MAINE STATE LEGISLATURE

Maine Technology Institute
Investing in Promising Technologies

Evaluation of Maine Technology Institute Programs

For Awards Ending June 30, 2002-June 30, 2006

Dr. Charles S. Colgan
Principal Investigator
Dr. Bruce H. Andrews
Project Director

January 16, 2007

usm
UNIVERSITY OF SOUTHERN MAINE

Center for Business and Economic Research
A Joint Center of the School of Business and the Muskie School of Public Service

Table of Contents

Introduction

- The Maine Technology Institute (MTI) is charged by the Legislature to conduct an evaluation of its programs every two years addressing issues of the effectiveness of MTI's grant programs in fostering technology-based economic development. MTI has engaged the Center for Business and Economic Research (CBER) at the University of Southern Maine to conduct this evaluation. This is the third evaluation report prepared by CBER; previous reports were released in 2002 and 2004.

- This report covers the first five years of grant making activity by the Institute, including all grants that were completed as of June 30, 2006. *All dates in this report refer to the fiscal year (July-June) in which a grant closed.*

- The assessment of MTI programs is conducted through a report by all recipients concerning their organization, the research projects, and grant awards. This report is filed through an online reporting system that is managed as part of the State of Maine's Research and Development Evaluation. All grants which close by June 30 of a given year are required to report within 1 year of grant closure, and are required to provide follow-up information once a year for each of the four subsequent years following grant closure. For more information about the survey, see the Technical Information section at the end of this report.

- Between MTI's inception and June 30, 2006 342 recipients have completed 440 research projects supported by 519 grants from MTI. A research project may be supported by multiple MTI grants including both seed grants and development awards.

- Because this report considers only closed grants from MTI, it does not cover the full range of grant making activity that has been undertaken. Through June 30, 2006, MTI had made 745 grants totaling $32 million. Grants not completed by June 30, 2006 will be covered in future reports.

- Of the 519 awards that were completed, 448 were seed grants and 71 were development awards. The total amounts awarded to these projects was $15.5 million, of which $11.4 million was from the Development Award program and $4.1 million was from the Seed Grant program. In addition, there were 27 SBIR Phase 0 awards totaling $115 thousand. These programs combined totaled $15.6 million.*

- In addition, 19 awards were made under the Cluster Enhancement Award program, totaling $1.5 million and matched by $4.9 million. An assessment of these grants is included in this report, but cluster enhancement projects are not followed with a survey of impacts similar to those used for the Seed Grant and Development Award programs, so Cluster grants are assessed in a separate section of this report. All other sections of this report cover the results of the Seed Grant and Development Award programs.

- Eleven MTI grants to the University of Maine are not covered in this report; they are examined in the overall evaluation of Maine Research & Development support programs.

- Dr. Charles Colgan, Professor of Public Policy and Management, was principal investigator for this project and author of this report. Dr. Bruce Andrews, Professor of Management Science, served as project director. Research Assistants on the project included Svet Kirtchev, Steven DesRoberts, Onur Oztuncer, Baris Sagiroglu, Ekaterina Morina, Anil Oztuncer, and Lindsey Howe. CBER Research Associates Fred Aiello, Professor of Management, and John Saunders, Professor of Accounting, contributed to the project.

* For a description of the MTI programs, see the MTI website at www.mainetechnology.org

Key Findings

- Over its first five years, MTI has largely succeeded in fulfilling the mission of the agency to assist in the development of new technological products for markets in Maine and elsewhere.

- MTI funds research and development which will lead to marketable products and services. Research is an inherently risky activity, but MTI-funded projects have had a high rate of success, with 60% of research projects resulting in marketable products, and of those, 60% were available for sale at the time of reporting. The number of successful research projects has increased steadily over the five years of funding activity.

- MTI-funded companies have shown economic growth over the five-year period. Total employment in MTI client companies has risen by over 600 (though not all companies have shown employment growth). This was a composite growth rate of 6.2% compared with 0.9% for the Maine economy as a whole from 2001-2006. Revenues from the MTI client companies equaled or exceeded $100 million by 2006. Total revenues for MTI clients were negative in the early years following project completion, but turned positive and grew rapidly as time passed, which is the pattern expected of entrepreneurial research-oriented firms.

- MTI clients indicate that a majority of the sales from their MTI-supported products will be in the U.S. and outside of Maine. A small portion of sales are expected to be in export markets.

- Through June 30, 2006, grants in the Development Award, Seed Grant, and SBIR Phase 0 programs totaling $15.6 million were completed. These state funds were matched by $26.6 million from grant recipients. These funds leveraged an additional $8.1 million in federal small business research grants. External equity investments totaling more than $81 million were made in a small number of MTI clients. MTI clients also secured more than $74 million in debt financing. This resulted in a leverage of more than $12.00 in private and other government funds for every $1.00 of MTI funding.

- MTI research projects have resulted in a high rate of products for which intellectual property protection in the form of patents, copyrights, trade marks, and registered trade secrets has been secured. Over the five years, 63% of MTI-funded research has secured intellectual property protection. Twenty-two percent of research projects (199 projects) resulted in U.S. and/or foreign patents. Precision manufacturing and information technologies were the largest sectors in terms of securing intellectual property protection. Precision manufacturing was also the largest in terms of patents, followed by environmental technologies and biotechnology.

Key Findings

- In terms of economic growth, biotechnology and composites showed the strongest patterns of revenue and employment growth. Precision manufacturing showed job declines, consistent with overall manufacturing employment trends. Manufacturing did have the largest number of patents granted, followed by biotechnology.

- MTI funds were distributed to all 16 Maine counties, with Cumberland County receiving the most funds, followed by Lincoln County. On a per capita basis, Lincoln and Washington counties were the largest recipients of MTI funds.

- Overall, grant recipients give MTI very high marks for its assistance, with over 93% indicating a positive working relationship with MTI, and over 80% indicating that MTI was helpful to the client.

- MTI functions in a network of supporting organizations for the technology industries in Maine, and provides a number of advisory services and assistance for its clients. Clients report a high rate of usage of these assistance services and MTI receives the highest rating of all organizations for the proportion of clients indicating such assistance was critical to their success. Campuses of the University of Maine System are the second highest in terms of use and critical assistance.

- MTI also administers the Cluster Enhancement Award Program. These grants, totaling $1.6 million and matched by $4.9 million over 2002-2006, have funded a variety of projects to provide research equipment and facilities, to assist in the development of trade associations, to prepare analysis of the markets for Maine technological products, and to conduct research of general interest to sectors. These projects have largely succeeded in their goals, though their impacts on overall cluster development cannot yet be assessed.

- MTI's success in assisting cluster development can also be assessed by examining the reported results for the Development Award and Seed Grant programs, specifically those sections of this report covering:
  - Inputs/Outputs (purchases of goods and services within Maine and sales within Maine
  - Relationships with supporting organizations
  - Innovation levels
  - Growth

Ideally, the strongest contribution to cluster development will be in sectors that have strong input purchases from within Maine and a high proportion of sales to other Maine firms, extensively use in-state supporting organizations, have high rates of innovation, and show strong growth. Based on these factors, the performance of MTI clients in the technology sectors can be briefly summarized:

Key Findings

	Inputs	Outputs	Supporting Organizations	Innovation	Growth
Biotech	Lowest proportion of service inputs, second lowest in materials	Weakest expected sales in Maine	Strong in-state	Third highest in patents, fifth in total IP	Strong Growth
Composites	High inputs of services	Seond weakest sales in Maine	Strong in-state	Smallest IP Secured	Strongest Growth
Environmental	Highest inputs of materials	Strongest expected sales in Maine	Stronger out-of-state	Second highest patents, fourth overall	Strong Employment, Middle Revenue Growth
Forestry & Ag	High inputs of both servies and materials	Second strongest sales in Maine	Stronger out-of-state	Tied for second lowest patents; 6th overall	Weak Employment & Revenue Growth
Info Tech	Lowest proportion of materials	About average for all sectors	Equal in- and out-of-state	Second highest because of copyrights	Moderate Employment, Weak Revenue Growth
Marine	Highest proportion of services	About average for all sectors	Equal in- and out-of-state	Third highest overall	Weak Employment & Revenue Growth
Precision Mfg	About average	About average for all sectors	Slightly more use of in-state	Highest in patents and overall	Employment decline & weak revenue growth
Page Reference	25	24	30	20	13-14

This analysis of the results of MTI development awards and seed grants shows that each sector has made some progress towards being a stronger cluster, but none makes consistent progress on all measures.

- Certain aspects of MTI performance cannot be assessed with the quantitative approaches utilized in this report, but should be noted. MTI is at the center of an increasingly dense network of organizations in the public and private sector that together comprise Maine's technology-focused industries. Through its many meetings, presentations, conferences, and events MTI provides opportunities for networking and communication among participants in the technology-focused industries that might otherwise not exist but which are critical to successful research and development.

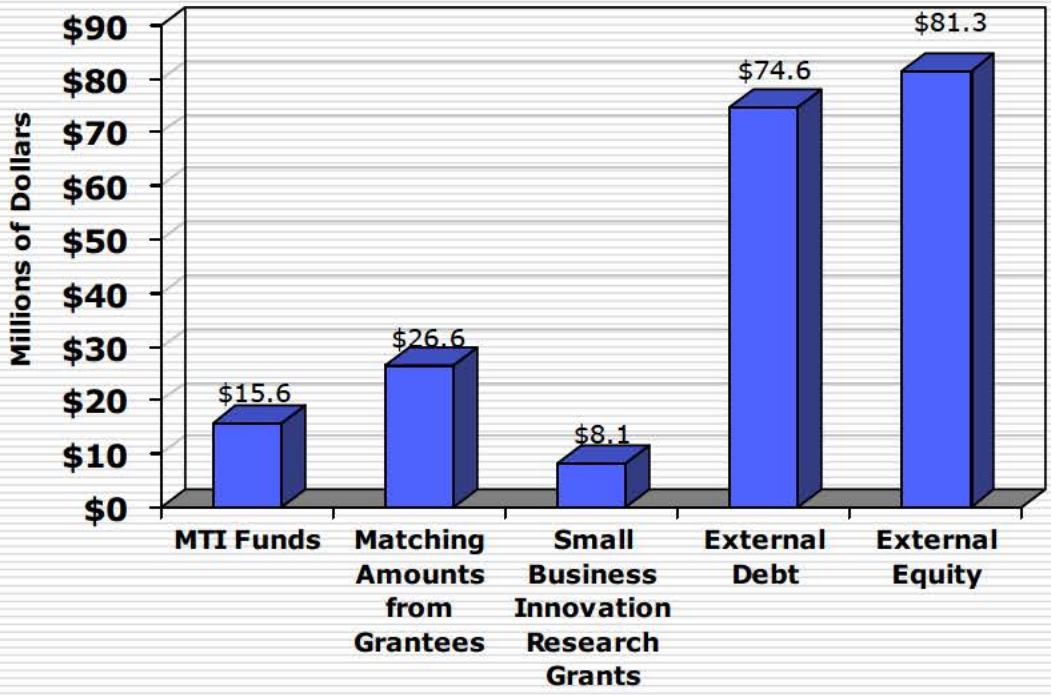
- While many of the measures noted in this report are strongly indicative of success, some measures are not widely distributed across the technology sectors. For example, employment growth has been concentrated in one sector (composites) and only a small number of firms have secured equity investments (though these investments are very large). This is a reflection of the still early stage of growth and evolution in the technology-focused firms and industries in Maine today. Broadening the success across more firms and industries will be a key challenge for MTI in the next phase of its programs.

Research Products

MTI's total investment of $15.6 million for all five years has multiplied many-fold in the form of matching funds pledged by grantees ($26.6 million), additional federal grants secured ($8.1 million), and the attraction of debt and equity investments for expansion of MTI client companies. Over the five years, MTI grantees pledged or secured $190.5 million in additional funds to support research, development, and production of new products. Including MTI grant funds, over $206 million was raised for research and development and for investments in businesses supported by MTI.

This meant that every $1.00 in MTI Seed Grant and Development Award grants leveraged factor of $12.00 in additional private and public support.

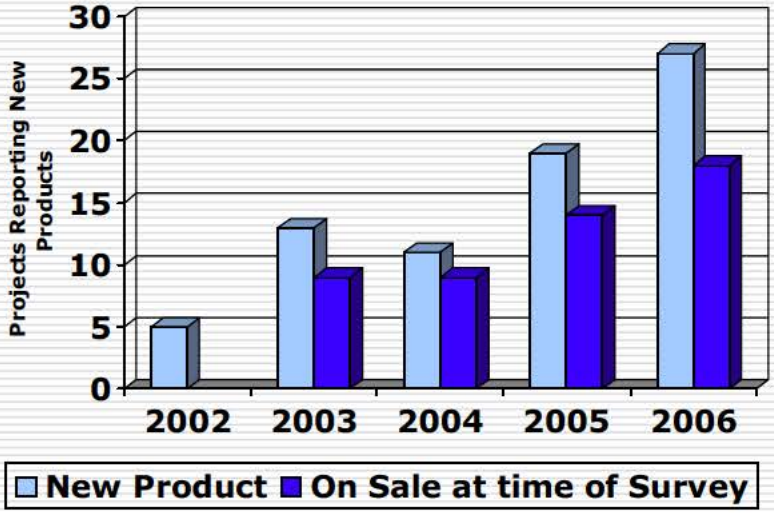
Funds for R&D and Production



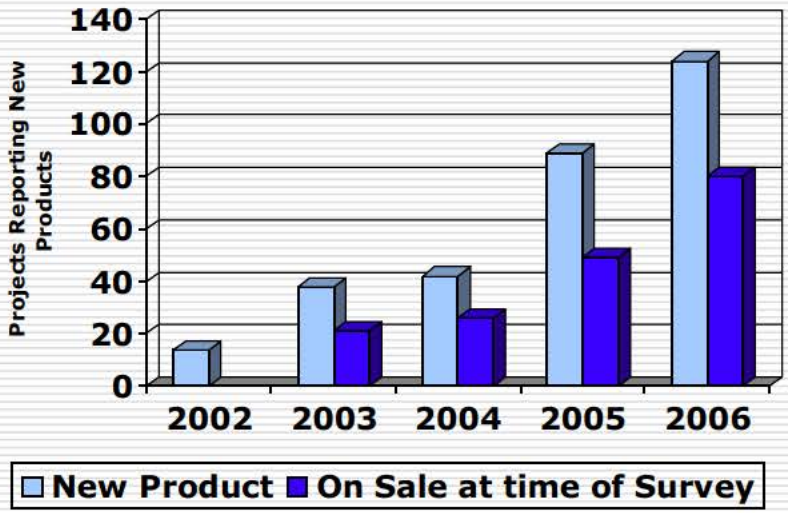
NOTE: Figures do not include cluster enhancement awards

MTI grant recipients report a high rate of success in developing new products. Of 440 research projects, 382 are reported to have successfully developed new products, a success rate of 60%. Of those projects, respondents report that 60% of the new products developed were on sale at the time the survey was conducted over the period 2003-2006. (The question of whether the product was for sale was not included in the 2002 survey). Product development success has increased with each year for both the Development Award and Seed Grant programs.

