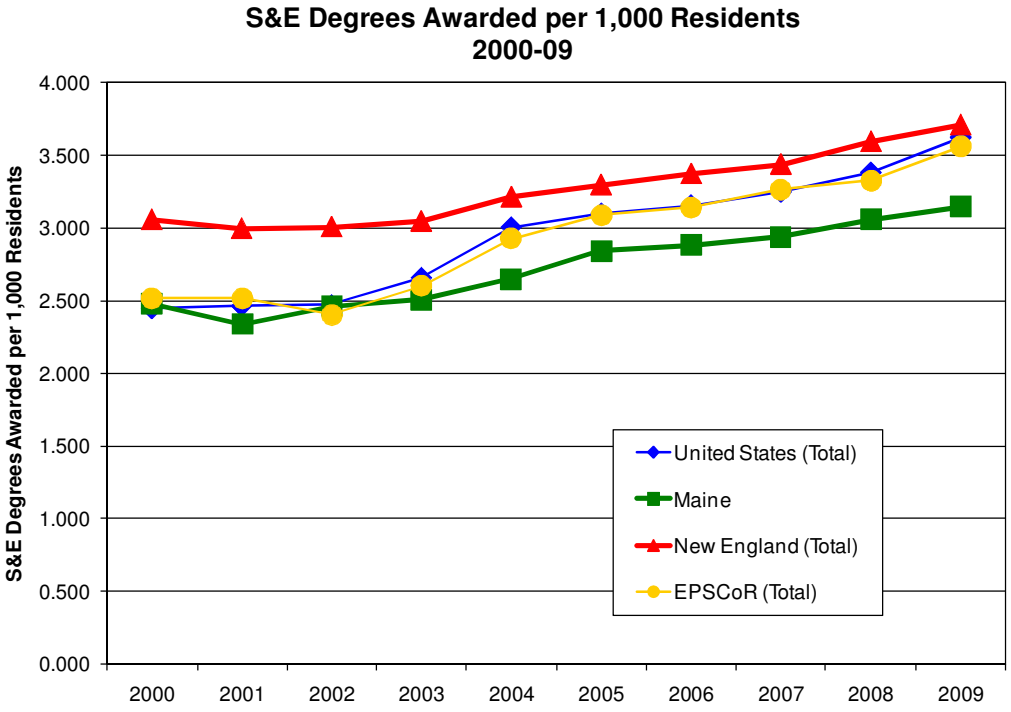
Is Maine's Education System Preparing Residents for Future Jobs?

Success in an innovation economy begins with math and science skills in our K-12 system. Maine's eighth grade students continue to perform well relative to other states in math and science. In 2009, the National Assessment of Education Programs found that Maine eighth graders ranked 9th in science and 19th in math. Despite this relatively strong foundation for science and engineering skills, students in Maine are not seeking college degrees in these fields, even though they are pursuing higher education at a level slightly above the U.S. average.

Science and Engineering (S&E) Degrees: Universities contribute to the skills and education of the workforce in many ways. One contribution is the preparation of students to enter science and engineering fields that drive innovation in many industries. In 2009, Maine-based institutions awarded 4,151 degrees in science and engineering fields, with master's degree or doctorate representing approximately 15 percent of those degrees. Although Maine was at the U.S. averages in 2002, the state has slowly lost ground and is now lagging behind both the U.S. average and EPSCoR states in the number of S&E

degrees per 1,000 residents (See **Figure 3.6).** Maine ranks 38th in S&E degrees among all other states.

Figure 3.6



Source: S&E Degrees Awarded – Extracted from NSF WebCASPAR Database System, http://webcaspar.nsf.gov, based on the Higher Education General Information Survey and Integrated Post-Secondary Education Data System, National Center for Education Statistics, U.S. Department of Education, www.nces.ed.gov.

Increasingly, knowledge-based jobs are requiring advanced degrees. While Maine's performance in terms of overall science and engineering degrees awarded is just slightly less than other states, the awarding graduate-level degrees falls far below other benchmarks. The number of students enrolled in graduate-level science and engineering fields expressed per 1,000 residents has remained flat over recent years, at levels two to three times lower than EPSCoR or U.S. averages, and almost six times less than that of New England. In 2008, Maine reported 0.63 graduate level students in S&E fields for every 1,000 residents. This compares to 2.06 for the U.S. average and 3.18 for New England.

Preparation for Maine's workforce can also be enhanced when science and engineering training is aligned with the needs of industries employing these graduates. An analysis of graduation data indicates that Maine is producing a large number of life sciences graduates, but a small number of engineers, mathematicians, and computer scientists, despite higher private sector demand for workers in these fields.

3.2 More Robust Entrepreneurial Climate

A second set of desired outcomes from Maine's research and development investments focuses on how the state's science and technology programs help contribute to a more robust and supportive environment for the state's entrepreneurs and their companies. The 2010 Maine Science and Technology Plan identifies four strategies for building these linkages:[5]

- To increase the rate at which new technologies and ideas become new products, processes, and services. Key tools for this goal include expanded angel investments and improved technology commercialization processes at Maine's universities and research centers.
- To support Maine's emerging and established industry clusters.
- To build a more support environment for high-growth entrepreneurs through investments in broadband infrastructure and efforts to build a more entrepreneur-friendly culture and business climate.
- To align Maine's innovation-based economic development efforts with the state's broader overall strategies for future economic prosperity.

While no single measure can account for all of these factors and impacts, a number of data points from this year's survey of companies receiving state support, Maine's annual Innovation Index, and related analysis can help us better understand how Maine's R&D investment programs are helping or impeding the growth of Maine technology businesses. If Maine's technology firms are prospering, their success will be reflected in faster company growth rates, increased revenues and sales (especially export sales), increased success in obtaining outside funding and success in developing new technologies. More details on these factors are detailed below.

Are Maine Technology Firms Growing Their Markets?

Overall Growth: Firms assisted by Maine's R&D programs are a diverse group. Yet, according to past surveys, as a group they have tended to outperform other Maine firms in areas such as annual growth rates. However, recent survey results suggest that these companies are feeling the pinch of the current economic downturn. For example, in 2009, surveyed companies receiving state R&D support shed jobs, reducing employment levels by three percent. While at the same time, these firms enjoyed robust annual revenue increases exceeding twelve percent.[6] This year's survey results are somewhat less promising. Among 2010's surveyed companies, overall employment levels dropped slightly from 2009. As a group, overall employment dropped 2.8 percent as firms employed 108 fewer workers in 2010. This 2010 job loss was not compensated for by an

[5] 2010 S&T Plan, pp. 14-16.

[6] See Maine Office of Innovation, *Maine Comprehensive Research and Development Evaluation 2009*, pp. A-4 to A-7.

improving revenue picture. Instead, firms reported a very slight annual revenue increase of only 0.7 percent.

As detailed in our accompanying research, this slowdown in company growth trends may be part of wider pattern affecting the overall Maine economy. A number of other measures suggest that Maine-based firms may face significant hurdles in achieving rapid growth and becoming what some observers refer to as a gazelle business, i.e. a firm that achieves a consistent annual growth rate exceeding twenty percent.

- Maine ranks 40 out of 50 on the number of Deloitte Technology Fast 500 and Inc. 500 firms as a share of total firms.[7]

- Similarly, in the 2010 Inc. 500 and Inc. 5000 listings of America's fastest growing companies, Maine has only one firm listed in the top 500 (Portland's Listen Up Español ranked at number 27).[8] Overall, only twelve Maine firms have achieved listing on the 2010 Inc. 5000 list.

Maine's weak performance on these measures is a potential cause for concern as recent research suggests that these gazelle businesses are the real generators of new jobs, new wealth, and community prosperity.[9]

Export Focus: A number of factors contribute to these lagging growth rates for Maine-based businesses. Our accompanying case study examines one important causal factor: Maine business' limited success in capturing new sources of global business. In today's globalized economy, firms can no longer prosper by doing business solely in their community, in their region, or even in their state. Rapid growth requires successful entry into wider national and global markets. While some Maine firms have succeeded via market expansion, many of state's businesses still struggle to do business outside of Maine.

Data on state export performance bolster this contention that Maine firms are underperforming in global markets. The 2010 State New Economy Index ranks Maine as 40th in the U.S. on the extent to which the state's manufacturing and service workforce is employed producing goods and services for export.[10] On the other-hand, Maine does appear to be a desirable location for foreign direct investment. The 2010 State New Economy Index ranks Maine 14th in the U.S. on its assessment of the share of the workforce employed by foreign-owned companies.

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[7] Robert D. Atkinson and Scott M. Andes, The 2010 State New Economy Index, (Washington, DC: The Information Technology and Innovation Foundation, November 2010.

[8] The 2010 Inc. 500 and Inc. 5000 listings can be accessed at http://www.inc.com/inc5000.

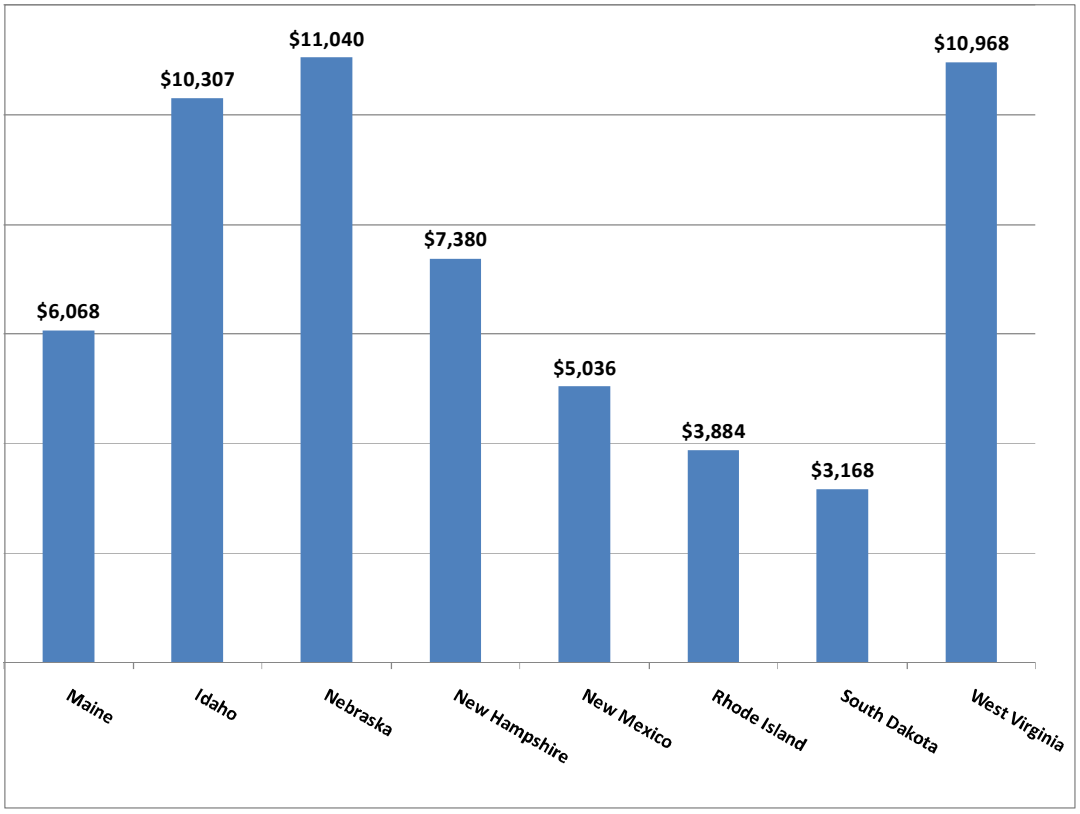
[9] Dane Stangler, "High Growth Firms and the Future of the American Economy," Kauffman Foundation Research Series: Firm Formation and Economic Growth, March 2010.

[10] Robert D. Atkinson and Scott M. Andes, The 2010 State New Economy Index, (Washington, DC: The Information Technology and Innovation Foundation, November 2010). p. 23.

In our past analyses, we have created benchmark comparisons for Maine with other states of a similar size and economic composition.[11] Several states fall into this category, including Idaho, Nebraska, New Hampshire, New Mexico, Rhode Island, South Dakota, and West Virginia. On a per capita basis, Maine's 2006-2009 export values fall below total export values from Idaho, Nebraska, New Hampshire, and West Virginia, but above New Mexico, Rhode Island, and South Dakota. Maine represents approximately 0.43 percent of the U.S. population, yet only exports 0.23 percent of the nation's products, indicating Maine's export rate is approximately half of the U.S. average. (See **Figure 3.7**)

Figure 3.7

Sum of 2006-2009 $ Value of Exports per Capita - Maine vs. Selected Comparison States



Through our annual R&D evaluation process, we ask recipients of R&D related state government programs to provide information on the location of their customers and key markets. As noted in **Table 3.1,** these results for 2010-11 provide further indications of weak export performance. Eighty-eight percent of surveyed firms noted that they generate 10 percent or less of sales from foreign customers. The survey further suggests

[11] Maine Comprehensive Economic Development Evaluation, 2008, Prepared for Maine Department of Community and Economic Development, March 2009.

that Maine-based businesses are also failing to capture markets within the U.S. itself. Sixty-one percent of respondents note that less than half of sales come from outside of Maine. Data from 2009-2010 indicate similar trends.

Table 3.1

U.S. and International Sales from Maine R&D Private Survey Respondents

Percent of Sales Outside Maine, in U.S.	All Respondents 2010-2011		All Respondents 2009-2010	
	Number	Percent	Number	Percent
0 - 10	136	48.4%	137	46.3%
11 - 25	13	4.6%	13	4.4%
26 - 50	23	8.2%	27	9.1%
51 - 75	30	10.7%	27	9.1%
76 - 100	79	28.1%	92	31.1%
Total	281	100%	296	100%
Percent of Sales Outside of U.S.	**All Respondents 2010-2011**		**All Respondents 2009-2010**	
	Number	**Percent**	**Number**	**Percent**
0 - 10	246	87.5%	261	88.2%
11 - 25	14	5.0%	18	6.1%
26 - 50	13	4.6%	8	2.7%
51 - 75	4	1.4%	5	1.7%
76 - 100	4	1.4%	4	1.4%
Total	281	100%	296	100%

As we note in this year's accompanying case study, *From Business Assistance to Market Expansion*, Maine's firms and state support agencies, need to be more aggressive in terms of promoting market expansion, especially into lucrative export markets. Too few Maine firms are aggressively seeking to enter national and global markets, and instead tend to rely on markets that are closer to home. While serving Maine businesses and consumers should be encouraged, a sole focus on markets in Maine (or Northern New England) places severe limits on a firm's growth potential. If Maine's entrepreneurs hope to achieve sustained rapid growth over the long term, they must capture markets outside of our region—in other parts of the U.S., and overseas. Where possible, this global outlook should be part of a new firm's culture at the outset. Even the newest start-ups should look beyond Maine for new markets and business opportunities.

Are Maine Technology Firms Succeeding in Obtaining Private Capital and Government Funding?

Capital is the fuel for business growth. If a firm hopes to grow and expand, it needs funds to hire new people, enter new markets, and to build new facilities. Some fortunate firms are able to grow organically, by investing sales revenue back into company expansion. Yet, just as few Mainers buy a house without a mortgage; few businesses grow without accessing outside capital. Most entrepreneurs use a variety of financing tools, including credit cards, savings, and other investments. In general, outside funds tend to come from three primary sources:

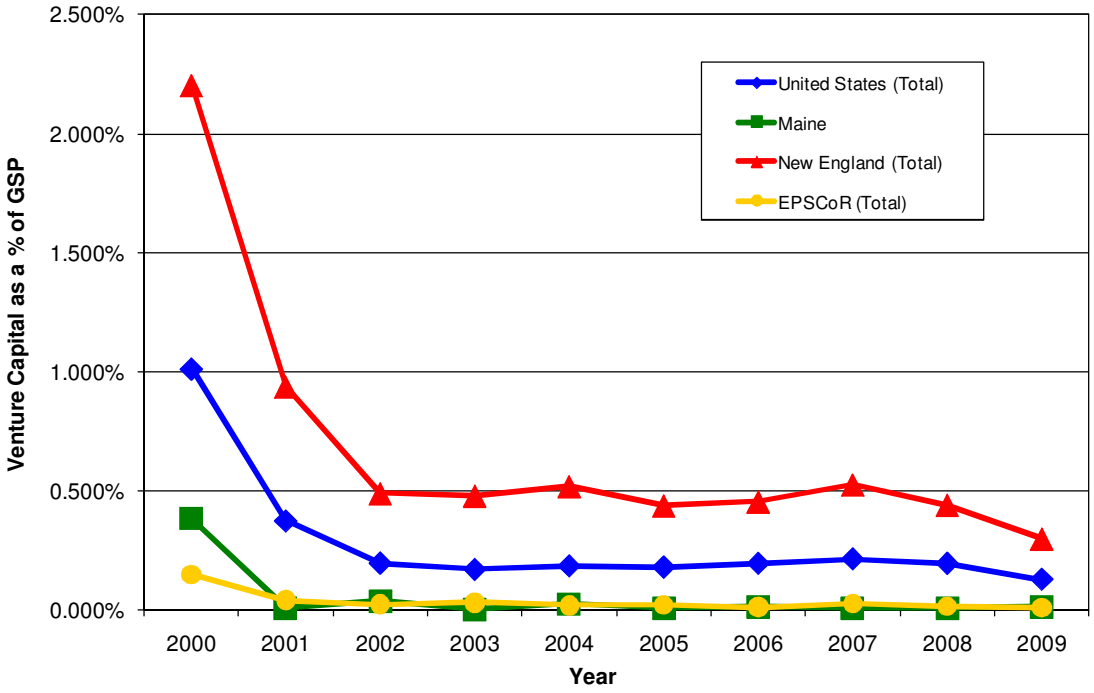
1) Equity investments from friends and family, angel investors, or venture capitalists.
2) Debt investments, typically in form of bank loans.
3) Grants and other support from government agencies and foundations.

Equity Investments: Like most states with smaller populations, Maine has not traditionally served as a major market for new venture capital investments. Over the past decade, Maine's overall venture capital investment totals have tended to fall in the range of several million dollars per year. 2009 was a strong year for venture capital investments as Maine-based firms received $8.1 million in new venture capital investments. This total represented a 98 percent jump from the Maine 2008 level of $4.1 million. These new venture capital investments came as part of five deals within the industry classes of biotechnology, consumer products and services, media and entertainment, and software.

As **Figure 3.8** suggests, this one year uptick in venture investing did not significantly affect Maine's relative position in the venture capital marketplace. In 2009, venture capital investments in Maine were 0.016 percent of GSP. This was significantly lower than the New England level of 0.300 percent and the total U.S. level of 0.129 percent for the same year, but above the level for all EPSCoR states combined at 0.009 percent. New England's high level is skewed by the performance of Massachusetts, which remains the second largest state recipient of venture capital investments. Over 61 percent of all reported venture capital goes to California and Massachusetts. Maine's venture capital investments as a percentage of GSP have remained relatively low between 2001 and 2009. Maine's national ranking has dropped slightly from 32nd in 2008 to 34th in 2009.

