



Evaluation of Maine Technology Institute Programs

For Awards Ending June 30, 2002-June 30, 2004

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

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

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Introduction

The Maine Technology Institute (MTI) has engaged the Center for Business and Economic Research (CBER) at the University of Southern Maine to conduct an evaluation of its Development Award and Seed Grant Programs to fulfill the statutory requirement of an independent evaluation for the Maine Legislature. This current phase of the evaluation project focused on collecting and analyzing information from the first three years of MTI awards.

This is the second evaluation of MTI's programs. The report of the first evaluation covering only those recipients who completed their projects as of June 30, 2002 was published in 2002 and is available from MTI. Because the MTI programs provide assistance at the early stages of research and product development, the effects of MTI assistance are likely to only become fully visible with the passage of time. Award recipients are resurveyed annually for a period of five years, but because of timing issues involving the implementation of the online survey process, 2002 and 2003 completed awards were not resurveyed in 2004. The first resurveys for awards closing in FY 2003 and FY 2004 will be in 2005.

Between MTI's inception and June 30, 2004 187 recipients have completed their projects. Of these, 185 were private sector firms. In 2002, recipients completed a mail survey. In 2003 and 2004, recipients completed an on-line survey developed in cooperation with the State of Maine Research and Development Evaluation Program of the Department of Economic and Community Development, Policy One Research, and Burgess Computers. Separate forms were used for private and public sector clients.

Over the three years, 306 awards were completed, of which 252 were seed grants and 54 were development awards. The total amounts awarded to these projects was \$8.1 million, of which \$5.7 million was from the Development Award program and \$2.4 million was from the Seed Grant Program. These funds were matched by the recipients with \$16.7 million in cash or in-kind value, bringing the total available resources for research and development to \$24.8 million. Twenty two firms receiving MTI assistance reported that they were out of business at the time of the survey.

In addition, eight awards were made under the Cluster Enhancement Award program, totaling \$398 thousand and matched by \$1.58 million.

The evaluation of cluster enhancement assistance is discussed on page 28. All other parts of this report cover the Development Award and Seed Grant programs.

A more detailed presentation of the analysis of survey responses is published as a separate Data Appendix, which is available from both MTI and CBER.

Dr. Charles Colgan, Professor of Public Policy and Management, was the Principal Investigator for this project and author of this report. Dr. Bruce Andrews, Professor of Management Science, served as Project Director. Business School Professors Frederic Aiello and John Sanders served as Research Associates. School of Business students Svet Kirtchev and Steven DesRoberts served as Research Assistants.

Summary

MTI programs have been very successful in a short time in supporting substantial innovative activity, particularly in the private sector, that is likely to have positive economic impacts throughout Maine. MTI funds have catalyzed more than \$20 in federal R&D support and private investment for every \$1 of MTI funding. Over a quarter of MTI-funded projects have already resulted in products that are on the market.

□ *MTI assistance recipients have had significant success in developing new products leading to intellectual property protection.*

- 46% of MTI-funded research projects completed prior to June 30, 2004 have led to new products and 24% of projects have resulted in products that are already offered for sale.
- MTI recipients are mostly very small companies (73% have fewer than 10 employees). Grants comprise a significant proportion of their revenues (30% on average), but sales revenues still comprise the largest source of revenues (60%).
- Almost half of MTI-funded projects (45%) have or will seek patent protection for the results of their research.
- An even higher proportion of projects (84%) will seek other intellectual property protection such as trade secrets, trademarks, and copyrights.
- Precision Manufacturing firms led the way in intellectual property protection. Biotechnology and composites were the lagging sectors in this activity.

□ *MTI recipients are likely to have substantial economic impact in Maine.*

- MTI recipients saw employment grow by 11% from the time their awards were completed compared with 12 months earlier. Companies gaining employment outnumbered those remaining stable or declining.
- Employment gains were concentrated in Composites. Consistent with larger economic trends, employment losses were reported primarily in Forest Products and Agriculture and Precision Manufacturing.
- MTI clients sell primarily in the U.S. and show growth in export markets. They also sell substantially in Maine.
- Grant recipients expect to purchase more than a third of their material inputs and nearly two thirds of their service inputs from within Maine for the products supported by MTI.
- When production begins for MTI-funded projects, the majority of production will take place within the firms doing the research and development.
- MTI award recipients are located in all sixteen counties. While the largest number of awards were in Cumberland County, the largest numbers of awards per capita were in Lincoln and Washington Counties.

Summary

□ *MTI grant assistance has been a substantial catalyst for firms seeking external financing.*

- MTI-assisted companies have secured nearly \$95 million in debt and equity funding. This included \$53 million in equity funding and nearly \$42 million in debt.
- MTI-assisted companies were awarded nearly \$100 million dollars in federal research and development support.
- Total public and private funding, including MTI, exceeded \$218 million.
- This represents more than \$26 in external financing for every \$1 of MTI assistance.
- Recipients matched \$8 million in MTI funds with more than \$16 million in private and other funds.
- The total public and private funds for research, development, and production associated with MTI projects were nearly \$120 million.

□ *Cluster enhancement*

- Eight cluster enhancement awards totaling \$464 thousand completed by June 30, 2004. MTI funds were matched with \$1.47 million in other funds for a total of \$1.93 million.
- Cluster awards supported projects that provided new technologies for use by a diversity of organizations within clusters, expanded and enhanced communication networks, and undertook market development research.
- Award recipients report that the process of undertaking the projects led to greatly enhanced relationships among participating organizations and individuals that will yield substantial benefits in cluster development beyond the projects themselves.

□ *MTI is viewed extremely positively by those who work with the Institute.*

- More than 95% of MTI awardees indicate a positive working relationship with MTI, and more than 80% indicated that MTI provided helpful information
- Over three quarters indicate that MTI assistance was critical to the success of their research and development endeavors.
- MTI is ranked as the most important of the various relationships by companies seeking assistance from both public and private sector organizations.

□ *All of the technology sectors have received substantial aid from MTI, but those with the highest growth potential have lagged somewhat in their product development.*

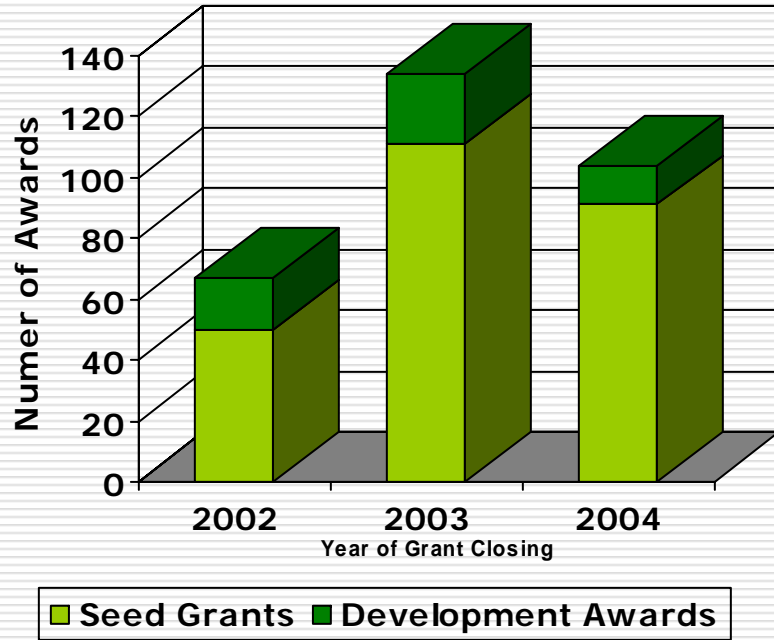
- Precision Manufacturing leads in new products and intellectual property protection.
- Biotechnology, Composites, and Environmental Technologies lag in these results. These are the most risky sectors, and future assessments may show improved results.

MTI Grant Recipients

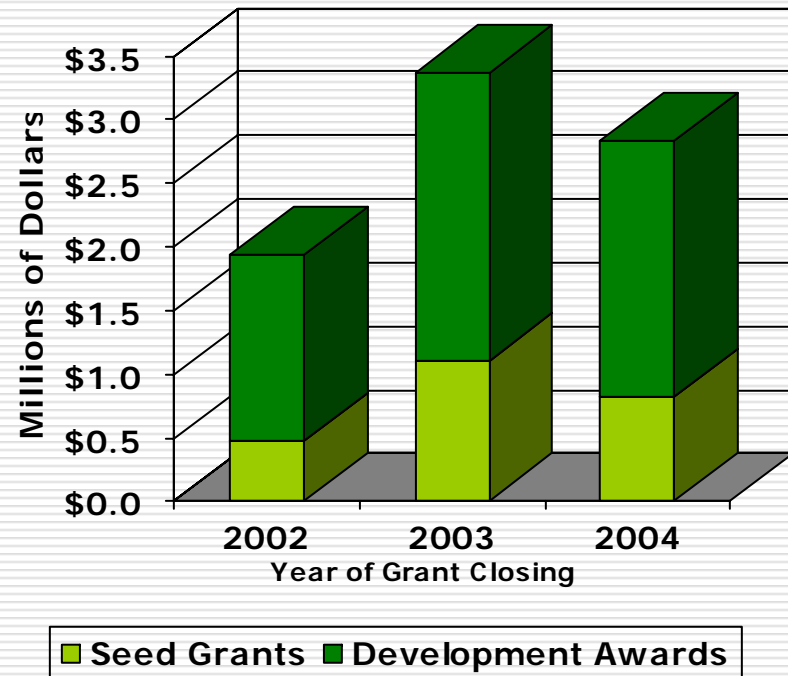
MTI awards doubled between 2002 and 2003 from 67 to 134, and then declined to 104 awards in 2004. Total award amounts grew from \$1.9 million for awards completed in FY 2002 to \$3.4 million for awards completed in FY 2003 and \$2.8 million for awards completed in FY 2004.