Development Awards



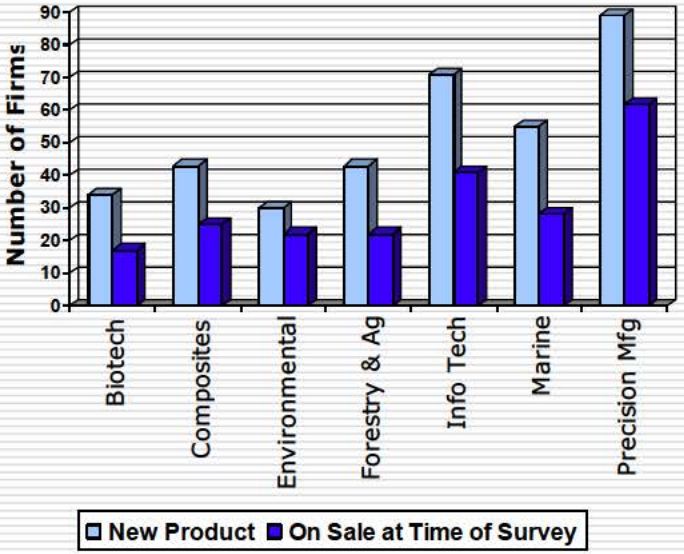
Seed Grants



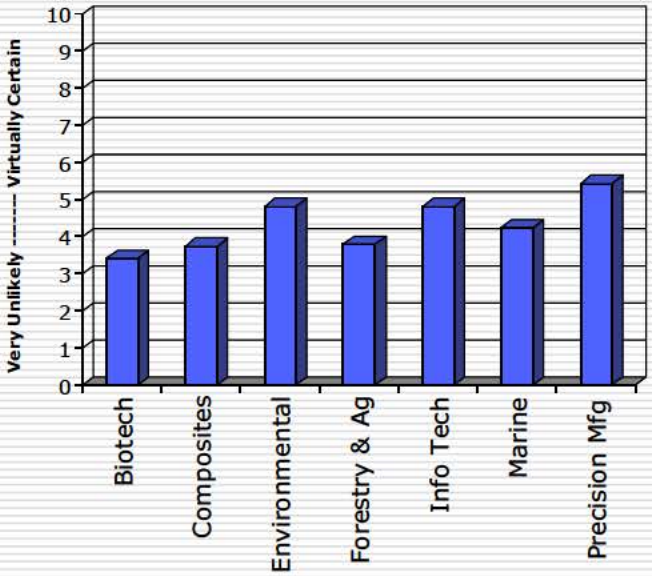
Firms in precision manufacturing and information technologies are more likely to have developed a new product with their MTI funds. Environmental technology firms were least likely to have a new product for sale, but have the highest proportion of new products on sale.

Respondents who did not indicate that their MTI-assisted product was on sale at the time of the survey were asked to estimate how likely (on a scale of 1-10) it is that their research would result in a new product for sale within two years (with 1 being least and 10 being most likely). Seed grant recipients were more optimistic about their projects (mean=5.8) than development award recipients (mean=4.4). Firms in precision manufacturing, environmental technologies, and information technologies tended to be the most optimistic.

Number of Firms Indicating MTI Assistance Led to Product for Sale



Likelihood of Marketing MTI-Supported Product Within Two Years



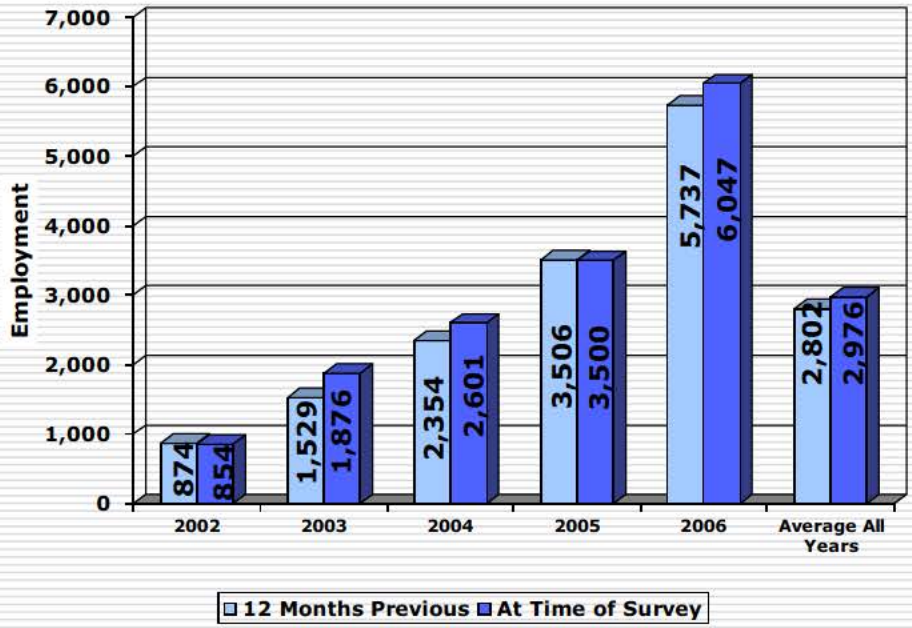
Economic Impacts

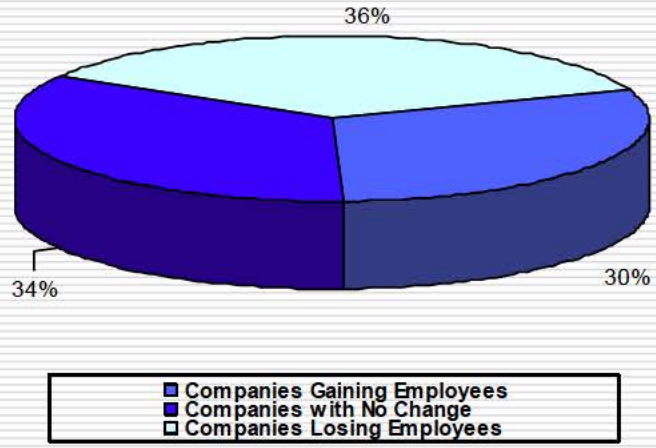
Employment in MTI-assisted companies increased by a total of 664 employees from 2002-2006 cumulating growth from the beginning of the first reporting period to the time of each annual survey. Based on the reported employment change within each year, average annual employment grew by 174 or 6.2%. (Wage & salary employment in Maine grew by 0.9% from 2001-2006)

The pattern of employment growth within each year is generally consistent with overall employment growth trends in Maine. Modest growth for the periods June-June 2003, 2004 and 2006 mirrored employment growth trends in the Maine economy as did a slight decline in 2002 and stability in 2005. Over the 5 years, MTI client companies were about evenly divided between firms gaining employment each year, losing employment, and showing no change in employment.

MTI recipients indicate an average wage paid over the five year period of $36,900 compared with a Maine average wage of $30,880 over the period 2002-2005*.

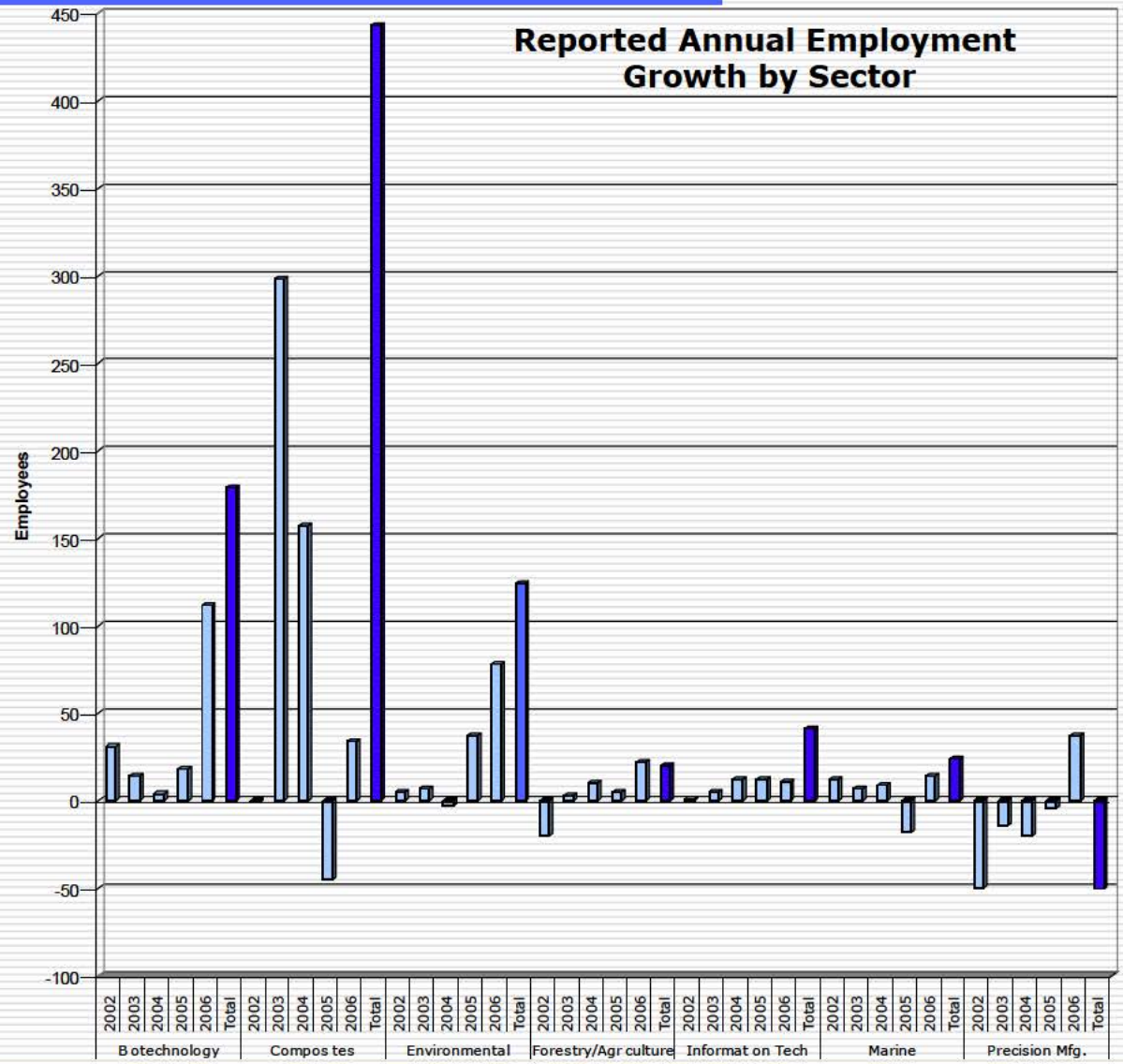
Employment in MTI-assisted Companies at Time of Survey and 12 Months Previous



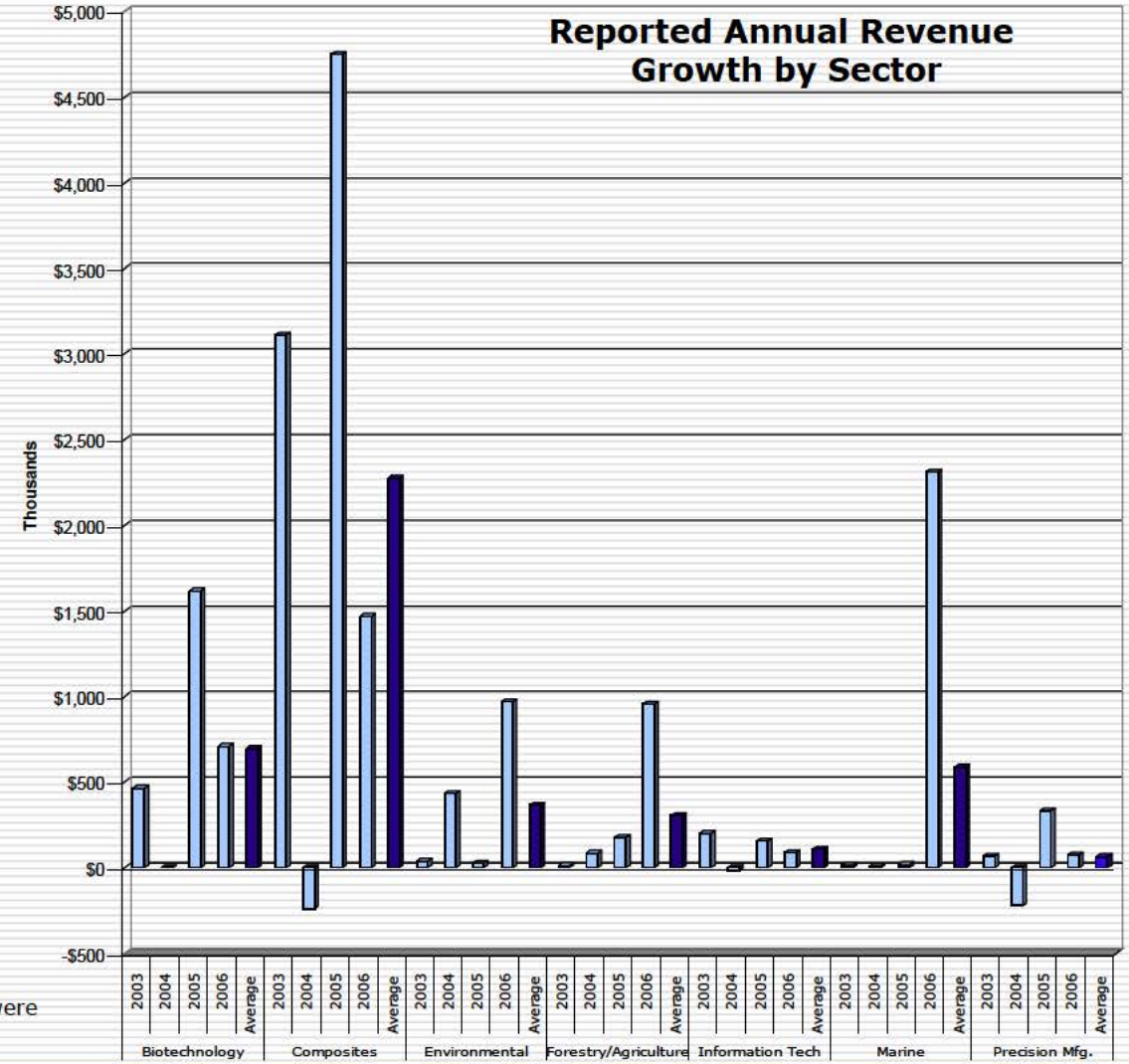


*2006 Data not available; average wages for Maine based on wage & salary employment Source: Bureau of Economic Analysis

Employment growth measured on an annual basis (employment at the time of survey v. one year earlier) over the 5 years shows that composites accounted for most of the employment growth, with biotechnology and environmental technology second and third. Despite MTI investments, precision manufacturing firms lost employment in 4 of the 5 years and in total. This is consistent with manufacturing employment overall.