Figure 3.8

Venture Capital Invested as a Percent of Gross State Product – 2000-09



While overall venture capital investing grew in Maine, survey respondents did not see a major improvement in their ability to access equity funding. As **Table 3.2** notes, thirty companies (10.7 percent of survey respondents) reported success in accessing new equity financing during their most recently completed fiscal year. In the previous survey year, 48 companies (13.2 percent of survey respondents) accessed new equity financing. Few of these firms have utilized venture capital. Friends and family or angel investors are a much more important source of equity finance. Other sources include owner and/or employee investments.

Table 3.2

Equity Financing Sources	All Respondents 2010-2011 Number of Transactions	Dollars of New Debt	Percent of Total Debt
Venture Capital	5	$ 2,865,000	20.4%
State Seed Capital Funds	0	$ -	0.0%
Angel Investors	8	$ 3,187,000	22.6%
Friends and Family	5	$ 267,414	1.9%
Other	14	$ 7,754,880	55.1%
Total	32	$14,074,294	100%

Equity Financing Sources	All Respondents 2009-2010 Number of Transactions	Dollars of New Debt	Percent of Total Debt
Venture Capital	4	$ 6,902,688	31.6%
State Seed Capital Funds	0	$ -	0.0%
Angel Investors	19	$ 7,207,573	33.0%
Friends and Family	17	$ 578,733	2.6%
Other	15	$ 7,179,517	32.8%
Total	55	$21,868,511	100%

Note: The number of transactions is greater than the number of companies/entities because some companies/entities may have had multiple transactions.

Debt Capital: Most companies rely on debt capital as a means to finance daily operations and growth. The 2010 survey respondents are not unique in this regard. **Table 3.3** indicates that overall, fifty-one surveyed firms (18.1 percent of respondents) accessed new debt financing (in 76 transactions) during their most recently completed fiscal year. In the previous survey year, 81 companies (22.3 percent of respondents) accessed new debt financing. Last year's data totals were skewed by one large investment in the "other" category, and the absence of this single deal explains the large drop in total debt financing for 2010. In other ways, the 2010 data revert to more traditional patterns, with bank financing accounting for the largest share (more than 37 percent) of total debt financing.

Table 3.3

Debt Financing Sources	All Respondents 2010-2011 Number of Transactions	Dollars of New Debt	Percent of Total Debt
Bank	27	$ 6,889,892	37.3%
SBA Loans	5	$ 1,159,500	6.3%
Friends and Family	15	$ 899,855	4.9%
Other	29	$ 9,542,206	51.6%
Total	76	$ 18,491,453	100%

Debt Financing Sources	All Respondents 2009-2010 Number of Transactions	Dollars of New Debt	Percent of Total Debt
Bank	32	$ 8,011,354	11.6%
SBA Loans	4	$ 244,000	0.4%
Friends and Family	22	$ 1,884,328	2.7%
Other	37	$ 58,925,918	85.3%
Total	95	$ 69,065,600	100%

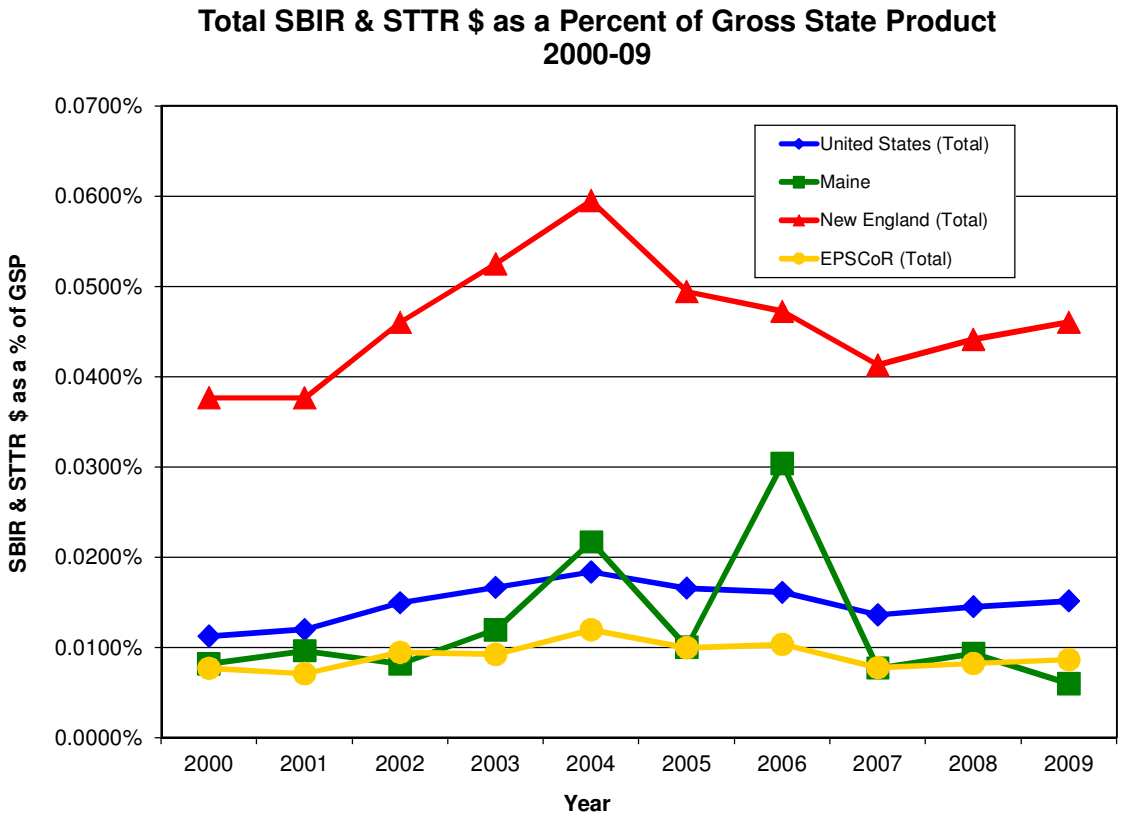
Note: The number of transactions companies/entities because some companies/entities may have had multiple transactions.

Government Funds: By definition, all of the firms assessed in this year's survey have received some level of funding from the state of Maine. A number of these companies have also succeeded in obtaining other research investments, generally from Federal R&D agencies. The Federal Small Business Innovation Research (SBIR) program is a particularly important funder for small technology companies. The SBIR program requires that two percent of all Federal research dollars be invested in small businesses. These grants help small firms develop research and technology that can meet the needs of key Federal agencies. The ability to obtain SBIR grants is an indicator of a strong base of small businesses with extensive scientific and technical expertise. Small technology firms face significant challenges in accessing capital. They have limited collateral and short track records. As such, they are weak candidates for traditional bank financing. Thus, SBIR grants can be a critical lifeline to these firms as they seek to refine their technologies and ideas. If successful, these firms can become the state's future technology leaders.

Maine-based businesses have enjoyed mixed success in terms of accessing grants from the SBIR and STTR (Small Business Technology Transfer) programs. According to the latest 2009 data, Maine ranks 36th in the U.S. in terms of SBIR/STTR funding as a Percent of Gross State Product (see **Figure 3.9**). When compared to the benchmark states noted earlier, Maine firms enjoy greater success in accessing SBIR awards. For

example, in 2009, thirteen SBIR awards were granted in Maine.[12] This outpaced award totals in Idaho, Nebraska, Rhode Island, South Dakota, and West Virginia. Firms in New Hampshire and New Mexico, the home of large Federal research facilities, outperformed Maine firms in 2009.

Figure 3.9



Because of their technology focus, firms that access Maine's R&D programs also tend to seek out SBIR grants and other Federal research funds. These companies have enjoyed some success. In the 2010-2011 survey, 8.2 percent of respondents had received some type of Federal grant for R&D in the most recently completed fiscal year. The total value of these awards exceeded $16.5 million. SBIR/STTR funds account for the vast bulk of these awards, and the data suggest that surveyed firms may account for nearly all SBIR grants in the state of Maine. In fact, it appears that nearly every Maine-based SBIR recipient has also accessed state R&D support; this is likely due in large part to the fact that the Maine Technology Institute assists applicants to submit competitive proposals.

As **Table 3.4** indicates, sixteen surveyed firms (5.7 percent of respondents) received either an SBIR Phase I or Phase II award or a STTR award during their most recently completed fiscal year. This compares to 12 (or 3.3 percent of respondents) who received

[12] See SSTI, *SBIR Phase 1 Awards and Proposals 2009.* Available at: http://www.ssti.org/Digest/Tables/051910t.htm

an SBIR or STTR award in 2009-2010. In 2010, these 16 SBIR/STTR awards accounted for $3.8 million and 7 awards from other federal programs accounted for roughly $13 million. Most SBIR/STTR awards tend to be somewhat small, averaging $237,000 per award in the past year. Other Federal R&D investments tend to be of larger size and scope.

Table 3.4

Federal Award	All Respondents 2010-2011 Number of Awards	Total $ of Awards
SBIR Phase I or Phase II	15	$ 3,653,326
STTR	1	$ 150,000
Total	16	$ 3,803,326

Federal Award	All Respondents 2009-2010 Number of Awards	Total $ of Awards
SBIR Phase I or Phase II	11	$ 4,176,215
STTR	1	$ 400,000
Total	12	$ 4,576,215

As comparisons of equity, debt and federal funding show, government funds have become a critical source of patient capital for Maine's technology sector. In fact, in 2010 these Federal funds represented roughly 1/3 or all outside capital raised by survey respondents.

3.3 Competitive and Well-Connected Innovation Industries

The bottom line for any technology or innovation-focused economic development strategy is no different from other economic development strategies: to create new jobs and to improve Maine's future economic prosperity. Investments in new technology and innovations make sense because technology or innovation-based businesses tend to create more jobs, to create better-paying jobs, and to generate more wealth for the company and the surrounding community.

The 2010 Maine Science and Technology Plan is based on this logic, and recommends that that Maine continue to support investments that help Maine businesses create better-paying jobs and careers, while also supporting initiatives that build and attract a more highly skilled and technology-savvy workforce. [13] Success on this front should be reflected in several ways. First, Maine R&D investments should help companies create more jobs. Second, they should help these firms create better jobs, i.e. jobs that pay higher wages and provide better career options. Third, the investments should help firms develop new technologies that can become new products, services, and processes. Finally, these efforts should help create a more robust Maine innovation infrastructure that support a more skilled and better trained workforce.

Are Maine's R&D Investments Creating New Jobs?

Past editions of this survey have indicated that Maine's technology sector is an important generator of new jobs. However, in the past two years, Maine's technology firms have been hard hit by the economic downturn, and their capacity to create new jobs has been similarly hampered.[14] As **Figure 3.10** shows, between 2009 and 2010 total average employment in Maine's targeted technology sectors remained flat. This stagnant performance actually outpaces national benchmarks; total employment in the U.S. in the same targeted technology sectors dropped by 1.7 percent. Overall employment in Maine dropped 0.7 percent in 2010, while the total U.S. employment levels decreased by 0.6 percent.

Job Growth by Sector: As **Figure 3.10** shows, employment patterns differ greatly by sector. After years of job loss, composites and advanced materials (up 4.3 percent) grew rapidly in the 2009-2010 time frame. Meanwhile, information technology (-7.9 percent) and forest products/agriculture (-6.8 percent) saw big job declines. More long-term data for the 2006-2010 timeframe suggest that many of Maine's leading technology sectors have faced significant challenges that may have preceded the current downturn. Closing these employment gaps will require more rapid job growth in coming years.

[13] 2010 S&T Plan, pp. 16-17.

[14] A detailed list of Maine's Targeted Technology Sectors is contained in Appendix C.

Figure 3.10

Percent Change in Average Annual Employment - Maine

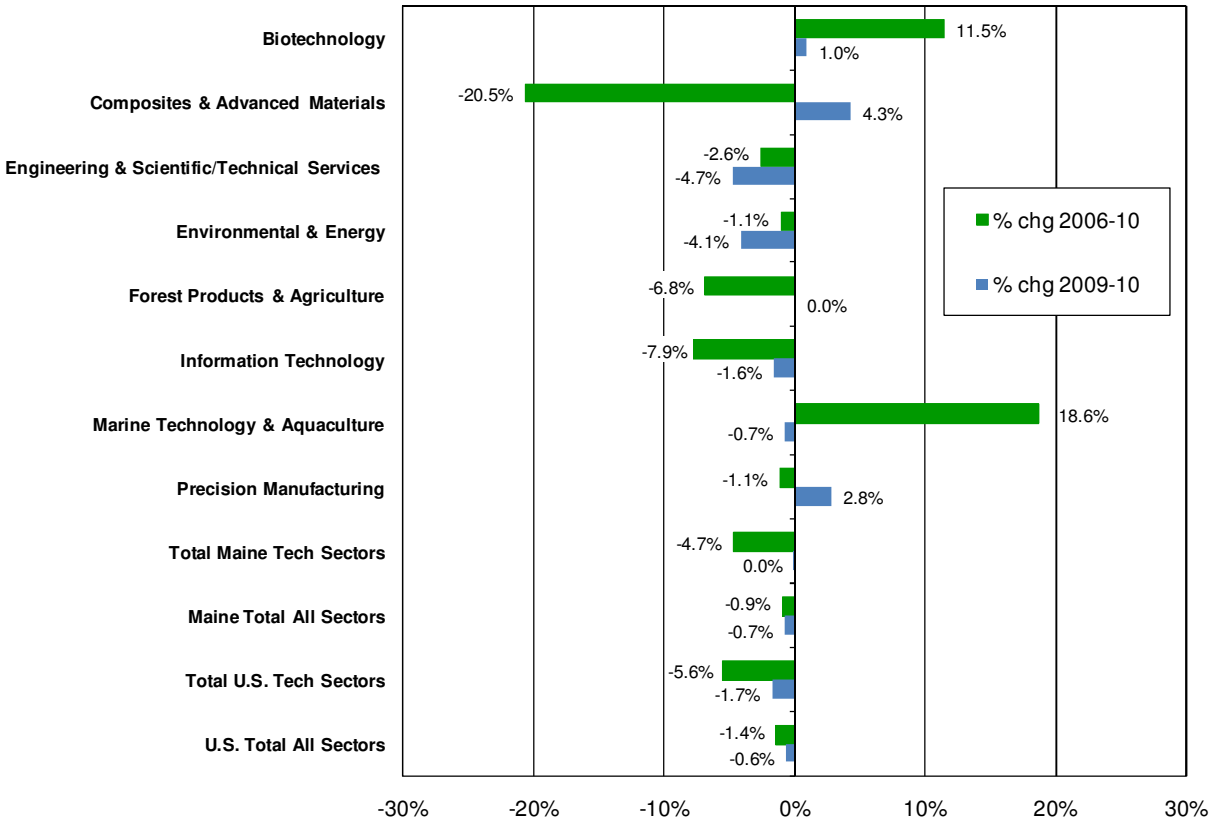
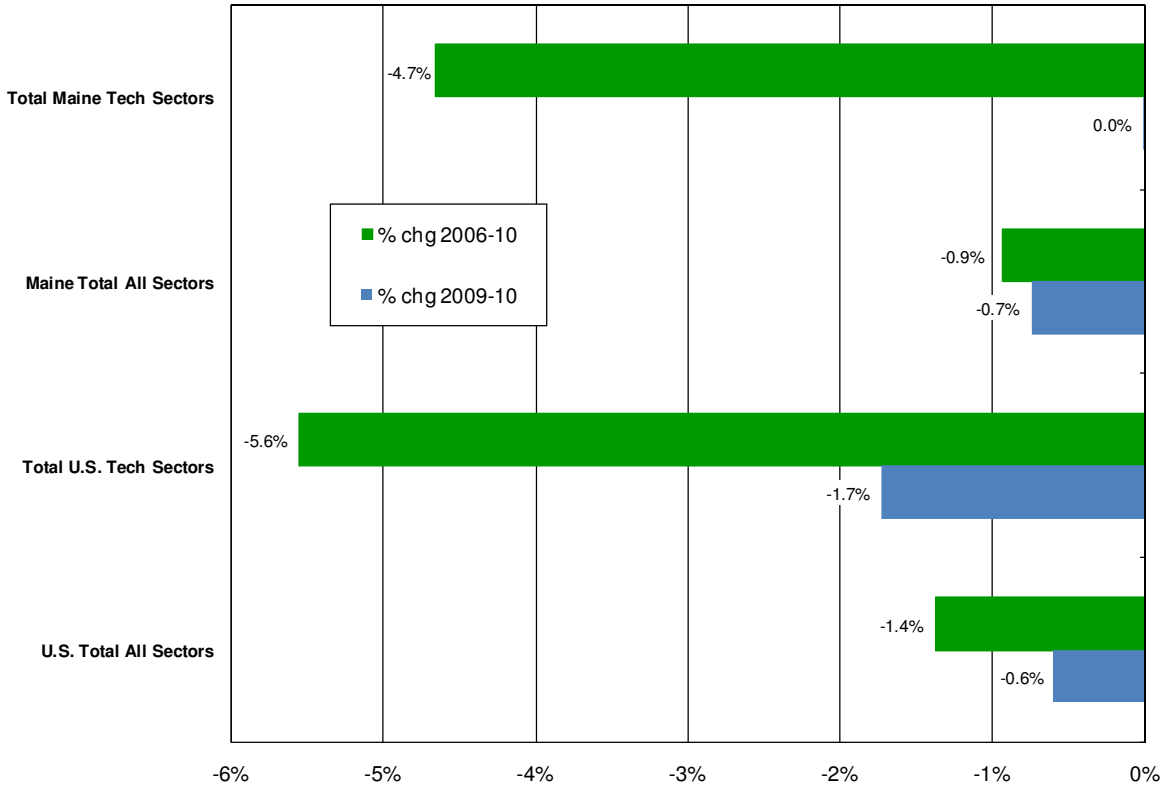


Figure 3.11

Percent Change in Average Annual Employment



During the 2006-2010 timeframe, Maine's targeted technology sectors lost 3,454 jobs. While a few sectors, especially biotechnology, succeeded in creating net new jobs, these totals were outpaced by major job losses in leading sectors such as composites and advanced materials, engineering and scientific/technical services, environment and energy, forest products and agriculture, information technology, and precision manufacturing. In fact, the forest products and agriculture sector alone accounts for 68.3 percent of the job loss. (See **Table 3.5**)

Table 3.5

2006-2010 Employment Trends by Sector

Cluster Summary - Employment Change 2006-10	2006	2007	2008	2009	2010	# Change 2006-2010	% of 2006-2010 Losses	% of 2006-2010 Gains
Biotechnology	5,411	5,743	5,935	5,976	6,033	622		96.58%
Composites & Advanced Materials	1,529	1,588	1,552	1,165	1,215	-314	7.71%	
Engineering & Scientific/Technical Services	4,539	4,681	4,868	4,642	4,422	-117	2.87%	
Environmental & Energy	1,713	1,890	1,953	1,768	1,695	-18	0.44%	
Forest Products & Agriculture	40,826	40,561	40,439	38,028	38,043	-2,783	68.31%	
Information Technology	9,080	9,180	9,132	8,498	8,365	-715	17.55%	
Marine Technology & Aquaculture	118	122	128	141	140	22		3.42%
Precision Manufacturing	11,082	10,862	11,525	10,653	10,955	-127	3.12%	
Total Maine Tech Sectors	74,157	74,467	75,381	70,710	70,703	-3,454		
Total Tech Sectors Jobs Lost						-4,074		
Total Tech Sectors Jobs Gained						644		
Total Tech Sectors Jobs Net						(3,430)		

*Total Maine Tech Sectors does not equal Total Tech Sectors Jobs Net and it's components due to duplicate industries included in the individual industry sectors and not in Total Maine Tech Sectors

This year's survey respondents were not immune to the effects of the economic downturn. As a group, they reported a slight decline in total employment levels. These firms employed 108 fewer workers in 2010, representing a 2.8 percent decrease in employment from the previous year.