Number of Awards by Year



Awards Amounts by Year



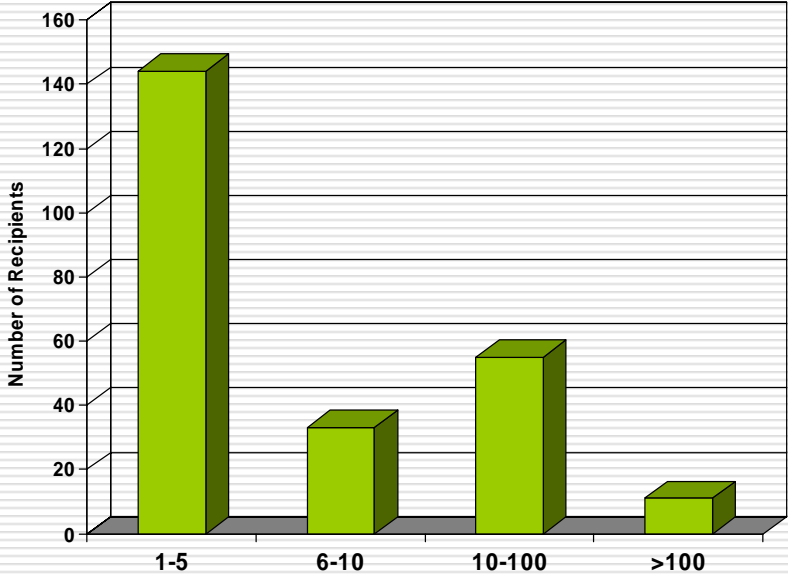
NOTE: These figures are for awards closed as of June 30 of the indicated year. For information on number and amount awarded each year, see the MTI *Annual Report*.

Private sector MTI award recipients are primarily small companies: 95% employ fewer than 100 people and 60% less than 5. Two thirds have annual revenues less than \$250 thousand and one third less than \$10 thousand. These patterns have been consistent across all three years. Although the companies are small, they tend to be well-established. The average age of recipients in 2003 and 2004¹ was 14.5 years. The youngest companies were in Information Technology and Marine Tech-Aquaculture (average age=6.8 years); the oldest were in Composites (average=50.3 years).

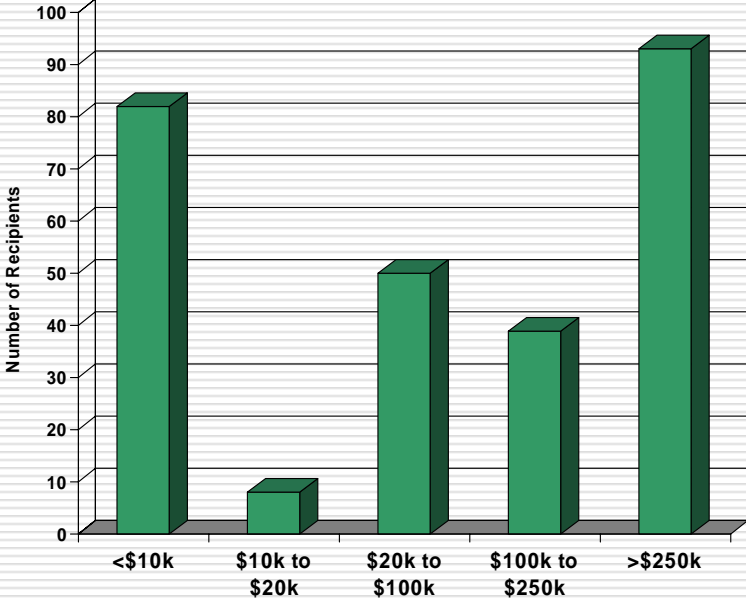
Little change in ownership structure occurred with MTI clients. Only 4 companies reported they had been acquired, and 5 indicated that they had purchased other companies. No company reported having undertaken an initial public offering (IPO) of stock.



Employee Size of Grant Recipients



MTI Grant Recipients by Total Company Revenues

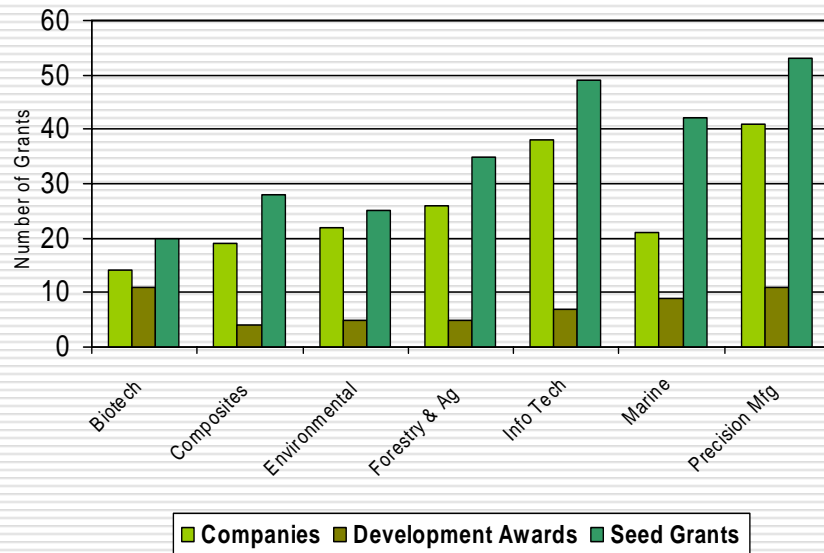


¹ The age of companies was not asked in 2002

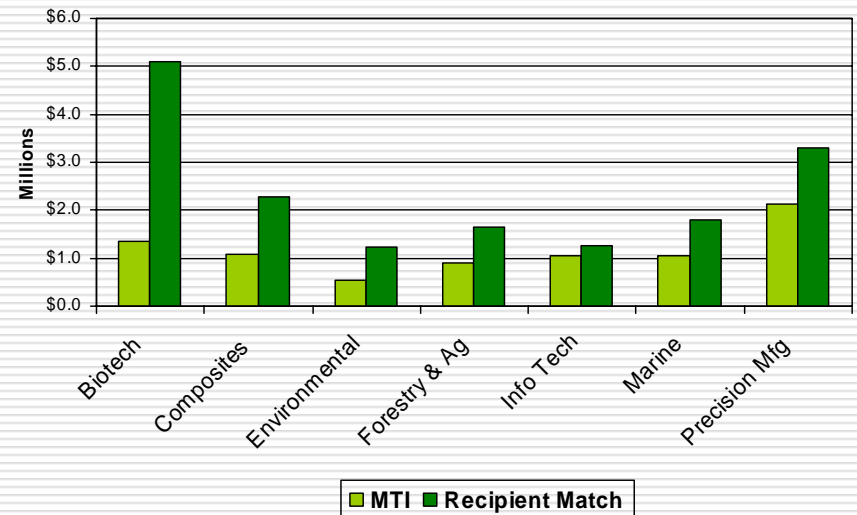
Of the 306 development awards and seed grants completed by June 30, 2004, 252 were seed grants and 54 were development awards. The largest number of completed awards went to Information Technology and Precision Manufacturing firms. The largest number of development awards went to Biotechnology organizations, while the largest number of seed grants went to Precision Manufacturing firms.

The total amounts awarded to these projects was \$8.1 million, of which \$5.7 million was in development awards and \$2.4 million in seed grants. These funds were matched by the recipients with \$16.7 million in cash or in-kind value, a match ratio of more than \$2.00 for every MTI dollar. The total available resources for research and development catalyzed by MTI was \$24.8 million over the three years. The largest value of MTI assistance went to Precision Manufacturing (\$2.1 million). The largest match came in Biotechnology, which provided \$3.76 in match dollars for each MTI dollar.

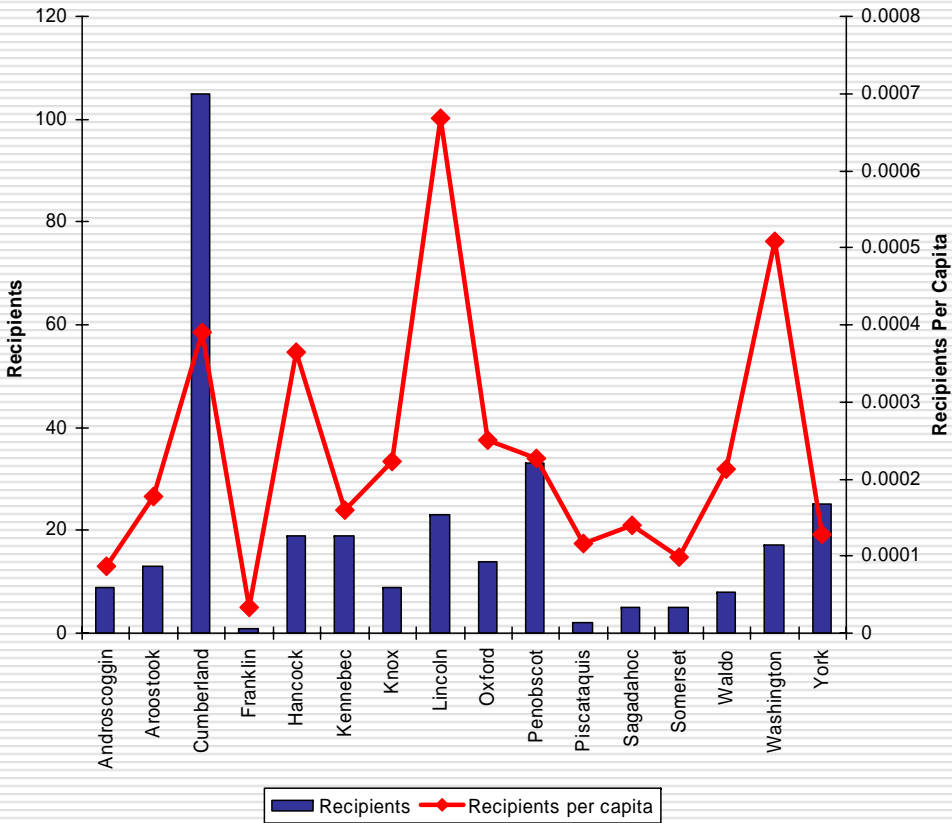
**Number of Grants by Award Type and Recipient
Technology Sector**



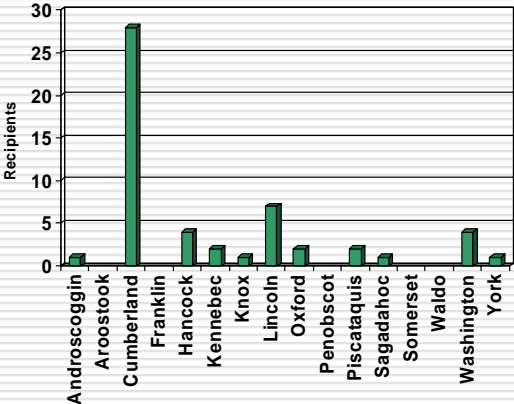
MTI and Matching Funds by Technology Sector



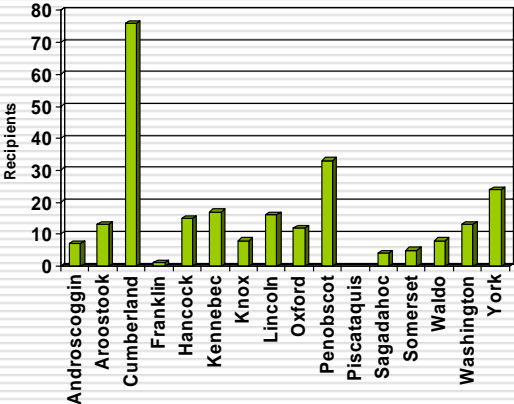
MTI funds have been awarded to organizations in all 16 counties. The largest number of awards, of both types, were to recipients in Cumberland County, but the largest distributions of MTI funds on a per capita basis were in Lincoln and Washington Counties. Following Cumberland County, Penobscot and York Counties were the most frequent locations for MTI assistance.