Revenue growth measured on the same basis as employment* on the previous page shows that composites and biotechnology also led in revenue growth, but marine technology was third among the sectors because of very strong growth in 2006. Manufacturing showed slight revenue growth.



*Revenues in prior year were not reported in 2002.

The preceding analysis of employment change focuses on grant recipient reported changes in employment during the year in which they are surveyed. The analysis of revenues focuses only on aggregate growth as reported each year. Another perspective on both employment and revenue growth is provided by tracing employment and revenue growth from year to year for the same company.

The following tables show the net changes in employment* and revenues (gains minus losses) for companies based on the first year of their reporting. In the employment table, those recipients who first reported in 2002 showed a net gain of 3 employees in 2003, but a net loss of 20 employees in 2004. This was followed by a net gain of 66 employees in 2005 and 181 employees in 2006. The table for revenues may be read in the same manner.

These two tables show that both employment and revenue growth have generally increased over time for MTI grant recipients. There is a general pattern shown in both tables. First there is a decline in employment and/or revenues in the first one or two years following completion of an MTI-funded grant (which may be in part related to employees being hired with MTI funds being let go at the conclusion of the research project). However, two to four years later there tends to be noticeable growth in both employment and revenues. This pattern is what would be expected of small firms in the early stages of product development who then move into a period of growth and maturity.

Employment Change 2001-2006: Same Firm

		Year of Follow-up Report				
Year of First Reporting		2003	2004	2005	2006	Total
	2002	3	-20	66	181	230
	2003		0	-6	347	341
	2004			-101	281	180
	2005				-217	-217
	2006				130	130
	Total					664

Revenue Change 2002-2006: Same Firm

		Year of Follow-up Report				
Year of First Reporting		2003	2004	2005	2006	Total
	2002	-$34.4	-$1,251.5	$10,306.1	$38,185.5	$47,205.7
	2003		-$146.2	$2,234.1	$36,665.3	$38,753.1
	2004			-$40,886.5	$115,894.6	$75,008.1
	2005				$98,961.1	$98,961.1

*Employment change measured as employment reported at time of survey and employment at the beginning of the first year of reporting. These tables sum the reports of the same firm over each year a report of employment or revenues is made and thus longitudinal history.

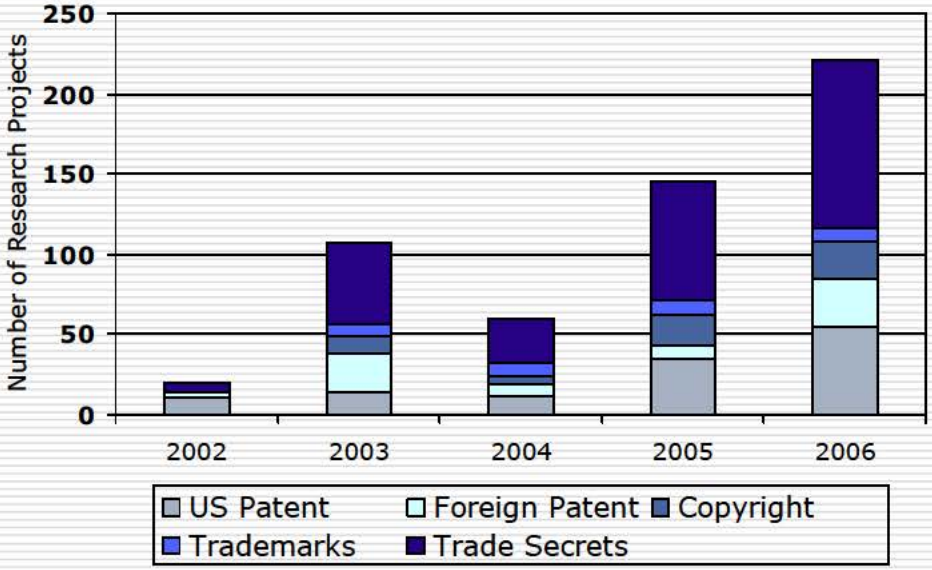
Intellectual Property

Maine has historically lagged other states in the development of patentable products, so the use of MTI assistance to create products that receive patents, or are otherwise subject to protection as the intellectual property of the firm, is an important outcome of MTI's programs. Intellectual property protection activities comprise patents (both in the U.S. and abroad), copyrights, trademarks, and trade secrets. Some of these methods are applicable to all sectors (e.g., trademarks), while others are more applicable to some sectors than others (copyrights are the most common form of intellectual property protection in the information technology sector).

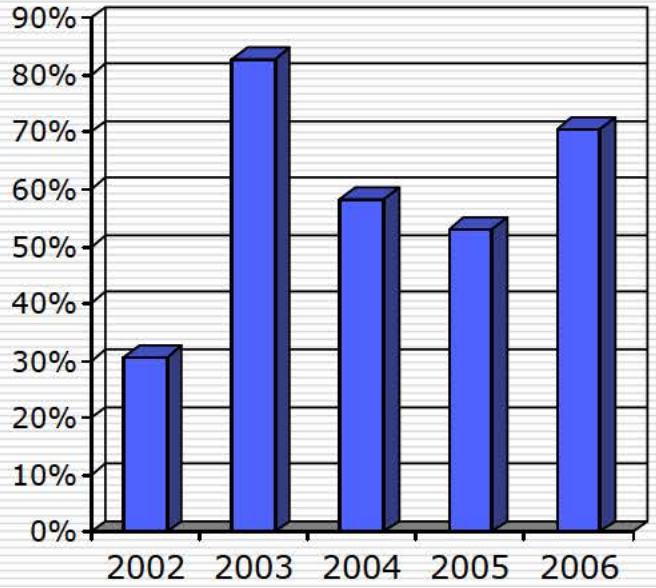
The number of intellectual property protection activities reported by MTI grantees increased with each year, although this has been driven in large part by the increases in the number of awards. However, the proportion of MTI-funded research projects which have resulted in some form of intellectual property protection has varied from year to year, from a low of 30% in 2002 to a high of 82% in 2003. Over the five years, 63% of MTI-funded research projects resulted in some form of intellectual property protection.

199 projects reported getting patents in the U.S. or abroad, which was 22% of all research projects.

Intellectual Property Protection Secured



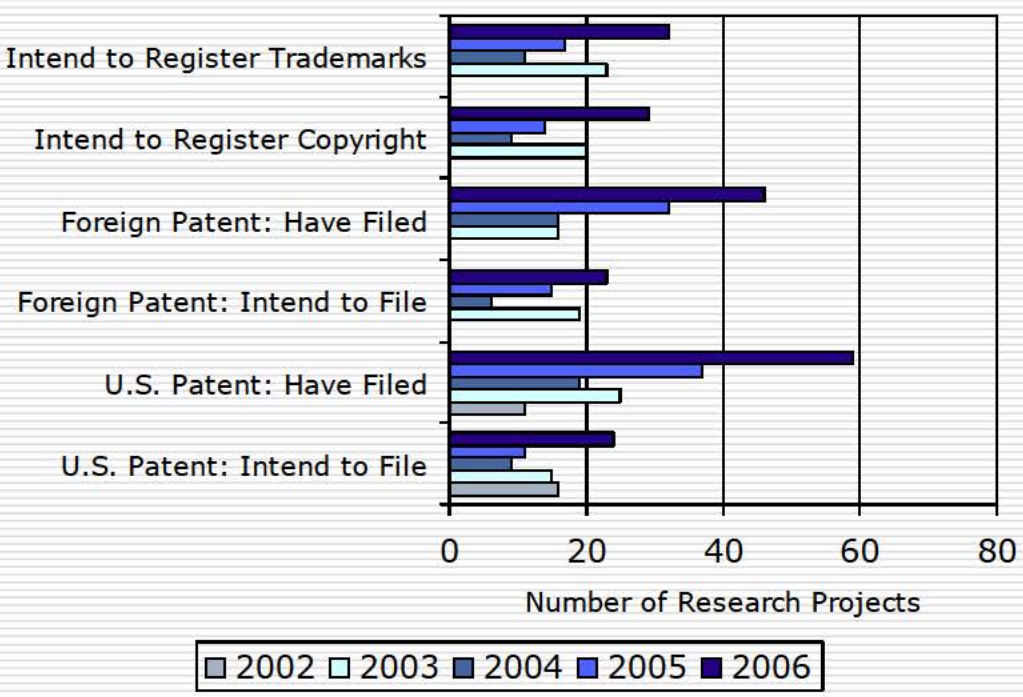
Percent of Projects Indicating Intellectual Property Protection Secured

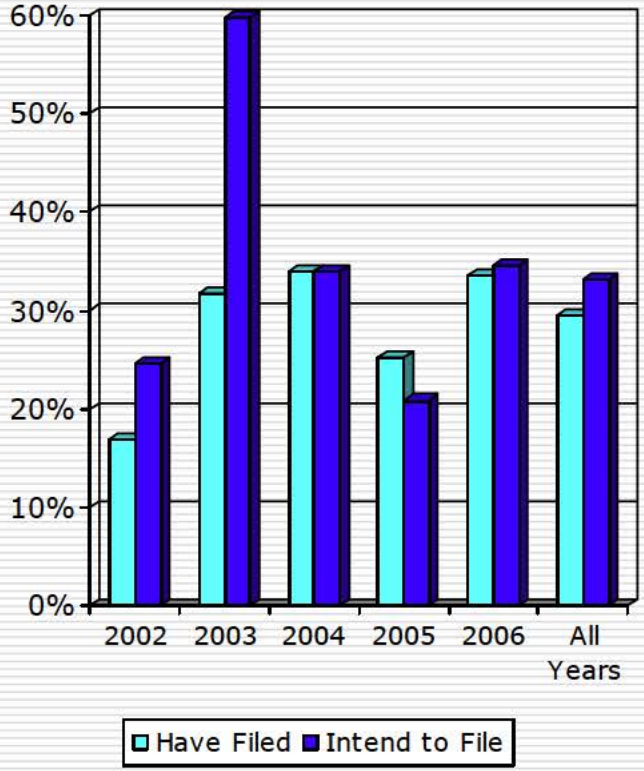


Granting of patents or other intellectual property protection takes time, so it is also necessary to examine the plans of MTI recipients to secure intellectual property protection. The number of projects for which respondents indicate they were seeking to or have filed for intellectual property protection has grown over the period, roughly consistent with the growth in the number of projects completed.

Overall, 30% of respondents report that they had filed for intellectual property protection with respect to their projects, and 34% indicate that they intend to file. Projects completed in 2003 showed the highest proportion of projects intending to file for some form of intellectual property protection. With the exception of 2002, which had the smallest number of projects, the rate of respondents reporting that they have filed for intellectual property protection has remained approximately constant at about 31%.

Intellectual Property Plans



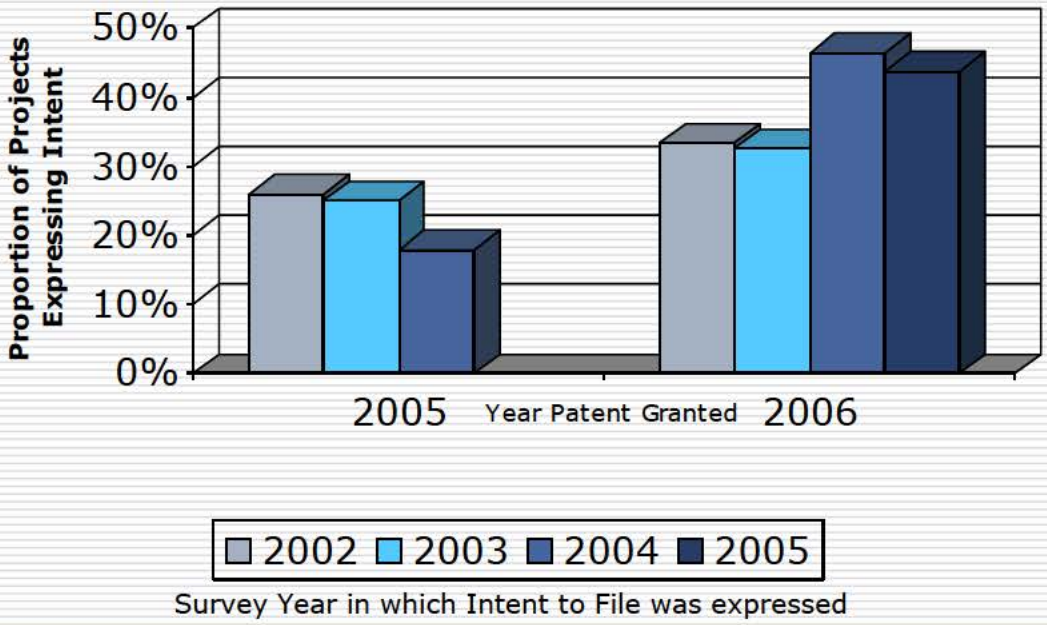


As indicated in the preceding analysis, there is a gap between initiating the process of securing intellectual property protection and being granted it. Patents are usually the most complex technically and legally to secure.