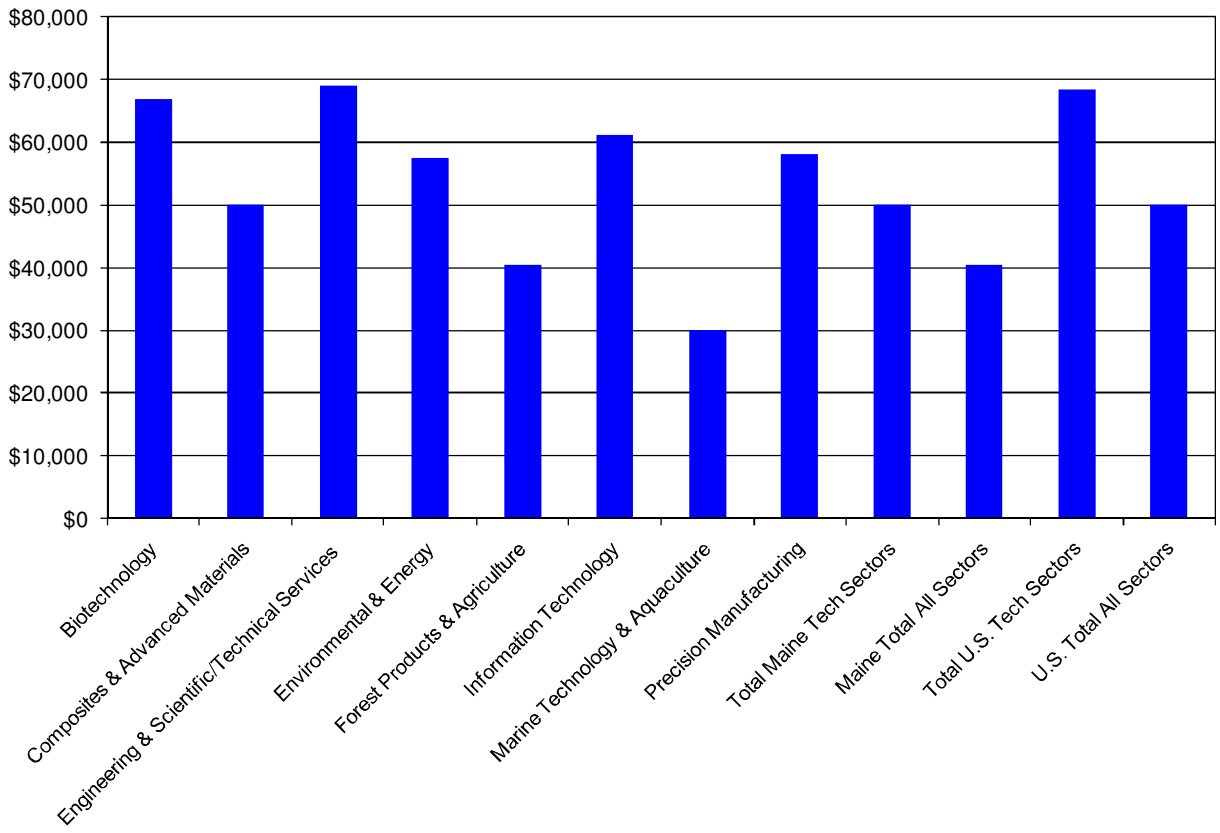
Are Maine's R&D Investments Creating Better Jobs?

While overall job growth numbers have been less positive than many had hoped, there is some good news on the job front. Data from our surveys and related research suggest that Maine's technology sector is helping to create better jobs and career opportunities for Mainers. Overall wage levels vary by sector, but, in most cases, Maine's technology businesses pay significantly higher wages when compared to statewide averages.

Wages: Figure 3.12 provides details on average wages per worker in 2010. Engineering & scientific/technical services ranked the highest with an average wage of $69,049 followed closely by biotechnology at $66,746, while Marine Technology came in the lowest at an average wage of $33,077. The average wage of all of Maine's targeted technology sectors was $49,053, which was higher than Maine as a whole at $40,399. However, this average was lower than that for both the U.S. targeted technology sectors at $68,291 and the U.S. total average of $50,104.

Figure 3.12

Average Earnings Per Worker - 2010



* note all sector numbers are for Maine

Firms that responded to the 2010 survey reported that their average wages reached $43,722 in 2010. This figure represents a slight increase from last year's average of $43,292. This average falls below national salary averages but does outpace Maine's statewide average salary of $40,399. Maine's technology firms are succeeding in creating better paying, higher quality jobs.

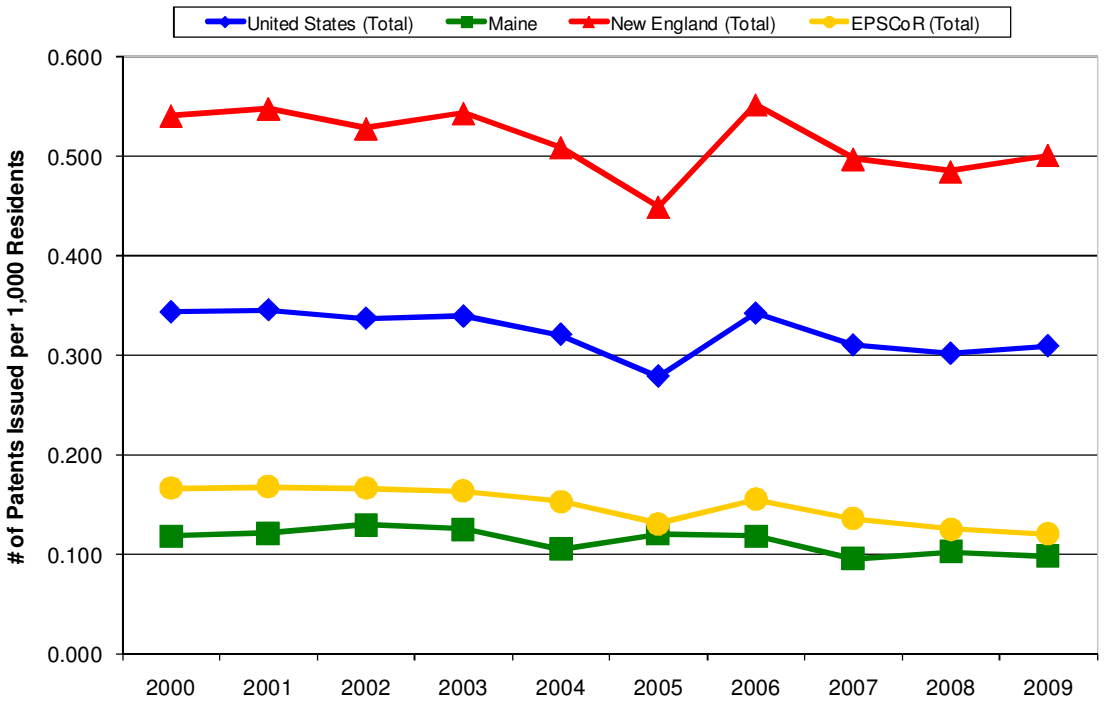
Are Maine firms succeeding in developing new technologies?

Investments in R&D have been shown to help generate real bottom line impacts in terms of economic development and prosperity. But, technology and new ideas do not have this impact on their own. They must be converted into new products, processes, services, and technologies. Patents and other forms of intellectual property help firms and researchers protect their rights, but they also serve as important proxy measures of whether a firm or a region is developing research with important commercial potential.

Patents: Maine has traditionally lagged other benchmark states in various measures of patenting activity. One key metric is the number of patents issued per 1,000 residents. On this measure (2009 data), there were 0.099 patents issued per 1,000 Maine residents in comparison to 0.310 for the U.S. as a whole, 0.502 in New England, and 0.121 among the EPSCoR states. This trend has remained relatively consistent for the past decade. In 2009, Maine's national ranking remained unchanged from 2008 at 42nd. (See **Figure 3.13**)

Figure 3.13

Patents Issued (all types) per 1,000 Residents 2000-09



Licenses, Copyrights and other Intellectual Property: Customers of Maine's R&D programs have aggressively pursued intellectual property protections for their technologies and products. As indicated in **Table 3.6,** sixty-one percent of all respondents report that they have used or intend to use a form of intellectual property protection (Patents, Trade Secrets, Licensing, Copyrights, Trademarks, or other) for one of their discoveries. This cohort likely represents a significant portion of the state's overall intellectual property activity. Data presented in this year's Innovation Index shows that Maine has averaged roughly 120-160 patents per year for the past five years.[15] In 2010, 88 were granted to survey respondents and an additional 197 patent requests were either filed for a patent or in the process of being filed. While not all of these

[15] *Maine Innovation Index 2011*, pp. 37-38

applications will be approved, it is clear that Maine R&D program users constitute a large part of Maine's overall patent portfolio.

Table 3.6

Intellectual Property Protection	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
Yes	172	61.2%	195	50.4%
No	109	38.8%	192	49.6%
Total	281	100%	387	100%

Additionally, 43 percent have or plan to enter into a licensing agreement and 26 percent of those will be agreements with companies in Maine (see **Table 3.7**).

Table 3.7

Licensing Agreements	All Respondents 2010-2011 Number of Companies	Percent	All Respondents 2009-2010 Number of Companies	Percent
Yes	74	43.3%	78	39.4%
No	33	19.3%	36	18.2%
Not Sure	64	37.4%	84	42.4%
Total	171	100%	198	100%

License Locations	All Respondents 2010-2011 Number of Companies	Percent	All Respondents 2009-2010 Number of Companies	Percent
Maine	45	26.3%	46	23.2%
Not in Maine	52	30.4%	53	26.8%
Not Sure	74	43.3%	99	50.0%
Total	171	100%	198	100%

Maine's technology businesses do not operate in a vacuum. They rely on many key parts of the state's broader innovation infrastructure. Many of their activities are based on closer partnerships with universities who provide technical assistance, research support, and other partnership opportunities. Many of Maine's leading technology sectors have emerged and continue to thrive thanks in part to their close partnerships with university researchers and research centers located across the state. For example, many firms involved in the Maine Composites Alliance have benefited greatly from collaboration with the University of Maine's Advanced Composites and Structures Center. Recent

projects include the development of hybrid composite concrete bridges and a whole host of initiatives to develop offshore wind generation capacity.

University Technology Transfer: University-industry partnerships and research activities are also generating improved outcomes in terms of increases in university spin-off companies and licensing activity between business and academia. In addition, research institutions are generating their own intellectual property. While the number of disclosures dropped slightly in 2010, the number of patent applications and licenses did grow rapidly this year. Given the jump in total R&D it is not surprising that the total number of patent applications doubled, while the number of signed licensing agreements grew by thirty-three percent.

Meanwhile, data from this year's analysis suggest that Maine's universities and research centers have been making progress in their capacity to support innovation-based economic development in Maine. These trends are welcome. 2010 data indicate progress in several key areas:

- Licensing Agreements: In 2010, research institutions signed five licensing agreements with Maine firms, up from only two in 2009.
- License Income: Total income from licensing activity reached $1.521 million last year, up slightly from 2009.
- New licenses: Nonprofits saw a sharp increase in licenses from 19 in 2009 to 36 in 2010. This was due to a breakthrough discovery by Jackson Labs, which illustrates the potential for technology transfer.
- New Firm Spin-Offs: Six new firms were spun-off from research centers in 2010, up from four such firms last year.
- New Jobs at Spin-off Firms: These new firms accounted for fifteen new jobs in 2010, up from only four jobs last year.

Given the increase in total R&D, it is not surprising that the universities and nonprofits experienced an increase in the intellectual property created by this research. Yet, compared to the U.S. average for measures of technology transfer, Maine's rate of commercializing research still underperforms. **Table 3.8** projects the levels of commercialization that might occur in Maine if universities and nonprofits were performing at the same level as the average for the 189 universities that report technology transfer activity to the Association of University Technology Managers (AUTM). The table takes AUTM averages and predicts performance based on two sets of data: the total reported to the National Science Foundation for all Maine universities, and the R&D expenditures reported through the evaluation survey each year.

Data indicate that the universities underperform for both sets of predicted results, suggesting that while overall R&D is increasing, the commercialization of research has not kept pace with this level of growth. Invention disclosures and issued patents were

about half of what might be expected from this volume of research. License agreements were weak at universities but strong at nonprofit institutions.

Table 3.8

Predicted and Actual Technology Transfer Metrics for Maine Universities

	Average U.S. for universities, hospitals, and nonprofit inst.	Predicted for all Maine universities based on NSF data reported for public & private universities	Actual for universities (survey totals)	Predictions based on the total R&D reported in evaluation survey to universities & nonprofits	Actual for both universities and nonprofits in Maine (survey totals)
Invention disclosures	**$2.46m in R&D expenditure per disclosure**	**52 disclosures**	**27**	**104 disclosures**	**43**
Patents Issued	**$13.47m in R&D expenditure per filed patent**	**9.5 patents**	**4**	**19 patents**	**6**
Licenses	**$9.55m in R&D expenditure per license**	**13.4 licenses based on survey reporting**	**6**	**27 licenses**	**42**
Start-ups	**$88m in R&D expenditure per start-up**	**1.5 start-ups per year**	**4**	**3 start-up**	**5**

Source: AUTM 2008 survey data was used to calculate U.S. averages for university, hospital, and nonprofit institutions. Predictions for Maine were calculated using AUTM averages and reported R&D expenditures in the current survey of nonprofits and the total university R&D reported to NSF ($128 m). Outcomes for Maine were determined by the 2010 survey results indicating $258 million for total university and nonprofit R&D.

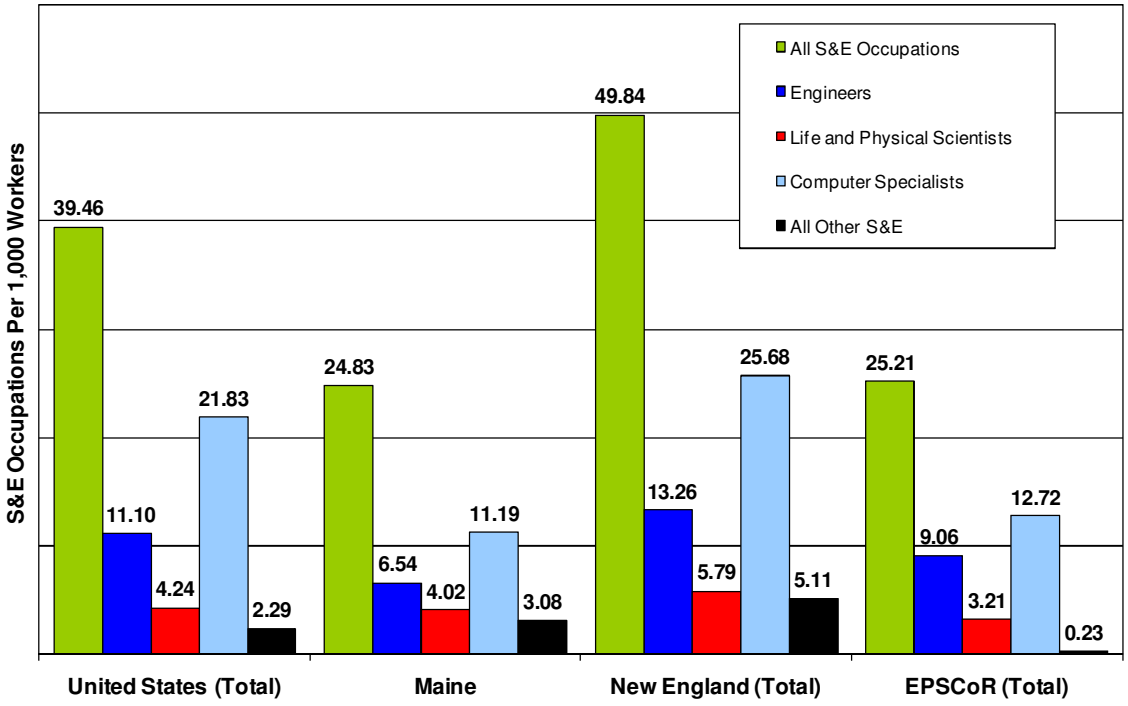
Are New Innovation Capacities and Infrastructure Being Developed?

Science and Technology Workforce: The development and expansion of a technology-savvy workforce is both a cause and an outcome of success in building critical innovation capacities and infrastructure. States with a large pool of workers with science and engineering training will be more attractive to technology firms seeking to relocate and even to home-grown entrepreneurs seeking to build their own ventures. As these firms grow, they hire and train more workers, thus creating a growing pool of technology savvy employees, managers, and entrepreneurs.

Data from this year's Innovation Index suggest that, if Maine seeks to create this virtuous cycle, it must do a better job of creating, supporting, and attracting a technology-savvy workforce. When compared to national or New England benchmarks, Maine has a lower proportion of workers in key science and engineering occupations. In 2008, there were an estimated 17,000 science and engineering (S&E) occupations in Maine's workforce. This represented 24.83 S&E occupations for every 1,000 Maine workers, a proportion that lagged behind the U.S. as a whole (39.46) and New England (49.84), but was on par with the EPSCoR states (25.21). Maine improved one spot in national ranking from 44th in 2006 to 43rd in 2008. (See **Figure 3.14**)

Figure 3.14

S&E Occupations in the Workforce Per 1,000 Workers – 2008



In terms of building a future science and engineering workforce, data from this year's Innovation Index do indicate some positive trends. Over the past decade, Maine has seen important improvements on key measures such as science and engineering graduate enrollments, degrees awarded, and overall educational attainment.[16] However, in most cases, these growth rates have simply kept pace with U.S. and regional benchmarks.