Development Awards by County



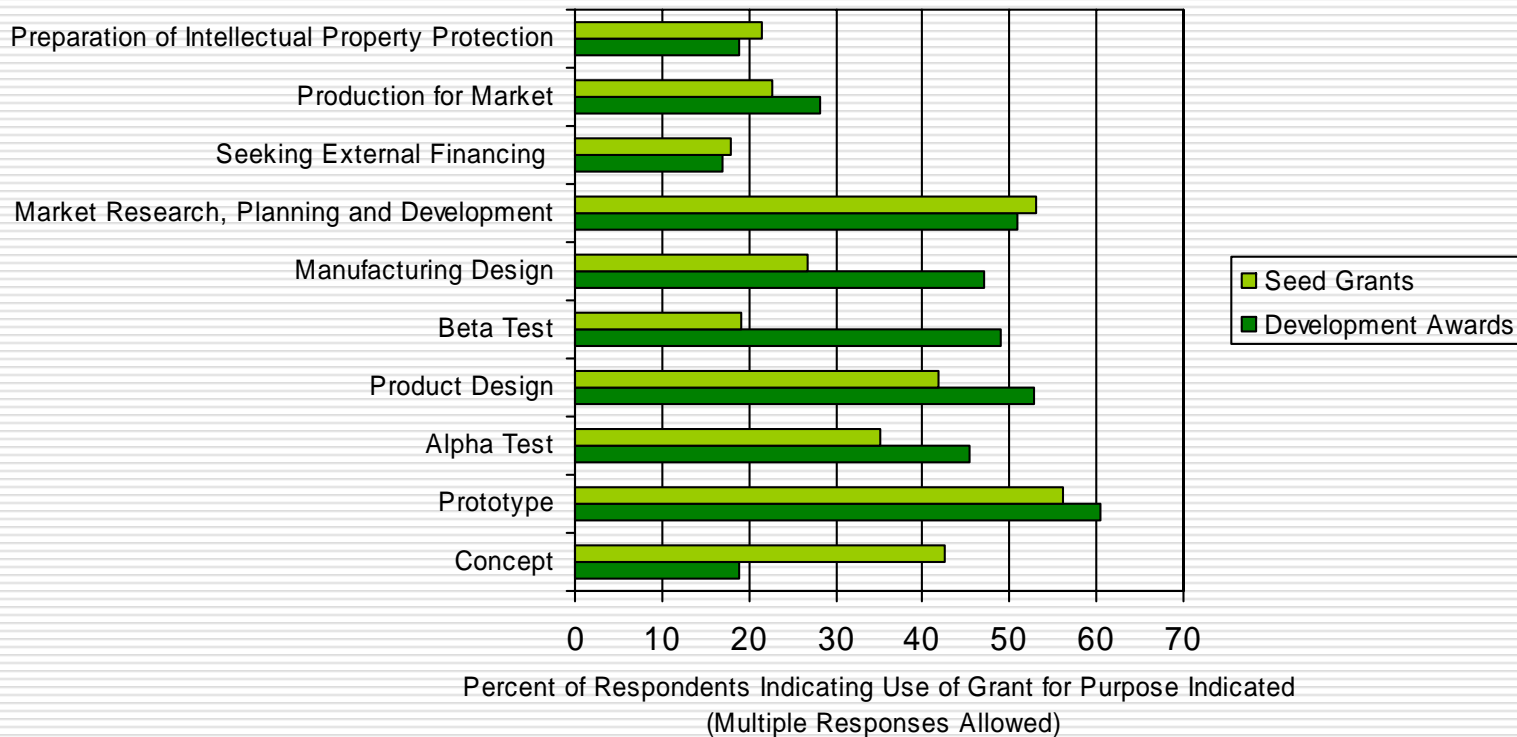
Seed Grants by County



A major feature of MTI's assistance is that it is flexible. It may be used for a variety of purposes related to research and development. 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.

Consistent with program purposes, seed grants are more likely to be used for early-stage activities such as concept development, and development awards for later-stage activities such as beta testing and designing for manufacturing.

Use of MTI Grants by Grant Type

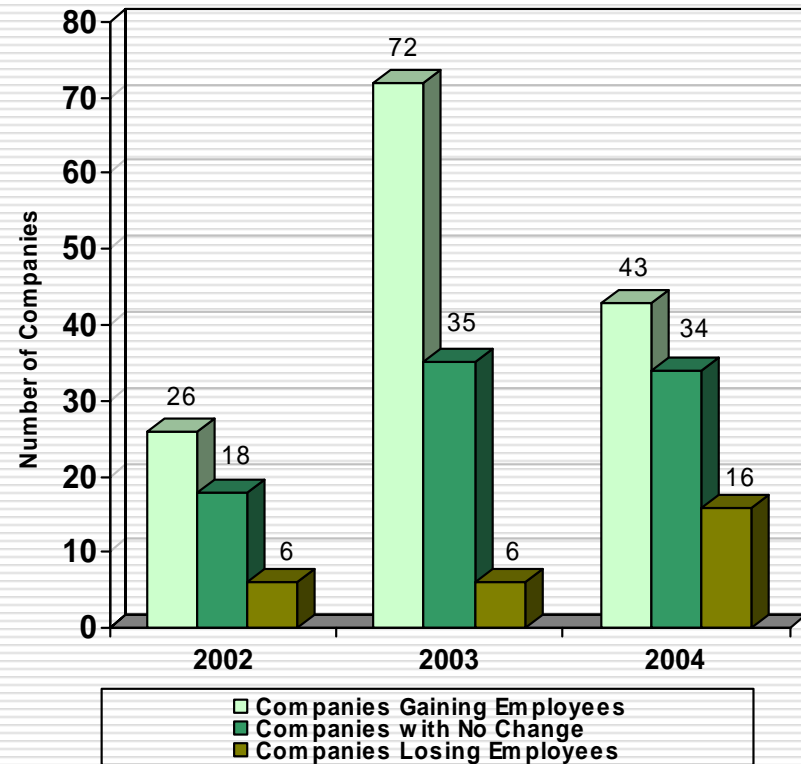
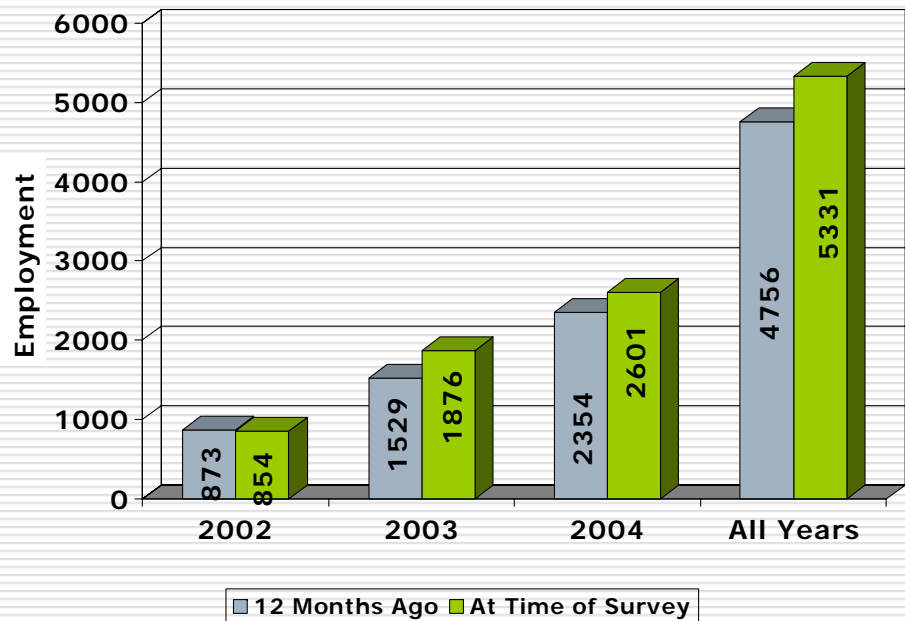


Economic Impacts

Employment in MTI-assisted companies increased by an average of 300 jobs in both 2003 and 2004. This represented an 11% growth rate, which far outpaced the overall Maine job growth rate during the same period, which was less than 1%. A high proportion of employment growth was in the Composites sector. Marine Technologies was the fastest growing sector measured by rate of growth. Consistent with statewide trends, employment dropped in Forest Products/Agriculture and in Precision Manufacturing.

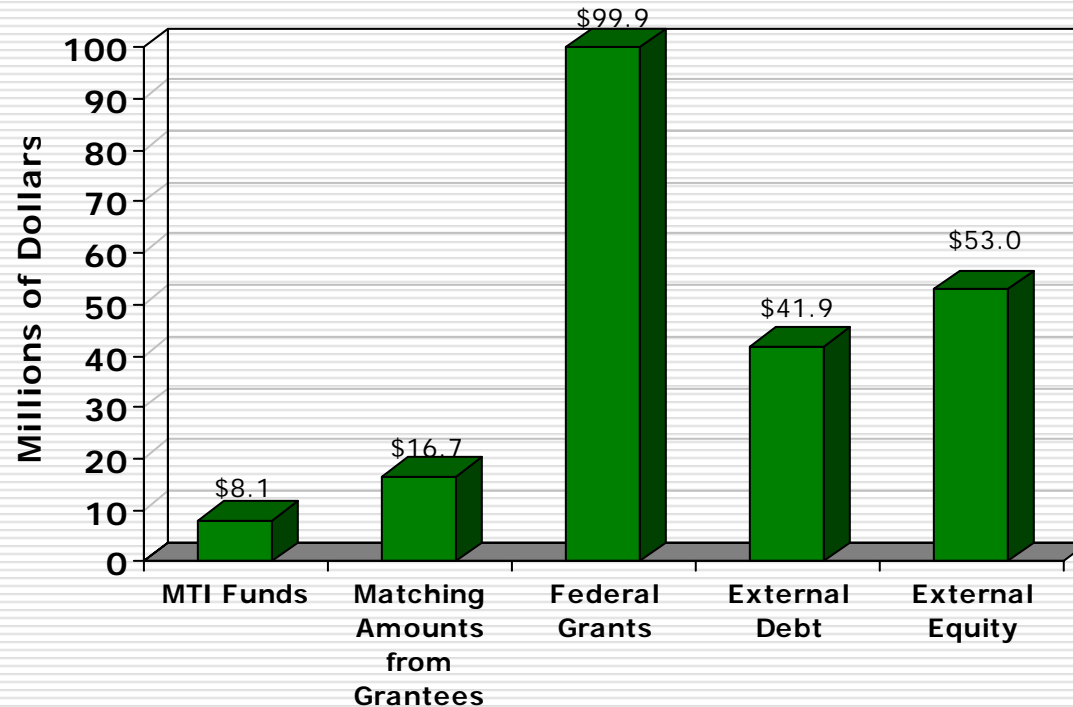
MTI recipients indicate an average wage paid of \$33,500, compared with a Maine average wage of \$30,200 in 2003.