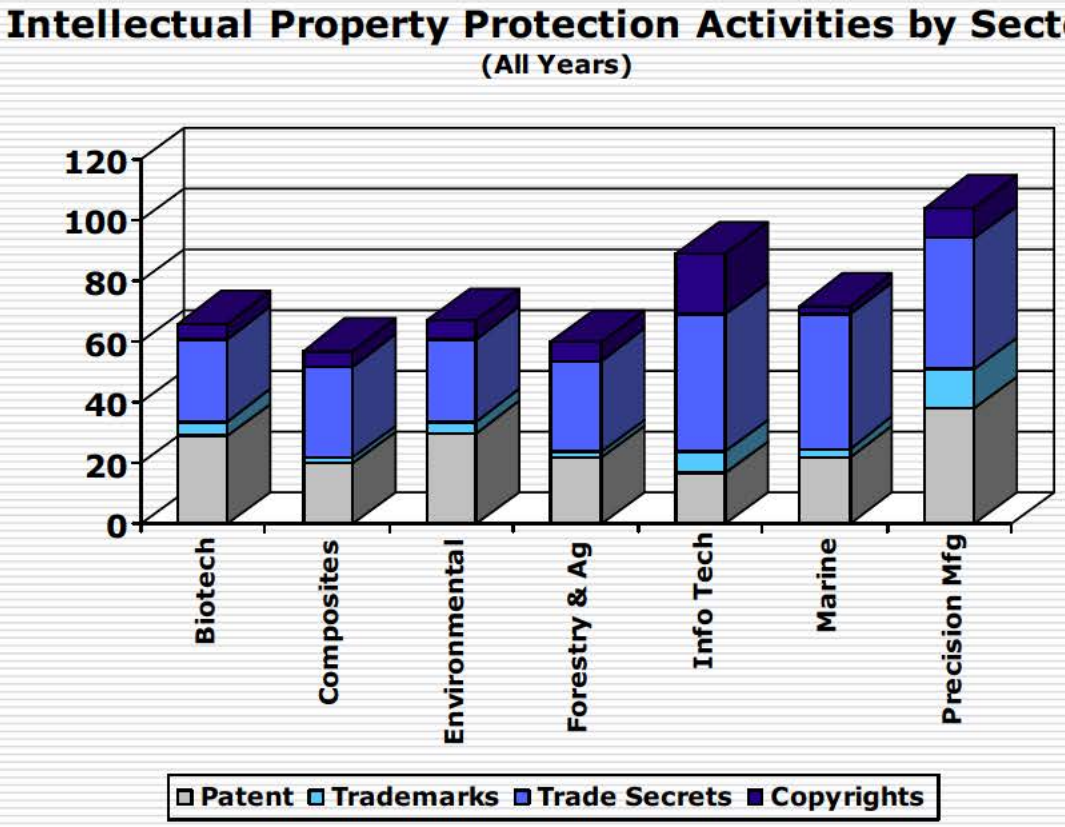
The figure below examines respondents' success in securing patents based on their indication that they intended to file for a patent. The bars represent the proportion of projects in each year that they received a patent as of 2005 or 2006. The color of the bars indicates the survey year in which a respondent indicated that they had filed for a patent. "Patent" in this analysis covers either a U.S. or foreign patent.

About one quarter of respondents indicating that they planned to seek a patent in 2002 or 2003 reported they had received a patent by 2005, with the number growing to about a third in 2006. For those indicating in 2004 that they planned to seek a patent, 18% had received a patent by 2005, while more than 40% had received it by 2006. Those reporting plans in 2005 that they plan to seek a patent also had a high success rate by 2006, with over 40% reporting a patent granted.

Patent Plans and Patents Granted



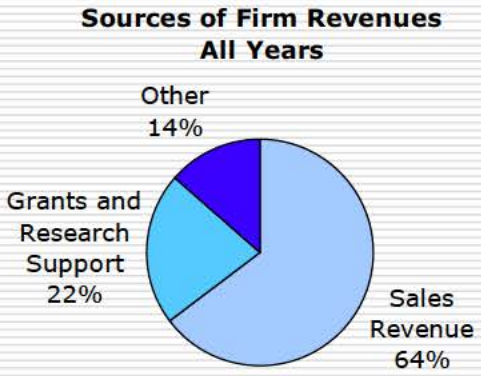
Projects related to precision manufacturing are the most likely to seek intellectual property protection overall, while projects in the composites industry are the least. Note that the different forms of intellectual property protection are not equally applicable to all sectors. For example, copyrights are more applicable in information technologies than in biotechnologies.

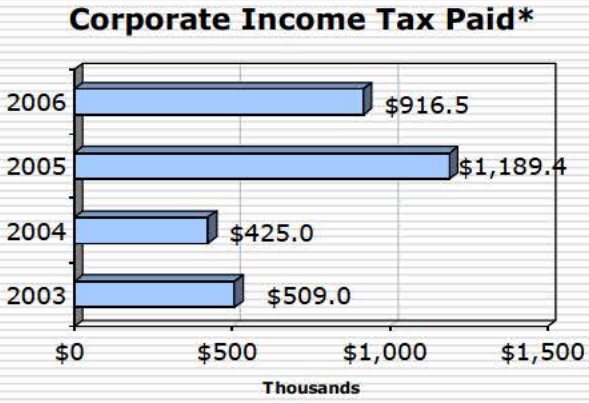


Effects on Company Finances

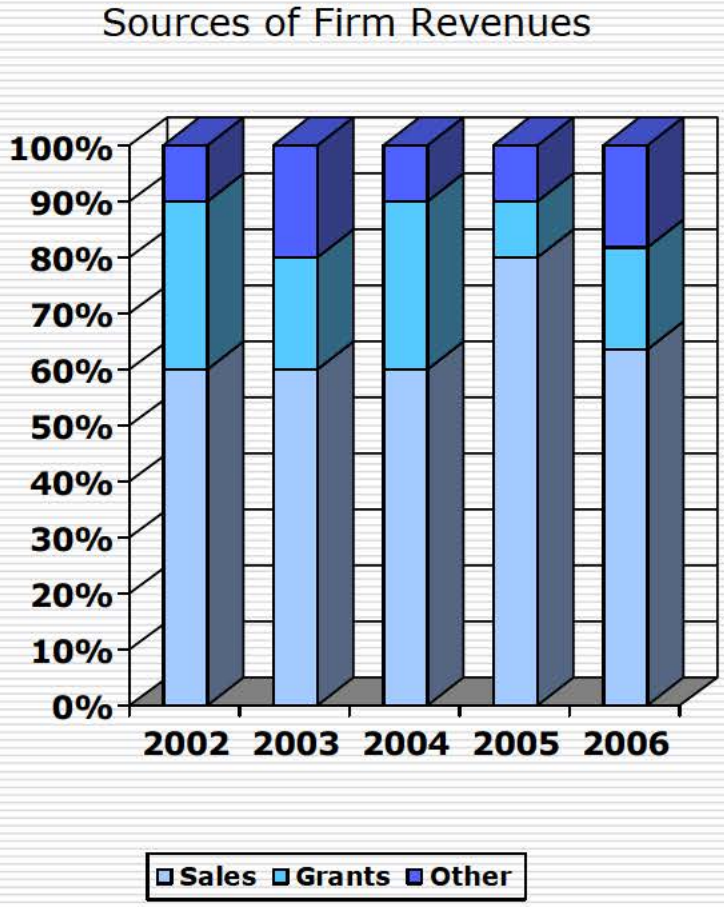
Overall, MTI recipient firms rely on sales for 64% of their revenues and on grants (from MTI and other research funders) for 22%. These proportions remained more or less consistent across all years, although grantees whose awards closed in 2005 had a very high percentage of their revenues from product sales.

Recipients completing their MTI-assisted projects from 2003 to 2006 report a total of $3.039 million in Maine corporate income taxes. However, this figure understates the tax impacts because many MTI clients will not have paid taxes through the corporate income tax, but through the personal income tax as partnerships, Chapter S corporations, or as sole proprietorships.



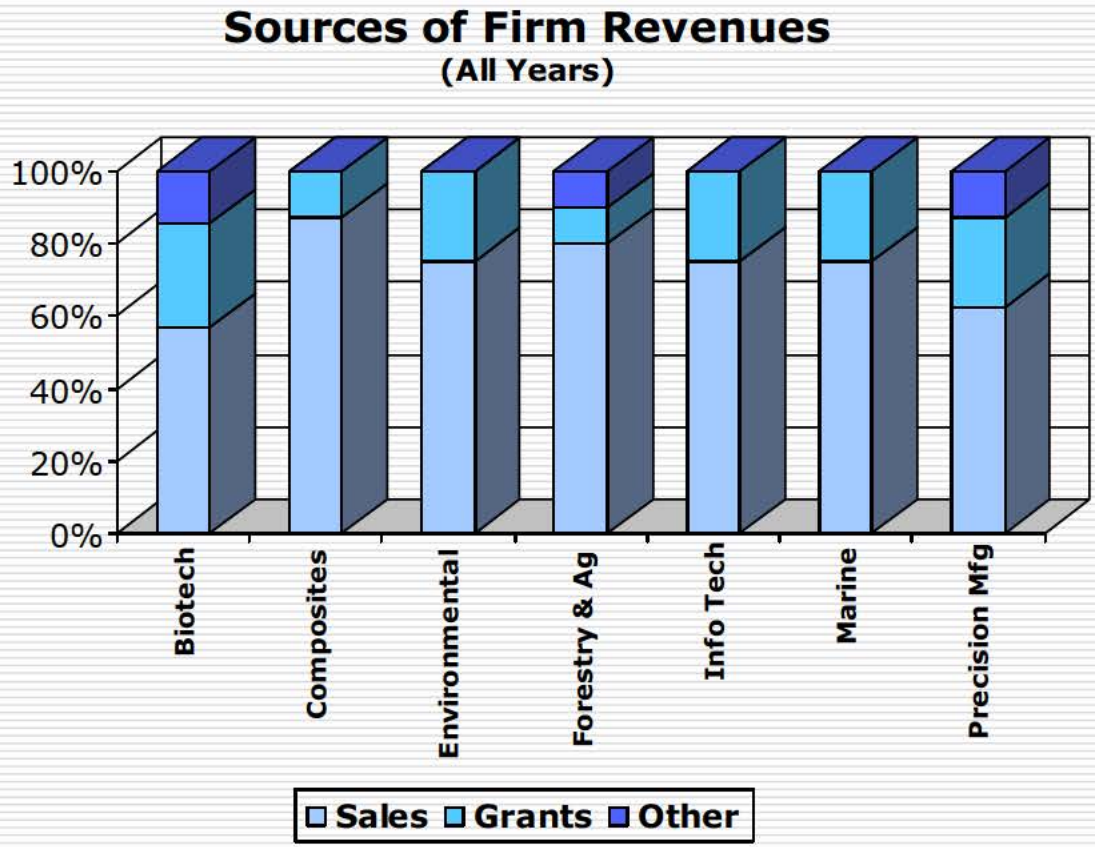


*Note: This question not asked in 2002



Biotechnology firms are the most dependent on grants and the least dependent on sales, as would be expected of this relatively young sector. In contrast, the more established sectors of composites and forestry/agriculture have the highest proportion of sales revenues.

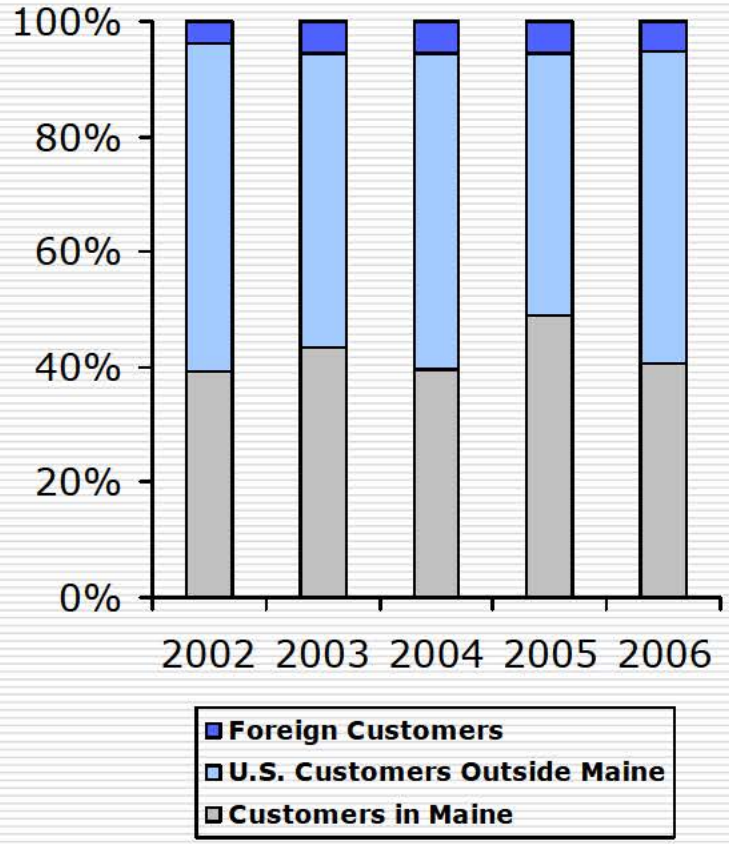
Grants are also a significant source of revenues for MTI clients in the environmental. marine, and manufacturing sectors. This reflects the orientation of firms in these sectors towards R&D that draws them to MTI in the first place.

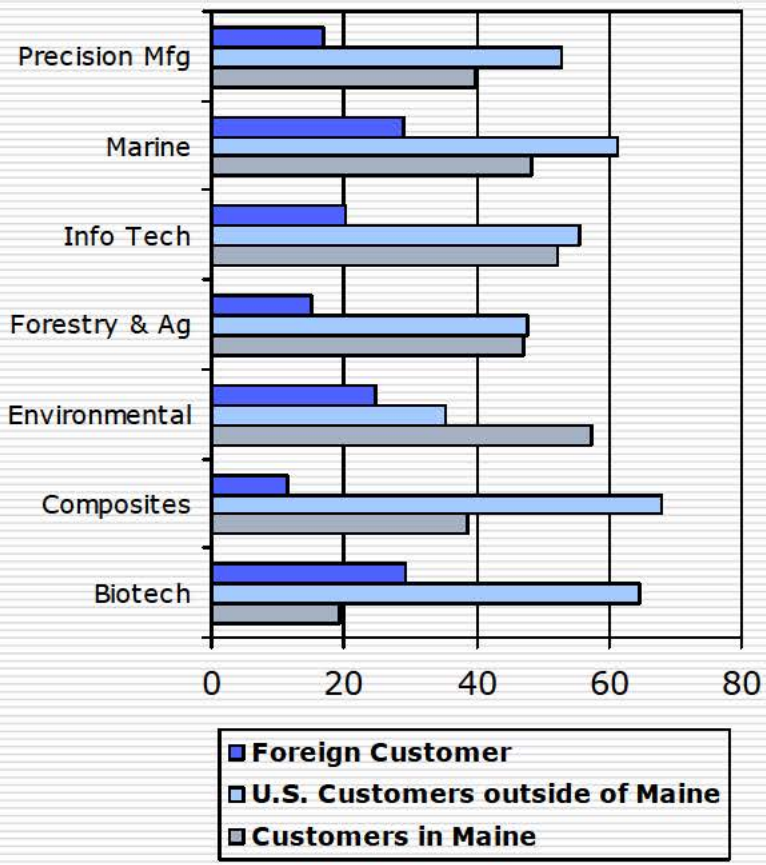


Over the evaluation period, MTI clients indicate that the majority of their sales are expected to be to customers outside of Maine, predominantly in the rest of the U.S., and this trend has been very consistent across all years. A much smaller proportion of clients indicate they will export outside the U.S., and this too has been consistent.

Firms in biotechnology expect Maine will be their smallest market for their MTI-funded projects, and have the largest expectations for exports. Composites have the smallest expectations for exports, while firms in environmental technology have the largest expectations for the Maine market.