[16] Maine Innovation Index 2011, pp v.

Maine Technology Asset Fund: In 2007, the Maine State Legislature authorized and Maine voters approved $50 million in bond funds for" research, development and commercialization projects that boost economic development and create jobs across the State." In 2010 voters approved an additional $3 million in for this fund. The Legislature directed the Maine Technology Institute (MTI) to administer this fund and MTI established the Maine Technology Asset Fund (MTAF) in response to this directive.

MTAF is a competitive award program to fund capital and related expenditures supporting research, development and commercialization projects that will lead to "significant" economic benefits for Maine. The expenses may include facilities construction and renovation, machinery and equipment (including computers, software and licenses required for their use, as well as related technician training for operation of equipment and machinery purchased) and land purchase. This may also include expenses directly associated with the acquisition and installation of such assets. The awards may not be used to fund ordinary annual operating expenses. Awardees can be academic and not-for-profit institutions or private companies.

Since 2008, the MTI Board has awarded approximately $53 million to fund 35 projects in three competitive rounds. For this year's annual R&D evaluation MTAF data was available and findings are reported assessed on the first two rounds of funding. Detailed findings are contained In Appendix D. Milestones to date for MTAF Rounds 1 and 2 include:

- 25 awards made
- $45.6m contracted through the awards
- $68.4m in amount of funding matched by the awardees or $1.50 in match for every $1.00 in award
- $21.2m in funds have been spent to date or 46.5% percent of contracted amount
- $24.4m in funds are remaining to be spent by awardees or 53.5% of contracted amount.

What Impact Do Companies Being Supported By Maine R&D Funding Have On The Maine Economy?

The following economic impact assessment was completed as part of the 2010 Maine Comprehensive Evaluation of R&D Investments and is based on 253 companies supported by State funded R&D Programs. Details regarding the methodology are contained in **Appendix B**.

R&D Performed

- In 2010 the companies received a total of $2,608,725 in state funding for R&D related activities.
- In 2010 the companies expended a total of $27,017,248 on R&D from all sources of revenues.

- **Therefore in 2010 the ratio of state dollars to total R&D performed was $1:$10**

Employment

- In 2010 these companies directly employed 3,545 persons
- This generated an estimated additional 5,898 indirect jobs
- **This resulted in an estimated total job impact of 9,443 jobs**

Revenues

- In 2010 these companies generated a total of $913,359,702 in revenues from all sources
- This generated an estimated additional $665,569,167 in indirect revenues
- **This resulted in an estimated total revenue impact of $1,578,928,869 or $605 in revenues for every $1 spent in R&D support in 2010 ($350 direct revenues plus $255 indirect)**

4. Recommendations

These recommendations focus on addressing the most critical innovation gaps in Maine and accelerating the creation of business and jobs in high growth industries. It is clear from data, surveys and interviews that the growth of existing innovation-based industries and the capacity for industry to conduct R&D is perhaps the most pressing of all R&D issues in Maine. For this reason, this year's R&D recommendations will focus on three themes:

Fostering the Growth of Existing Innovation-based Companies

Building Lasting Entrepreneurial Capacity and Accelerating Early-stage Growth

Enhancing Overall Industry R&D and Competitiveness

Each theme will highlight award-winning and best practices of other states and region, the progress made in Maine, and specific recommendations for moving ahead. Details of other state and regional programs are found in Appendix F.

Fostering the Growth of Existing Innovation-based Companies

Help Existing Innovation-based Companies Grow through Market Expansion

As we have noted in our accompanying case study, *From Business Assistance to Market Expansion*, Maine-based firms must make more aggressive efforts to compete and win in the global marketplace. Maine's entrepreneurs need to "think global" from the start and seek out new market opportunities elsewhere in the U.S. and overseas.

Maine-based businesses need to embrace a global mindset, but they could also benefit from a more robust set of support tools. Maine is home to several useful initiatives, such as the Maine International Trade Center (MITC), which helps firms succeed in export markets. Yet these important support programs are greatly underfunded; especially when compared to similar efforts in other states and in other nations. Programs like MITC need additional funding and support. At the same time, existing technology and economic development programs should also embrace this new mindset. Finally, leading technology trade associations can also provide support via training and by linking their members into wider national and global business networks.

Expand Opportunities by Being a "Go-To" Place for Specific Industry Expertise

To improve its competitive position, Maine must become very strategic about managing its R&D investments. While overall capacity is critical, it is not enough to simply have an assortment of institutions and companies performing research. Research has shown that the economic impact of R&D reaches its peak when research becomes a differentiating asset—"the place to go" for specific knowledge and technologies. In these cases, leveraged assets of industry, academic and nonprofits create a sum that is greater than the parts. While Maine has identified a number of industry sectors with R&D needs and growth potential, it has not necessarily established a global reputation around specific sets of differentiating assets.

Successful state technology-based economic development (TBED) efforts, especially in smaller states with more limited resources, tend to focus on allocating public funds toward fewer, larger, and strategic R&D and cluster efforts (rather than multiple unconnected projects). These projects (detailed in previous R&D evaluations) are industry-driven, have strong connections between the private sector and academic or nonprofits institutions, and make strategic plays for national and international markets where their expertise or technology is a key or differentiating asset.

Since nationally, over 80 percent of R&D comes from the private sector, Maine may want to increase or reallocate a greater portion of its R&D investments to industry driven efforts; concentrating funding in fewer projects with more funding per project and in industries and technology platforms where the state has differentiating assets, and global market projections indicate high levels of growth. For example, Maine's expertise in composites, environmental and engineering services, and advanced structures has been leveraged to create the Maine Wind Industry Initiative and the state's ocean and tidal energy efforts. However, research on materials, environmental assessments and energy transmission systems have applications in both wind and ocean energy. Much could be gained by connecting these and other related projects under a combined signature research initiative that can be more proactively marketed and aggressively pursue funding from strategic industry partners and federal agencies.

Building Lasting Entrepreneurial Capacity and Accelerating Early Stage Growth

There are several key strategies that would support the accelerated growth of innovation-based companies in Maine. Some of these recommendations have been made in previous R&D evaluations, yet remain viable strategies since there is still a need in Maine and the progress of best practices in other states reinforces the value of these recommendations.

Maximize the Growth Potential of Startups and Early Stage Companies

Providing funds that help companies launch a business and bring a technology to advanced stages of commercialization is critical for attracting angel and venture capital. Maine's early stage investment programs like Maine Technology Institute Seed Grants and Development Awards provide approximately $5 million in capital per year. Research clearly indicates that early stage funding is most successful when it is connected with hands-on advisory services to ensure the business model and management team is being effectively developed alongside the technology. In Maine, the majority of early-stage funding programs have little direct advisory capacity attached to the funding; although MTI has strengthened its referral network and conditions of awards to include more advisory services, intense advisory services are not yet automatically a part of their early stage funding.

A growing number of regions and states are enjoying great success with new programs that help to connect capital with advisory services and maximize the economic impact of state support. Examples include Northeast Ohio's JumpStart Ventures and Oklahoma's i2E Technology Business Finance Program and Seed Fund. In addition, the new Federal Start-Up America project also utilizes this approach. Maine should build on recent efforts to connect capital to business development by providing more direct advisory services alongside and connected to state funding, with such services being provided by experienced entrepreneurs and investors.

Establish Growth Focused Entrepreneurial Networks

Many states and regions across the U.S. are recognizing that local entrepreneurs face significant challenges in accessing the resources and capabilities they need to start and grow new ventures with world class coaching, mentoring, and access to larger pools of capital and emerging markets. Smart regions are building or supporting organizations that provide these critical connections. These organizations do more than provide an entrepreneurial boot camp course or after hours networking, they view their primary role as that of a resource broker to help the entrepreneur launch and grow their business. They provide ongoing assistance--connecting budding entrepreneurs with experience ones, hosting CEO forums, organizing venture forums and connections to capital networks, etc. The organizations can assume multiple names like Entrepreneurial Support Organizations (ESOs), entrepreneurial networks, or even enterprise builders. Well-known examples include Tech Columbus (Ohio), North Carolina's Council for Entrepreneurial Development, Oklahoma's i2E, and the Oregon Entrepreneur's Network.

Some nascent efforts to encourage similar networks in Maine are already underway. These include the informal Maine Entrepreneurs Network, which operates a popular LinkedIn discussion group, along with monthly meetings held in the Portland metro area. The Kennebec Valley Entrepreneurial Network and the Eastern Maine Development

Corporation are promoting networking in other parts of the state. In addition, the Maine Center for Enterprise Development's Top Gun program offers a 15-week curriculum based training and mentoring program which provides a strong education foundation for entrepreneurs. Maine, however, is missing a more formal and complete entrepreneurial organization that pulls these threads together and connects them with growth related programs such as export assistance.

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Help Small Companies Demonstrate Their Market Potential

Another way in which states are helping early stage companies grow is to provide demonstration funding and connections to strategic industry partners. Similar to federal contracts, this is a way in which small companies can validate their products or service and attract new clients or enter new markets. These demonstration programs are particularly popular in emerging markets such as renewable energy or clean technology, and in areas where the state has set specific goals like energy efficiency and wants to use in-state companies to help achieve those goals. Examples of accelerator and demonstration projects include the following:

Southwest Pennsylvania's **AlphaLab** is an intensive, 20-week program for launching the next generation of software, entertainment technology and Internet-related companies.

The Connecticut Clean Energy Fund (CCEF) created the Operational Demonstration Program in August 2005 to enable early-stage companies to demonstrate the effectiveness of their own near-commercial, clean-energy technologies.

In Colorado, the state strategy for cleantech recommended that utilities partner with Colorado start-up companies to demonstrate new technologies. Xcel Energy, with approval from the Colorado Public Utilities Commission, has established the **Innovative Clean Technology (ICT) Program** to test promising new technologies with potential to lower greenhouse gas emissions and result in other environmental improvements.

The current MTI cluster program provides an opportunity for funding of this type of pilot collaboration in a more limited scale; yet additional means to specifically connect small firms to larger Maine companies may be needed.

Enhancing Industry R&D and Competitiveness

Increase Access to Federal R&D Funding

Maine ranks below the U.S. average in terms of federal funding for industry R&D. During our interviews with successful Maine exporters, many entrepreneurs described

how Federal contracts and grants served as important company validators. This funding helped the firm to validate its product, attract new clients, and grow jobs and revenue. It is time consuming, however, for companies to seek out, evaluate and prioritize which federal program best fits their needs. States that receive a higher percent of federal funding tend to have active state and regional programs that act as an intermediary or a navigator to help companies find relevant federal resources. While Maine offers some assistance, it is limited.

Small Business Innovation Research (SBIR) awards are one of the most effective ways to help industry advance the commercialization of a new technology. States with active and adequately funded assistance programs and matching dollars have a higher rate of SBIR awards per capita and more companies participating in R&D. For example, **North Carolina** received 94 Phase I SBIR awards in 2009 (417 SBIR applications). Their state program matches 100 percent or up to $100,000 for Phase I awards to help make them more competitive to receive larger phase II commercialization grants. **Michigan** provides $1.4 million each year and matches 25 percent of Phase I and Phase II; in 2009, the state received 87 Phase I SBIR awards. States like **Minnesota and Oregon** actively promote SBIR among their industry associations, the SBDC network and other venues. In 2009, Oregon received 45 awards as compared to Oklahoma (the same size state) with only 13 awards. While matching grants can help companies take products to market faster, even just strong promotion of SBIR among the business community can help increase industry R&D.

There are other federal contracts and grants that can serve to validate a company's market potential for new products and technologies. To help firms minimize their investigation time and focus on options best suited to their needs, a growing number of states have developed programs where a dedicated staff person works with a contractor in Washington DC to identify programs within federal agencies like USDA, Economic Development Agency (EDA), Department of Energy and others in which companies would be qualified to apply. These opportunities are then communicated back to companies in the home state, providing companies with a much more targeted list of potential funding. These efforts require minimal operational resources and can greatly expand funding opportunities that are made available to companies.

Maine, through MTI, has an SBIR assistance program that has limited funding. Yet, while the number of awards per capita in Maine relatively low, the ratio of applications to awards is fairly high, suggesting that the program generates better success rates. On average, there are almost six applications per award, yet in Maine the ratio is 4.3 applications per award. Maine should establish a federal liaison program to access other federal grants and contracts and expand the SBIR program beyond proposal assistance to also include business development or advisory services for companies. This will help to multiply the impact of this funding in Maine by helping entrepreneurs to be more

successful bringing their products to market, boosting revenues, and creating and sustaining jobs.

Establish an Industry-Supported Pathway to Commercialize University Research

States that appear to have growing success with technology transfer from universities tend to have a systematic program for spin-outs and strong support and partnerships from industry and investors. Programs in Austin, Texas, the Research Triangle region of North Carolina, the Tech Corridor of Florida, Oregon and others provide services to actively spin-out technologies by providing facilities, intensive entrepreneurial support services, and gap funding—all with heavy industry interaction.

One example that illustrates this systematic approach is the Georgia Research Alliance (GRA) **VentureLab program**. According to GRA, VentureLab helps create early-stage businesses that are ready to advance into traditional technology business incubators. VentureLab is more than just an incubator space, it has significant professional and advisory services that reduces both the costs and risks associated with technology transfer through one-stop centers that provide technology assessments and commercialization grants, as well as a Fellows program that connects faculty researchers with experienced entrepreneurs and professional managers who serve as coaches and drive the commercialization process forward.

Maine should establish a more coordinated effort that combine entrepreneurial education and mentoring efforts like Top Gun and others, with proof of concept funding and incubator facilities, alongside experienced private sector advisors to support and accelerate the spin-out of technologies and companies from Maine Universities. Currently, Maine's Center for Enterprise Development and Target technology Center has both mentoring and incubation, but lacks the critical proof of concept capital that many other states have.

Reward Companies that Grow their Innovation Workforce in Maine

Today, many companies, even smaller firms, have multiple locations in various states, allowing them to grow in areas where market demands are strongest and where there is a cost or strategic advantage to expand. Our interviews suggest that Maine companies tend to have multiple locations concentrated in the Northeast and Mid-Atlantic regions of the country, which is in close proximity considering the global markets for many of these firms. Our interviews also suggested that companies started or headquartered in Maine preferred to have their key R&D and product development staff in the state. However, incentives and business support networks in other states made it attractive to grow in places other than Maine. Therefore, in addition to enhancing support for business and entrepreneurial networks that were recommended earlier, the state should also review and modify tax credits and other incentives used to attract high technology companies.

The state should make modifications to High Technology Investment Tax Credit and Jobs & Investment Tax Credit to reflect the current environment of innovation-based companies. Many tax credits were developed in an era of recruiting large businesses rather than growing strong companies from within. Therefore, these tax credits may actually be counterproductive to the growth of start-ups into larger enterprises. Reducing job or investment requirements to be more in line with the size of today's science and technology companies would work to grow businesses that already have a foothold in the state.

Conclusion

Across the nation, states continue to make investments in R&D and innovation initiatives to maintain a competitive edge and to create high wage jobs. Maine is no different. However, without these investments, data suggests that the state would fall further behind in its economic competitiveness. Over time, Maine has made modest progress in many aspects of R&D, and in areas where the state has focused its investments (e.g. university R&D), more rapid improvements have been made.

Maine's recent R&D outcomes are a cause for cautious optimism. If these trends continue, they may indicate important progress in building a strong foundation for Maine's innovation economy. However, industry, the state's largest engine for R&D, is still woefully underperforming. Over the past ten years, state programs directed toward industry have been cut, and even though industry accounts for almost 60 percent of all R&D in Maine, it receives only 17 percent of the state's programmatic investments. This relatively weak performance is a potential concern as industry R&D is generally considered to have higher direct economic impact (jobs) and commercialization potential.

Yet, some of the key institutional ingredients---a growing base of tech-savvy workers and researchers, and effective research partnerships between industry and academia---appear to be emerging. As we have noted in this report and in previous evaluations, these outcomes are a necessary, but not sufficient, condition for success in the 21st century innovation economy. They must be accompanied by continued efforts to nurture the transition of ideas into commercial products and new businesses, and to grow companies by expanding markets and attracting talent.

Appendices

Appendix A: Data from Private Sector Survey

Appendix B: Economic Impact of Supported Private Sector Companies

Appendix C: R&D Institutions Survey Data 2002-2009

Appendix D: Findings Related to Funding for the Maine Technology Asset Fund

Appendix E: Target Technology Sector Description

Appendix F: Best Practices

Appendix A: Findings from Annual Private Sector Survey, 2010[17]

1. Survey Response

The total number of companies/entities surveyed in 2010–2011 is 826 (in comparison with 862 in the 2009-2010 survey). 323 companies/entities started the survey and 281 companies/entities have completed the survey for a response rate of 34.0 percent. This compares to 363 companies that completed the survey and a response rate of 42.1 percent for 2009-2010. The response rate for individual questions varies and is noted throughout the narrative.

2. Maine R&D Program Affiliation

826 total entities surveyed in 2010-2011, represented 995 awards or instances of assistance from State R&D programs, and the 281 total respondents to the survey represented 408 awards or instances of assistance. Entities can receive assistance from multiple programs. On a program basis response, 2010-2011 survey rates range from a low of 10.0 percent for the Small Enterprise Growth Fun (SEGF) to a high of 100 percent for the Experimental Program for the Stimulation of Competitive Research (EPSCoR). The response rate for Maine Technology Institute (MTI) clients is 73.3 percent.

	All Respondents 2010-2011		All Surveyed 2010-2011		2010-2011 Program
State R&D Programs	Number	Percent	Number	Percent	Response Rate
ATDC	32	7.8%	76	7.6%	42.1%
MAIC	1	0.2%	5	0.5%	20.0%
EPSCOR	1	0.2%	1	0.1%	100.0%
MPP	100	24.5%	499	50.2%	20.0%
MSCTCP	20	4.9%	59	5.9%	33.9%
SEGF	1	0.2%	10	1.0%	10.0%
MTI	253	62.0%	345	34.7%	73.3%
Total	408	100.0%	995	100.0%	41.0%

	All Respondents 2009-2010		All Surveyed 2009-2010		2009-2010 Program
State R&D Programs	Number	Percent	Number	Percent	Response Rate
ATDC	50	8.6%	106	9.5%	47.2%
MAIC	4	2.1%	9	2.0%	44.4%
EPSCOR	2	0.3%	2	0.2%	100.0%
MPP	136	26.9%	503	44.6%	27.0%
MSCTCP	31	6.7%	62	6.4%	50.0%
SEGF	8	1.8%	13	1.5%	61.5%
MTI	316	53.6%	393	35.7%	80.4%
Total	547	100.0%	1088	100.0%	50.3%

[17] All data is from Annual Survey of Private Sector Recipients of State R&D Support.