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



MTI's modest total investment of \$8.1 million dollars for all three years has multiplied many-fold in the form of matching funds pledged by grantees, additional federal grants secured, and the attraction of debt and equity investments for expansion of MTI client companies. Over the three years examined, MTI grantees pledged or secured \$211.5 million in additional funds to support research, development, and production of new products. Private funds (\$111.6 million) slightly exceeded public funds (\$108.0 million). Federal grants (\$99.9 million) slightly exceeded debt and equity combined (\$94.9 million).

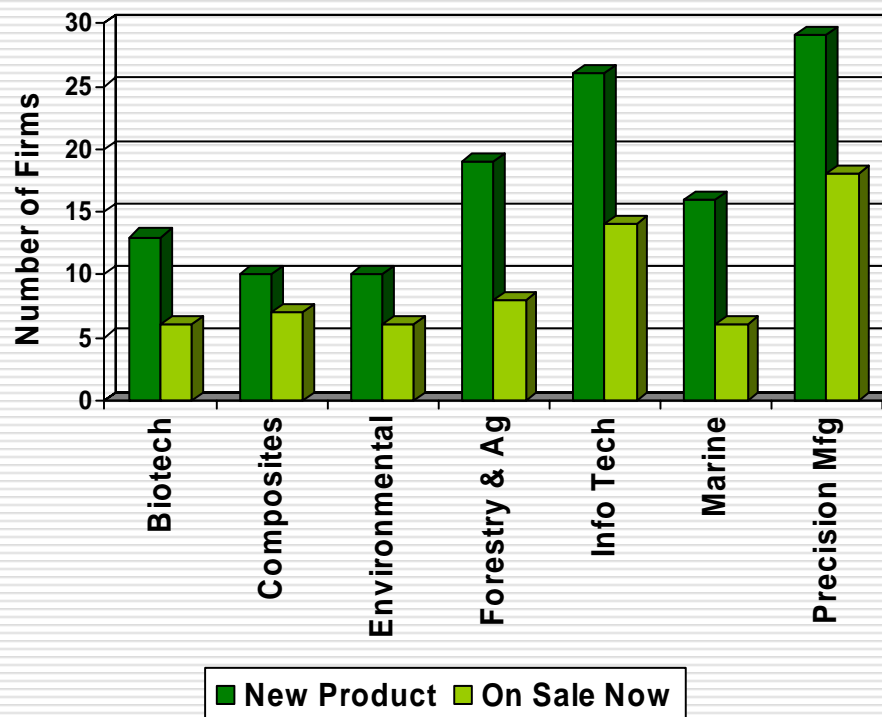
Funds for R&D and Production



The 306 awards completed since June 2002 have been associated with 270 different research and development projects (many recipients receive more than one grant in support of a particular project). Of these projects, 123 (46%) have resulted in the development of new products. Manufacturing and Information Technologies have led the way in new products, with Forest Products and Agriculture third. Sixty-five projects (24%) have resulted in products that respondents report as being on sale at the time of the survey. Sixty-two percent of new Precision Manufacturing projects and 53% of new Information Technology projects are on sale now.

Respondents were asked how likely (on a scale of 1-10) they considered that their research would result in a new product for sale (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).

Number of Firms Indicating MTI Assistance Led to Product for Sale

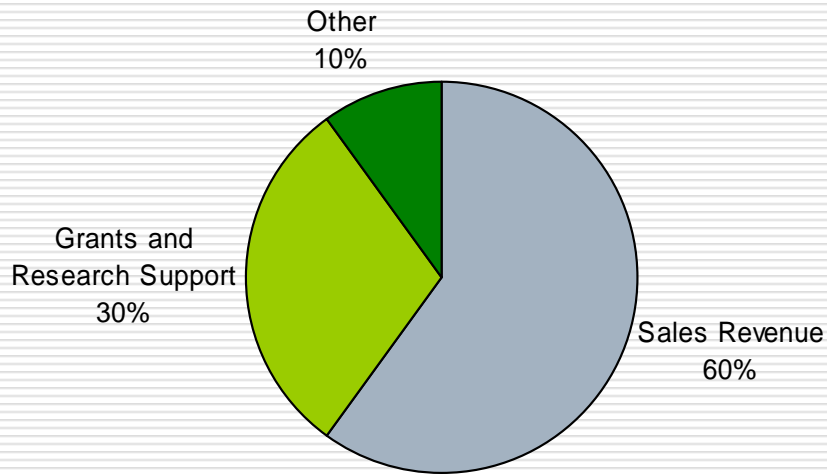


A key element of MTI assistance is to help firms transition from grant revenues to sales revenues. Overall, MTI recipient firms rely on sales for 60% of their revenues and on grants (MTI and other) for 30%. These proportions remained consistent across all three years. The Composites sector has the highest proportion of revenues from sales, while Biotechnology the least.

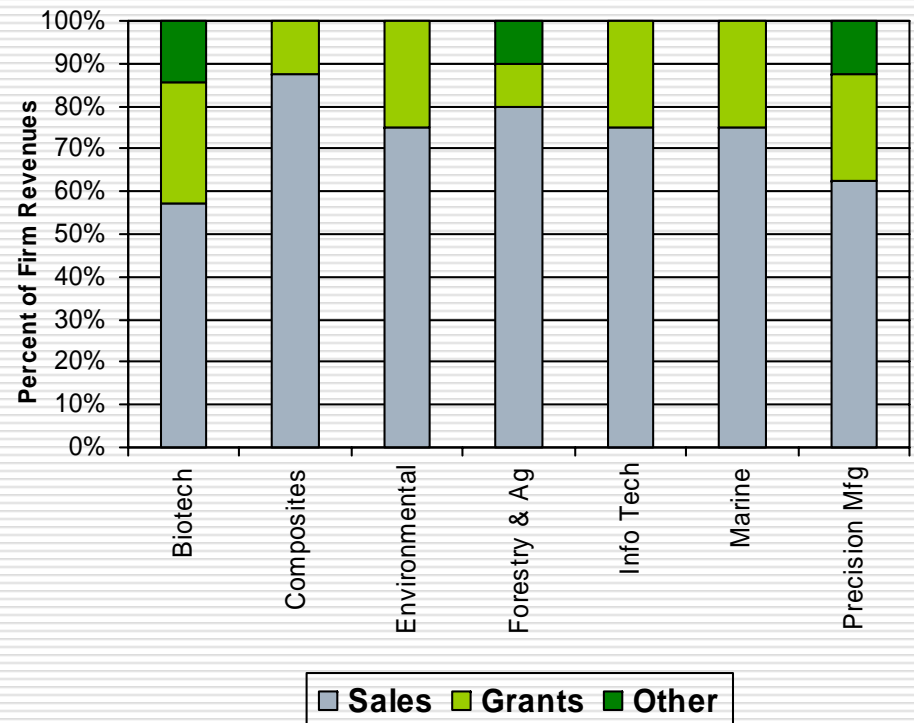
The products supported by MTI accounted for 30.6% of firm revenues on average. The highest proportion was in Biotechnology (53%) and the lowest in Composites (10%).

Recipients completing their MTI-assisted projects in 2003 and 2004 report a total of \$934 thousand in Maine corporate income taxes for the two years. (\$509 thousand in 2003 and \$425 thousand in 2004.) However, these figures understate 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 of Chapter S corporations.

**Sources of Firm Revenues*
All Years**



Sources of Firm Revenues by Technology Sector*

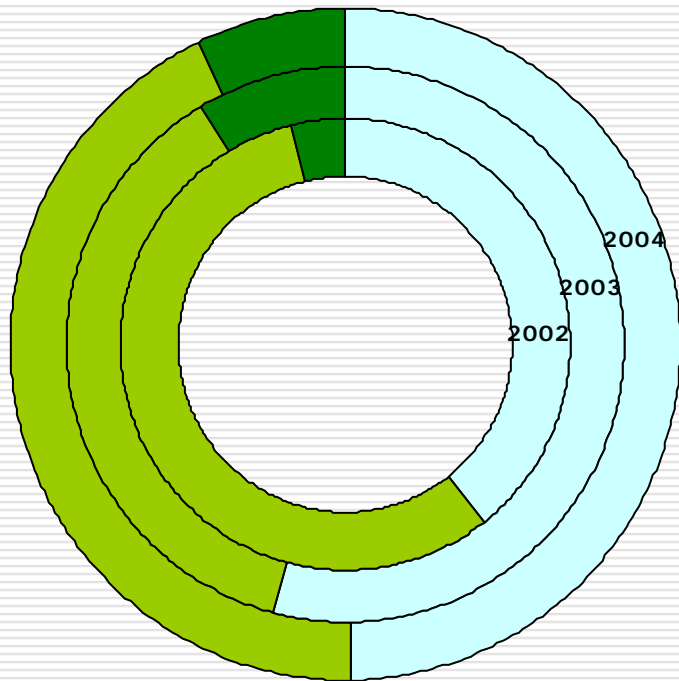


* Percentages are approximate due to missing data.

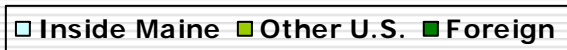
MTI award recipients who completed their projects in 2003 and 2004 have increased both their sales within Maine and their export sales outside the U.S. compared with those grantees who completed in 2002. The sales within Maine indicate that other firms within the state are increasingly customers for the advanced products being developed with MTI assistance. The export sales are a sign of increased competitiveness.