Sales Expectations for MTI-Funded Projects

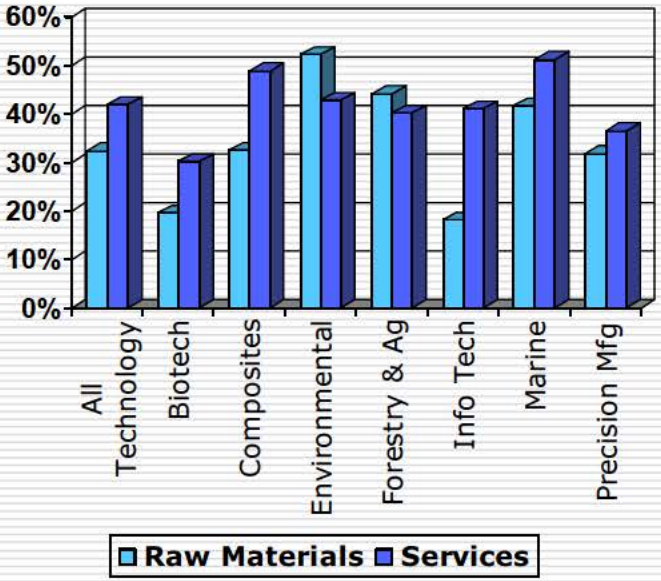


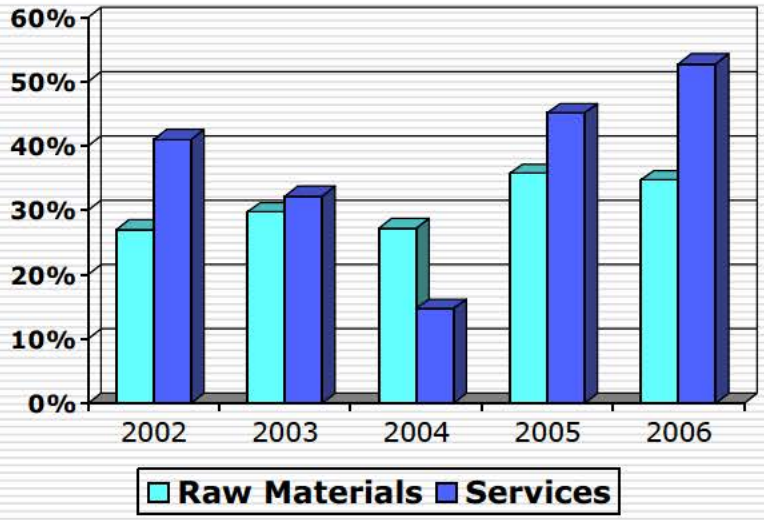


MTI clients indicated that they expect to purchase 32% of their material inputs and 42% of their services inputs from other firms within Maine for the production of the MTI-assisted products. Environmental technology indicates the largest portion of raw material inputs from Maine (52%), while firms in Marine Technology expect to purchase the largest proportion of services (51%). Biotechnology firms expect to purchase the smallest proportion of raw materials (19%) and services (30%).

Clients with projects closing in 2005 and 2006 indicate they will purchase a higher proportion of raw materials and services from within Maine than those closing in earlier years. Growth in this measure will be an important indicator of future economic impacts.

Proportion of Raw Materials and Services to be Sourced within Maine

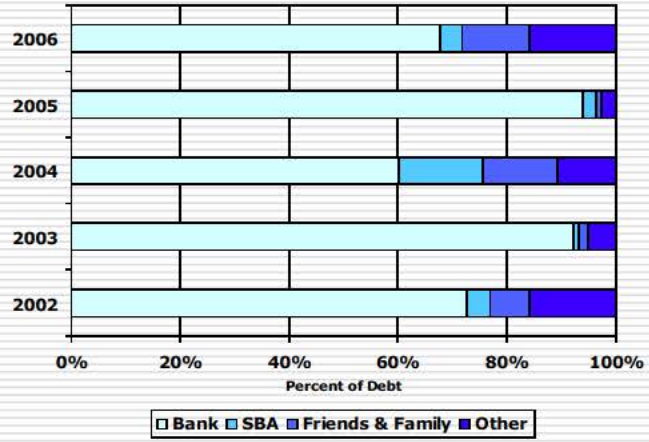




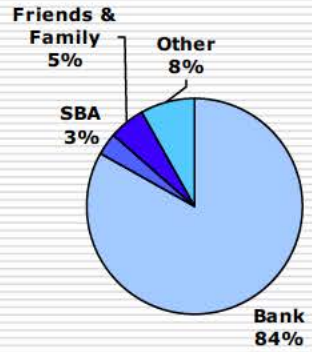
Over the past five years, MTI-assisted companies attracted $81.3 million in equity investments and $74.6 million in debt, for a total of $155.9 million in investment. The number of firms taking on debt (133) was about twice the number securing equity investments (65). This represented 39% of MTI companies taking on debt and 19% securing equity investments.

Bank debt comprises the largest source of debt financing, and this is consistent across each of the years. Friends and family are the second largest source of debt, though this varies from year to year, with "other sources" and SBA loans significant to those companies whose awards closed in 2004.

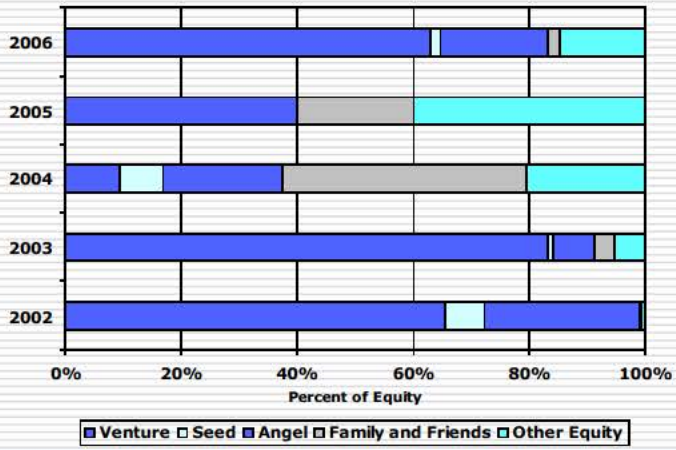
Venture capital comprises the largest portion of equity investment, but this is accounted for by only 6 companies. There is also substantial variability among the sources of equity investment, with friends and family being the largest source in 2004, but a small source in 2003 and 2006.



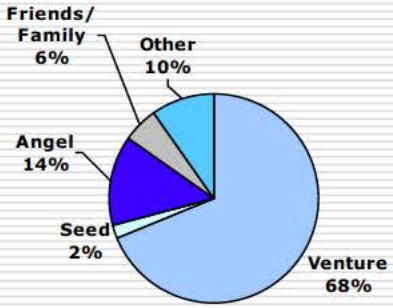
Types of Debt



All Years



Types of Equity



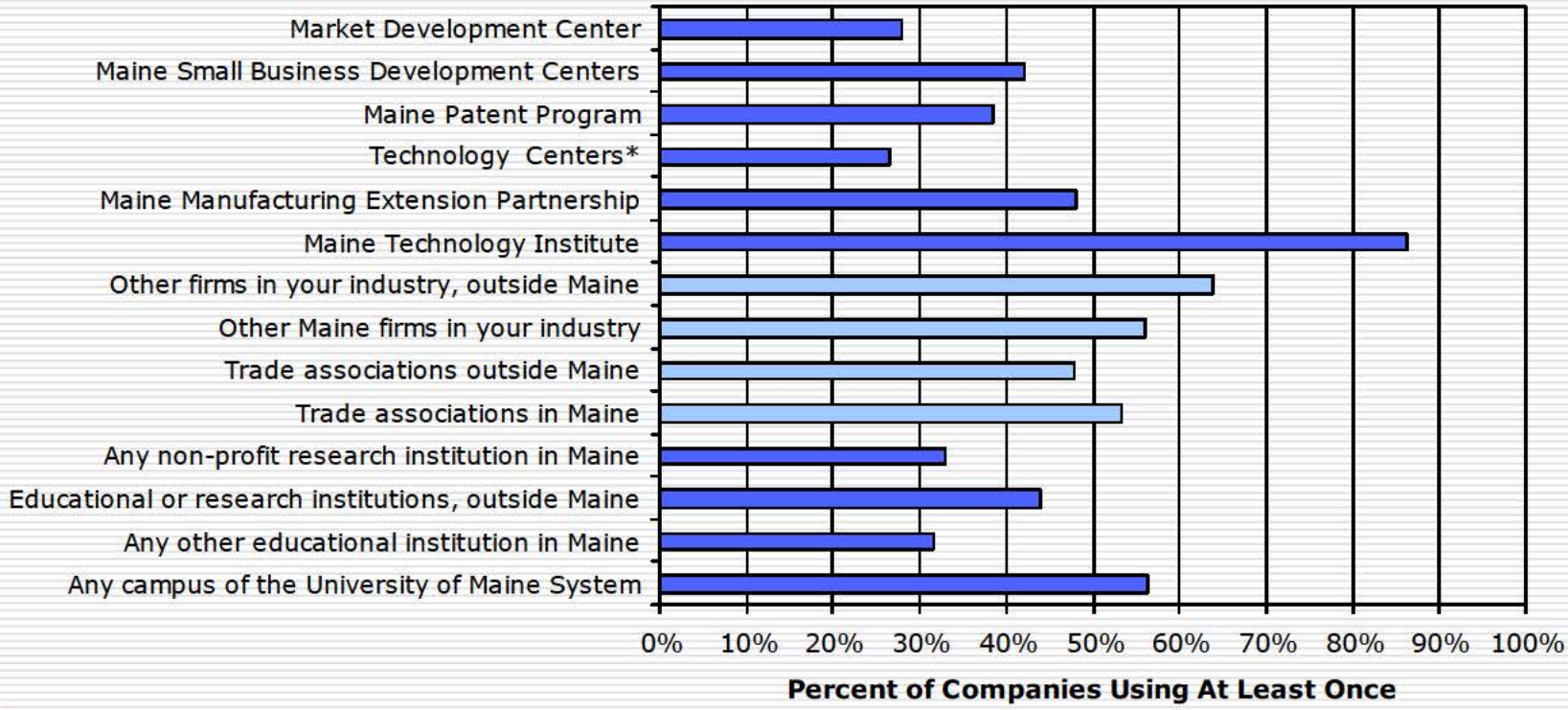
All Years

Relationships

Two types of organizations provide support and assistance to MTI firms in research and development: those supported by the public sector (both state and federal governments) and those in the private and nonprofit sectors. In terms of utilization, MTI is the most frequently mentioned organization of any type, which reflects in part the large degree of assistance that MTI offers beyond its funding programs. Campuses of the University of Maine System are the next most-used public organizations followed by the Manufacturing Extension Partnership and SBDC's.

Among the private organizations, the most commonly consulted are other firms in the same industry outside of Maine. This reflects the network of contacts among both competitors and customers in helping conduct R&D. Other Maine firms in the same industry and trade associations, both inside and outside of Maine, are the next most frequently cited. The least cited, Technology Centers, is a relatively new program, each of which has a specific focus that limits their use by a broad array of firms.

Number of Respondents that Received Assistance from Listed Organization: All Years



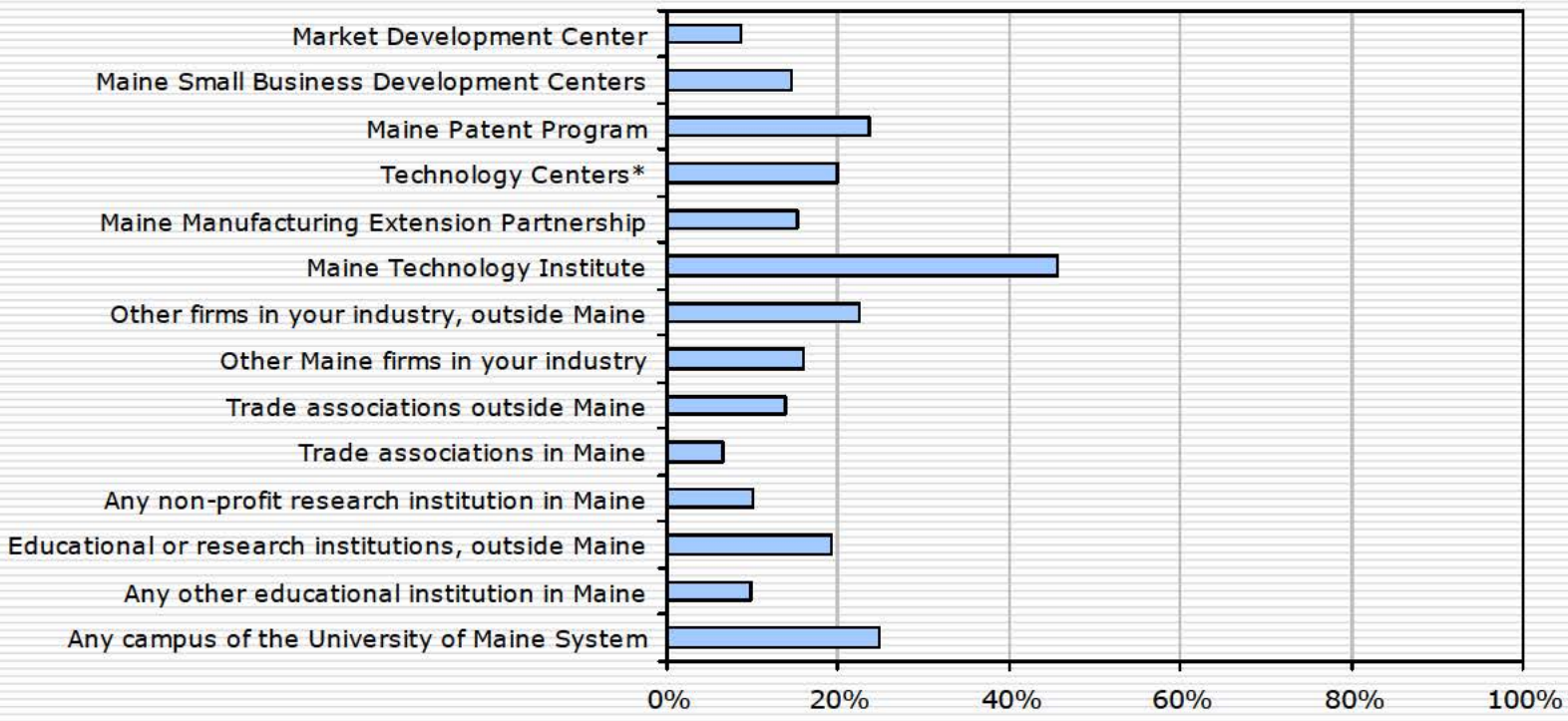
*Formerly Applied Technology Development Centers

Respondents were asked to rate the importance of their interactions with organizations to the success of their R&D activities on a scale from 1 (not important) to 5 (critical). The results are similar to the level of use, indicating MTI-assisted companies have a good sense of where to go for the help they require.