Note: State R&D programs include:

ATDC: Advanced Technology Development Centers
MAIC: Maine Aquaculture Innovation Center
EPSCOR: Experimental Program for the Stimulation of Competitive Research
MPP: Maine Patent Program
MSGC: Maine Space Grant Consortium
MSCTCP: Maine Seed Capital Tax Credit Program
SEGF: Small Enterprise Growth Fund
MTI: Maine Technology Institute. The program includes Development Awards, Performance Grants, Small Business Innovation Research Phase 0 Grants, and the Seed Grant Program.

In comparison between the 2009-2010 and 2010-2011 surveys, program response rates ranged from 5.1 percent (for the ATDC) to 51.5 percent (for the SEGF) higher in the 2009– 2010 survey, with the exception of the EPSCOR program, which had 100 percent response rate in both. The response rate for MTI clients decreased from 80.4 percent to 73.3 percent , or 7.1 percent .

3. Company Headquarters

Of the 283 companies/entities who responded to this question in the current survey, 273, or 96.4 percent, are headquartered in Maine.

Eleven companies are headquartered in the U.S., but outside of Maine. The other states represented are Alabama, Connecticut, Idaho, Massachusetts, New York, Ohio and Rhode Island. No companies reported having their headquarters outside of the United States.

In the previous survey, 317 companies responded to this question, and 302, or 95.3 percent, were headquartered in Maine.

4. Geographic Breakdown

County Breakdown	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
Androscoggin	6	2.1%	8	2.7%
Aroostook	7	2.5%	10	3.4%
Cumberland	94	33.2%	104	35.4%
Franklin	3	1.1%	7	2.4%
Hancock	17	6.0%	13	4.4%
Kennebec	16	5.7%	18	6.1%
Knox	9	3.2%	9	3.1%
Lincoln	12	4.2%	11	3.7%
Oxford	8	2.8%	6	2.0%
Penobscot	36	12.7%	37	12.6%
Piscataquis	0	0.0%	1	0.3%
Sagadahoc	8	2.8%	8	2.7%
Somerset	3	1.1%	2	0.7%
Waldo	5	1.8%	4	1.4%
Washington	8	2.8%	6	2.0%
York	40	14.1%	38	12.9%
Other State	11	3.9%	12	4.1%
Total	283	100%	294	100%

Regional Breakdown	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
Central	56	19.8%	58	19.7%
Eastern	25	8.8%	19	6.5%
North	7	2.5%	10	3.4%
South	134	47.3%	142	48.3%
Western	50	17.7%	53	18.0%
Other State	11	3.9%	12	4.1%
Total	283	100%	294	100%

Central region: Androscoggin, Kennebec, Knox, Lincoln, Sagadahoc, and Waldo
Eastern region: Hancock and Washington
North region: Aroostook
South region: Cumberland and York
Western region: Franklin, Oxford, Penobscot, Piscataquis, and Somerset

There were no significant changes between the 2009-2010 and 2010-2011 surveys as far as where company headquarters are located. Cumberland, Penobscot and York counties remain the counties with the highest representation.

5. Industry Breakdown

Industry Sector	All Respondents 2010-2011 Number	Percent	All Surveyed 2010-2011 Number	Percent
Advanced Materials & Composites	24	11.8%	33	10.8%
Advanced Technologies for Forestry & Agriculture	23	11.3%	35	11.5%
Biotechnology	25	12.3%	37	12.1%
Environmental Technology	24	11.8%	35	11.5%
Information Technology	34	16.7%	56	18.4%
Marine Technology & Aquaculture	24	11.8%	34	11.1%
Precision Manufacturing	46	22.5%	63	20.7%
Other	4	2.0%	12	3.9%
Total	204	100%	305	100%

Industry Sector	All Respondents 2009-2010 Number	Percent	All Surveyed 2009-2010 Number	Percent
Advanced Materials & Composites	37	12.2%	51	11.8%
Advanced Technologies for Forestry & Agriculture	38	12.5%	54	12.4%
Biotechnology	31	10.2%	42	9.7%
Environmental Technology	35	11.5%	49	11.3%
Information Technology	56	18.4%	86	19.8%
Marine Technology & Aquaculture	33	10.9%	49	11.3%
Precision Manufacturing	68	22.4%	88	20.3%
Other	6	2.0%	15	3.5%
Total	304	100%	434	100%

In 2010-2011, the 281 total respondents to the survey represented 204 sector instances. Entities can be classified within more than one industry sector. Sectors were assigned by the research team based on information provided by the entities, website research, project categories, etc.

In a comparison between 2009-2010 and 2019-2011, there are no noteworthy changes.

6. Year Organized

Year Organized	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
Pre-1980	21	7.4%	22	7.0%
1980-1984	13	4.6%	15	4.8%
1985-1989	13	4.6%	14	4.4%
1990-1994	21	7.4%	21	6.7%
1995-1999	33	11.6%	39	12.4%
2000-2004	77	27.1%	104	33.0%
2005-2009	106	37.3%	100	31.7%
Total	284	100%	315	100%

In 2010-2011, of the 284 respondents, 37.3 percent were organized within the last five years. A total of 64.4 percent were organized within the last ten years.

7. Number of Employees (including employer)

Number of Employees	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
1 - 10	210	81.1%	230	81.3%
11 - 20	14	5.4%	23	8.1%
21 - 30	6	2.3%	7	2.5%
31 - 40	5	1.9%	2	0.7%
41 - 50	6	2.3%	5	1.8%
51 - 100	10	3.9%	8	2.8%
101 - 499	7	2.7%	7	2.5%
500+	1	0.4%	1	0.4%
Total	259	100%	283	100%

Total number of employees this year: 3,825 (11.8 employees per firm average)
Total number of employees last year: 3,933 (12.1 employees per firm average)

Change in employment: 2.8% decrease / 108 fewer employees

*Note: The above data is based on the 2010-2011 respondents reporting their employment numbers for the prior month and twelve months prior.

8. Wages

Total wages and salaries paid this year: $167,240,051
Average wage and salary per employee this year: $43,722
Average wage and salary per employee last year: $43,292 (data based on 2009-2010 survey respondents)

Change in average wage and salary per employee: 1.0% / $430

9. Revenues

	All Respondents 2010-2011		All Respondents 2009-2010	
Company Revenues	Number	Percent	Number	Percent
$0	71	25.3%	66	21.9%
$1 - 49,999	65	23.1%	71	23.6%
$50,000 - 99,999	21	7.5%	28	9.3%
$100,000 - 499,999	57	20.3%	62	20.6%
$500,000 - 999,999	16	5.7%	19	6.3%
$1,000,000 - 4,999,999	25	8.9%	31	10.3%
$5,000,000+	26	9.3%	24	8.0%
Total	281	100%	301	100%

Company revenues earned this year: $926,491,953 ($2,868,396 per firm average)
Company revenues earned last year: $920,283,561 ($2,849,175 per firm average)

Change in company revenue: 0.7% / $6,208,392 (0.7% / $19,221 per firm average)

Revenue per employee this year: $242,220
Revenue per employee last year: $233,990

Change in revenue per employee: 3.5% / $8,230

*Note: The above data is based on the 2010-2011 respondents reporting their employment numbers for the prior month and twelve months prior.

10. Sources of Revenue

Revenues	All Respondents 2010-2011 Dollars	All Respondents 2010-2011 Percent of Total	All Respondents 2009-2010 Dollars	All Respondents 2009-2010 Percent of Total
Sales of Products and Services	$ 888,428,575	95.0%	$ 905,988,526	93.0%
Grants and Contracts	$ 30,104,885	3.2%	$ 15,833,817	1.6%
All Other Sources	$ 16,711,735	1.8%	$ 52,791,270	5.4%
Total	$ 935,245,195	100%	$ 974,613,613	100%

Note: The totals in the previous revenue section do not match the totals here because respondents utilized different sources of data for the two sets of questions.

11. R&D Expenditures

The respondents spent $34,123,504 in R&D in the reporting period ($180,548 per firm average).
The respondents spent $31,470,969 in R&D in the previous year ($106,321 per firm average) (data taken from 2009-2010 survey).

Change in R&D Expenditures: 70.0% / $74,227 per firm average

12. Corporate Income Tax Paid

The respondents spent $475,608 in Maine corporate income tax in the reporting period ($1,815 per firm average).
The respondents spent $828,414 in Maine corporate income tax in the previous year ($2,799 per firm average) (data taken from 2009-2010 survey).

Change in Corporate Income Tax Paid: -35.2% / -$984 per firm average

13. Tax Credits Claimed

Maine R&D Tax Credits Claimed	All Respondents 2010-2011 Number	All Respondents 2010-2011 Percent of Total	All Respondents 2009-2010 Number	All Respondents 2009-2010 Percent of Total
No	266	94.7%	284	95.9%
Yes	15	5.3%	12	4.1%
Total	281	100%	296	100%

There are no noteworthy changes in tax credits claimed between the 2009-2010 and 2010-2011 surveys.

14. Where are Your Customers?

Percent of Sales in Maine	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
0 - 10	187	66.5%	178	60.1%
11 - 25	14	5.0%	15	5.1%
26 - 50	16	5.7%	20	6.8%
51 - 75	15	5.3%	16	5.4%
76 - 100	49	17.4%	67	22.6%
Total	281	100%	296	100%

Percent of Sales Outside Maine, in U.S.	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
0 - 10	136	48.4%	137	46.3%
11 - 25	13	4.6%	13	4.4%
26 - 50	23	8.2%	27	9.1%
51 - 75	30	10.7%	27	9.1%
76 - 100	79	28.1%	92	31.1%
Total	281	100%	296	100%

Percent of Sales Outside of U.S.	All Respondents 2010-2011 Number	Percent	All Respondents 2009-2010 Number	Percent
0 - 10	246	87.5%	261	88.2%
11 - 25	14	5.0%	18	6.1%
26 - 50	13	4.6%	8	2.7%
51 - 75	4	1.4%	5	1.7%
76 - 100	4	1.4%	4	1.4%
Total	281	100%	296	100%

A comparison of the above three tables between the previous and current surveys shows no noteworthy increase in the percentage of sales occurring in Maine between 2009-2010 and 2010-2011, and a slight increase in those that have 51-75 percent of their sales outside of Maine, but in the U.S. There is a slight increase of 1.3 percent in the percentage of companies that have 26-50 percent of their sales outside the U.S.

15. Debt Financing

51 companies or 18.1percent (51 out of the 281 respondents who answered that question) accessed new debt financing during their most recently completed fiscal year.

In the previous survey year, 81 companies or 22.3 percent (81 out of 363 respondents who answered that question) accessed new debt financing.

	All Respondents 2010-2011		
Debt Financing Sources	Number of Transactions	Dollars of New Debt	Percent of Total Debt
Bank	27	$ 6,889,892	37.3%
SBA Loans	5	$ 1,159,500	6.3%
Friends and Family	15	$ 899,855	4.9%
Other	29	$ 9,542,206	51.6%
Total	76	$ 18,491,453	100%

	All Respondents 2009-2010		
Debt Financing Sources	Number of Transactions	Dollars of New Debt	Percent of Total Debt
Bank	32	$ 8,011,354	11.6%
SBA Loans	4	$ 244,000	0.4%
Friends and Family	22	$ 1,884,328	2.7%
Other	37	$ 58,925,918	85.3%
Total	95	$ 69,065,600	100%

Note: The number of transactions is greater than 51 because some companies/entities may have had multiple transactions.

In a comparison between the 2009-2010 and 2010-2011 surveys, bank financing has increased from 11.6 to 37.3 percent, an increase of 25.7 percent between the previous and current surveys. Financing from other sources has decreased from 85.3 to 51.6 percent, a decrease of 33.7 percent, driven primarily by a large loan received by one company in the prior year.

16. Equity Financing

30 companies or 10.7 percent (30 out of the 281 respondents who answered that questions) accessed new equity financing during their most recently completed fiscal year.

In the previous survey year, 48 companies or 13.2 percent (48 out of 363 respondents who answered that question) accessed new equity financing.

Equity Financing Sources	All Respondents 2010-2011 Number of Transactions	Dollars of New Debt	Percent of Total Debt
Venture Capital	5	$ 2,865,000	20.4%
State Seed Capital Funds	0	$ -	0.0%
Angel Investors	8	$ 3,187,000	22.6%
Friends and Family	5	$ 267,414	1.9%
Other	14	$ 7,754,880	55.1%
Total	32	$14,074,294	100%

Equity Financing Sources	All Respondents 2009-2010 Number of Transactions	Dollars of New Debt	Percent of Total Debt
Venture Capital	4	$ 6,902,688	31.6%
State Seed Capital Funds	0	$ -	0.0%
Angel Investors	19	$ 7,207,573	33.0%
Friends and Family	17	$ 578,733	2.6%
Other	15	$ 7,179,517	32.8%
Total	55	$21,868,511	100%

Note: The number of transactions is greater than 30 because some companies/entities may have had multiple transactions.

In a comparison between the 2009-2010 and 2010-2011 surveys, venture capital has decreased from 31.6 to 20.4 percent, a difference (decrease) of 11.2 percent between the previous and current surveys. Financing from other sources has increased from 32.8 to 55.1 percent, an increase of 22.3 percent.

17. Federal Awards

In the 2010-2011 survey year, 23 or 8.2 percent (23 out of 281 respondents who answered that question) of respondents received some type of Federal grant for R&D in the most recently completed fiscal year. The total of the awards was $ 16,482,655 ($50,716 per company average). 15 or 4.1 percent (15 out of 363 respondents who answered that question) of respondents in 2009-2010 received some type of Federal grant. The total of awards for 2009-2010 was $5,127,925 ($14,127 per company average).

16 or 5.7 percent (16 out of 281 respondents who answered that question) of respondents received either an SBIR Phase I or Phase II award or a Small Business Technology Transfer (STTR) award during their most recently completed fiscal year. This compares to 12 or 3.3 percent (12 out of 363 respondents who answered that question) of respondents who received an SBIR or STTR award in 2009-2010.

Federal Award	All Respondents 2010-2011 Number of Awards	Total $ of Awards
SBIR Phase I or Phase II	15	$ 3,653,326
STTR	1	$ 150,000
Total	16	$ 3,803,326

Federal Award	All Respondents 2009-2010 Number of Awards	Total $ of Awards
SBIR Phase I or Phase II	11	$ 4,176,215
STTR	1	$ 400,000
Total	12	$ 4,576,215

Respondents in 2010-2011 reported $3,803,326 in SBIR and STTR awards ($11,703 per firm average) which was a decrease of $772,889 or -20.3 percent from the 2009-2010 amount of $4,576,215 ($12,607 per firm average).

18. Intellectual Property

Did you or do you intend to use any form of intellectual property protection (Patents, Trade Secrets, Licensing, Copyrights, Trademarks, or other) for any of your discoveries?

Intellectual Property Protection	All Respondents 2010-2011		All Respondents 2009-2010	
	Number	Percent	Number	Percent
Yes	172	61.2%	195	50.4%
No	109	38.8%	192	49.6%
Total	281	100%	387	100%

Copyrights:
Did you or do you plan to use copyright protection?

Copyright Registration	All Respondents 2010-2011 Number of Companies	Percent (of 172)	All Respondents 2009-2010 Number of Companies	Percent (of 195)
Have Registered	12	7.0%	12	6.2%
Intend to Register	28	16.3%	38	19.5%
Filed	9	5.2%	19	9.7%
Not Sure	54	31.4%	62	31.8%
Total	103	60%	131	67%

The above table shows that 28.5 percent are in some aspect of actively pursuing copyright protection, compared to 35.4 percent of respondents in the 2009-2010 survey.
Comparing the previous and current survey years, the data show a decrease in all areas in number of companies, as well as a decrease in the percent of companies, except for those who indicated that they "Have Registered".

Licenses:
Did you or do you plan to enter into a licensing agreement?

	All Respondents 2010-2011		All Respondents 2009-2010	
Licensing Agreements	Number of Companies	Percent	Number of Companies	Percent
Yes	74	43.3%	78	39.4%
No	33	19.3%	36	18.2%
Not Sure	64	37.4%	84	42.4%
Total	171	100%	198	100%

	All Respondents 2010-2011		All Respondents 2009-2010	
License Locations	Number of Companies	Percent	Number of Companies	Percent
Maine	45	26.3%	46	23.2%
Not in Maine	52	30.4%	53	26.8%
Not Sure	74	43.3%	99	50.0%
Total	171	100%	198	100%

In the two tables above, a comparison of the survey years shows a slight increase from 39.4 percent to 43.3 percent, or 3.9 percent, from 2009-2010 to 2010-2011 in the percentage of companies who either did or plan to enter into a licensing agreement. The data also show an increase of 3.1 percent (from 23.2 to 26.3 percent) in the percentage of companies for whom Maine is or will be the licensing agreement location. There is also an increase of 3.6 percent and a decrease of 6.7 percent in the companies who did or plan to enter into a licensing agreement in locations other than Maine, or are not sure, respectively.

Patents:
Did you or do you plan to file for patent protection for any of your discoveries?

U.S patent protection:

U.S. Patent Protection	All Respondents 2010-2011 Number of Companies	Percent (of 325)	All Respondents 2009-2010 Number of Companies	Percent (of 363)
Have Filed	59	18.2%	61	16.8%
Intend to File	53	16.3%	66	18.2%
Granted	52	16.0%	47	12.9%
Rejected	6	1.8%	7	1.9%
Total	170	52%	181	50%

A comparison of survey years in the table above shows a slight increase of 1.4 percent from 2009-2010 to 2010-2011 in the percentage of companies that have filed, an increase of 3.1 percent in those that have been granted U.S. patent protect, and decreases of 1.9 percent and 0.1 percent in intending to file and rejected respectively.

U.S. Patent Protection	Patents 2010-2011	Patents 2009-2010
Have Filed	119	90
Intend to File	78	182
Granted	88	89
Rejected	7	7
Total	292	368

Foreign patent protection:

Foreign Patent Protection	All Respondents 2010-2011 Number of Companies	Percent (of 325)	All Respondents 2009-2010 Number of Companies	Percent (of 363)
Have Filed	27	8.3%	27	7.4%
Intend to File	28	8.6%	32	8.8%
Granted	18	5.5%	16	4.4%
Rejected	1	0.3%	2	0.6%
Total	74	23%	77	21%

The percentage of companies who have been granted foreign patent protection has increased from 4.4 percent to 5.5 percent from the previous to the current survey. The percent of companies that have filed has also increased and those who intend to file has decreased.

Foreign Patent Protection	Patents 2010-2011	Patents 2009-2010
Have Filed	93	62
Intend to File	160	205
Granted	37	25
Rejected	2	2
Total	292	294

For total U.S. and foreign patents granted this represents 0.38 per all respondent companies in 2010-2011 and 0.31 per respondent company in 2009-2010.