However, there is substantial variation among sectors. Environmental Technologies and Forestry/Agriculture have the highest sales within state and the lowest exports. Biotechnology has the highest exports and lowest sales within Maine.

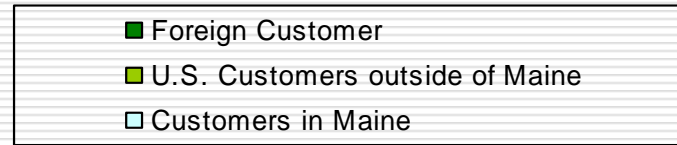
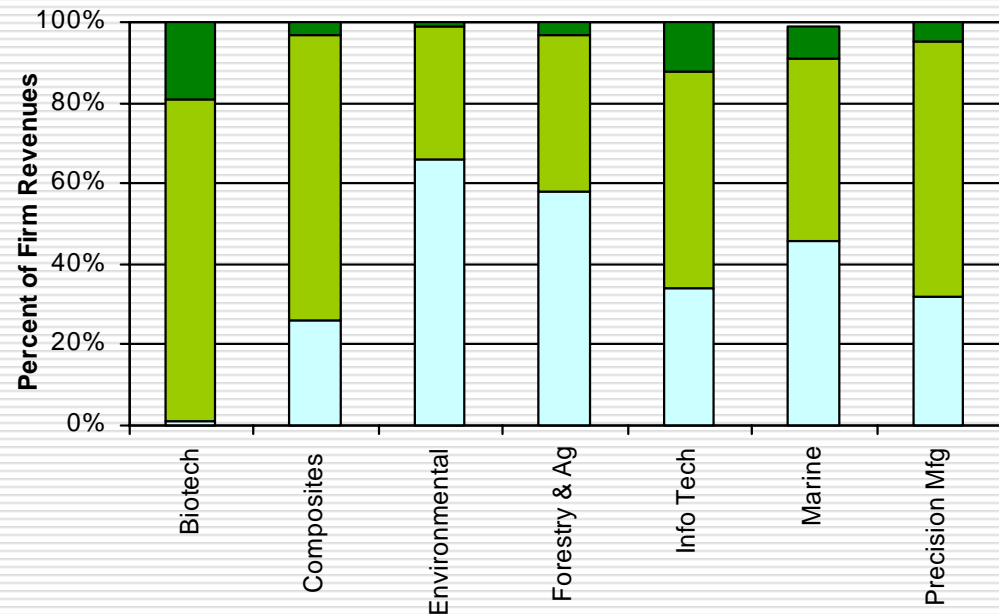
Distribution of Company Sales by Year*



Year: Companies completing project that fiscal year



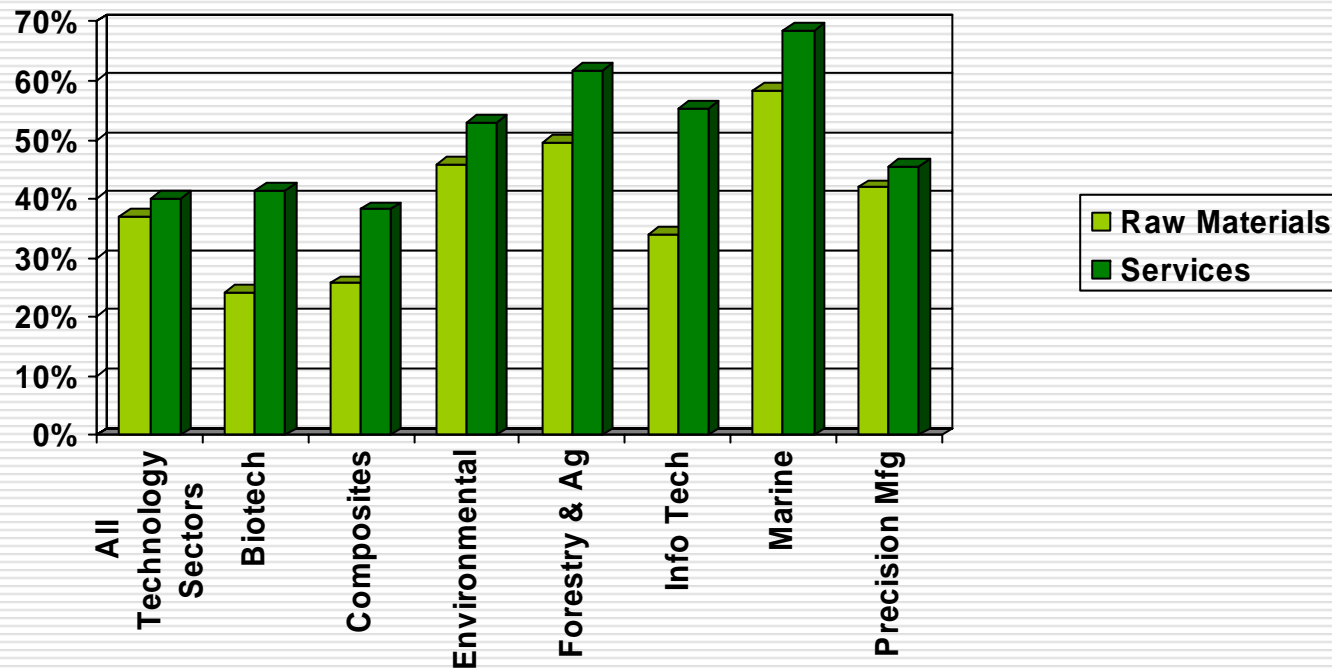
Distribution of Company Sales by Technology Sector (All Years)



* Percentages are approximate due to missing data.

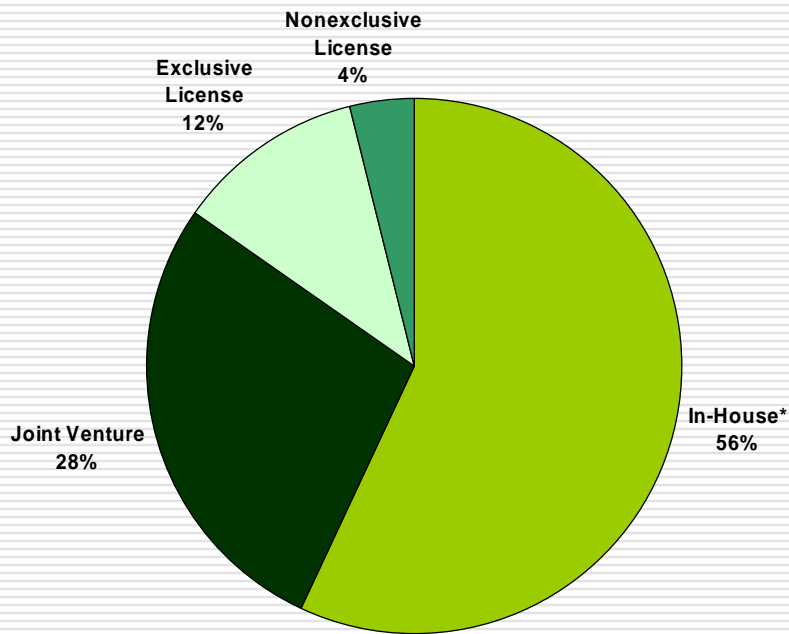
Overall, MTI clients indicated that they expect to purchase 37% of their material inputs and 59% of their services inputs from other firms within Maine for the production of the MTI-assisted products. Marine Technology projects expect to purchase the largest proportion of goods and services; Biotechnology expects to purchase the smallest proportion of goods, while Composites expects to purchase the smallest proportion of services.

Expected Proportions of Raw Materials and Services to be Purchased in Maine for MTI-Assisted Products

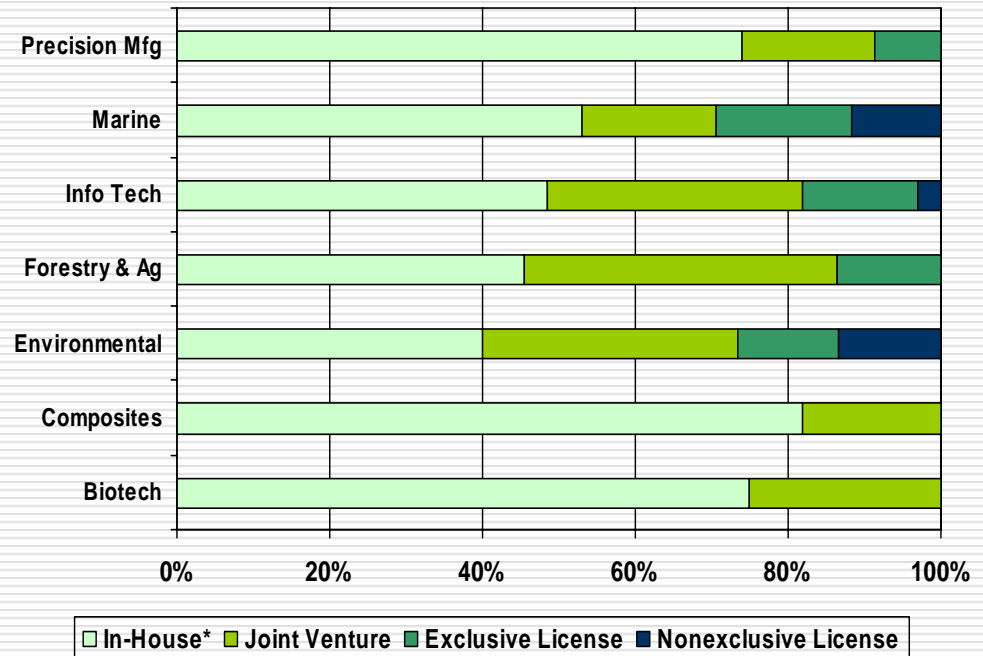


Respondents were able to identify production plans for the products from 130 of the projects. Two thirds will be produced in-house. Joint ventures are the next most common approach. Composites and Precision Manufacturing are the sectors most likely to produce in house, while Environmental Technology companies are most likely to enter into agreements with other companies for the production of their MTI-funded projects.