This chart shows the percentage of respondents who indicated that the assistance of the designated organization was "critical to the success of their research". The most highly-rated organization is the Maine Technology Institute, which has by far the highest proportion of respondents indicating "critical" assistance, followed by the Maine Patent Program, the University of Maine System campuses, and other firms in a respondent's industry outside of Maine.

It is worth noting that firms outside of Maine and trade associations based outside of Maine receive somewhat higher scores than firms or trade associations within Maine, an indicator that supporting organizations within Maine still need development.

Mean Rating of Organizations Consulted and Percent of Users Indicating Relationship was Critical to Success

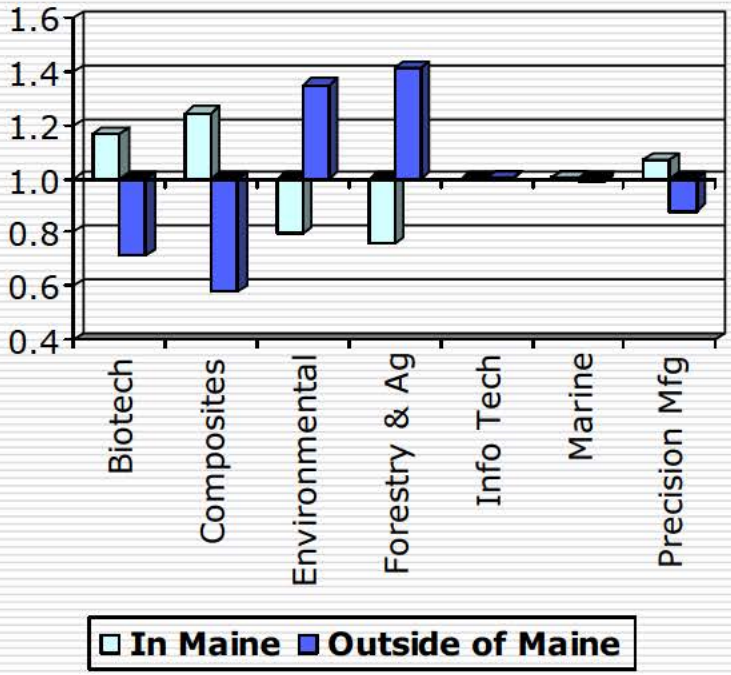


*Formerly Applied Technology Development Centers

An important element of cluster development in Maine is the availability and use of the supporting organizations discussed in this section. A stronger cluster will make extensive use of in-state supporting organizations. This figure examines the use, by technology sector, of the supporting institutions that are in Maine and outside of Maine. The data displayed is the use by each sector relative to all sectors. A positive number indicates that MTI clients in that sector used in (or outside) supporting organizations more than all MTI clients; a negative number indicates less use.

Biotechnology and composite firms are the strongest user of in-state organizations and the weakest users of out-of-state organizations. Environmental and, interestingly, forestry and agriculture, are stronger users of out of state organizations.

Sectoral Use of Supporting Organizations Compared with All Responses



Cluster Enhancement Award Program

The Cluster Enhancement (CE) Award Program was established to "seed efforts that will stimulate and support the formation

and growth of technology businesses and increase Maine's capacity for research and development leading to commercialization in Maine's technology-intensive sectors." The CE program provides grants up to $200,000 which may be used for a wide variety of purposes related to the seven technology sectors defined by the Legislature. Over the past five years nineteen cluster enhancement awards were completed, totaling $1.55 million. The awards and matching amounts are shown in Table CE-1*:

CE-1

Grant Close Year	Number of Awards	Award Amount	Matching Amount
2002	2	$173,981	$377,716
2003	4	$235,000	$1,018,500
2004	3	$131,000	$200,499
2005	4	$223,770	$959,073
2006	6	$788,435	$2,391,082
Total	19	$1,552,186	$4,946,870

The flexibility of the CE program means that there is a significant amount of variety in the projects that MTI funded. The CE awards made so far may be roughly grouped into five areas:

- **Association Development** Funds are used to support the development or enhancement of trade association services in one of the technology sectors.
- **Demonstration/Education** Funds are used to demonstrate the feasibility or applications of a Maine-developed technology and to educate the public or potential users about the technology.
- **General Research & Development** Research projects whose results will have broad applications in a technology sector.
- **Market Analysis** Investigation of potential markets for Maine-based technologies.
- **Research Capacity Enhancement** Investment in physical facilities, including building and equipment, which may be used for expanded or enhanced research capabilities.

The number and amounts awarded to these various purposes are shown in Table CE 2.

* Note that actual expenditures may differ from award amounts, as some projects closed earlier than anticipated.

CE-2

Award Purpose	Number of Awards	Award Amount	Matching Amount
Association Development	4	$255,421	$339,015
Demonstration/Education	1	$51,000	$121,050
General R&D	4	$236,410	$1,043,845
Market Analysis	5	$319,980	$452,460
Research Capacity	5	$689,375	$2,990,500
Total	19	$1,552,186	$4,946,870

A review of the cluster enhancement grants shows that most projects were completed on time and within budget. This was particularly the case with the research capacity projects, in which MTI contributed to the development of new equipment for wood composite testing, aquaculture research, and potato storage.

Some projects, such as those in furniture markets and wood composites use in marine facilities were not completed because of changes in personnel, circumstances in the grantee organization, or because they were connected to larger projects whose schedules changed. Other projects discovered through their research activities that their original premises were faulty and that activities needed to be redirected and reorganized. This was the case with projects related to "green" wood products, fish trapping, and the development of fractionation testing facilities for use in the creation of new products from biological materials such as wood pulp. These projects pointed to the need for further research before commercial applications would be possible.

Cluster enhancement funds were used as part of larger research projects in studies involving offshore wave power and in-stream tidal power. In both cases, cluster enhancement funds assisted Maine's participation in larger scale multi-state studies.

A key element to the ability of clusters of economic activity to play a propulsive role in regional economies is the strength of the associations among private firms and "related and supporting organizations" such as universities, trade associations, and economic development organizations. The four association development awards were intended to strengthen these relationships in biotechnology and the environmental/energy sectors. Each of these sectors received two awards, the first of which pointed to directions that required more focused activities to develop the associations. Those activities were supported with the second awards which lead to associations in each sector that appear to be quite vibrant based on available documentation.

Assessing the longer term effects of cluster enhancement awards is inherently more difficult than for those MTI programs which focus on the development of specific products for the market. This is particularly the case with R&D projects such as those funded in aquaculture in the past five years examining disease resistance in oysters and funding equipment at a research center as well as those noted above in energy research. Such projects are much closer to basic research than that typically undertaken with development award and seed grant assistance.

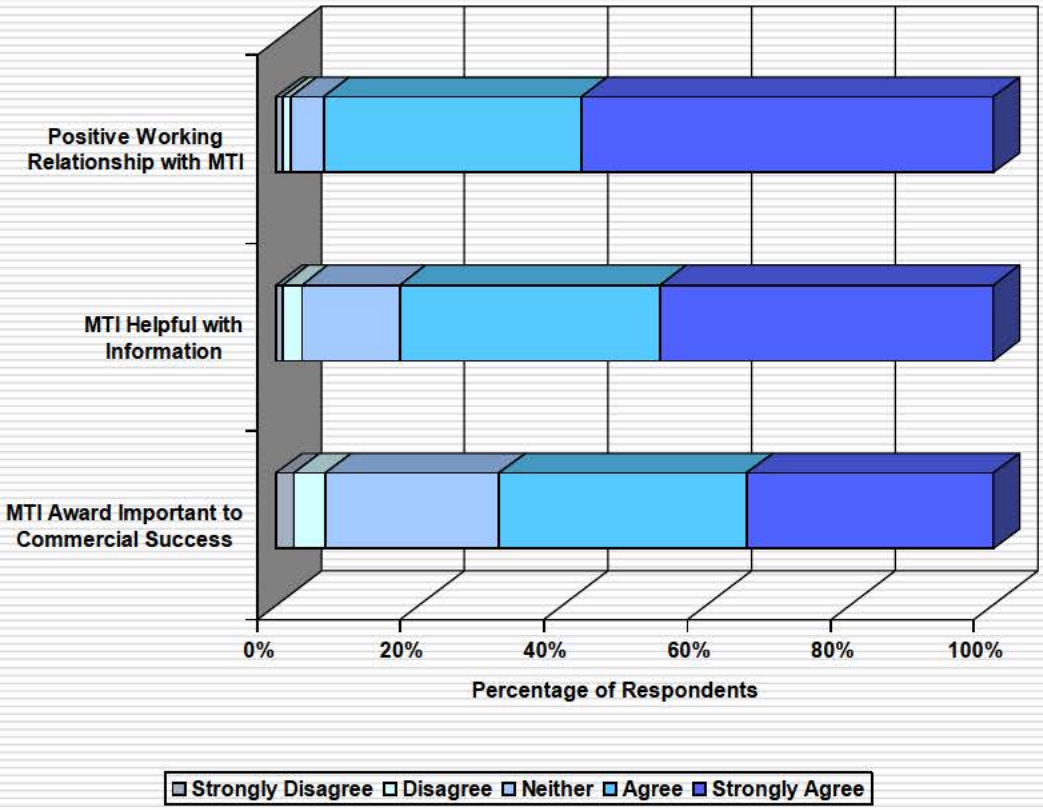
MTI's assistance is clearly important to the success of these research projects for Maine, but the commercial applications of these projects is likely to be further in the future and tracking the impacts will be more difficult as many factors beyond the control or influence of MTI will determine ultimate technological success and economic impacts. Their effects on cluster development are thus particularly difficult to assess.

Recipients' Assessment of MTI Services

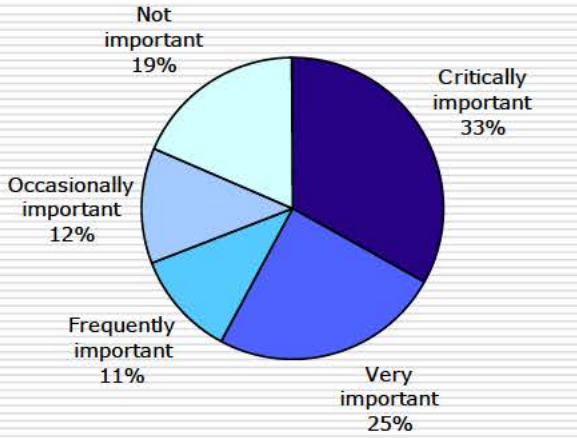
Clients gave MTI very high marks for the quality and usefulness of their services. Substantial majorities of MTI grant recipients agreed or strongly agreed that their working relationship with MTI was positive (>93%), that MTI was helpful, (>82%), and that MTI assistance had been important to their commercial success and in finding other funding (>75%).

MTI clients also gave high marks to the overall suite of state R&D assistance programs, with 58% indicating that such support was highly important to their success, and over 90% indicating some level of satisfaction with the assistance they received.

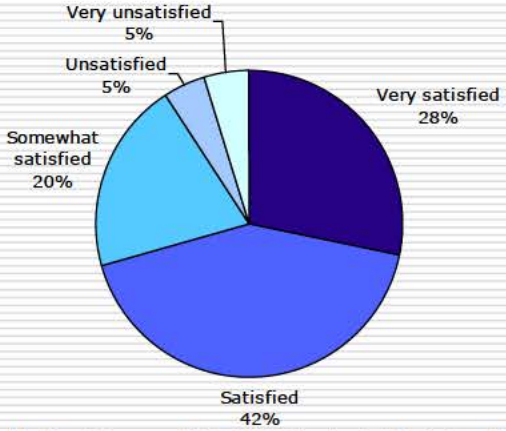
Client's Assessment of Interactions with Maine Technology Institute



Importance of all State R&D Assistance



Responses in 2003-2006 Only

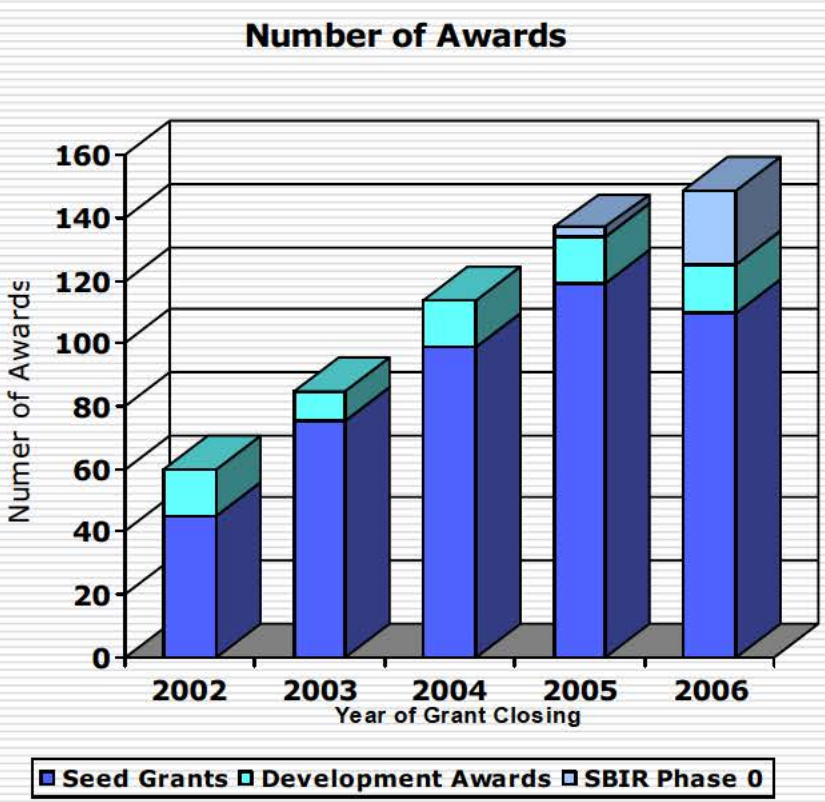


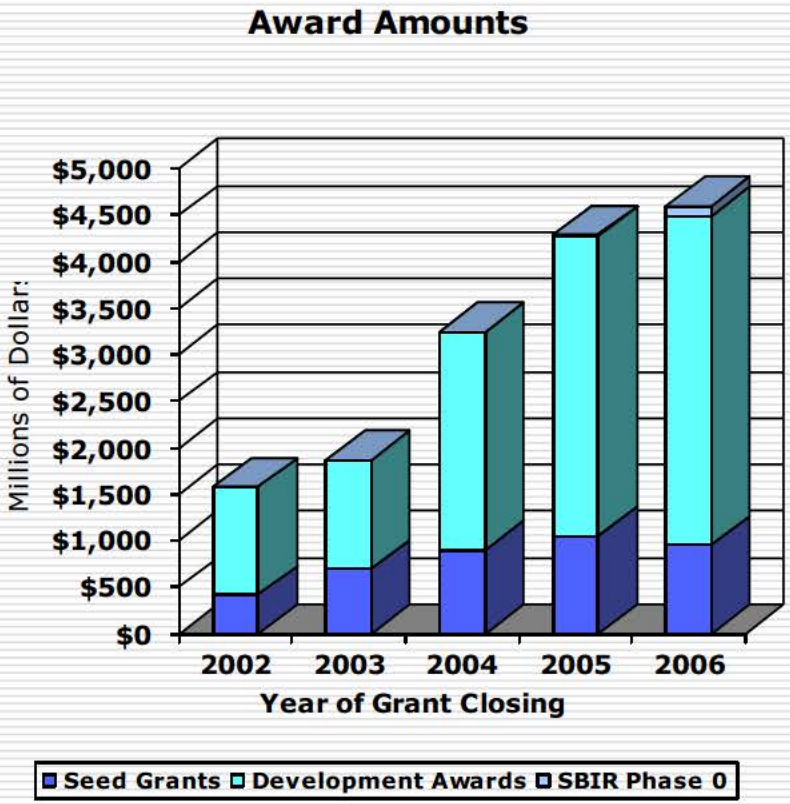
Satisfaction with All State R&D Assistance

Characteristics of MTI Clients and Grants

Over the period from July 1 2001-June 30, 2006, MTI closed grant awards totaling $15.57 million, of which $11.44 million was in the Development Award program, $4.1 million in seed grants, and $0.12 million in the SBIR Phase 0 program.