Trademarks:

Did you or do you plan to use trademark protection?

	All Respondents 2010-2011		All Respondents 2009-2010	
Trademark Registration	Number of Companies	Percent (of 172)	Number of Companies	Percent (of 195)
Have Registered	40	23.3%	38	19.5%
Intend to Register	39	22.7%	52	26.7%
Filed	39	22.7%	42	21.5%
Not Sure	42	24.4%	55	28.2%
Total	160	93%	187	96%

The above table shows that 68.7 percent of respondents are in some aspect of actively pursuing trademark protection (compared to 67.7 percent in the 2009-2010 survey). Additionally, comparing the previous and current survey years, the data in the table above show a 3.8 percent increase (from 19.5 to 23.3 percent) in the percentage of companies who registered for trademark protection, while the actual number of companies increased by 2.

Trade Secrets:

Did you or do you plan to use trade secrets?

	All Respondents 2010-2011		All Respondents 2009-2010	
Trade Secret Usage	Number of Companies	Percent	Number of Companies	Percent
Yes	72	42.1%	74	37.4%
No	51	29.8%	67	33.8%
Not Sure	48	28.1%	57	28.8%
Total	171	100%	198	100%

There is an increase of 4.7 percent (from 37.4 to 42.1 percent) in the percentage of companies who did or who plan to use trade secrets between the 2009-2010 and 2010-2011 survey years. There is a corresponding decrease, from 33.8 to 29.8 percent, or 4.0 percent, in the percentage of companies who did not or who planned not to use trade secrets.

Other Intellectual Property:
Did you or do you plan to use other intellectual property protection?

Utilization of Other Intellectual Property	All Respondents 2010-2011 Number of Companies	Percent (of 172)	All Respondents 2009-2010 Number of Companies	Percent (of 195)
Have Registered	2	1.4%	4	2.1%
Intend to File	26	17.6%	28	14.4%
Filed	8	5.4%	8	4.1%
Not Sure	56	37.8%	63	32.3%
Total	92	62%	103	53%

The table shows that 24.4 percent of respondents in the current survey are in some aspect of actively pursuing other intellectual property protection. This compares to 20.6 percent in the 2009-2010 survey.

19. Support Organizations

The tables below show the support organizations that were used and a ranking of how important the services were to the participating companies (1 = 'completely unimportant', to 5 = 'critically important').

Approximately 68 percent of the 325 respondents who answered this question in the 2010-2011 survey received some level of support from MTI during the survey period. This percentage showed a decrease from the 2009-2010 survey (in which there were 294 respondents who answered this question) of approximately 14 percent from 82 percent. More than 52 percent of those recipients in the current survey year found the assistance to be 'critically important', compared to more than 56 percent in the 2009-2010 survey year. Additionally, MTI received the highest mean score at 4.18 in the current year. MTI also received the highest mean score in the previous survey year at 4.19.

Support Organizations	All Respondents 2010-2011						
		Degree of Importance					
	Didn't Use	1	2	3	4	5	Mean Score
MTI	59	5	12	37	51	117	4.18
Umaine System	123	5	21	36	35	61	3.80
Maine Patent Program	161	7	22	24	26	41	3.60
Other Firms Outside Maine	128	7	25	49	39	33	3.43
Other Maine Firms	121	10	29	36	54	31	3.42
Education/Research Outside Maine	156	7	24	40	27	27	3.34
Other Educational Instutitions in Maine	197	5	17	24	22	16	3.32
Non-Profit Research Institutes in Maine	194	9	18	30	16	14	3.09
MSBDC	180	17	22	22	19	21	3.05
Trade Associations Outside Maine	169	8	35	34	21	14	2.98
MEP	191	13	28	20	14	15	2.89
ATDC	223	7	19	17	7	8	2.83
Maine Trade Associations	150	11	41	50	20	9	2.81
Maine Procurement Technical Assistance Center	215	12	20	17	12	5	2.67

Penetration rates for the current survey year range from a high of 68.3 percent for MTI to a low of 16.1 percent for ATDC. These results are similar for the 2009-2010 survey with penetration rates being lower for every organization in the current survey year. Penetration rates are a function of several variables, including the use of support among the companies who responded to this question. Although our function has included only the number of companies who did not use support, it can still provide some information about use of program support in a comparative basis. The higher the penetration rate, the greater the number of companies who used the specific program support tool.

Support Organizations	2010-2011 Penetration Rates	2009-2010 Penetration Rates
MTI	79.0%	82.7%
Other Maine Firms	56.9%	61.6%
Umaine System	56.2%	60.9%
Other Firms Outside Maine	54.4%	62.6%
Maine Trade Associations	46.6%	43.9%
Education/Research Outside Maine	44.5%	46.9%
Maine Patent Program	42.7%	44.9%
Trade Associations Outside Maine	39.9%	43.5%
MSBDC	35.9%	42.2%
MEP	32.0%	32.0%
Non-Profit Research Institutes in Maine	31.0%	29.6%
Other Educational Instutitions in Maine	29.9%	31.0%
Maine Procurement Technical Assistance Center	23.5%	25.5%
ATDC	20.6%	22.4%

Support Organizations	Mean Scores 2008-2009 to 2010-2011		
	2010-2011	2009-2010	2008-2009
MTI	4.18	4.19	4.13
Umaine System	3.80	3.67	3.52
Maine Patent Program	3.60	3.39	3.57
Other Firms Outside Maine	3.43	3.44	3.34
Other Maine Firms	3.42	3.40	3.27
Education/Research Outside Maine	3.34	3.33	3.05
Other Educational Instutitions in Maine	3.32	2.92	2.84
Non-Profit Research Institutes in Maine	3.09	2.85	2.81
MSBDC	3.05	3.06	2.97
Trade Associations Outside Maine	2.98	3.08	3.06
MEP	2.89	2.85	2.87
ATDC	2.83	2.80	2.86
Maine Trade Associations	2.81	3.02	2.76
Maine Procurement Technical Assistance Center	2.67	2.75	2.58

Note for above tables: MTI: Maine Technology Institute; ATDC: Advanced Technology Development Centers; MSBDC: Maine Small Business Development Centers; MEP: Manufacturing Extension Partnership

A visual comparison of the means in the table above shows a general steadiness in the importance of support, with some change from year-to-year. There are no consistent increases or decreases in the importance of support as a whole. UMaine System, "Other Maine Firms", "Education/Research Outside Maine", "Other Education Institutions in Maine", and "Non-Profit Research Institutes in Maine" have seen a year-to-year increase.

20. Importance of Assistance

How Important?	All Respondents 2010-2011		All Respondents 2009-2010	
	Number of Companies	Percent	Number of Companies	Percent
Critically Important (5)	50	19.2%	61	20.7%
Very Important (4)	39	15.0%	33	11.2%
Frequently Important (3)	10	3.8%	14	4.8%
Occasionally Important (2)	14	5.4%	17	5.8%
Not Important (1)	5	1.9%	4	1.4%
N/A	142	54.6%	165	56.1%
Total	260	100%	294	100%

The mean score for importance of assistance received was 3.97 in the current survey year, compared to 4.0 in the previous survey. Additionally, 34.2 percent of respondents in the current survey (2010-2011)

indicated that the assistance they received was either very important or critically important. In the previous survey (2009-2010), the comparable percentage was 31.9 percent.

21. Satisfaction with Assistance

Satisfaction With State Assistance by Companies in Private Survey	All Respondents 2010-2011 Number of Companies	Percent	All Respondents 2009-2010 Number of Companies	Percent
Very Satisfied (5)	61	23.6%	64	21.8%
Satisfied (4)	40	15.4%	51	17.3%
Somewhat Satisfied (3)	10	3.9%	13	4.4%
Unsatisfied (2)	1	0.4%	2	0.7%
Very Unsatisfied (1)	5	1.9%	1	0.3%
N/A	142	54.8%	163	55.4%
Total	259	100%	294	100%

The mean score for satisfaction with assistance received was 4.29 in the current survey year, compared to 4.3 in the previous survey. Additionally, 39.0 percent of respondents in the current survey indicated that they were either very satisfied or satisfied in the assistance they received. In the previous survey (2009-2010), the comparable percentage was 39.1 percent.

Appendix B: Economic Impact of Supported Private Sector Companies

The following economic impact assessment was completed as part of the 2010 Maine Comprehensive Evaluation of R&D Investments.

Summary of Findings

The following findings are based on the 253 companies included in the impact analysis:

R&D Performed

- In 2010 the companies received a total of $2,608,725 in state funding for R&D related activities.
- In 2010 the companies expended a total of $27,017,248 on R&D from all sources of revenues.
- **Therefore in 2010 the ratio of state dollars to total R&D performed was $1:$10**

Employment

- In 2010 these companies directly employed 3,545 persons
- This generated an estimated additional 5,898 indirect jobs
- **This resulted in an estimated total job impact of 9,443 jobs**

Revenues

- In 2010 these companies generated a total of $913,359,702 in revenues from all sources
- This generated an estimated additional $665,569,167 in indirect revenues
- **This resulted in an estimated total revenue impact of $1,578,928,869 or $605 in revenues for every $1 spent in R&D support in 2010 ($350 direct revenues plus $255 indirect)**

Methodology

To measure the economic impact resulting from companies supported by Maine's R&D programs, the input-output model developed by the Economic Modeling Specialist, Inc (EMSI) was used. The EMSI's Economic Impact Regional I/O model produces regional multipliers for each industry at the six-digit level of NAICS codes. The multiplier values allow for the estimation of the outcomes of direct and indirect jobs and revenues generated from additional inputs into the regional economy[18].

The analysis is based on the results from the annual private survey conducted for this evaluation by PolicyOne Research. Each survey respondent was asked to identify a six-digit North American Industrial Classification code (NAICS) that best described their business operations. For those companies didn't indicate the NAICS code on the survey, we used the business database of *InfoUSA and web research* to assign an appropriate NAICS code to each respondent.

To estimate the economic impact of state investment on Maine's R&D companies, it is assumed that all impacts are exclusively the results of state grants. No other variables or additional funding (i.e., federal money or state tax credits) were included in the estimates. In actuality these other factors do contribute to the impacts. Furthermore it is assumed that the impacts from state funding would not otherwise occur is state funding was not provided.

The total number of companies surveyed was 826. 253 companies responded and provided the employment, revenue, and R&D Expenditure data needed for the impact analysis for a response rate of 31%.

[18] See detailed explanations on the EMSI's Economic Impact Input-Output Model at http://www.economicmodeling.com/resources/wp-content/uploads/2007/10/ed_multiplier_methodology_comparison.pdf

Appendix C: Findings from Annual Institution Survey, 2010

	Non-Profit Research Institutions		University Research-based Institutions	
	2010 Total Non-Profit Institutions	**2009 Total Non-Profit Institutions**	**2010 Total for University Institutions**	**2009 Total for University Institutions**
Institutional Capacity				
a. Number (headcount) of enrolled science and engineering graduate students in fall Semester	13	12	834	786
b. Number of science and engineering graduate degrees conferred	1	1	197	145
c. DELETED (Number of degree programs)				
d. Number (headcount) undergraduate students enrolled in science and engineering majors in Fall Semester	2	0	6,823	5,947
e. Number of undergraduate students science and engineering degrees conferred	0	0	1,207	1,097
f. DELETED (Number (FTE) of graduate students participating in science and engineering programs)				
g. Total R&D space	405,424	406,444	983,779	973,279
h. Current, depreciated, value of facilities and fixed equipment	$ 229,195,758	$ 322,374,205	$ 429,507,410	$ 409,729,759
i. Major (purchase price >$50,000) research equipment purchased this year.	$ 3,180,458	$ 3,538,102	$ 3,707,229	$ 2,424,876
j. Number of positions FTE	1,702.9	1,710.2	3,704.9	4,340.0
k. Faculty	77.0	64.0	1,177.8	1,214.0
l. Research staff (non-faculty)	192.8	586.4	19.0	22.0
m. Professional staff	663.5	327.1	1,220.0	1,574.0
n. Students	77.2	80.9	152.0	24.0
o. Classified personnel	692.4	651.8	1,136.1	1,506.0
Research and Development Outcomes				
A. Publications	456	498	5,387	1,620

	Non-Profit Research Institutions		University Research-based Institutions	
	2010 Total Non-Profit Institutions	**2009 Total Non-Profit Institutions**	**2010 Total for University Institutions**	**2009 Total for University Institutions**
1. Number of scientific peer-reviewed journal articles published	355	365	1,076	775
2. Number of scientific peer-reviewed book chapters published	18	19	156	166
3. Number of scientific peer-reviewed books published	2	0	48	59
4. Number of other scientific papers published	66	92	1,203	257
5. Number of other scientific papers not published (e.g. research reports for industry)	15	22	2,904	363
B. Research Proposals				
1.a. Number of extramural research proposal submitted	372	340	955	1,056
1b. Dollars requested	$ 328,216,705	$ 214,320,366	$ 337,802,826	$ 426,825,342
2.a. Number of these proposals submitted jointly with other Maine institutions	38	34	95	200
2.b. Dollar Value	$ 36,887,833	$ 30,587,041	$ 25,867,117	$ 74,710,234
3.a. Number of these proposals submitted jointly with non-Maine institutions only	67	72	121	196
3.b. Dollar Value	$ 39,334,281	$ 54,477,136	$ 27,904,047	$ 19,520,415
4. Number of these proposal submitted jointly with both Maine and non-Maine institutions	19	20	2	10
4.b. Dollar Value	$ 15,572,175	$ 13,009,533	$ 926,168	$ 19,909,064
C. Research Awards				
1.a. Number of new Federal research grants, contracts, subcontracts (total value for all costs and years)	130	88	569	421
1.b. Dollar Value	$ 88,078,627	$ 68,246,735	$ 130,658,184	$ 122,070,967

	Non-Profit Research Institutions		University Research-based Institutions	
	2010 Total Non-Profit Institutions	**2009 Total Non-Profit Institutions**	**2010 Total for University Institutions**	**2009 Total for University Institutions**
2.a. Number of these awarded under EPSCOR	2	0	16	4
2.b. Dollar Value	$ 1,562,000	0	$ 7,906,631	$ 20,723,236
3.a Number of these that were earmarked	2	1	9	12
3.b. Dollar Value	$ 2,790,007	$ 132,289	$ 5,635,530	$ 3,701,826
4.a. Total expenditures for research and development	$ 112,499,683	$ 95,836,330	$ 145,776,289	$ 102,041,923
4.b. Sources of funds for R&D expenditures: federal	$ 85,997,293	$ 76,872,058	$ 82,498,767	$ 69,407,504
4.b. State	$ 1,250,233	$ 1,889,902	$ 5,316,650	$ 22,909,853
4.b. Industry	$ 2,281,156	$ 2,020,758	$ 4,001,323	$ 1,209,895
4.b. Individuals and foundations	$ 12,448,873	$ 11,274,919	$ 5,373,191	$ 8,744,586
5.a. Number of industrial research grants, contracts and subcontracts awarded	24	37	341	303
5.b. Dollar Value	$ 1,896,420	$ 3,987,000	$ 5,957,864	$ 3,359,280
6.a. Number of these industrial research contracts awarded by Maine companies	4	1	184	154
6.b. Dollar Value	$ 259,840	$ 12,500	$ 3,402,522	$ 1,923,841
7.a. Number of new foundation grants and gifts	50	56	44	83
7.b. Dollar Value	$ 3,347,731	$ 7,179,390	$ 5,227,382	$ 6,790,659
D. Intellectual Property				
1. Number of disclosures made	16	17	27	28
2. Number of patents applied for	15	18	37	17
3. Number of patents awarded	2	3	4	3
4. Number of copyrights obtained	0	0	1	1
5. Number of plant breeder's rights obtained	0	0	0	0

	Non-Profit Research Institutions		University Research-based Institutions	
	2010 Total Non-Profit Institutions	**2009 Total Non-Profit Institutions**	**2010 Total for University Institutions**	**2009 Total for University Institutions**
6. Number of licensing agreements signed	36	19	6	2
7. Number of licensing agreements signed with Maine companies	1	0	4	2
8. License income received this year	$ 1,271,465	$ 1,403,812	$ 250,000	$ 85,048
E. Spin-off Companies				
1. Number of new companies formed	1	0	5	1
2. Number of jobs in these companies at spin-off	3	0	12	4

Gray areas = no data or data question has changed significantly so no longer tracked

Source: From Annual Survey of Academic and Not-for Profit Research Institutions conducted for this evaluation

Appendix D: Findings Related to Funding for the Maine Technology Asset Fund

Background

In 2007, the Maine State Legislature authorized and Maine voters approved $50 million in bond funds for" research, development and commercialization projects that boost economic development and create jobs across the State." In 2010 voters approved an additional $3 million in for this fund. The Legislature directed the Maine Technology Institute (MTI) to administer this fund and MTI established the Maine Technology Asset Fund (MTAF) in response to this directive.

MTAF is a competitive award program to fund capital and related expenditures supporting research, development and commercialization projects that will lead to "significant" economic benefits for Maine. The expenses may include facilities construction and renovation, machinery and equipment (including computers, software and licenses required for their use, as well as related technician training for operation of equipment and machinery purchased) and land purchase. This may also include expenses directly associated with the acquisition and installation of such assets. The awards may not be used to fund ordinary annual operating expenses.

Since 2008, the MTI Board has awarded approximately $53 million to fund 35 projects in three competitive rounds. For this year's annual R&D evaluation MTAF data was available and findings are reported assessed on the first two rounds of funding.

Findings on MTAF for Rounds 1 and 2

25 awards made including[19]:

- 12 to Maine's academic institutions
- 7 to Maine's not-for-profit research labs
- 6 to Private companies in Maine's

$45.6m in amount contracted through the awards including:

- $25.6m to Maine's academic institutions
- $14.1m to Maine's not-for-profit research labs
- $5.9m to Private companies in Maine's

$68.4m in amount of funding matched by the awardees or $1.50 in match for every $1.00 in award including:

[19] Award break-out is based on the primary recipient. Awards may include multiple entities.