Production Plans for MTI-Funded Projects



All Project Responses



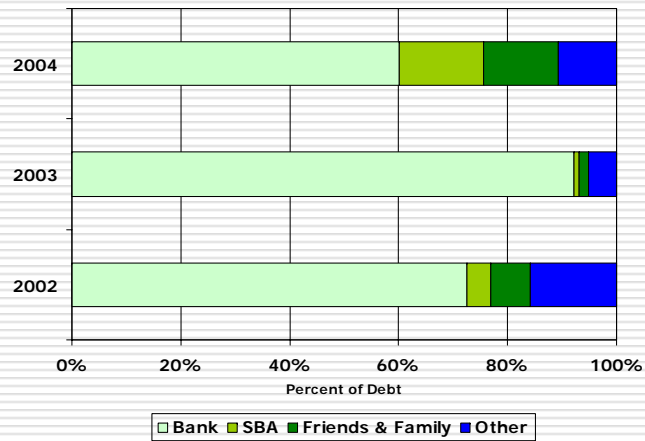
By Sector

* In-house responses for 2003 and 2004 only

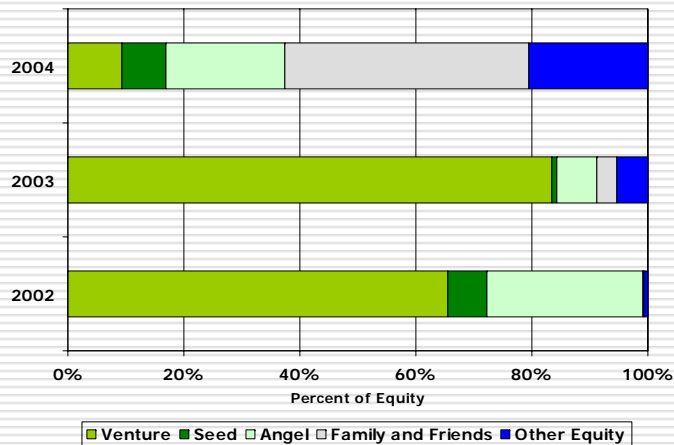
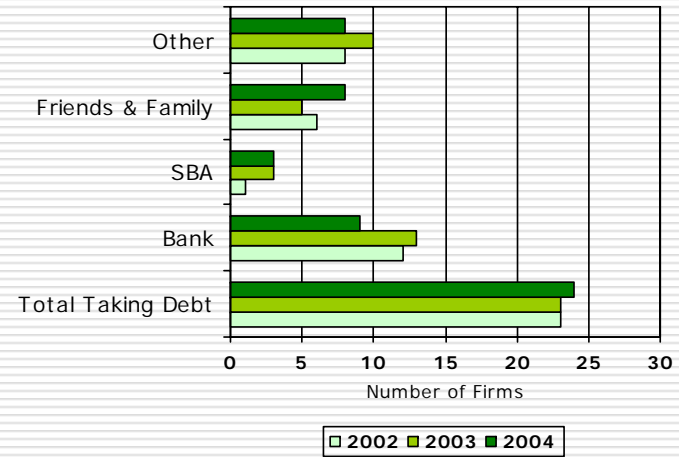
Effects on Company Finances

Over the past three years, MTI-assisted companies attracted \$53 million in equity investments and \$41.9 million in debt, for a total of \$94.9 million in investment. The total debt and equity investments were distributed over a relatively small number of firms. On average about 23 a year take on debt and 22 a year secure equity investments. The rate at which firms take on equity was substantially more variable than the rate which firms take on debt.

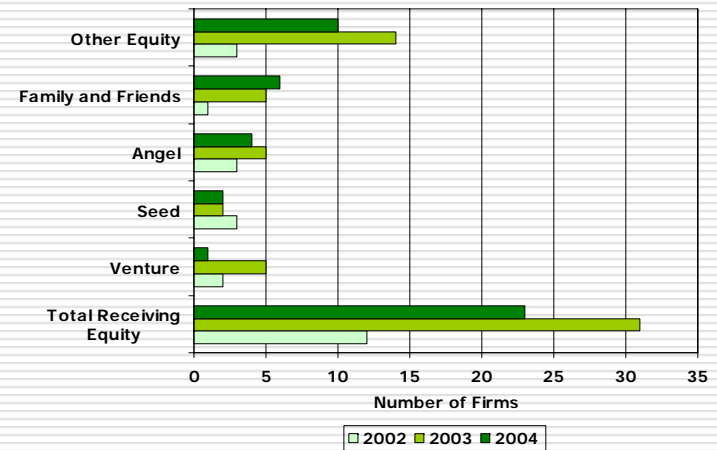
The largest source of debt was bank lending both in terms of the number of companies and the proportion of debt obtained. The largest source of equity by number of firms is "other", but the largest source by equity dollars was venture capital, at least in 2003 and 2004. (Friends and family was the largest source in 2004.) It should be noted that the large amount of debt and equity was accounted by a small number of firms who secured substantial debt and equity investments in 2003.



Debt

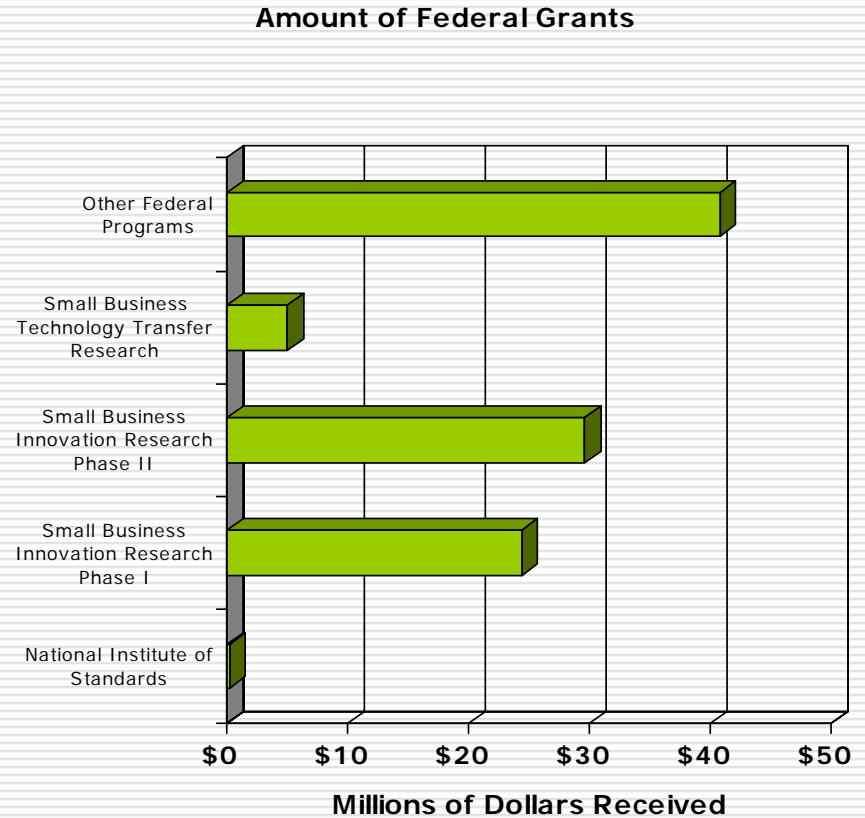
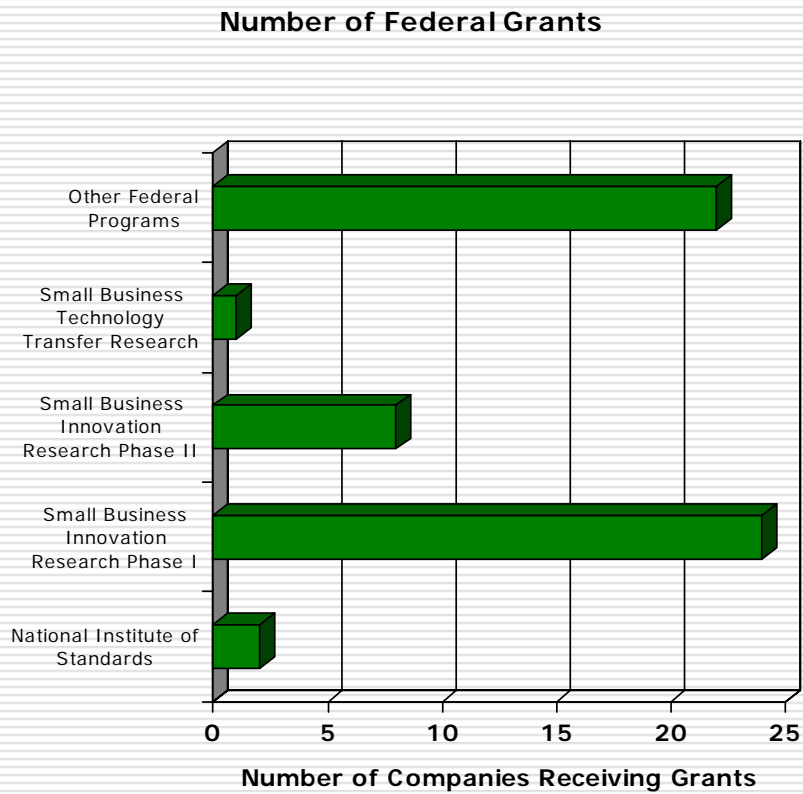


Equity



Fifty-seven MTI grantees have secured almost \$100 million in additional federal support for research and development. The largest number of federal grants were in the Small Business Innovation Research Phase I Program, followed by other federal grant programs. Other federal grant programs were the largest category of grants by dollar amount.

The other federal grant programs tapped by MTI grantees were a varied group, which included programs from the Department of Defense, the National Oceanic and Atmospheric Administration, U.S. Department of Agriculture, and NASA.



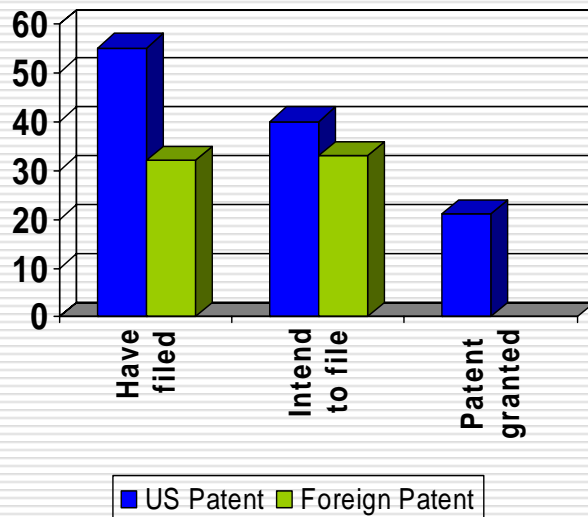
Intellectual Property Development

Of the 277 R&D projects supported by MTI, 124 (45%) will seek patents or have already been granted patents in the U.S. and/or foreign countries. The level of patent activity each year is consistent with the number of projects supported by MTI, indicating a stable rate of patenting. Of those companies who indicate they will not seek patent protection, most indicate that patents have already been granted or are not appropriate.