MTI grant making activity grew steadily throughout the five-year period resulting in a steady increase in the number of grants and amount of grants closed in each fiscal year.



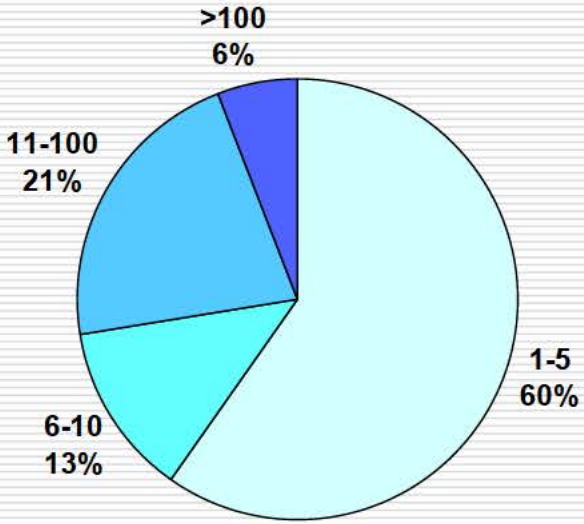


NOTE: These figures are for awards closed as of June 30 of the indicated year. For information on number and amount awarded each year, see the MTI *Annual Report*. Figures do not include Cluster Enhancement Awards.

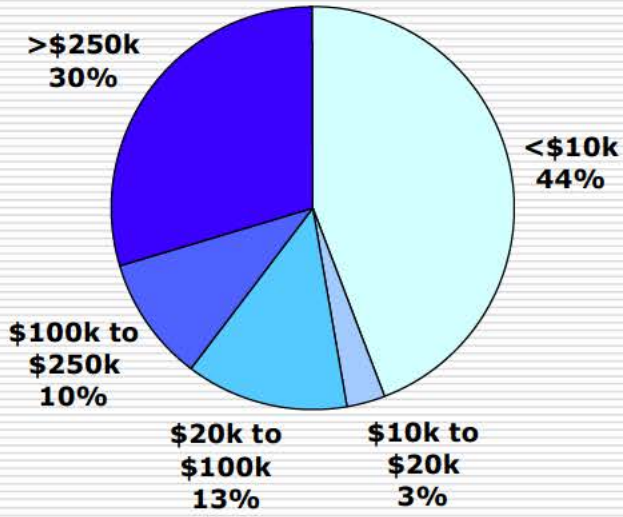
MTI grant recipients are overwhelmingly small businesses. Nearly three quarters (73%) have 10 or fewer employees and only 6% have more than 100 employees. On the basis of annual revenues, the population is divided between large and small firms. Nearly half (47%) have less than $20,000 in annual revenues, while 40% have revenues in excess of $100,000.

Although MTI firms are small overall, they are not all young.* Thirty percent of MTI grant-receiving companies were established in 2000 or later, but 38% were founded before 1980, and the remaining 31% between 1980 and 1999.

MTI Grant Recipients by Employment Size



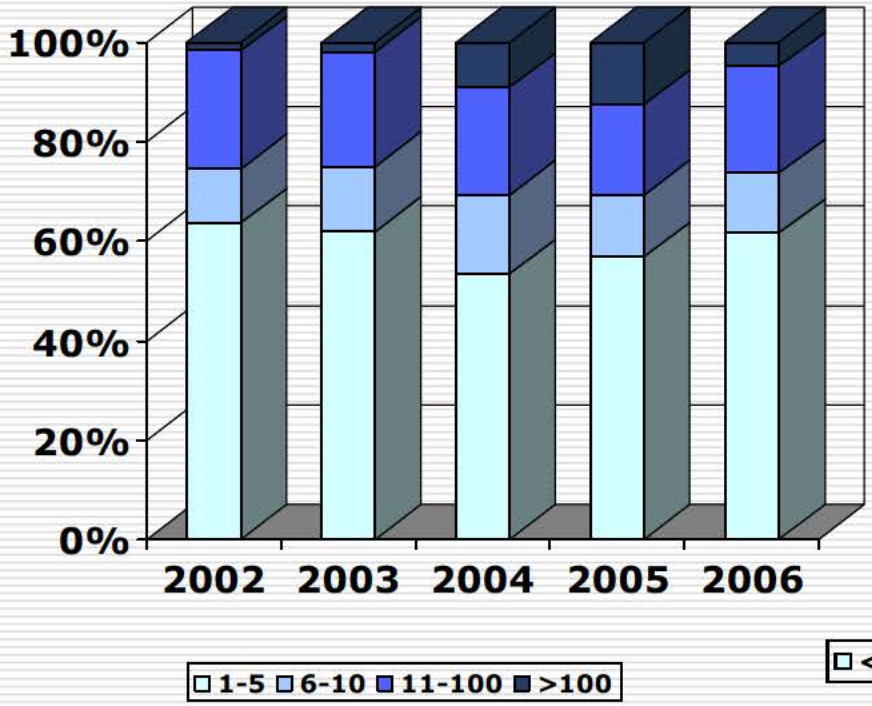
MTI Grant Recipients by Total Company Revenues



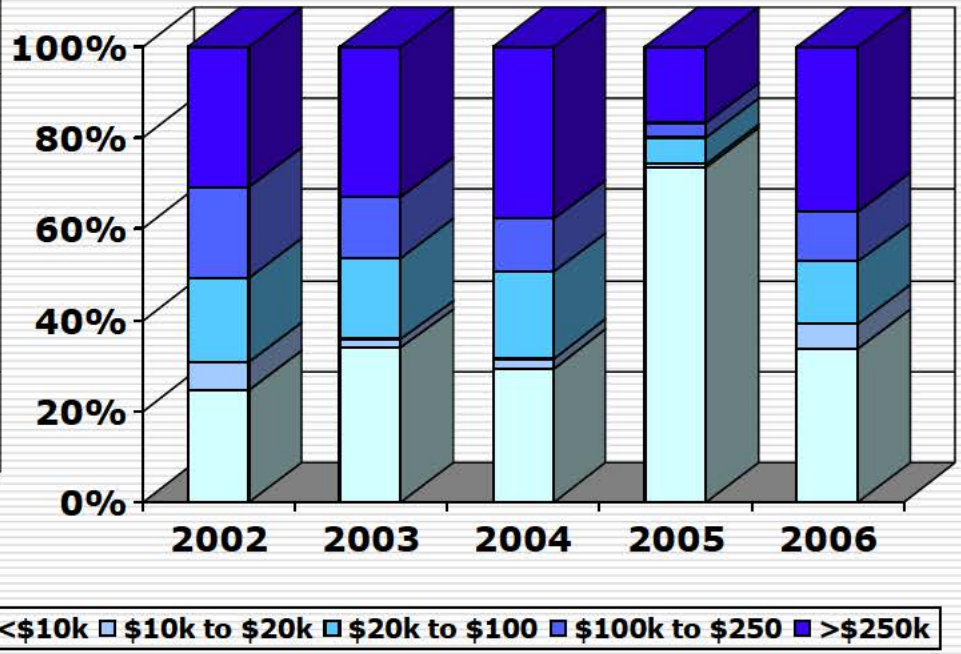
* The age of companies was not asked in 2002

The prevalence of recipient firms with employment of 5 or less has been consistent over the past five years. However, larger firms with over 100 employees have become more common in the past three years. Revenue size has varied somewhat over the five years.

MTI Grant Recipients by Employment Size



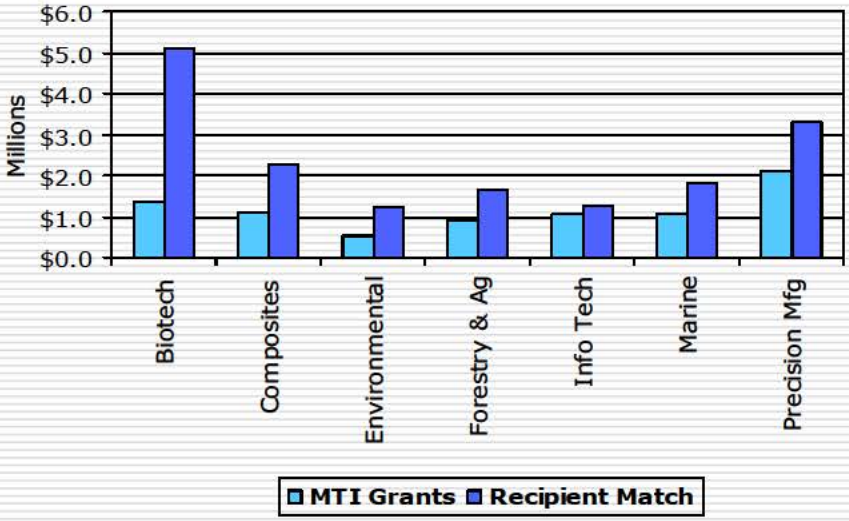
MTI Grant Recipients by Revenue Size



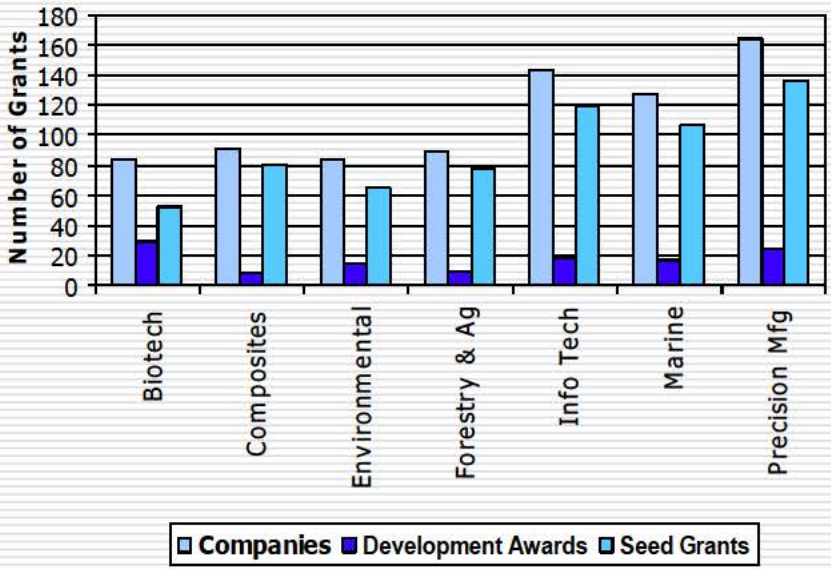
Over the evaluation period, Maine grant recipients provided $1.79 in matching dollars for every $1.00 of MTI grants. Biotechnology firms showed the greatest ratio of matching funds to MTI funds of all the sectors with $2.30 in matching funds for each MTI dollar. Information technology firms provided an average of $1.61 to every MTI dollar.

The distribution of MTI assistance among the technology sectors can be assessed on the basis of the number of companies receiving assistance and the distribution of grants under the two major grant programs. The largest number of companies and the largest number of seed grants has been in manufacturing, followed by information technology and marine technology. Biotechnology has been the largest recipient of development awards over the five years.

MTI Grant and Recipient Matching Funds



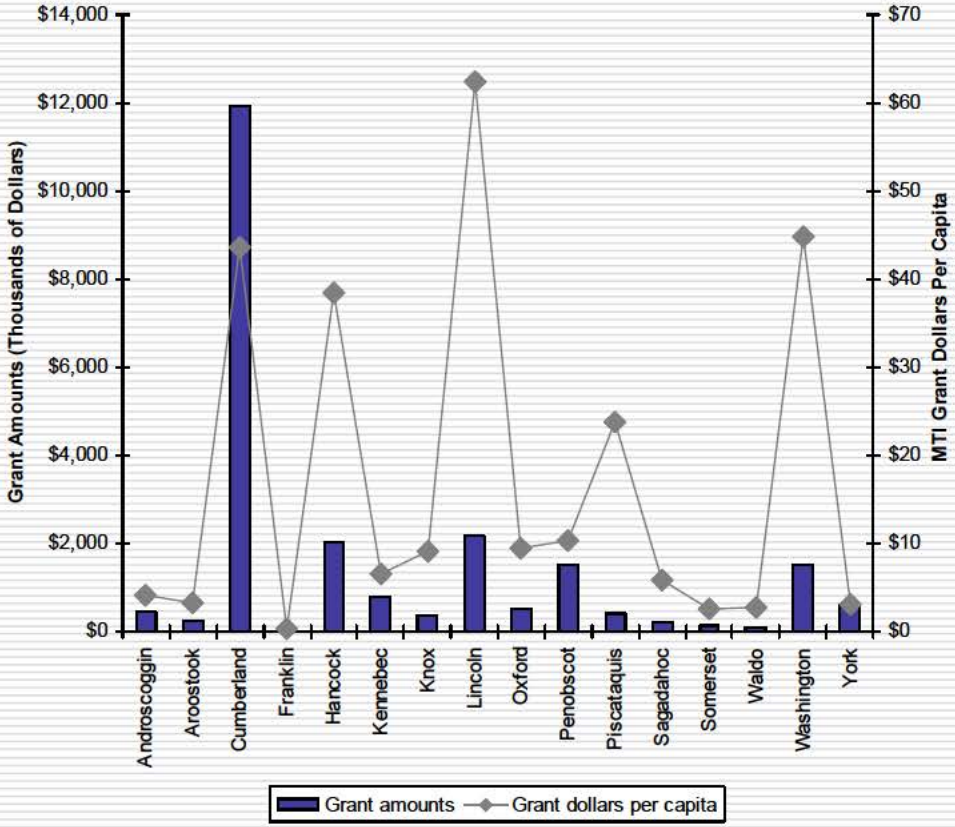
Number of Recipients and Grants



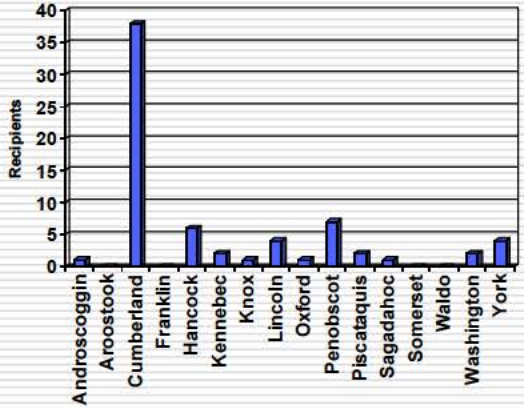
Cumberland County has been the largest recipient of funds from MTI. This is the result of being the recipient of the most development awards and seed grants. Penobscot County is the second largest recipient of both seed grants and development awards.