- $34.5m from Maine's academic institutions
- $25.3m from Maine's not-for-profit research labs
- $8.6m from Private companies in Maine's

$21.2m in funds have been spent to date or 46.5% percent of contracted amount including:

- $8.3m by Maine's academic institutions
- $9.3m by Maine's not-for-profit research labs
- $3.6m by Private companies in Maine's

* 2 of the 25 projects are fully completed

$24.4m in funds are remaining to be spent by awardees or 53.5% including:

- $17.3m by Maine's academic institutions
- $4.8m by Maine's not-for-profit research labs
- $2.3m by Private companies in Maine's

Appendix E: Targeted Technology Sector Description

Definition of Targeted Technology Sectors is from Maine Office of Innovation and is based on targeted sectors identified by State Legislature in late 1990's and further defined by Statewide Cluster Analyses in 2002 and 2008, most recently reported in: Maine's Technology Sectors and Clusters: Status and Strategy; Maine Center for Business and Economic Research, University of Southern Maine; Battelle Technology Partnership Practice, Battelle Institute; Planning Decisions Inc; and PolicyOne Research, March 2008. To this definition engineering and other scientific/technical was added as it relates to most of the tech sectors. They include the following:

NAICS Description	NAICS Code	Cluster Description
Pharmaceutical and medicine manufacturing	3254	Biotechnology
Medicinal and Botanical Manufacturing	325411	Biotechnology
Pharmaceutical Preparation Manufacturing	325412	Biotechnology
In-Vitro Diagnostic Substance Manufacturing	325413	Biotechnology
Biological Product (except Diagnostic) Manufacturing	325414	Biotechnology
Electromedical apparatus manufacturing	334510	Biotechnology
Analytical laboratory instrument mfg.	334516	Biotechnology
Irradiation apparatus manufacturing	334517	Biotechnology
Medical equipment and supplies manufacturing	3391	Biotechnology
Surgical and Medical Instrument Manufacturing	339112	Biotechnology
Surgical Appliance and Supplies Manufacturing	339113	Biotechnology
Dental Equipment and Supplies Manufacturing	339114	Biotechnology
Ophthalmic Goods Manufacturing	339115	Biotechnology
Dental Laboratories	339116	Biotechnology
Physical, engineering and biological research	541710	Biotechnology
Research and Development in Biotechnology	541711	Biotechnology
Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	541712	Biotechnology
Medical laboratories	621511	Biotechnology
Diagnostic imaging centers	621512	Biotechnology
Resin, rubber, and artificial fibers mfg.	3252	Composites & Advanced Materials
Plastics Material and Resin Manufacturing	325211	Composites & Advanced Materials
Synthetic Rubber Manufacturing	325212	Composites & Advanced Materials
Cellulosic Organic Fiber Manufacturing	325221	Composites & Advanced Materials
Noncellulosic Organic Fiber Manufacturing	325222	Composites & Advanced Materials
Boat building	336612	Composites & Advanced Materials
Engineering services	541330	Engineering & Scientific/Technical Services

NAICS Description	NAICS Code	Cluster Description
Other technical consulting services	541690	Engineering & Scientific/Technical Services
Water, sewage and other systems	2213	Environmental & Energy
Water Supply and Irrigation Systems	221310	Environmental & Energy
Sewage Treatment Facilities	221320	Environmental & Energy
Steam and Air-Conditioning Supply	221330	Environmental & Energy
Waste treatment and disposal	5622	Environmental & Energy
Hazardous Waste Treatment and Disposal	562211	Environmental & Energy
Solid Waste Landfill	562212	Environmental & Energy
Solid Waste Combustors and Incinerators	562213	Environmental & Energy
Other Nonhazardous Waste Treatment and Disposal	562219	Environmental & Energy
Other electric power generation	221119	Environmental & Energy
Testing laboratories	541380	Environmental & Energy
Environmental consulting services	541620	Environmental & Energy
Forestry and logging	113	Forest Products & Agriculture
Timber Tract Operations	113110	Forest Products & Agriculture
Forest Nurseries and Gathering of Forest Products	113210	Forest Products & Agriculture
Logging	113310	Forest Products & Agriculture
Wood product manufacturing	321	Forest Products & Agriculture
Sawmills	321113	Forest Products & Agriculture
Wood Preservation	321114	Forest Products & Agriculture
Hardwood Veneer and Plywood Manufacturing	321211	Forest Products & Agriculture
Softwood Veneer and Plywood Manufacturing	321212	Forest Products & Agriculture
Engineered Wood Member (except Truss) Manufacturing	321213	Forest Products & Agriculture
Truss Manufacturing	321214	Forest Products & Agriculture
Reconstituted Wood Product Manufacturing	321219	Forest Products & Agriculture
Wood Window and Door Manufacturing	321911	Forest Products & Agriculture
Cut Stock, Resawing Lumber, and Planing	321912	Forest Products & Agriculture
Other Millwork (including Flooring)	321918	Forest Products & Agriculture
Wood Container and Pallet Manufacturing	321920	Forest Products & Agriculture
Manufactured Home (Mobile Home) Manufacturing	321991	Forest Products & Agriculture
Prefabricated Wood Building Manufacturing	321992	Forest Products & Agriculture
All Other Miscellaneous Wood Product Manufacturing	321999	Forest Products & Agriculture
Paper manufacturing	322	Forest Products & Agriculture
Pulp Mills	322110	Forest Products & Agriculture
Paper (except Newsprint) Mills	322121	Forest Products & Agriculture

NAICS Description	NAICS Code	Cluster Description
Newsprint Mills	322122	Forest Products & Agriculture
Paperboard Mills	322130	Forest Products & Agriculture
Corrugated and Solid Fiber Box Manufacturing	322211	Forest Products & Agriculture
Folding Paperboard Box Manufacturing	322212	Forest Products & Agriculture
Setup Paperboard Box Manufacturing	322213	Forest Products & Agriculture
Fiber Can, Tube, Drum, and Similar Products Manufacturing	322214	Forest Products & Agriculture
Nonfolding Sanitary Food Container Manufacturing	322215	Forest Products & Agriculture
Coated and Laminated Packaging Paper Manufacturing	322221	Forest Products & Agriculture
Coated and Laminated Paper Manufacturing	322222	Forest Products & Agriculture
Coated Paper Bag and Pouch Manufacturing	322223	Forest Products & Agriculture
Uncoated Paper and Multiwall Bag Manufacturing	322224	Forest Products & Agriculture
Laminated Aluminum Foil Manufacturing for Flexible Packaging Uses	322225	Forest Products & Agriculture
Surface-Coated Paperboard Manufacturing	322226	Forest Products & Agriculture
Die-Cut Paper and Paperboard Office Supplies Manufacturing	322231	Forest Products & Agriculture
Envelope Manufacturing	322232	Forest Products & Agriculture
Stationery, Tablet, and Related Product Manufacturing	322233	Forest Products & Agriculture
Sanitary Paper Product Manufacturing	322291	Forest Products & Agriculture
All Other Converted Paper Product Manufacturing	322299	Forest Products & Agriculture
Furniture and related product manufacturing	337	Forest Products & Agriculture
Wood Kitchen Cabinet and Countertop Manufacturing	337110	Forest Products & Agriculture
Upholstered Household Furniture Manufacturing	337121	Forest Products & Agriculture
Nonupholstered Wood Household Furniture Manufacturing	337122	Forest Products & Agriculture
Metal Household Furniture Manufacturing	337124	Forest Products & Agriculture
Household Furniture (except Wood and Metal) Manufacturing	337125	Forest Products & Agriculture
Institutional Furniture Manufacturing	337127	Forest Products & Agriculture
Wood Television, Radio, and Sewing Machine Cabinet Manufacturing	337129	Forest Products & Agriculture
Wood Office Furniture Manufacturing	337211	Forest Products & Agriculture
Custom Architectural Woodwork and Millwork Manufacturing	337212	Forest Products & Agriculture
Office Furniture (except Wood) Manufacturing	337214	Forest Products & Agriculture
Showcase, Partition, Shelving, and Locker Manufacturing	337215	Forest Products & Agriculture
Mattress Manufacturing	337910	Forest Products & Agriculture
Blind and Shade Manufacturing	337920	Forest Products & Agriculture
Support activities for crop production	1151	Forest Products & Agriculture

NAICS Description	NAICS Code	Cluster Description
Cotton Ginning	115111	Forest Products & Agriculture
Soil Preparation, Planting, and Cultivating	115112	Forest Products & Agriculture
Crop Harvesting, Primarily by Machine	115113	Forest Products & Agriculture
Postharvest Crop Activities (except Cotton Ginning)	115114	Forest Products & Agriculture
Farm Labor Contractors and Crew Leaders	115115	Forest Products & Agriculture
Farm Management Services	115116	Forest Products & Agriculture
Support activities for animal production	1152	Forest Products & Agriculture
Support Activities for Animal Production	115210	Forest Products & Agriculture
Support activities for forestry	1153	Forest Products & Agriculture
Support activities for forestry	115310	Forest Products & Agriculture
Sugar and confectionery product manufacturing	3113	Forest Products & Agriculture
Sugarcane Mills	311311	Forest Products & Agriculture
Cane Sugar Refining	311312	Forest Products & Agriculture
Beet Sugar Manufacturing	311313	Forest Products & Agriculture
Chocolate and Confectionery Manufacturing from Cacao Beans	311320	Forest Products & Agriculture
Confectionery Manufacturing from Purchased Chocolate	311330	Forest Products & Agriculture
Nonchocolate Confectionery Manufacturing	311340	Forest Products & Agriculture
Fruit and vegetable preserving and specialty	3114	Forest Products & Agriculture
Frozen Fruit, Juice, and Vegetable Manufacturing	311411	Forest Products & Agriculture
Frozen Specialty Food Manufacturing	311412	Forest Products & Agriculture
Fruit and Vegetable Canning	311421	Forest Products & Agriculture
Specialty Canning	311422	Forest Products & Agriculture
Dried and Dehydrated Food Manufacturing	311423	Forest Products & Agriculture
Dairy product manufacturing	3115	Forest Products & Agriculture
Fluid Milk Manufacturing	311511	Forest Products & Agriculture
Creamery Butter Manufacturing	311512	Forest Products & Agriculture
Cheese Manufacturing	311513	Forest Products & Agriculture
Dry, Condensed, and Evaporated Dairy Product Manufacturing	311514	Forest Products & Agriculture
Ice Cream and Frozen Dessert Manufacturing	311520	Forest Products & Agriculture
Bakeries and tortilla manufacturing	3118	Forest Products & Agriculture
Retail Bakeries	311811	Forest Products & Agriculture
Commercial Bakeries	311812	Forest Products & Agriculture
Frozen Cakes, Pies, and Other Pastries Manufacturing	311813	Forest Products & Agriculture
Cookie and Cracker Manufacturing	311821	Forest Products & Agriculture

NAICS Description	NAICS Code	Cluster Description
Flour Mixes and Dough Manufacturing from Purchased Flour	311822	Forest Products & Agriculture
Dry Pasta Manufacturing	311823	Forest Products & Agriculture
Tortilla Manufacturing	311830	Forest Products & Agriculture
Other food manufacturing	3119	Forest Products & Agriculture
Roasted Nuts and Peanut Butter Manufacturing	311911	Forest Products & Agriculture
Other Snack Food Manufacturing	311919	Forest Products & Agriculture
Coffee and Tea Manufacturing	311920	Forest Products & Agriculture
Flavoring Syrup and Concentrate Manufacturing	311930	Forest Products & Agriculture
Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	311941	Forest Products & Agriculture
Spice and Extract Manufacturing	311942	Forest Products & Agriculture
Perishable Prepared Food Manufacturing	311991	Forest Products & Agriculture
All Other Miscellaneous Food Manufacturing	311999	Forest Products & Agriculture
Beverage manufacturing	3121	Forest Products & Agriculture
Soft Drink Manufacturing	312111	Forest Products & Agriculture
Bottled Water Manufacturing	312112	Forest Products & Agriculture
Ice Manufacturing	312113	Forest Products & Agriculture
Breweries	312120	Forest Products & Agriculture
Wineries	312130	Forest Products & Agriculture
Distilleries	312140	Forest Products & Agriculture
Wet corn milling	311221	Forest Products & Agriculture
Soybean processing	311222	Forest Products & Agriculture
Other oilseed processing	311223	Forest Products & Agriculture
Ethyl alcohol manufacturing	325193	Forest Products & Agriculture
All other basic organic chemical manufacturing	325199	Forest Products & Agriculture
Cellulosic organic fiber manufacturing	325221	Forest Products & Agriculture
Nitrogenous fertilizer manufacturing	325311	Forest Products & Agriculture
Phosphatic fertilizer manufacturing	325312	Forest Products & Agriculture
Fertilizer (mixing only) manufacturing	325314	Forest Products & Agriculture
Pesticide and other agricultural chemical manufacturing	325320	Forest Products & Agriculture
Crop and animal production	11A0	Forest Products & Agriculture
Crop and animal production	11A000	Forest Products & Agriculture
Computer systems design and related services	5415	Information Technology
Custom Computer Programming Services	541511	Information Technology
Computer Systems Design Services	541512	Information Technology

NAICS Description	NAICS Code	Cluster Description
Computer Facilities Management Services	541513	Information Technology
Other Computer Related Services	541519	Information Technology
Software publishers	511210	Information Technology
Internet publishing and broadcasting	516110	Information Technology
Wired telecommunications carriers	517110	Information Technology
Internet service providers	518111	Information Technology
Web search portals	518112	Information Technology
Data processing and related services	518210	Information Technology
Animal aquaculture	1125	Marine Technology & Aquaculture
Search, detection, and navigation instruments	334511	Marine Technology & Aquaculture
Fabricated metal product manufacturing	332	Precision Manufacturing
Iron and Steel Forging	332111	Precision Manufacturing
Nonferrous Forging	332112	Precision Manufacturing
Custom Roll Forming	332114	Precision Manufacturing
Crown and Closure Manufacturing	332115	Precision Manufacturing
Metal Stamping	332116	Precision Manufacturing
Powder Metallurgy Part Manufacturing	332117	Precision Manufacturing
Cutlery and Flatware (except Precious) Manufacturing	332211	Precision Manufacturing
Hand and Edge Tool Manufacturing	332212	Precision Manufacturing
Saw Blade and Handsaw Manufacturing	332213	Precision Manufacturing
Kitchen Utensil, Pot, and Pan Manufacturing	332214	Precision Manufacturing
Prefabricated Metal Building and Component Manufacturing	332311	Precision Manufacturing
Fabricated Structural Metal Manufacturing	332312	Precision Manufacturing
Plate Work Manufacturing	332313	Precision Manufacturing
Metal Window and Door Manufacturing	332321	Precision Manufacturing
Sheet Metal Work Manufacturing	332322	Precision Manufacturing
Ornamental and Architectural Metal Work Manufacturing	332323	Precision Manufacturing
Power Boiler and Heat Exchanger Manufacturing	332410	Precision Manufacturing
Metal Tank (Heavy Gauge) Manufacturing	332420	Precision Manufacturing
Metal Can Manufacturing	332431	Precision Manufacturing
Other Metal Container Manufacturing	332439	Precision Manufacturing
Hardware Manufacturing	332510	Precision Manufacturing
Spring (Heavy Gauge) Manufacturing	332611	Precision Manufacturing
Spring (Light Gauge) Manufacturing	332612	Precision Manufacturing

NAICS Description	NAICS Code	Cluster Description
Other Fabricated Wire Product Manufacturing	332618	Precision Manufacturing
Machine Shops	332710	Precision Manufacturing
Precision Turned Product Manufacturing	332721	Precision Manufacturing
Bolt, Nut, Screw, Rivet, and Washer Manufacturing	332722	Precision Manufacturing
Metal Heat Treating	332811	Precision Manufacturing
Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	332812	Precision Manufacturing
Electroplating, Plating, Polishing, Anodizing, and Coloring	332813	Precision Manufacturing
Industrial Valve Manufacturing	332911	Precision Manufacturing
Fluid Power Valve and Hose Fitting Manufacturing	332912	Precision Manufacturing
Plumbing Fixture Fitting and Trim Manufacturing	332913	Precision Manufacturing
Other Metal Valve and Pipe Fitting Manufacturing	332919	Precision Manufacturing
Ball and Roller Bearing Manufacturing	332991	Precision Manufacturing
Small Arms Ammunition Manufacturing	332992	Precision Manufacturing
Ammunition (except Small Arms) Manufacturing	332993	Precision Manufacturing
Small Arms Manufacturing	332994	Precision Manufacturing
Other Ordnance and Accessories Manufacturing	332995	Precision Manufacturing
Fabricated Pipe and Pipe Fitting Manufacturing	332996	Precision Manufacturing
Industrial Pattern Manufacturing	332997	Precision Manufacturing
Enameled Iron and Metal Sanitary Ware Manufacturing	332998	Precision Manufacturing
All Other Miscellaneous Fabricated Metal Product Manufacturing	332999	Precision Manufacturing
Machinery manufacturing	333	Precision Manufacturing
Farm Machinery and Equipment Manufacturing	333111	Precision Manufacturing
Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	333112	Precision Manufacturing
Construction Machinery Manufacturing	333120	Precision Manufacturing
Mining Machinery and Equipment Manufacturing	333131	Precision Manufacturing
Oil and Gas Field Machinery and Equipment Manufacturing	333132	Precision Manufacturing
Sawmill and Woodworking Machinery Manufacturing	333210	Precision Manufacturing
Plastics and Rubber Industry Machinery Manufacturing	333220	Precision Manufacturing
Paper Industry Machinery Manufacturing	333291	Precision Manufacturing
Textile Machinery Manufacturing	333292	Precision Manufacturing
Printing Machinery and Equipment Manufacturing	333293	Precision Manufacturing
Food Product Machinery Manufacturing	333294	Precision Manufacturing
Semiconductor Machinery Manufacturing	333295	Precision Manufacturing
All Other Industrial Machinery Manufacturing	333298	Precision Manufacturing

NAICS Description	NAICS Code	Cluster Description
Automatic Vending Machine Manufacturing	333311	Precision Manufacturing
Commercial Laundry, Drycleaning, and Pressing Machine Manufacturing	333312	Precision Manufacturing
Office Machinery Manufacturing	333313	Precision Manufacturing
Optical Instrument and Lens Manufacturing	333314	Precision Manufacturing
Photographic and Photocopying Equipment Manufacturing	333315	Precision Manufacturing
Other Commercial and Service Industry Machinery Manufacturing	333319	Precision Manufacturing
Air Purification Equipment Manufacturing	333411	Precision Manufacturing
Industrial and Commercial Fan and Blower Manufacturing	333412	Precision Manufacturing
Heating Equipment (except Warm Air Furnaces) Manufacturing	333414	Precision Manufacturing
Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	333415	Precision Manufacturing
Industrial Mold Manufacturing	333511	Precision Manufacturing
Machine Tool (Metal Cutting Types) Manufacturing	333512	Precision Manufacturing
Machine Tool (Metal Forming Types) Manufacturing	333513	Precision Manufacturing
Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	333514	Precision Manufacturing
Cutting Tool and Machine Tool Accessory Manufacturing	333515	Precision Manufacturing
Rolling Mill Machinery and Equipment Manufacturing	333516	Precision Manufacturing
Other Metalworking Machinery Manufacturing	333518	Precision Manufacturing
Turbine and Turbine Generator Set Units Manufacturing	333611	Precision Manufacturing
Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing	333612	Precision Manufacturing
Mechanical Power Transmission Equipment Manufacturing	333613	Precision Manufacturing
Other Engine Equipment Manufacturing	333618	Precision Manufacturing
Pump and Pumping Equipment Manufacturing	333911	Precision Manufacturing
Air and Gas Compressor Manufacturing	333912	Precision Manufacturing
Measuring and Dispensing Pump Manufacturing	333913	Precision Manufacturing
Elevator and Moving Stairway Manufacturing	333921	Precision Manufacturing
Conveyor and Conveying Equipment Manufacturing	333922	Precision Manufacturing
Overhead Traveling Crane, Hoist, and Monorail System Manufacturing	333923	Precision Manufacturing
Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	333924	Precision Manufacturing
Power-Driven Handtool Manufacturing	333991	Precision Manufacturing
Welding and Soldering Equipment Manufacturing	333992	Precision Manufacturing
Packaging Machinery Manufacturing	333993	Precision Manufacturing