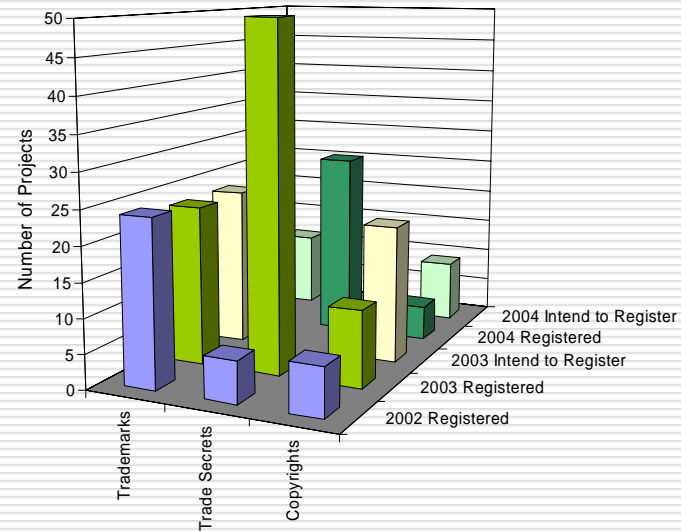
Grantees are more likely to seek patents in the U.S., but it is noteworthy that the “intended” level of patent filing activity in foreign countries is almost as high as that for domestic patents. (NOTE: Foreign patent granted data are not available.)

Respondents indicate that a very high proportion (84%) of MTI-assisted projects will result in products for which intellectual property protection other than patents will be sought. Such protection includes trademarks, trade secrets, and copyrights. Trademarks are the largest of these protection measures sought by MTI clients, with 96 projects registering or intending to register trademarks. Trade secrets are the next most popular, with 83 projects.

Patent Activity



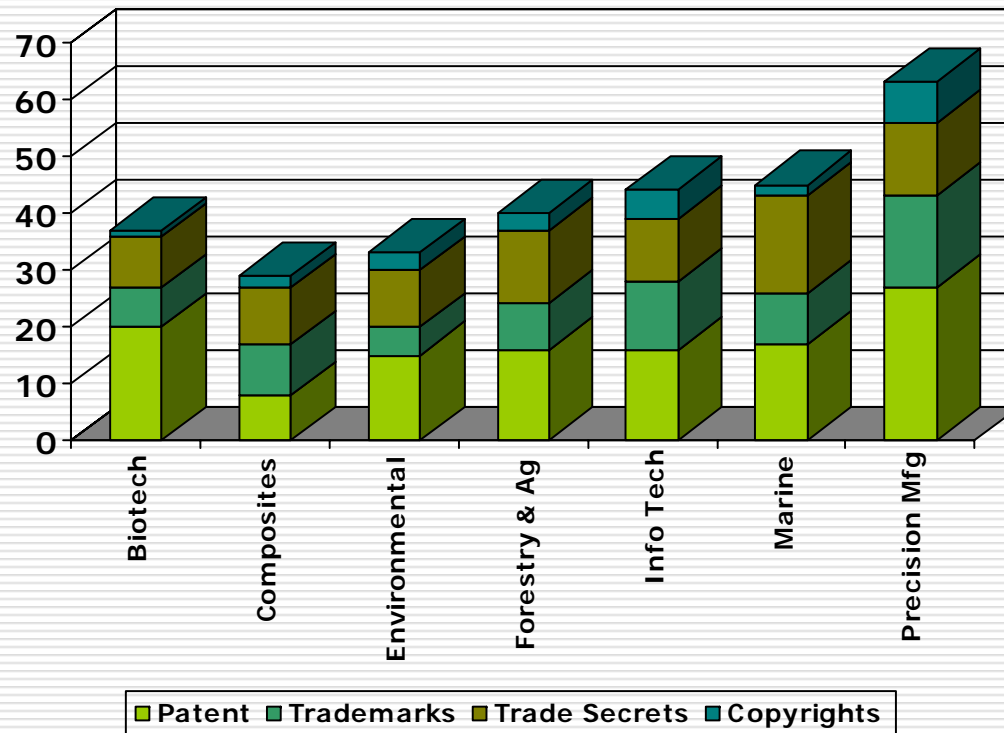
Other Intellectual Property Protection Activity



Note: Intend to Register not available for 2002.

Projects related to Precision Manufacturing are the most likely to seek intellectual property protection overall, while Composites 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.

Intellectual Property Protection Activities by Sector

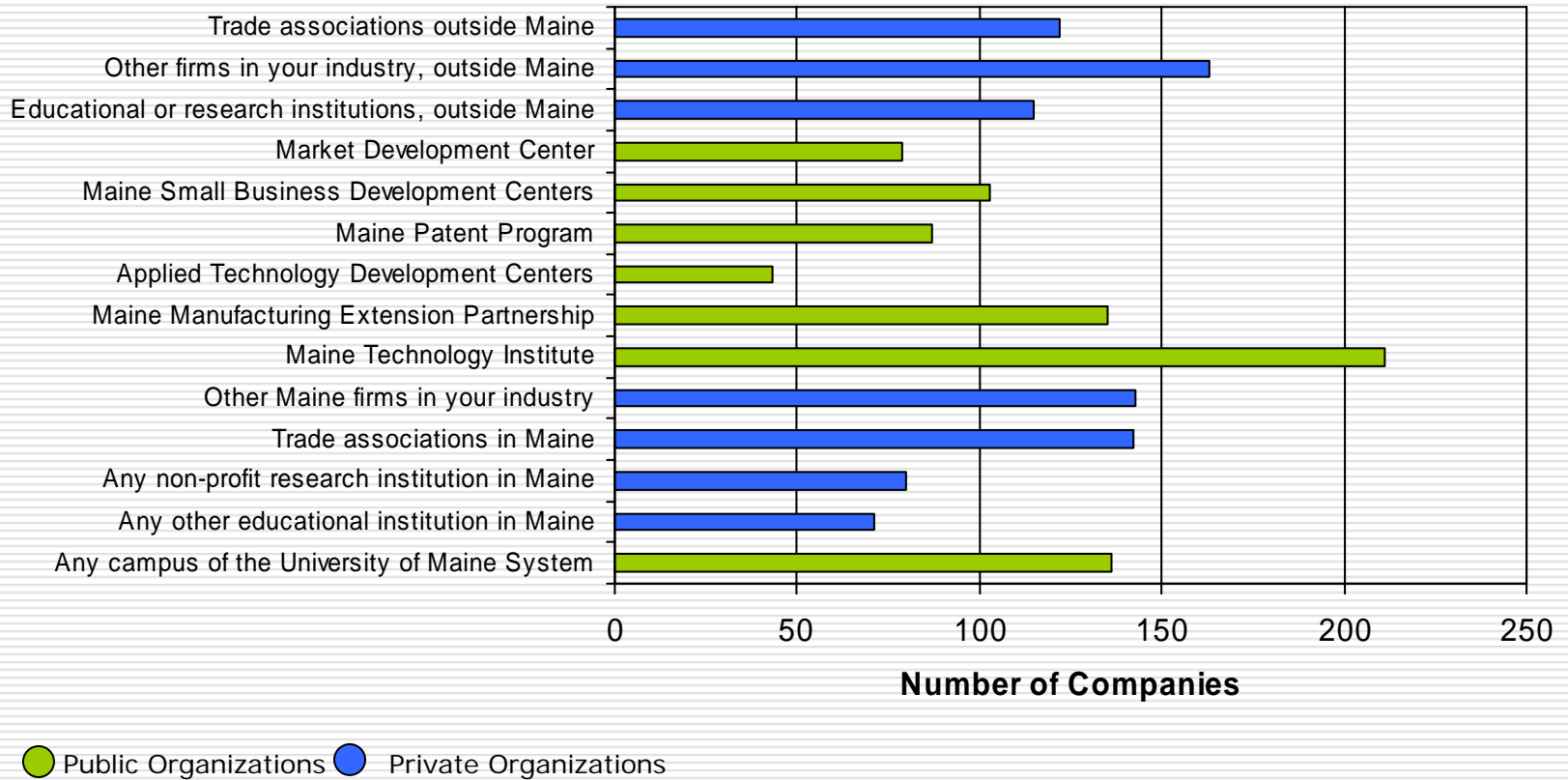


Relationships

Two types of organizations provide support and assistance to MTI firms in the 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.

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, the Applied Technology Development Centers (ATDC's) are a relatively new program, each of which has a specific focus that limits their use by a broad array of firms.

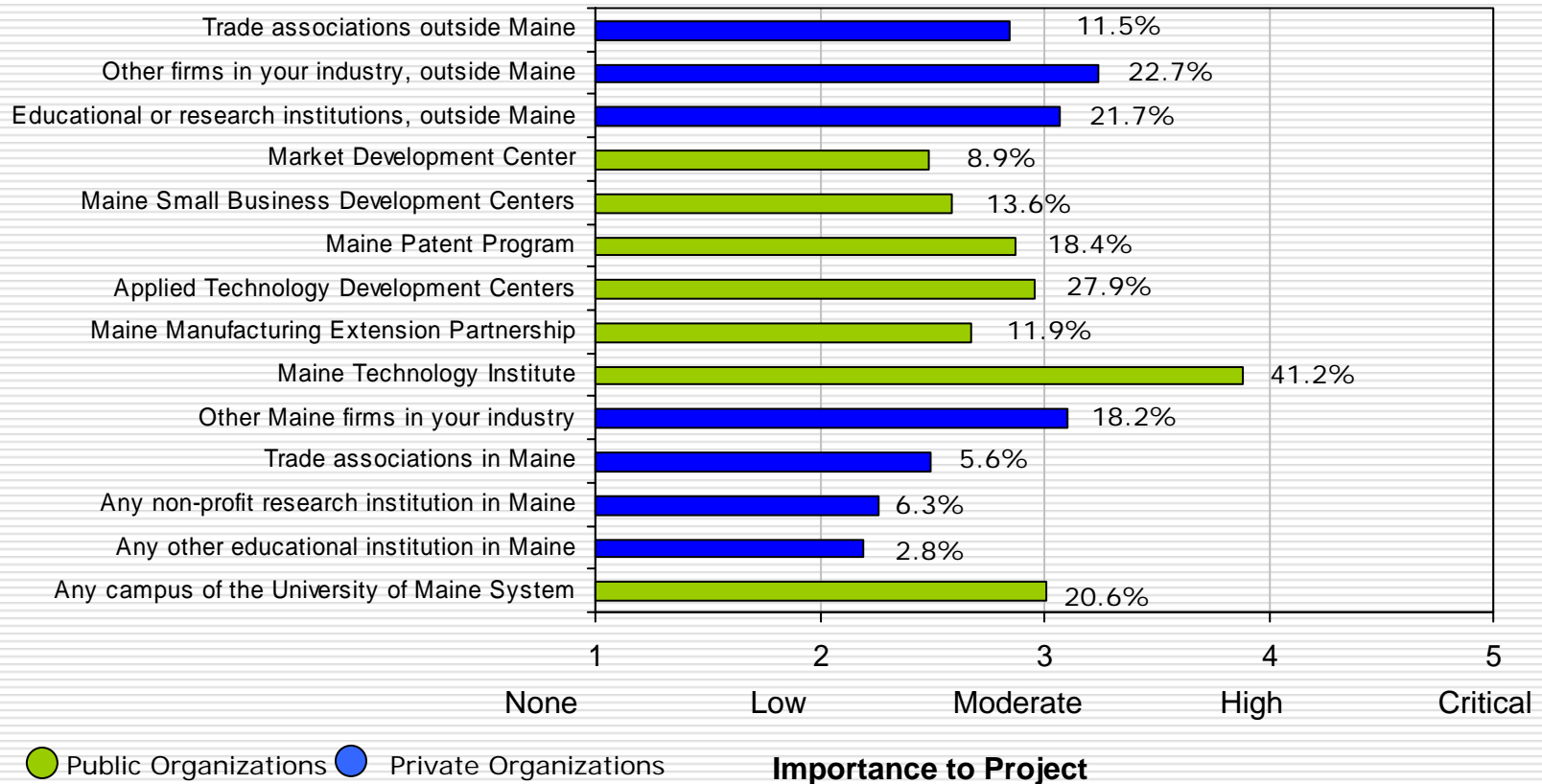
**Number of Respondents that Received Assistance from Listed Organization:
All Years**