In terms of grant dollars, Lincoln, Hancock, Penobscot, and Washington counties follow Cumberland. On a dollars-per-capita basis, Lincoln and Washington counties are the two leading recipients of MTI dollars, followed by Cumberland and Hancock counties.

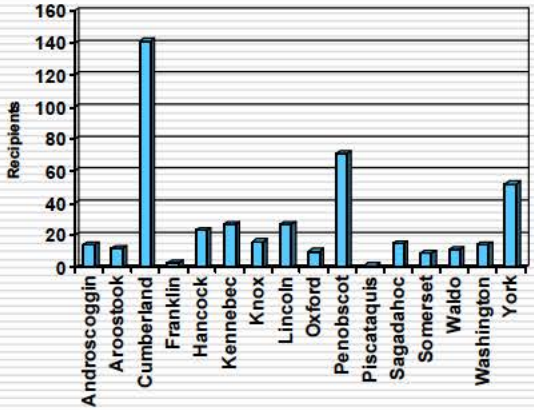
Distribution of MTI Funds by County



Development Awards by County



Seed Grants by County

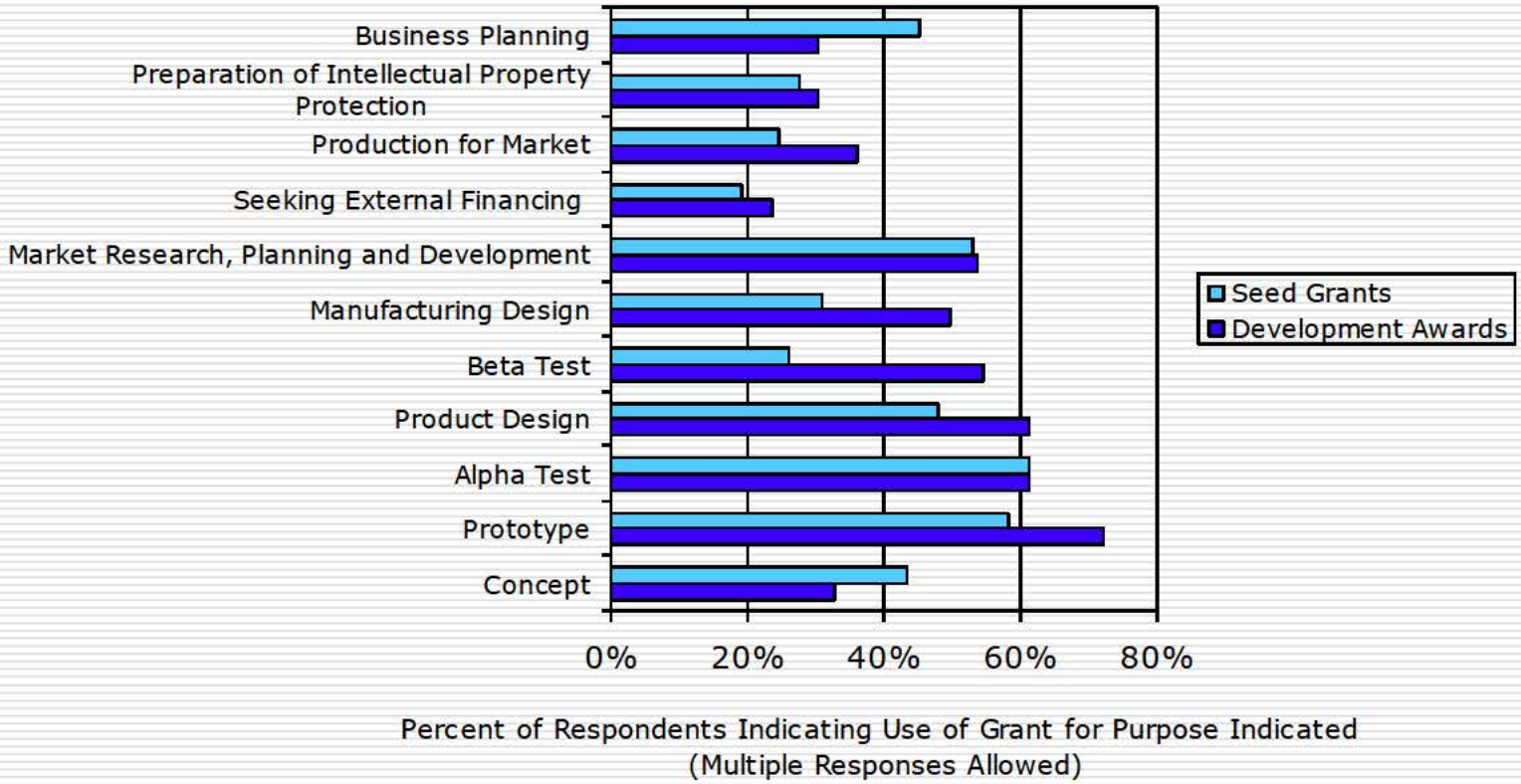


Figures do not include cluster enhancement awards

A vital feature of MTI's assistance is that it is flexible. Funds may be used for a variety of purposes related to research and development. Almost all grant recipients reported using the assistance for multiple purposes. Prototype development and market research are the most frequently cited uses for both programs. Seeking external financing, intellectual property activities, and production are the least frequently cited.

Although the Seed Grant and Development Award programs are designed to support activities at different stages of the R&D process, (i.e., seed grants are designed for earlier stages and development awards for later stages), it is apparent that there are not significant differences in how funds from the two programs are used. Development awards are clearly more likely to be used for beta testing and manufacturing design, which is consistent with that program's purposes, but both programs are equally likely to be used for such activities as market research and alpha tests.

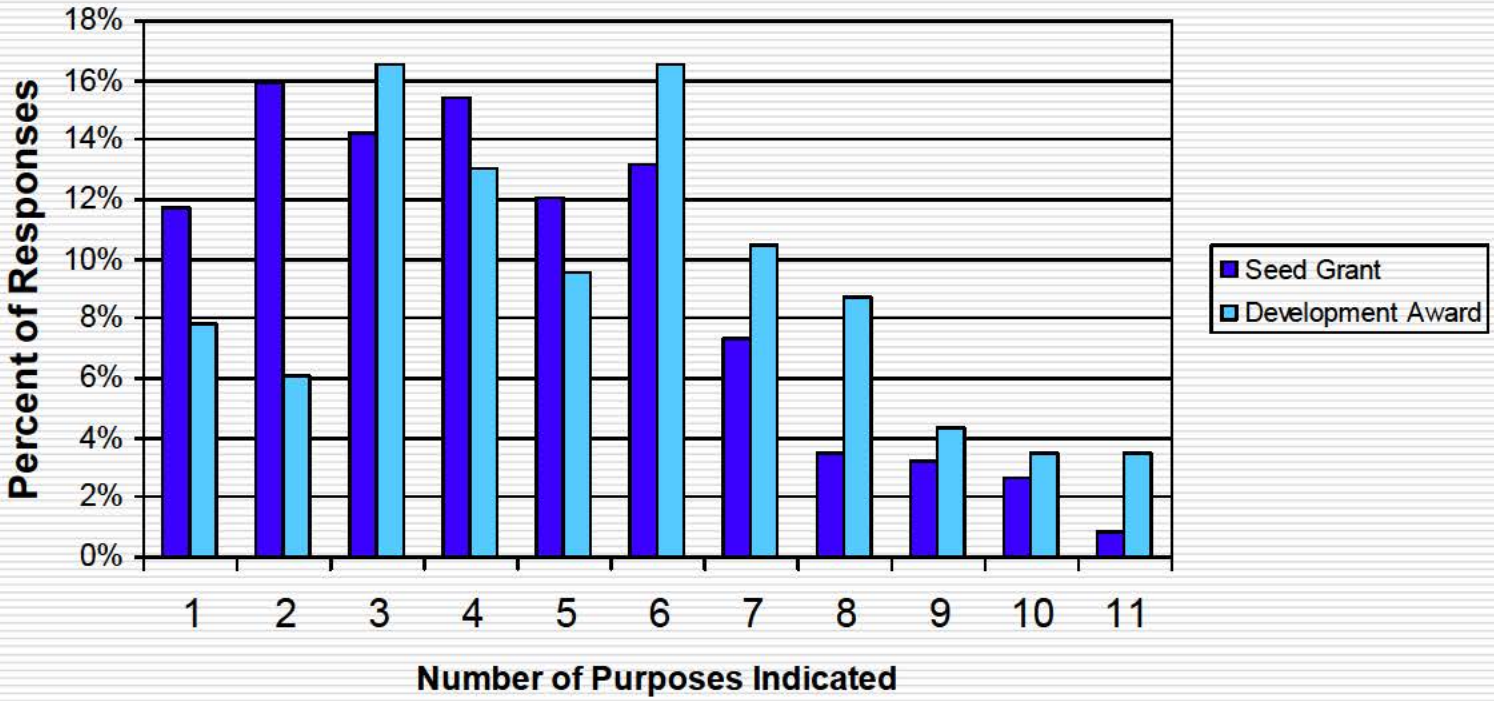
Use of MTI Grants by Grant Type



MTI clients are offered the opportunity to indicate up to eleven different purposes to which they may have put the funds provided. The distribution of responses for each purpose is shown on the previous page. The frequency with which one or more of the purposes are indicated is presented in the figure below. The frequency is expressed as a percentage of all responses.

As would be expected given the larger funds available in development awards, recipients of these funds indicate a larger number of uses than for seed grants, but there are not large differences between the smaller seed grants and the larger development awards in terms of the number of uses.

Use of MTI Grants by Grant Type



Recommendations

- A major goal of the legislation creating MTI is the development and enhancement of clusters of technology-focused economic activity in Maine. The complex nature of cluster relationships means that the ultimate effectiveness of MTI programs to meet this goal, most particularly its cluster enhancement awards can only be assessed through examining the evolution of clusters themselves. A follow-up study to the 2000 Cluster Assessment should be undertaken in which the specific role of MTI programs, including cluster enhancement awards, is considered.

- MTI clients report a relatively low level of expected sales outside of the U.S. MTI should consider linking clients with successful projects to organizations that can assist firms with increasing exports. International economic conditions are particularly propitious for U.S. exports at this time.

- MTI should continue requiring annual reports from grant recipients for up to 5 years. The online reporting process should continue to be simplified and made more user-friendly, particularly for those providing follow-up reports after their initial report in the year of grant closure. The periodic evaluation prepared from the grant recipient reports should continue to focus on the effectiveness of MTI programs in promoting economic development and also examine ways to improve the grant-making processes at MTI.

- When a grant is made, recipients should be provided a copy of the evaluation reporting form so that they can be aware of the kind of information that will be tracked upon completion of the grant. This will enable recipients to organize data collection for the reporting and also better understand the key areas of interest to MTI.

- The assessment of the effectiveness of Cluster Enhancement Awards is difficult because of the great variety of activities for which recipients can use these funds. This makes standardized follow-up of the type used for other MTI programs extremely difficult. However, three steps could be taken to improve understanding of the effectiveness of these funds.

  - Cluster Award grant applications should require recipients to identify a set of specific goals and accomplishments relative to the effects on product and market development and the effects of the award on the cluster of which the recipient is part.
  - Cluster Award recipients should be required to address the defined goals and accomplishments in their final reports and once a year for a defined number of years after the final report.
  - MTI should take steps to make sure that the results of cluster enhancement studies are broadly disseminated to the firms and organizations in the relevant technology sectors.

Technical Notes

- Data on the Seed Grant, Development Award, and SBIR Phase 0 programs is collected by survey of all MTI grant funds recipients. The survey is conducted of recipients whose MTI grants are closed in each fiscal year (July 1-June 30). All references to years in this report are to the fiscal year in which a grant closed, not the year in which the award was made.
- In 2002 the survey was conducted by mail. From 2003 on, the survey was conducted using an internet-based survey instrument developed in partnership with the State of Maine Research and Development Evaluation Program conducted for the Department of Economic and Community Development. Jim Damicis of Policy One Research in Portland provided liaison services to the overall evaluation process. Chase Saunders of Burgess Computer in Bath provided programming and web services.
- All MTI clients are required to complete the evaluation as a condition of their assistance, and all clients who were still in business and could be contacted at the time the surveys were administered complied. However, not all respondents answered all questions. Interpretation of results may be limited by small numbers of answers.
- MTI clients are assured that their individual responses will not be revealed. To protect the confidentiality of responses, no data analysis is shown in which there are 3 or fewer respondents or in which any one respondent can account for more than 80% of the information in business-sensitive areas such as employment and finances.
- Because of technical issues involved in the shift to an online survey, grant recipients who closed their grant in 2002 and 2003 were not resurveyed in 2004. They were resurveyed as part of the 2005 and 2006 data collection process.
- MTI-funded projects at the University of Maine are not included in the surveys on which this report is based. Those projects are included in the general evaluation of Maine R&D programs conducted for the Maine Department of Economic & Community Development.
- Twenty-two firms that received MTI grants went out of business at some point during the five-year period. These firms may have partial or no data included in this dataset depending on the dates they went out of business.
- Details on MTI programs including up to date information on award numbers and amounts are available from the MTI website: www.mainetechnology.org. MTI Annual Reports provide additional detail on the funding awards.