NAICS Description	NAICS Code	Cluster Description
Industrial Process Furnace and Oven Manufacturing	333994	Precision Manufacturing
Fluid Power Cylinder and Actuator Manufacturing	333995	Precision Manufacturing
Fluid Power Pump and Motor Manufacturing	333996	Precision Manufacturing
Scale and Balance Manufacturing	333997	Precision Manufacturing
All Other Miscellaneous General Purpose Machinery Manufacturing	333999	Precision Manufacturing
Computer and electronic product manufacturing	334	Precision Manufacturing
Electronic Computer Manufacturing	334111	Precision Manufacturing
Computer Storage Device Manufacturing	334112	Precision Manufacturing
Computer Terminal Manufacturing	334113	Precision Manufacturing
Other Computer Peripheral Equipment Manufacturing	334119	Precision Manufacturing
Telephone Apparatus Manufacturing	334210	Precision Manufacturing
Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	334220	Precision Manufacturing
Other Communications Equipment Manufacturing	334290	Precision Manufacturing
Audio and Video Equipment Manufacturing	334310	Precision Manufacturing
Electron Tube Manufacturing	334411	Precision Manufacturing
Bare Printed Circuit Board Manufacturing	334412	Precision Manufacturing
Semiconductor and Related Device Manufacturing	334413	Precision Manufacturing
Electronic Capacitor Manufacturing	334414	Precision Manufacturing
Electronic Resistor Manufacturing	334415	Precision Manufacturing
Electronic Coil, Transformer, and Other Inductor Manufacturing	334416	Precision Manufacturing
Electronic Connector Manufacturing	334417	Precision Manufacturing
Printed Circuit Assembly (Electronic Assembly) Manufacturing	334418	Precision Manufacturing
Other Electronic Component Manufacturing	334419	Precision Manufacturing
Electromedical and Electrotherapeutic Apparatus Manufacturing	334510	Precision Manufacturing
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	334511	Precision Manufacturing
Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	334512	Precision Manufacturing
Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	334513	Precision Manufacturing
Totalizing Fluid Meter and Counting Device Manufacturing	334514	Precision Manufacturing
Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	334515	Precision Manufacturing
Analytical Laboratory Instrument Manufacturing	334516	Precision Manufacturing
Irradiation Apparatus Manufacturing	334517	Precision Manufacturing
Watch, Clock, and Part Manufacturing	334518	Precision Manufacturing

NAICS Description	NAICS Code	Cluster Description
Other Measuring and Controlling Device Manufacturing	334519	Precision Manufacturing
Software Reproducing	334611	Precision Manufacturing
Prerecorded Compact Disc (except Software), Tape, and Record Reproducing	334612	Precision Manufacturing
Magnetic and Optical Recording Media Manufacturing	334613	Precision Manufacturing

Appendix F: Best Practices

I2E, Oklahoma

Since 1998, i2E has been Oklahoma's hub for helping entrepreneurs turn their ideas and innovations into successful enterprises. Their network of technology specialists, serial entrepreneurs, investors, and business development organizations means that clients not only access services they provide, they are connected to a full array of professionals through one door. The cornerstone of i2E is their nationally-recognized services that guide innovators and entrepreneurs through the steps needed to validate and grow a business. Since each client comes to i2E with their own skills and experiences, they provide a customized mix of coaching, technical services, and access to capital.

Advisors and Coaches: Experienced *executive advisors* work one on one with clients, mentoring and coaching them from initial technology development and business planning through the launch of a company. As companies launch and begin to grow, *executives in residence* will work intensely with entrepreneurs to build their management teams and operations. Advisory pathways are customized for each business.

Start-Up Funding: i2E's operates two early stage capital funds connected to their advisory services: the **Technology Business Finance Program (TBFP) and Seed Fund.** The award-winning TBFP distributes approximately $1 million each year through awards of up to $100,000 for companies in pre-seed or proof of concept stage. The $19 million Seed Fund, ($9 million in previous funding and $10 million for the next several years) provides early stage equity investments to companies.

Oklahoma's awarding proof-of-concept fund combines seed capital with entrepreneurial mentoring and advisory services. The organization provides an experienced entrepreneur to work with companies to oversee their business progress and help evaluate business development needs, while funding from the TBFP or Seed Program helps to pay for more specialized services. A recent audit of the program showed that:

- Through 2010, TBFP approved 112 awards to 101 different companies; the $9.5 million in actual funded awards have leveraged $226.3 million in private investment capital, leveraging the state's investment 23:1. Only 15 percent of awards have been written-off or written-down.
- TBFP has received repayments totaling over $3.4 million and now accounts for almost 40 percent of capital available for new awards. Repayments are 2 times higher than write-off/write/downs.
- TBFP clients applied for 197 patents, were issued 84 patents, and introduced 105 new products .
- TBFP clients reported average annual wages of $71,605 per job, double the state's average; companies reported bringing in over $38 million of revenues into the state.
- 78 percent of responding TBFP clients are still in business after three years, significantly above industry averages.

An independent evaluation from North Carolina State University noted that "Ventures receiving TBFP funds raised almost $550,000 more in seed/early-stage capital than ventures which did not participate in this program. Furthermore, the meetings arranged by i2E staff for client ventures with Venture Capital funds yielded almost $800,000 more in seed/early-stage capital than ventures which did not utilize these meetings."

These advisory services are critical to a company's rate of job and revenue growth. In addition to providing early stage capital, i2E assists approximately 100 companies per year with expanded business development services and tracks their economic impact for 5 years. While Oklahoma's job base has grown less than 5 percent each year since 2003, i2E clients added jobs to their payroll at a rate more than 20 percent each year. In 2009, Oklahoma lost jobs while the 107 client companies responding to the annual survey added jobs at a growth rate of 36 percent and brought in $143 million in revenue (more than twice the average of revenues reported by Maine companies working with state R&D programs).

TechColumbus, Columbus, Ohio Region

TechColumbus accelerates the growth of the innovation economy in central Ohio by providing vital resources and assistance to people and enterprises that depend on technology to achieve their business goals. TechColumbus works to "create new companies, strengthen existing businesses, open doors to technology resources, help promote and attract the next generation of high-wage/high-growth industry sectors, support the attraction and retention of talented people, and promote opportunity for all citizens."

TechColumbus advocates for major regional initiatives that strengthen the tech economy. One example is talent development and attraction -- many Central Ohio companies (large and small) are growing rapidly and can't find the technical talent they need to fill existing openings. Working with the Chamber and others, TechColumbus provides programming and services that develop and retain the current workforce and help attract young professionals to the community to fill essential roles in the economy.

Tech Columbus is founded on the premise that the vision and potential of a new business is tested in the first three years--transforming technology breakthroughs into marketable products and services and helping innovators become business leaders. Through professional development and commercialization strategies, they help entrepreneurs make effective, informed decisions specializing in three areas: IT, bioscience, and advanced materials.

Consulting: ongoing mentoring, resident programs, and commercialization efforts including start-up mentoring and consulting, business plan development, a strong pathway to capital investment.

Entrepreneurs in Residence: Companies that have reached a level of maturity are selected as candidates to receive the TechColumbus Pre-Seed Fund. At this point, TechColumbus assigns an Entrepreneur in Residence (EIRs) to join the team as an experienced CEO to help the company prepare for the next round of funding and venture capital investments. TechColumbus' EIRs have executive level experience to take companies to the next level of funding and growth.

Incubator: The TechStart Incubator program combines the two critical components needed for early phase success: highly skilled advisors and affordable facilities and administrative support. The business Incubator center offers more than 62,000 square feet of flexible, affordable lab, office, and conference space.

Platform Lab is the nation's only non-profit information technology test and training facility. They provide organizations in Ohio and across the nation the complete means to conduct a variety of IT test projects. Platform Lab provides clients short term physical or remote access to IT hardware, software and massive bandwidth for all types of companies for the explicit purpose of IT testing and projects. They create custom test infrastructure configured to the client's precise specifications using their hardware, software, high-speed bandwidth and networking resources.

Networking and Education. TechColumbus keeps a calendar of events with 20-30 events listed each month representing programs offered by TechColumbus and partner organizations.

JumpStart, Northeast Ohio

JumpStart is a nationally recognized venture development organization that accelerates the progress of high potential, early-stage businesses in Northeast Ohio. A non-profit organization formed in 2004 by a collaboration between NorTech (the Northeast Ohio Technology Coalition) and Case Western Reserve University, was created to combine the efforts of four of the region's entrepreneurial service organizations to support the continued emergence of Northeast Ohio's innovative economy.

- It guides smart, motivated, high potential entrepreneurs to turn their disruptive, innovative ideas into plans, their plans into operating businesses, and their businesses into rapidly growing ventures.
- It has a special focus on supporting women and minority entrepreneurs working in the highest growth industries.
- It selectively invests risk capital in the early-stage companies to accelerate their growth by pairing risk capital with expert guidance.

JumpStart services are primarily delivered through three lines of business. Each of these businesses offers different services, to meet the varying needs of companies based on their stage of growth, business sector, and entrepreneurial profile.

JumpStart Ventures invests in and assists innovative, early-stage companies that have the potential to generate $30-$50 million in revenues in five to seven years by bundling guidance from experienced Venture Partners with seed investment capital. Early-stage investment from JumpStart Ventures, starting at $250K and up to a total of $600K, allows these companies to complete product prototypes, conduct early marketing campaigns, and add key team members. Similarly, the strategic and operational guidance from Venture Partners enables innovation-oriented entrepreneurs to hit key growth milestones, advance through stages of the business, and attract follow-on funding.

JumpStart Inclusion Advisors guides high impact minority and women-owned businesses seeking to raise capital from private investors in order to become larger scale national and

international firms. It also assists high impact businesses situated in the urban centers of Northeast Ohio, whose businesses directly impact minority populations. By providing intensive hands-on guidance and strategic planning, it enables these high impact entrepreneurs to articulate high growth plans, access investment funds, and move their businesses through key milestones.

JumpStartTechLift Advisors assists entrepreneurs in creating and articulating high growth strategic and operational plans, accessing investment funds and moving their businesses toward key milestones. TechLift Advisors' Entrepreneurs-in-Residence are former technology CEOs that work with entrepreneurs within that sector. JumpStartTechLift Advisors offers a variety of different programs, funds, and services, which are delivered by various organizations in Northeast Ohio.

Entrepreneurs-in-Residence (EIR) are experienced, former technology CEOs that serve as an entrepreneur's connection to a comprehensive suite of resources. Each EIR specializes in one of the five technology sectors and works with the clients operating in that sector. EIRs work one-on-one with companies to create and articulate high growth, strategic and operational plans; access investment capital; plan and achieve key growth milestones; and connect with potential customers, partners and investors. JumpStartTechLift Advisors are connected to several pre-seed capital funds:

- North Coast Opportunities Fund
- Lorain County Community College Foundation's GLIDE Innovation Fund
- North Coast Angel Fund
- Other funds in the region, including Glengary and JumpStart

Educational Seminars and Events: JumpStart sponsors, organizes, and facilitates educational events with topics specifically geared toward enabling entrepreneurs to build their businesses. For example, the:

- *Growing Bright Ideas* educational series brings national entrepreneurial expertise to the region. It focuses on topics such as capital formation, talent, organizational structure, and sales and marketing.
- *First Pitch*: gives entrepreneurs the opportunity to "try out" their investor presentation to a highly evaluative, yet risk-free audience. Entrepreneurs receive detailed, hard-hitting feedback in role-playing and coaching sessions as well as a detailed written report and video transcript.

Grant Funding and Grant Writing Assistance: To help entrepreneurs learn the complex process of applying for government SBIR grants, JumpStartTechLift Advisors and partners run workshops that assist entrepreneurs in accessing these sources of investment.

Student Internship Programs: JumpStartTechLift advisors has partnered with several internship programs that match talented college students to technology entrepreneurs and their companies. Most internships are subsidized, making these students a real value. Interns are a great way to create a pipeline of future employees, while getting real work done. More information about these programs is available at NEOintern.net.

BioEnterprise Programs: BioEnterprise offers specific programs that support companies in the bioscience sector, including the Health Care CEO-in-Residence program and the Health Care Opportunities at Technology Intersections program.

IdeaCrossing: Launched by JumpStart, IdeaCrossing is a free online community for entrepreneurs, accredited investor, business mentor, and service providers. Users register and create profiles that are used to match them with the resources they need to grow their businesses. Entrepreneurs are matched to accredited investors and business mentors. Investors can find deal flow that fits their investment criteria. Mentors can find startups to advise, and service providers can promote their services to the entire community. IdeaCrossing is completely private and secure, available at no cost, and requires minimal effort to start connecting and building great companies. www.ideacrossing.org

InnovationWorks (IW), Southwestern Pennsylvania

IW's programs infuse business expertise and funding into early-stage technology companies and those pursuing the next competitive edge. They also act as an active seed-stage investor, providing risk capital and business expertise. They help researchers commercialize ideas and small manufacturers to open new markets by adapting new technologies into their products and processes.

IW Seed Fund makes direct investments in promising, early-stage technology companies that are focused on high-opportunity markets.

Business Assistance: Seasoned industry and business professionals that are former CEOs, entrepreneurs and investors guide entrepreneurs by providing them with the understanding of technology markets and the nuances of starting and growing an early-stage company, including: developing a viable business plan, staffing for growth, researching market opportunities and positioning the company to attract investment capital.

Executives in residence: IW has four Executives in Residence that actively engage in start-up companies. Each executive has a different industry background.

Strategic HR: IW combines its knowledge of the unique needs of start-up companies with resident HR expertise to help entrepreneurs develop and execute HR strategies to drive growth and success.

AlphaLab In 2007, IW launched AlphaLab, an intensive, 20-week program for launching the next generation of software, entertainment technology and Internet-related companies. AlphaLab provides funding, free office space, and expertise to help companies rapidly develop their technology, gain early user feedback, develop go-to-market strategies, and move toward commercialization.

University Grants—IW works in partnership with local universities, including Carnegie Mellon University, the University of Pittsburgh, Duquesne University and Robert Morris University to identify and cultivate high-potential ideas, and provide grants up to $25,000 to help speed commercialization. IW has provided $564,000 in University Innovation Grants (UIGs) since the program's inception.

IW also works with university partners on educational initiatives designed to demystify the commercialization process for university researchers and make it easier for them to see a path from their research to market potential.

Other programs:

- *Energy Programs*— IW helps the region play a leading role in energy technology development and commercialization.
- *Small Manufacturer Grants*—IW provides grants and connects small manufacturers with the region's Centers of Excellence to help them improve product and process engineering for competitive advantage.
- *Internship Program*—IW identifies high-caliber MBA and undergraduate students who show high potential in business, engineering and other in-demand fields, for placement as interns in regional technology start-ups and innovative manufacturing companies.

Georgia Research Alliance - Industry Partnership Grants and Venture Lab Program

The Georgia Research Alliance (GRA) acts as a "deal-maker" for Georgia's research universities to grow Georgia's economy through university-based research. GRA recruits enterprising scholars to Georgia, fuels the launch of companies, strengthens centers of research so that they break new ground on discovery, and brokers working partnerships between businesses and industries.

The Alliance is a public-private partnership of the state's leading research universities, business and state government. The operations of the Alliance are funded through grants from private foundations and industry. The investments that the Alliance makes in its programs are part of the budget of the Office of the Governor of Georgia and are approved by the Georgia Legislature. Among its commercialization efforts, GRA offers industry partnership grants and manages the Venture Lab Program.

In 2007, the Georgia Research Alliance (GRA) provided grants to fund university-industry partnerships in targeted technology areas. Grants were made up to an amount of $100,000 and all investments required the involvement of at least one active industry partner. Projects had to be within three targeted technologies areas including: advanced communications, computing and content, bioscience, nanoscience and advanced materials. The program provided targeted focus on state strengths while fostering university and industry relationships. www.gra.org

GRA also supports the VentureLab program. According to GRA, VentureLab helps create early-stage businesses that are ready to advance into traditional technology business incubators. Venture Lab reduces both the costs and risks associated with technology transfer in one-stop centers that serve as advocates for faculty researchers through:

- Technology assessment. VentureLab looks for timely innovations that will mesh with marketplace needs. In addition, staff members help faculty determine the best route for commercialization – be it licensing the technology to an existing company or forming a startup.

- VentureLab Fellows. The program connects faculty researchers with experienced entrepreneurs and professional managers who serve as coaches and drive the commercialization process forward.
- VentureLab commercialization grants. Funding is available to bridge the gap between research and commercial product.

Georgia's Intellectual Capital Partnership Program

Georgia's Intellectual Capital Partnership Program (ICAPP) is the University System of Georgia's economic development program. ICAPP connects the intellectual resources of Georgia's public colleges and universities to the state's business community in innovative ways. ICAPP staff and a team of economic development leaders from each campus help Georgia businesses to tap into the University System of Georgia to recruit college-educated employees, access the latest research, and access business and operations advice. The program helps industry connect to research through a variety of mechanisms.

- Database of research centers **to search** more than 400 entries in the ICAPP Catalog of USG Centers, Institutes and Special Programs to find expertise in a wide range of areas.
- Industry-directed research **working** with businesses to conduct research that meets industry needs through a wide range of programs.
- The regional offices of Georgia Tech Enterprise Innovation Institute help companies improve productivity and quality, reduce costs, plan expansions, start new operations, and implement proven manufacturing technologies.
- Advanced Technology Development Center (ATDC) helps technology-based companies rapidly bring new innovations to market. ATDC has four locations in Atlanta, Savannah and Warner Robins, Georgia.
- The SBIR Resource Program helps Georgia companies with less than 500 employees get Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants, available from federal agencies for high-risk research.

University of Washington - LaunchPad Program

In an effort to catalyze the creation of new ventures based on promising University technologies and innovations, the Technology Transfer Office at the University has developed the LaunchPad. Once an entrepreneur expresses an interest in starting a company based on their UW innovation, the staff reviews the case, works with entrepreneurs to develop a detailed start-up plan, and additionally supports the entrepreneur through:

- Managing start-up project plans
- Identifying next steps and milestones
- Finding community mentors and advisors

- Coaching team members
- Facilitating communication and networking with business and investment professionals
- Linking the project team to needed resources