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.

The chart shows the average rating on the 1-5 scale and the proportion of respondents using each organization who deemed the relationship “critical” to their success. MTI scores highest on both measures. The ATDC’s were less used, but scored high on “critical” for those companies using them. The ratings also indicate that out-of-state firms and trade organizations are viewed as more important than Maine firms and associations, probably reflecting the greater levels of expertise in many technical fields that still exist outside of Maine.

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



Cluster Enhancement Program

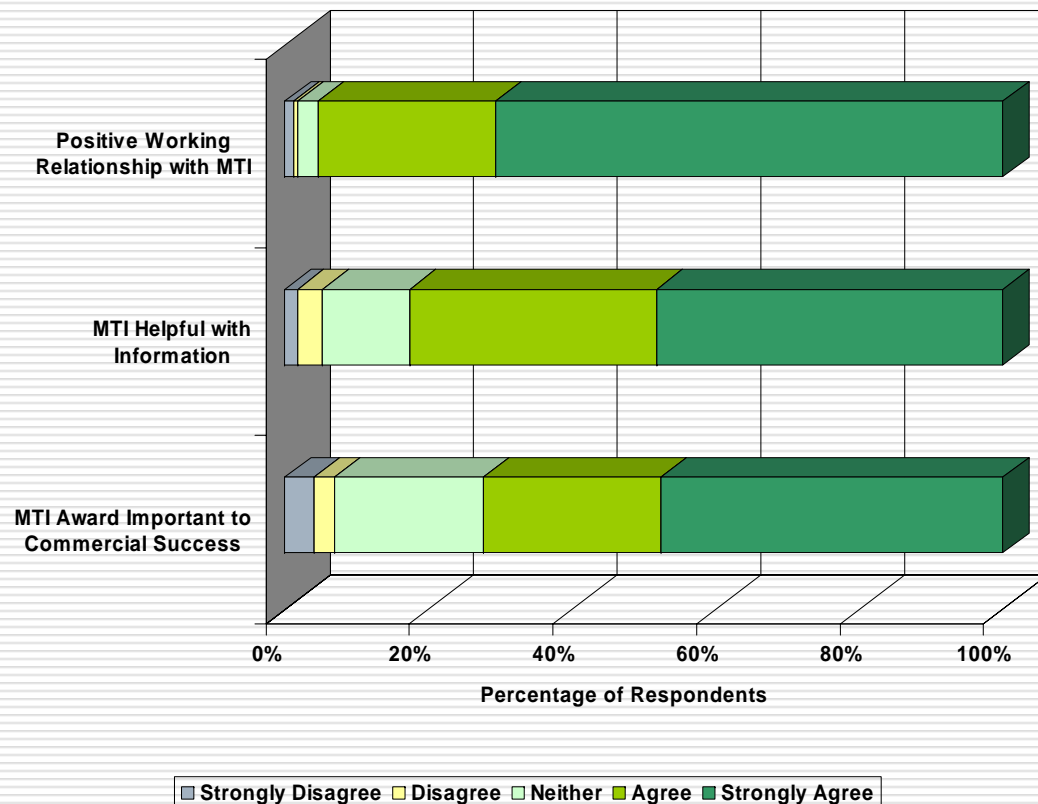
- From June 30, 2002 to June 30, 2004, eight cluster enhancement awards ended. Seven projects were completed as proposed; one was not completed because of changes in personnel at the proposing organization. The seven completed projects received \$464 thousand in MTI funding, and matched this total with \$1.47 million for a total of \$1.93 million.
- Five of the eight projects were to support the Forest Products and Agriculture sector, two in support of Environmental Technologies, and one for Biotechnology.
- The cluster awards were used for three broad purposes:
 - Infrastructure development (providing new technologies for testing and research to be used by many organizations)
 - Communication network development (Setting up websites, expanding association activities, etc.)
 - Market development (investigating new market opportunities that many firms within a cluster can pursue)
- Cluster award recipients report that the process of undertaking the MTI-funded projects provided extremely valuable contacts and communications and increased awareness of the cluster concept. The process of undertaking the projects expanded and enhanced existing relationships among diverse individuals and organizations necessary to the successful completion of their projects.
- Three of the seven respondents indicated that the work undertaken with MTI assistance had exceeded planned outcomes. Additional uses for infrastructure technologies were developed, and additional enhancements to communication networks were implemented.
- Projects involving infrastructure technologies appear to have the most likely payoffs in terms of new products and economic impacts. Specific impacts were not documented as part of this assessment, but may be in the future.
- Cluster award recipients gave MTI very high marks for the support received during the grant-making process and afterwards. A number commented that the ease of MTI's processes were in marked contrast to the federal programs with which several award recipients had experience. MTI's strong Maine-based service was also noted.

Evaluation of MTI Programs

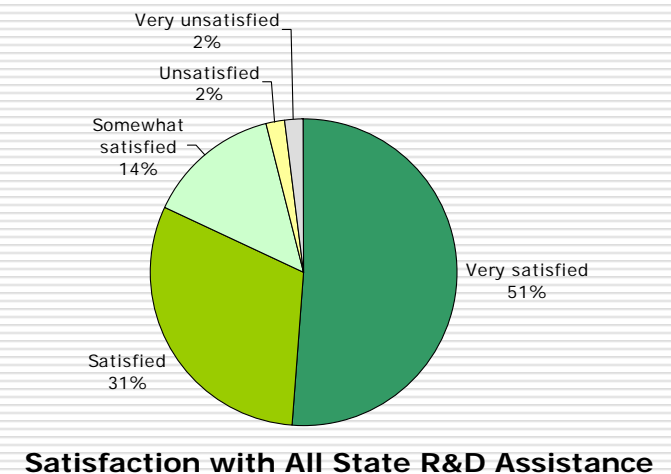
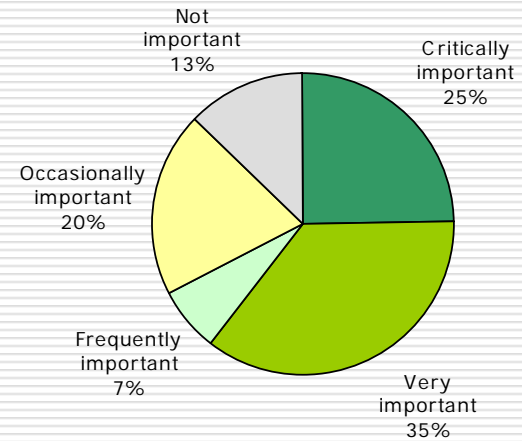
Clients gave MTI very high marks for the quality and usefulness of their services. Substantial majorities of MTI grant recipients agreed or strongly agreed that their working relationship with MTI was positive (>90%), that MTI was helpful, (>80%) and that MTI assistance had been important to their commercial success and in finding other funding. (>75%)

MTI clients also gave high marks to the overall suite of State R&D assistance programs, with 60% indicating that such support was highly important to their success, and over 80% indicating strong satisfaction with the assistance they received.

Client's Assessment of Interactions with Maine Technology Institute



Importance of all State R&D Assistance



Satisfaction with All State R&D Assistance

Recommendations

- MTI has done a good job diversifying its support among the seven technology sectors. Based on the projects that completed through June 30, 2004, the biotechnology sector has received the fewest awards (though the largest total amount of funding) and might be the target of additional attention in developing new clients.
- MTI offers a very high level of service to its potential clients and awardees. This service includes assistance with MTI and other R&D support programs as well as serving as the center of a number of networks for organizations (public, private, and non-profit) involved in Maine's innovation economy. This high level of service is costly for a small organization such as MTI which has limits on the proportion of its funding that can be used for administrative costs. But this service is critical to both MTI's success and to the high level of satisfaction among award recipients, and should be maintained.
- Because the significant diversity of projects under the Cluster Enhancement Award program is so large, it is not suitable to the form of survey-based evaluation used for development awards and seed grants. To track the effects of cluster awards, it is recommended that award recipients be asked to self-design a report on the effects of their awards at the time of their application and to commit to reporting under that design for a period equal to that required of development award and seed grant recipients. USM CBER will work with MTI to provide guidelines for the development of self-assessments to be incorporated in Cluster Enhancement proposals.

Technical Notes

- In 2003 and 2004, the survey of MTI clients was conducted on-line in partnership with the State of Maine Research and Development Evaluation Program. 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. For more information about response rates to individual questions, see the Data Appendix available from MTI or CBER.
- 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 will be resurveyed as part of the 2005 data collection process.
- Details on MTI programs and award numbers and amounts are available from the MTI website: www.mainetechnology.org. MTI Annual Reports provide additional detail on the funding awards.